Ichthys Project Gas Export Pipeline (Operation)

Environment Plan

RECORD OF AMENDMENT

Revision	Section	Amendment

DOCUMENT DISTRIBUTION

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Environment plan summary

The WA-50-L 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 3.3
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	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 1.6

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Terms, abbreviations and acronyms

Abbreviation/acronym	Description
°C	degrees Celsius
AFMA	Australian Fisheries Management Authority (Cwlth)
AHS	Australian Hydrographic Service
AICS	Australian Inventory of Chemical Substances
AIM	asset integrity management
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)
APASA	Asia-Pacific Applied Science Associates
APPEA	Australian Petroleum Production and Exploration Association
ARP	applied research program
AS/NZS	Australian/New Zealand Standard
AUV	autonomous underwater vehicle
BCF	bioconcentration factor
BIA	Biologically Important Area
BMS	INPEX's business management system containing all HSE requirements
BOM	Bureau of Meteorology
Bq/L	becquerels per litre
BROPEP	INPEX Browse Regional Oil Pollution Emergency Plan
BWM	ballast water management
CAMBA	China Australia Migratory Bird Agreement

Abbreviation/acronym	Description
CCR	central control room
CMMS	Computerised Maintenance Management System
CMST	Centre of Marine Science and Technology
CMT	crisis management team
CO_2	carbon dioxide
COLREGs	International Regulations for Preventing Collisions at Sea 1972
CONOPS	concurrent operations
CPF	central processing facility
CRA	corrosion resistant alloy
CRWG	INPEX Community Relations Working Group
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CW	cooling water
Cwlth	Commonwealth
DAWE	Department of Agriculture, Water and the Environment (Cwlth) (formerly the DEE and Department of Agriculture)
DAWR	Department of Agriculture and Water Resources (Cwlth) (now known as the Department of Agriculture, Water and the Environment)
dB	decibel
DBCA	Department of Biodiversity, Conservation and Attractions (WA)
DEE	Department of the Environment and Energy (Cwlth) (now known as the Department of Agriculture, Water and the Environment)
dense phase	When a pure or mixed compound is heated and compressed above the critical temperature and pressure, such that it becomes a dense, highly compressed fluid that demonstrates properties of both liquid and gas.
DMIRS	Department of Mines, Industry Regulation and Safety WA (formerly Department of Mines and Petroleum)
DP	dynamic positioning

Abbreviation/acronym	Description
DPaW	Department of Parks and Wildlife (WA) now known as DBCA
DPIRD	Department of Primary Industries and Regional Development (WA)
DSEWPaC	Department of Sustainability, Environment, Water, Population and Communities
EEZ	exclusive economic zone
EIAPP	Engine International Air Pollution Prevention
EIS	environmental impact statement
EMBA	environment that may be affected
ENVID	environmental hazard identification
EP	environment plan
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cwlth)
EPRS	emergency pipeline repair system
ERT	emergency response team
ESD	ecological sustainable development
FIS	filtered inhibited seawater
FLNG	floating liquified natural gas
FMA	field management area
FPSO	floating production, storage and offtake (facility)
g/m^2	grams per square metre
g/m^3	grams per cubic metre
GEP	gas export pipeline
GEP gas	The contents of the GEP during operations
GERB	gas export riser base
GS	gathering system
GT	gross tonnage

Abbreviation/acronym	Description
h	hour
ha	hectare(s)
HAZID	hazard identification
HFO	heavy fuel oil
HLV	heavy-lift vessel
HSE	health, safety and environment
Hz	hertz
IAP2	International Association for Public Participation
IAPP	International Air Pollution Prevention
IBA	Important Bird Area
ICAO	International Civil Aviation Organization
IFC	International Finance Corporation
IFO	intermediate fuel oil
I-GEM	Industry–Government Environmental Metadata
ILT	inline tee
IMG	incident management guide
IMM	inspection, maintenance and monitoring
IMO	International Maritime Organization
IMR	inspection, maintenance and repair
IMS	invasive marine species
IMSMP	invasive marine species monitoring program
IMT	incident management team
INPEX Operations Australia Pty Ltd	INPEX Operations Australia Pty Ltd is the delegated operator
INPEX Ichthys Pty Ltd	INPEX Ichthys Pty Ltd is one of the upstream titleholders and joint venture partners.

Abbreviation/acronym	Description
Ichthys LNG Pty Ltd	Ichthys LNG Pty Ltd is the titleholder of Pipeline Licences WA-22-PL and NT/PL4
IOGP	International Association of Oil and Gas Producers
IOPP	International Oil Pollution Prevention
ISPP	International Sewage Pollution Prevention
ITOPF	International Tanker Owners Pollution Federation
IUCN	International Union for Conservation of Nature
JAMBA	Japan Australia Migratory Bird Agreement
KEF	key ecological feature
kHz	kilohertz
km	kilometre
KP	kilometre point
LAT	lowest astronomical tide
LC_{50}	lethal concentration required to kill 50% of a population
LLR	lower limits of reporting
LNG	liquefied natural gas
LPG	liquefied petroleum gas
m^2	square metres
m^3	cubic metres
m/m	mass-for-mass
m/s	metres per second
m^3/d	cubic metres per day
MARPOL 73/78	International Convention for the Prevention of Pollution from Ships, 1973/1978
MBES	multibeam echo sounders
MEG	monoethylene glycol

Abbreviation/acronym	Description
mg/L	milligrams per litre
MGO	marine gas oil
MNES	Matters of National Environmental Significance
mm/h	millimetres per hour
MMscf	million standard cubic feet
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
NGER	National Greenhouse and Energy Reporting
nm	nautical mile
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority (Cwlth)
NOPTA	National Offshore Petroleum Titles Administrator
NO_X	mononitrogen oxides
NPI	National Pollutant Inventory
NRSMPA	National representative system of marine protected areas
NT	Northern Territory
NT/PL4	Pipeline licence
NT DIPL	Northern Territory Department of Infrastructure, Planning and Logistics
NT DITT	Northern Territory Department of Industry, Tourism and Trade
NTSC	Northern Territory Seafood Council
NMR	north marine region

Abbreviation/acronym	Description
NWMR	North-west Marine Region
ODS	ozone-depleting substance
OIM	Offshore Installation Manager
OIW	oil-in-water
OLGA	A dynamic multi-phase simulator which models time-dependent behaviour or transient flow of oil and gas in a pipeline
OPEP	oil pollution emergency plan
operations stage	The principal activity will be the flow of GEP gas from the CPF to the Ichthys LNG Plant in Darwin
OPGGS (E) Regulations	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cwlth)
OPGGS Act	*Offshore Petroleum and Greenhouse Gas Storage Act 2006* (Cwlth)
OSCP	oil spill contingency plan
OSPAR	Oslo (1972) and Paris (1974) Convention for the Protection of the Marine Environment of the North-East Atlantic
OSRL	Oil Spill Response Limited
OSTM	oil spill trajectory modelling
OWS	oily–water separator
PAH	polycyclic aromatic hydrocarbons
PDCA	plan, do, check, act
PEZ	potential exposure zone
PIG	pipeline inspection and gauging tool
PLET	pipeline end termination
PLMS	pipeline management system
PLONOR	pose little or no risk (to the environment)
PLR	PIG launcher and receiver
PMS	preventative maintenance system

Abbreviation/acronym	Description
POLREP	(marine) pollution report
POTS Act	Protection of the Sea (Prevention of Pollution from Ships) Act 1983
ppb	parts per billion
PPE	personal protective equipment
ppm	parts per million
PPRR	prevention, preparedness, response, recovery
PSD	particle size distribution
PSV	platform supply vessel
PSZ	petroleum safety zone
PTS	permanent threshold shift
QRA	quantitative risk analysis
Ramsar Convention	The Convention on Wetlands of International Importance, especially as Waterfowl Habitat
RBI	risk-based inspection
RO	reverse osmosis
ROV	remotely operated underwater vehicle
SAR	seabed asset register
SDS	safety data sheet
SEEMP	ship energy efficiency management plan
SIMOPS	simultaneous operations
SMPEP	shipboard marine pollution emergency plan
SOLAS	International Convention for the Safety of Life at Sea
SOPEP	shipboard oil pollution emergency plan
SO_2	sulfur dioxide
SO_X	sulfur oxides

Abbreviation/acronym	Description
SPS	subsea production system
SSS	side scan sonar
STP	sewage treatment plant
SWASP	State-wide array surveillance program
t	tonne
TSS	total suspended solids
TTS	temporary threshold shift
URF	umbilicals, risers and flowlines
VOC	volatile organic compound
VP	vice president
WA	Western Australia
WA-22-PL	Pipeline licence
WA-50-L	Production licence area within the Browse basin
WA DoT	Department of Transport (WA)
WA EPA	Western Australian Environmental Protection Authority
WAFIC	Western Australian Fishing Industry Council
WCSS	worst case spill scenario
XT	xmas tree
µg/L	micrograms per litre
µPa	micropascal

1 INTRODUCTION

1.1 Background

In 2011, Commonwealth approval (EPBC 2008/4208) was obtained to develop the Ichthys Field in the Browse Basin. This included, but was not limited to, the installation and operation of the offshore infrastructure for the 40-year field life. The Ichthys Field is in petroleum production licence WA-50-L in the Browse Basin about 220 kilometres off the north west coast of Western Australia and 820 kilometres south west of Darwin (Figure 1-1). Water depths range from 235 to 275 m in WA-50-L and along the gas export pipeline (GEP) range from 250 m at the gas export riser base (GERB) in WA-50-L, to 30 m at the boundary of Commonwealth waters and the NT three nautical-mile (nm) limit. INPEX Ichthys Pty Ltd, on behalf of the Ichthys Upstream Unincorporated Joint Venture Participants, is recovering gas and condensate from these reservoirs and processing them offshore.

The Ichthys Field consists of two reservoirs: an upper reservoir in the Brewster Member and a lower reservoir in the Plover Formation. Continued development of the Ichthys Project, in accordance with the Commonwealth ministerial approval will see the introduction of hydrocarbons from the lower Plover Formation during the life of this EP.

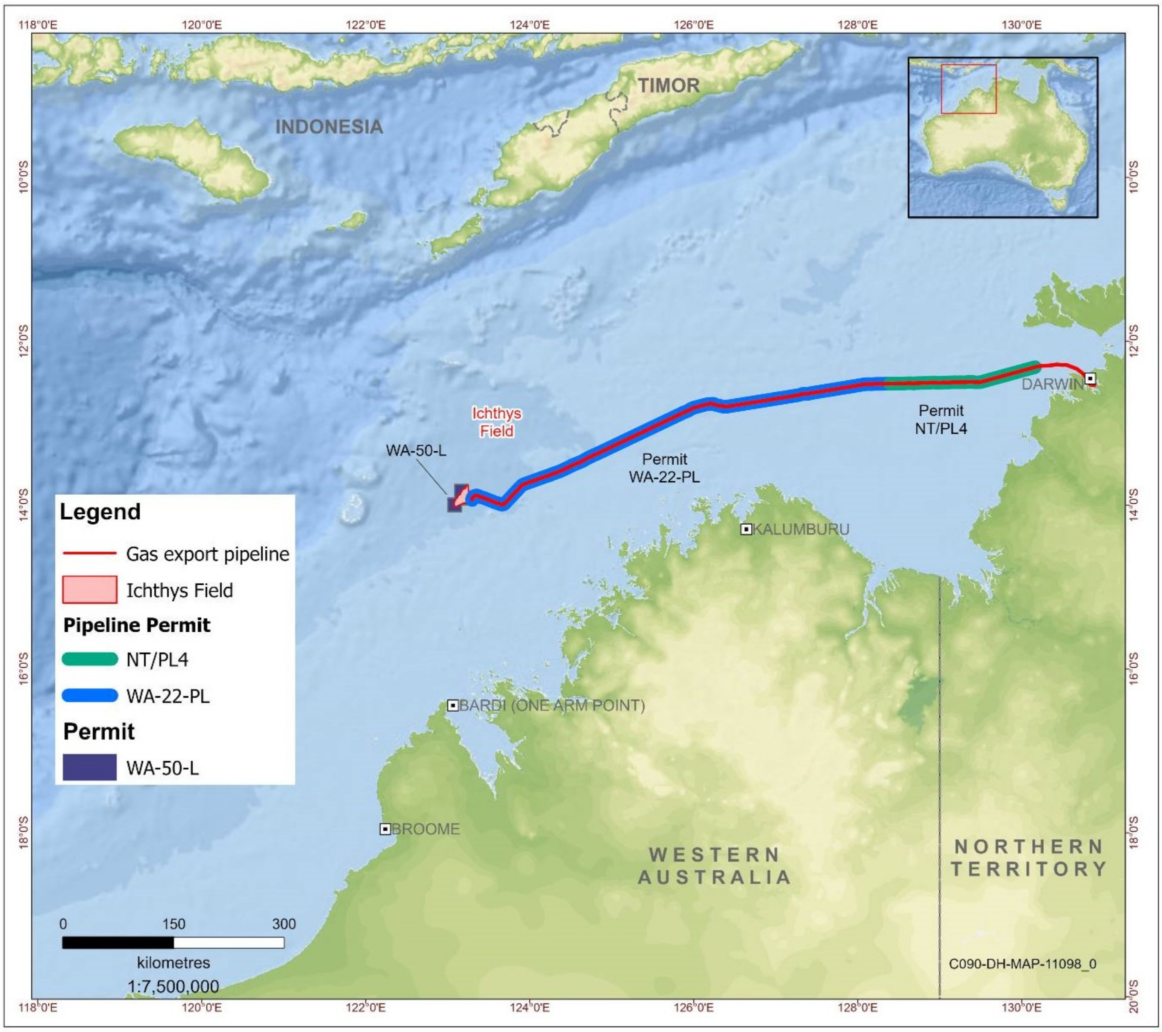

Figure 1-1: Location of INPEX Ichthys LNG Project

Hydrocarbon production involves gas from the Ichthys Field undergoing preliminary processing at the offshore central processing facility (CPF) to remove water and raw liquids, including the greater part of the condensate. This condensate is pumped to the interlinked floating production, storage, and offtake facility (FPSO) with hydrocarbon processing and monoethylene glycol (MEG) regeneration capabilities. The FPSO has a condensate storage capacity of more than 1,000,000 barrels (approx. 137,000 m^3) and transfers the condensate to tankers for export to overseas markets.

The gas and some condensate are transported from the CPF along an 890 kilometre long subsea GEP for further processing at Bladin Point in Darwin. Liquefied petroleum gases (LPG) and liquefied natural gas (LNG) and condensate are produced onshore from the export gas on behalf of the Ichthys Downstream Incorporated Joint Venture.

Construction and installation of Ichthys Project subsea infrastructure and commencement of drilling for the first 20 development wells began in 2014. INPEX is continuing with the expansion of the capacity of the Ichthys Field, as approved under the Ichthys LNG Project Commonwealth approval decision EPBC 4208/2008. Table 1-1 lists environment plans associated with the Ichthys LNG Project.

Table 1-1: INPEX Ichthys LNG Project environment plans

Title	Activities	Indicative timing
Ichthys Project Offshore Facility (Operation) Environment Plan (X075-AH-PLN-00015: Accepted) (X060-AH-PLN-70007: 5-year EP revision undergoing NOPSEMA assessment)	• Conveyance of fluids, comprising gas, hydrocarbon condensate, MEG and produced water (PW) from the reservoirs by means of the subsea infrastructure to the CPF and FPSO. • Regeneration of MEG by the FPSO used during processing so that it can be recycled back to the SPS and wells. • Processing and storage of gas and condensate via the CPF and FPSO, including transfer of condensate via an offtake hose to an offloading tanker; and gas export up to the GEP. • IMR activities on the CPF, FPSO and subsea infrastructure including deployment of the PIG launcher receiver (PLR) attached at the GERB (excluding well intervention or well workover activities). • Further development of the Ichthys Field with installation and commissioning of a booster compression module (BCM) on the CPF. • Shutdown to undertake major maintenance, GEP pigging (deployment of PLR) and installation/commissioning of the BCM will require shutdowns of the CPF, FPSO and the full field during the life of this EP.	Dec 2016 – Dec 2021 Expected Dec 2021 – Dec 2026

Title	Activities	Indicative timing
Ichthys Development Drilling Campaign WA-50-L Environment Plan (0000-AD-PLN-60003) (Accepted)	• 12-15 well drilling program utilising semisubmersible drilling rigs • installation of well infrastructure and xmas trees (XTs) • well clean-up and completions • support activities, including equipment transfers, refuelling, crew transfers, and transfer of waste and general supplies to and from logistics support vessels • control and maintenance of well integrity.	Mar 2020 – Mar 2025
Umbilicals, Risers and Flowlines and Subsea Production Systems Installation Environment Plan (E075-AH-PLN-7000) (Accepted)	• construction and installation of URF infrastructure associated with the further development of the Ichthys LNG Project • survey activities • installation, mechanical completion, pre-commissioning and commissioning of URF infrastructure • connection of URF infrastructure and systems to the existing subsea infrastructure and offshore facility • pre-commissioning and commissioning of the well head XTs at drill centres.	Jan 2021 – Jan 2026

1.2 Petroleum activity

The Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGS (E) Regulations) define a petroleum activity as the operations or works in an offshore area undertaken for the purpose of:

1. exercising a right conferred on a petroleum titleholder under the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (OPGGS Act) by a petroleum title, or
2. discharging an obligation imposed on a petroleum titleholder by the OPGGS Act or a legislative instrument under the Act.

Regulation 59C of the Offshore Petroleum Greenhouse Gas Storage (Regulatory Levies) Regulations 2004 further splits petroleum activities by type. Accordingly, the petroleum activity associated with this plan is described in item four:

“Operation of a licensed petroleum pipeline”

Specifically, infrastructure relating to this EP is the GEP (excluding the GERB, which connects the GEP to the CPF) located within Commonwealth waters.

For the purposes of this EP, the petroleum activity consists of:

- operation of the GEP from the GERB to the boundary of Commonwealth waters adjacent to NT waters
- inspection, maintenance and repair (IMR) activities of the GEP during operations
- vessel activities within the operational area.

1.3 Out of Scope

Activities out of the scope of this EP include:

- operation of the offshore facility (i.e. CPF, FPSO and subsea production system infrastructure).
- use of a heavy-lift vessel for installation, operation and removal of a PIG launcher receiver (PLR) at the GERB in WA-50-L which is managed under the Offshore Facility (Operation) EP.
- operational/inspection pigging of the GEP, (the launching of inspection pigs into the GERB, and the flow of GEP gas which drives the pigs through the GEP, to the Ichthys LNG Plant in Darwin) which is managed under the Ichthys Project Offshore Facility (Operation) EP.
- major repair/spool replacement and re-commissioning of the GEP. Major repair/spool replacement and re-commissioning of the GEP will be managed under another EP, to be submitted to NOPSEMA for review/acceptance, prior to undertaking the activity. Refer to Table 3-4 for further information.

1.4 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 petroleum activity
- define an appropriate implementation strategy and monitoring, recording and reporting arrangements, whereby compliance with this EP, the 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.

1.5 Overview of activity description

Table 1-2: Overview of the activity description

Item	Description
Pipeline licence	WA-22-PL and NT/PL4.
Gas field	Ichthys Field (Browse Basin)
Hydrocarbon type	Gas and condensate (referred to as "GEP gas").

Activity location	The GEP is approximately 889 km long, with approximately 790 km of it located within Commonwealth waters, between the Ichthys Field and the Northern Territory (NT) three-nautical-mile (nm) limit. Activities covered by this EP are wholly located in Commonwealth waters and the operational area is defined as a two-kilometre-wide corridor, 1 km either side of the GEP centreline, up to the GERB. The water depths range from ~250 m below lowest astronomical tide (LAT) at the GERB, to ~30 m LAT, at the boundary of Commonwealth waters and the NT three-nautical-mile limit.
Activity description	Operation of the GEP involves the transportation of GEP gas through the GEP to the Ichthys LNG Plant in Darwin. Inspections provide assurance that infrastructure is performing according to design. They also proactively identify maintenance and/or repair activities that may be required to protect the GEP integrity. Inspection activities within the EP include: • remotely operated underwater vehicle (ROV) or autonomous underwater vehicle (AUV) inspections • marine acoustic surveys. Maintenance and repair activities described in this EP are not intended to occur but, if required, may include: • seabed intervention (e.g. jetting, mass flow excavation, installing grout bags, rock placement or concrete mattress installation) • marine growth removal • pigging to recover the integrity of, or isolate, the GEP in the event of a repair • minor/clamp repairs.
Vessels	Typically, a single vessel can be used to conduct IMR activities. However, depending on the nature and location of a repair activity, additional vessels may be required. Vessels involved in IMR activities, including minor repair activities, will only use Group II (marine gas oil/diesel) fuels.
Duration	This EP revision will cover continuous operations 24 hours per day, for a period of up to five years from acceptance of this EP revision.

1.6 Titleholder details

Ichthys LNG Pty Ltd is the titleholder of pipeline licences WA-22-PL and NT/PL4.

In accordance with Regulation 15(1) of the OPGGS (E) Regulations, details of the titleholder are described in Table 1-3. INPEX will be responsible for ensuring that activities covered within this EP are carried out in accordance with the OPGGS (E) Regulations, this EP and other applicable Australian legislation.

Table 1-3: Titleholder details

Name	Ichthys LNG Pty Ltd
Business address	Level 22, 100 St Georges Terrace, Perth, WA 6000
Telephone number	+61 8 6213 6000
Fax number	+61 8 6213 6455
Email address	enquiries@inpex.com.au
ABN	46 150 217 299

In accordance with Regulation 15(2) of the OPGGS (E) Regulations, details of the titleholder's nominated liaison person are provided in Table 1-4.

Table 1-4: Titleholder nominated liaison person

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

1.6.1 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

1.7 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 Australian Petroleum Production and Exploration Association (APPEA) methodology for estimating levels of financial assurance (2018), based on the maximum credible spill scenarios.

Declarations of financial assurance will be provided in relation to pipeline licences WA-22-PL and NT/PL4 prior to acceptance of this EP by 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 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. This system and 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 petroleum 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 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. The EPBC Act provides for protection of 'matters of national environmental significance' (MNES) 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 (NatPlan). Australian Marine Parks (AMPs) are proclaimed under this Act and associated management plans are enacted under this legislation. In accordance with Regulation 9 of the OPGGS (E) Regulations, the activities described in this EP were approved by the Commonwealth Environment Minister under Part 9 of the EPBC Act (EPBC Approval Decision 2008/4208).	Relevant approval conditions within approval decision EPBC 2008/4208 have been addressed in this EP and are summarised in Appendix A. Section 4.3 – Australian marine parks Section 7.2.2 – Atmospheric emissions Section 7.7.1 – Physical presence of vessels and Section 7.5.2 interaction with marine fauna. Section 8 – Emergency conditions. INPEX Browse Regional OPEP A demonstration of how this EP addresses the relevant conservation management documents related to EPBC-listed species has been presented in Appendix B.
OPGGS (E) Regulations (Cwlth)	The OPGGS (E) Regulations under the OPGGS Act require a titleholder to have an accepted plan in place for a petroleum activity.	The OPGGS (E) Regulations require that the petroleum activity is undertaken in an ecologically sustainable manner, and in accordance with an accepted EP.	Throughout this EP. Implementation of the BMS

Legislation	Description	Requirements	Demonstration of how requirements are met in 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 arrangements 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* (POTS Act) and through legislative Marine Orders, also requires vessels to have pollution prevention certificates (see below).	Section 7.7.1 – Physical presence – disruption to other marine users Section 8.2 - Vessel collision Implementation of the BMS.
OPGGS Act 2006 Section 572(2)(3)	The OPGGS Act provides the regulatory framework for petroleum exploration, production and greenhouse gas activities in Commonwealth waters.	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.	Section 3.2 (IMR) Section 3.4 (Decommissioning) Implementation of the BMS.
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 Orders Part 91 implements Part II of the POTS Act, Chapter 4 of the *Navigation Act 2012*, and Annex I of MARPOL (oil pollution). The Marine Orders provide 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.	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 AMSA.	Section 7.2.4 – Routine vessel liquid discharges Section 7.8.1 – 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. They set out the guidelines for developing a shipboard marine pollution emergency plan (SMPEP).	INPEX and vessel contractor will comply with the Marine Order 93: Marine Pollution Prevention– noxious liquid substances (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 7.8.1 – 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.	INPEX and vessel contractor will comply with the *Navigation Act 2012* – Marine Order 94: pollution prevention — packaged harmful substances (as appropriate to vessel class), through reporting the loss or discharge to sea of any harmful materials.	Section 7.3 – Waste Management Implementation of the BMS.
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).	Vessels ≥100 GT, or vessels certified to carry 15 persons or more, are required to maintain a Garbage Management Plan. Vessels ≥400 GT are required to maintain a Garbage Record Book. The requirements will apply to vessels (as appropriate to their size, type and class) at all times.	Section 7.3 – 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. They also set 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 (ISPP) certificate to be maintained on board.	Vessels ≥400 GT are required to maintain International Sewage Pollution Prevention (ISPP) certificates 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 7.2.4 – Routine vessel liquid 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).	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 7.2.2 – 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). vessels ≥400 GT are required to have an International Maritime Organization (IMO)-approved waste incinerator, as confirmed by the IAPP certificate. vessels ≥400 GT with rechargeable systems containing ODS to maintain an ODS Record Book. vessels ≥400 GT to have an International Energy Efficiency (IEE) certificate (as applicable to the vessel and engine size, type and class). 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 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 Act 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 BWM Convention - 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).	Section 7.5.1 - 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
Fish Resources Management Act 1994 (WA)	The *Fish Resources Management Act 1994* 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 7.5.1 - Invasive marine species Implementation of the BMS.

Legislation	Description	Requirements	Demonstration of how requirements are met in EP
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 7.5.1 - Invasive marine species Implementation of the BMS.
National Greenhouse and Energy Reporting Act 2007 (Cwlth) National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015	The *National Greenhouse and Energy Reporting Act 2007* provides a single, national framework for the reporting and distribution of information related to greenhouse gas (GHG) emissions, GHG projects, energy production and energy consumption. The Act includes National Greenhouse and Energy Reporting (NGER) requirements and the Safeguard Mechanism requirements.	Reporting obligations are imposed upon corporations that meet emissions/energy thresholds. The Safeguard Mechanism is administered through the NGER scheme by the Clean Energy Regulator and is designed to minimise additional mandatory reporting requirements. As well as keeping their emissions below their baseline, safeguard facilities must adhere to the reporting and record keeping requirements of the NGER scheme. INPEX reports on the Ichthys Project as a whole and has committed to a baseline under the Safeguard Mechanism requirement.	Section 7.2.2 – Atmospheric emissions Implementation of the BMS.

Legislation	Description	Requirements	Demonstration of how requirements are met in EP
National Environment Protection (National Pollutant Inventory) Measure 1998 (established under the *National Environment Protection Council Act 1994*)	The National Pollutant Inventory (NPI) provides publicly available information on the types and amounts of toxic substances being emitted into the Australian environment. Ninety-three substances have been identified as important due to their possible effect on human health and the environment.	Australian, state and territory governments have agreed to legislative instruments called National Environment Protection Measures (NEPMs), which help protect or manage particular aspects of the environment. Australian industries are required to monitor, measure and report their emissions under this legislation. INPEX reports relevant NPI substances to comply with the NPI NEPM.	Section 7.2.2 – Atmospheric emissions Implementation of the BMS.

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

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 and sediment 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 *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 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 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.
EPBC Act 1999 Policy Statement – Section 527E	Section 527E defines the 'impact' of an action (primary action) as an event or circumstance which is a direct consequence of the action; or an indirect consequence of the action, if the action is a substantial cause of the event or circumstance. Indirect consequences may also be referred to as indirect impacts and can be either upstream or downstream; they may include emissions or discharges that could result in harm to a MNES. The indirect consequence of an action must be a substantial cause of an event or circumstance for it to be considered an impact of the action.

Guideline	Description
Matters of National Environmental Significance - Significant Impact Guidelines 1.1 EPBC Act 1999	Under the EPBC Act an action will require approval from the minister if the action has, will have, or is likely to have, a significant impact on a MNES. A 'significant impact' is an impact which is important, notable, or of consequence, having regard to its context or intensity. Whether an action is likely to have a significant impact depends upon the sensitivity, value, and quality of the environment, which is impacted, and upon the intensity, duration, magnitude and geographic extent of the impacts.

3 DESCRIPTION OF THE ACTIVITY

3.1 Operation of the GEP

The operational activity covered by this EP is the flow and transportation of GEP gas from WA-50-L to the Ichthys LNG Plant in Darwin. For the purpose of transporting GEP gas to the Ichthys LNG Plant, the GEP is an entirely closed system, with no planned discharges to the marine environment during the normal operation. The pressure within the GEP is monitored from the GERB (GEP inlet pressure) and the Ichthys LNG Plant (GEP outlet pressure).

GEP gas is often in 'dense phase' i.e. heated and compressed above its critical temperature and pressure, such that it becomes a dense, highly compressed fluid that demonstrates properties of both liquid and gas as it travels along the length of the GEP. The transfer of dense phase gas via a pipeline is uncommon in Australian waters. However, it is a requirement for this activity due to the length of the GEP and the required inlet pressure at the Ichthys LNG Plant.

The GEP is a 42-inch outer diameter, steel pipeline, installed with concrete weight and asphalt enamel external coating. The concrete coating provides a degree of protection for the GEP against potential impacts, such as from dropped objects or fishing gear. The GEP has been installed with five hot-tap-tees and one midline dummy spool, all with 'over-trawl' covers installed. All infrastructure associated with this EP is listed in Table 3-1, noting that the GERB itself is captured in the Ichthys Project Offshore Facility (Operation) EP and all equipment beyond the NT coastal waters boundary (3 nm) including the beach valve and the onshore GEP are out of scope.

Table 3-1: GEP and associated infrastructure in WA-22-PL

Infrastructure item	Status	Latitude (South)	Longitude (East)
Export tie-in spool (42 inch)	Active	13° 56' 01.609''	123° 17' 50.183''
GEP pipeline end termination (PLET) to support the connector between the 42 inch tie in spool and the GEP	Active	13° 56' 01.609''	123° 17' 50.183''
GEP: KP 0 to KP 790 (NT coastal water mark)	Active	13° 56' 04.423'' to 12° 19' 04.800''	123° 17' 50.183'' to 130° 09' 46.800''
Hot tap tee 1 and overtrawlable protection shroud at KP 48.25	Active	13° 58' 26.527''	123° 42' 10.961''
Hot tap tee 2 and overtrawlable protection shroud at KP 84.55	Active	13° 44' 35.454''	123° 56' 16.856''
Hot tap tee 3 and overtrawlable protection shroud at KP 185.10	Active	13° 23' 13.337''	124° 47' 26.149''
Hot tap tee 4 and overtrawlable protection shroud at KP 373.50	Active	12° 47' 48.775''	126° 22' 48.337''
Mid-line spool (flanged removal spool) and over trawl structure KP 381.50	Active	12° 47' 31.550''	126° 27' 10.599''

Hot tap tee 5 and overtrawlable protection shroud at KP 594.09	Active	12° 31' 10.430''	128° 23' 02.770''

GEP gas consists of Ichthys Field reservoir hydrocarbons which have been processed offshore to remove most of the water and long-chain hydrocarbons. The GEP gas consists primarily of natural gases with a minor fraction of light condensate (C_5–C_{13}), a very light oil, when stabilised at ambient temperature (25 °C) and pressure (1 bar). The current and expected (next five years) components of GEP gas are provided in Table 3-2. GEP gas in dense phase will be achieved through high pressure only; the temperature of the gas within the GEP will be broadly consistent with seabed ambient temperature.

Table 3-2: GEP gas composition (current and expected over next 5 years)

Component	Current composition (Mol %)	Expected highest Plover contribution over next 5 years (Mol %)
Methane (C1)	72.44	73.32
Ethane (C2)	10.38	8.89
Propane (C3)	4.06	3.29
Butane (C4)	1.84	1.52
C5–C7	1.96	1.99
C8–C13	0.11	0.13
Carbon dioxide (CO2)	9.19	11.05
Nitrogen (N2)	0.49	0.49
Water (H2O)	<0.01	<0.01
Hydrogen sulfide (H2S)	<0.01	<0.01

The GEP will typically operate with an inlet pressure of approximately 170 - 210 bar on the offshore end. Due to the 889 km length of the GEP, a significant pressure drop will occur as the gas transits towards the Ichthys LNG Plant, due to frictional losses and because there are no booster compressors along the GEP. The inlet pressure at the Ichthys LNG Plant boundary (the onshore end of the GEP) will typically be between 65 bar and 130 bar. Note that when the pipeline is not flowing, the onshore pressure will settle out at a higher value then during a flowing regime. Conversely the offshore / CPF end of the pipeline will see a pressure decrease compared to a flowing regime. The GEP has a maximum allowable operating pressure of 21 MPa at LAT +25m.

The flow into and out of the GEP is dependent on the CPF and Ichthys LNG Plant production rates. The pressure in the GEP will vary depending on accumulated inventory and will be monitored from the CPF and Ichthys LNG Plant central control rooms (CCRs) respectively.

The GEP inventory during operation is up to 5,900 million standard cubic feet (MMscf). However, prior to a planned maintenance shut-downs, the GEP will be allowed to 'settle-out', where the pressure between the CPF and Ichthys LNG plant beach-valve become effectively equal. The GEP inventory at maximum settle-out pressure is up to 6,200 MMscf.

3.2 Inspection, maintenance and repair (IMR) activities

3.2.1 Inspection

Inspection of the GEP will be conducted in accordance with a risk-based inspection (RBI) schedule.

Inspections of the pipeline will generally involve a vessel travelling along the route of the pipeline using towed acoustic instruments, a ROV connected to the vessel via an umbilical, or an AUV which is launched and recovered from the vessel.

Typically, vessels will be on site for approximately 5 to 60 days per year depending on the type of inspection. Events such as cyclones, known dropped/dragged objects or seismic activity that could affect the GEP may also trigger inspections. Foreseeable inspection activities are detailed in Table 3-3.

Table 3-3: Inspection activities

Inspection activity	Description
ROV/AUV inspections	ROVs/AUVs will be deployed from a vessel to undertake visual, cathodic protection and pipeline integrity inspections.
Marine acoustic surveys	These may include the use of sidescan sonar (SSS) and multibeam echo sounders (MBES) and are typically conducted by towed acoustic instruments or by launching AUVs containing acoustic survey equipment from a vessel.

3.2.2 Maintenance and repairs

Maintenance and repair activities (such as a minor repair involving installation of a clamp) will be conducted based on the results of inspection and monitoring of the GEP. If maintenance or repairs are required, a vessel may remain on site for approximately 15 to 60 days at a time, depending on the nature of the work required.

Should a major repair (spool replacement) be required, the activity of de-pressuring the GEP, including pigging/dewatering/isolation and discharges of GEP contents into the marine environment is within the scope of this EP. However, the actual spool replacement and re-commissioning of the GEP will be managed under another EP, to be submitted to NOPSEMA for review/acceptance, prior to undertaking the spool replacement. Maintenance and repair activities are described in Table 3-4.

Table 3-4: Maintenance and repair activities

Maintenance and repair activities	Description
Maintenance	
Seabed intervention activities	Involves activities such as physical seabed intervention/excavation alongside the GEP infrastructure to gain access to, or enable maintenance and/or repairs including pipeline de-burial. Excavation could involve activities such as jetting, side-casting or mass flow excavation. Seabed intervention activities could include the installation of grout bags, concrete mattresses, rock placement or other physical structures to stabilise, protect and repair infrastructure on the seabed and/or to prevent ongoing erosion of the seabed.
Cathodic protection system maintenance	Involves activities such as the replacement of anodes and cathodic protection equipment. This equipment may be added to, or placed adjacent to the GEP infrastructure using a vessel and ROV spread. Over time, anodes and cathodic protection equipment become naturally depleted and therefore they are not recovered. To retain protection, new anodes will be added by means of an adjacent skid structure. There will be no emissions, discharges, or wastes generated from cathodic protection system maintenance.
Marine growth removal activities	Involves the removal of marine growth and calcareous deposits using mechanical techniques and/or chemical treatments using a vessel and ROV spread.
Repair	
Clamp repair (minor repair)	Minor repairs using clamps may be required following a minor physical impact or integrity issue with the GEP. In the event that a minor/clamp repair is required, the seabed around the GEP may need to be excavated to enable access for the clamp to be placed around the full diameter of the GEP. Alternatively, the GEP may be lifted and grout-bags placed under the GEP. Alternatively, the emergency pipeline repair system (EPRS) may be used to raise the GEP above the seabed to allow access for a clamp repair. The EPRS is a combination of equipment which, when used together, enables a section of the GEP to be lifted above the seafloor and repaired, including clamp repair, or a spool cut out and replacement. Note, spool replacement is outside of the scope of this EP. The EPRS would be deployed from the back deck of a support vessel and supported with ROVs. The EPRS equipment includes: • hydraulic-actuated pipeline lifting frames • pipe preparation tools, including but not limited to grinding and water-jetting equipment • grout injection spread. Once full access to the GEP is achieved, the concrete weight and asphalt enamel coating will be removed using physical removal techniques, such as high-pressure water-jetting. The exposed GEP outer steel surface will then be prepared for the clamp installation. The clamp will then be lowered around the GEP section to be repaired and locked into position.

GEP dewatering	A major repair (spool replacement) may be required following scenarios such as a large physical impact to the GEP (e.g. a dragging anchor deforming or rupturing the pipe) or an inspection PIG stuck inside the GEP. While spool replacement and re-commissioning of the GEP is outside of the scope of this EP, the isolation of the GEP, prior to spool replacement, remains within the scope of this EP. In the event that a major repair is required, generally the following activities would be undertaken to isolate the GEP: Step 1: Upon detection of a significant defect and/or loss of hydrocarbons, the CPF export compression to the GEP would be shut down and Ichthys LNG Plant production maximised, followed by flaring, to reduce the GEP line-pack. If there is a rupture, seawater would flow into the GEP defect opening and the GEP would naturally depressurise to seabed ambient pressure over several days to a week. Step 2: To minimise the risk of corrosion of the GEP, it is imperative to dewater the GEP as soon as possible (GEP passivation). This will be achieved by launching dewatering PIG trains from the GERB and the Ichthys LNG Plant in Darwin. The PIGs will be driven by seawater which has been treated via physical filtration, ultraviolet (UV) sterilisation and a chemical oxygen scavenger. The PIG trains will move towards the rupture location, resulting in the discharge of all residual GEP gas, condensate and seawater, via the rupture location, into the marine environment. The PIG trains will typically involve 8 PIGs, with 1000 m^3 of freshwater slugs and 500 m^3 of MEG slugs. Note, there are no plans to discharge the freshwater or MEG slugs into the Commonwealth marine environment. Once the PIG trains have arrived at the rupture location and the GEP has been pacified and isolated to prevent any further seawater ingress, the next activity would be the spool replacement (managed under a new EP). Therefore, the arrival of the PIGs and successful isolation at the rupture location is considered the end of the major repair activity under this EP. Note, the flooding spread (pumps, compressors, filtration, UV sterilisation and oxygen scavenger chemical injection system, and all associated emissions and discharges) are within the scope of this EP. However, as the floating vessel/barge will be at the CPF/GERB location inside the Ichthys Field, the 'vessel' components, including vessel emissions and discharges, will be managed under the Ichthys Offshore Facility (Operation) EP. The onshore flooding spread (pumps, compressors, filtration, UV sterilisation and oxygen scavenger chemical injection system) located at the Ichthys LNG Plant, and all associated emissions/discharges will be managed under the Ichthys LNG Operations Environmental Management Plan. However, the risks/impacts associated with the treated seawater in the GEP within Commonwealth waters is under the scope of this EP. Note, following the major repair (spool replacement), all GEP contents (treated seawater), will be sent to the Ichthys LNG Plant for treatment/disposal, under the Ichthys LNG Operations Environmental Management Plan, and in accordance with NT regulations. There are no plans to discharge any treated seawater in Commonwealth waters. For reference, emissions and discharges managed under this EP are defined in Section 3.5.

3.2.3 Vessel activities

Vessel IMR activities could occur at any time during the petroleum activity. Vessels used for IMR activities are expected to range between approximately 30 m and 130 m in length. However, vessel type and specifications will depend on availability and specific activity requirements. All maintenance and repair vessels will operate using dynamic positioning (DP) preventing the need for anchoring (except in vessel safety related emergency situations). Inspection vessels conducting marine acoustic surveys will not be required to be DP vessels; however, neither will they anchor while conducting the petroleum activity.

Vessels will use Group II fuel (marine gas oil – MGO). Lifting and transfer of equipment and supplies between vessels may be required in the operational area.

It is possible that during an IMR campaign crew transfers may be undertaken by helicopter.

3.3 Operational area

The GEP is approximately 889 km long, with approximately 790 km located within Commonwealth waters, between the Ichthys Field and the NT coastal waters (3 nm) boundary (Figure 1-1). The operational area for the petroleum activity is defined as a two-kilometre wide corridor, 1 km either side of the GEP centreline. This corridor is considered to be the area within which any repair activity may interact with the seabed.

Water depths along the GEP route range from approximately 250 m at the Offshore Facility end of WA-22-PL through to approximately 30 m in the shallowest location at the NT coastal waters limit of NT PL/4.

3.4 Decommissioning

This EP is the first 5-year EP revision for the operation of the GEP and covers the next 5 years of the expected 40-year Ichthys Field life. INPEX as the titleholder recognises the requirement for the maintenance and removal of structures, equipment and property brought into WA-22-PL and NT PL/4, as specified by Section 572 of the OPGGS Act (Maintenance and removal of property etc. by titleholder).

Maintenance and removal of infrastructure described in this EP (Table 3-1) will be undertaken in accordance with the requirements of the OPGGS Act and the OPGGS (Resource Management and Administration) Regulations 2011 and NOPSEMA's Section 572 Maintenance and removal of property policy (NOPSEMA 2020a).

In preparation for the eventual decommissioning of Ichthys Project infrastructure, INPEX has developed a Decommissioning (Environmental) Standard (0000-AH-STD-60049) to define the business rules that will be implemented to eliminate or minimise any adverse environmental or social impacts from decommissioning activities. The impacts from decommissioning activities will be reduced to levels that are ALARP through robust and effective planning, management and monitoring practices.

Inspection, maintenance and repair activities will be undertaken as described in Section 3.2 in order to ensure that all property and equipment is maintained in a state that ensures it can be removed safely at the end of its life. Assurance of the ongoing integrity of the GEP and further details on maintenance and inspections with respect to asset integrity management over the whole lifecycle of the asset is described in Section 9.6.4.

All subsea assets including the GEP have associated inspection tasks which are implemented in a database (SAP) for routine actioning and tracking. All corrective maintenance activities are undertaken in accordance with the findings/anomalies from the routine inspection or identified failures which are captured in INPEX's subsea integrity and inspection management tool, COABIS. COABIS is the controlled source of information (codes and reference data) to maintain consistency for the capture and reporting of all subsea IMR activities and anomalies, any corrective actions are logged in SAP. The system is also used to catalogue and archive ROV and diver footage that has been recorded.

3.5 Summary of emissions discharges and wastes

A summary of the various emissions, discharges and wastes associated with the petroleum activity are presented in Table 3-5.

Table 3-5: Emissions (E), discharges (D) and wastes (W) associated with the petroleum activity

Source	E, D, W	Description
Power generation e.g. vessel engines	E	Combustion gas emissions from diesel-powered engines are emitted to the atmosphere via an exhaust stack.
	E	Acoustic emissions from vessel engines and propulsion systems (such as DP thrusters).
Survey equipment	E	Acoustic emissions from marine acoustic equipment (SSS and MBES).
Seabed intervention activities – sealing clamps and use of grout bags	D	Minor losses of grout may occur (typically less than 1 m^3).
IMR - marine growth removal	D	Use of weak acids (acetic acid/sulfamic acid) to remove residual marine growth / calcium deposits.
Minor repair – discarded material from GEP	W	Small steel shavings, asphalt enamel, concrete weight coating removed from GEP surface using physical removal techniques
GEP passivation discharges	D	GEP passivation involves the use of PIGs trains to drive residual GEP gas, condensate and seawater out of the GEP, via a rupture location. Driving the PIG trains may also require physical filtration/sediment backflush to sea (returning sediment particles back into the marine environment from which they came).
Seawater cooling	D	Seawater used as heat-exchange medium for machinery engines. Return seawater containing residual heat and residual sodium hypochlorite is returned to sea.
Vessel deck drainage	D	Vessel deck drainage water may be discharged to sea.
Bilge system	D	Treated contaminated bilge water with <15 ppm (v) oil-in-water (OIW) is discharged to sea.

Source	E, D, W	Description
Sewage, grey water and macerated food waste effluent	D	Treated effluent produced by vessel sewage treatment plants and macerated food waste is discharged to sea.
Ballast system	D	Return ballast from vessels is discharged to sea.
Foam fire-extinguishing	D	Firefighting foam is routed to the open-drains/ deck drainage system of vessels and may be released to sea in the event of system deployment. Minor quantities of wind-blown foam may also be released. (Note no planned discharges from system testing will occur during the activity)
Deck wash	D	Deck wash used to clean vessel decks is discharged to sea.
Desalination brine	D	Brine produced from the Reverse Osmosis (RO) process will be diluted and discharged to sea.
Fresh/potable water	D	Saline reject-water stream will be discharged to sea.
Waste incineration	E	Combustion gas emissions from on board incineration of permitted wastes.
	W	Ash from incinerators will be stored as waste for disposal on the mainland.
Sundries / miscellaneous	E	Combustion gas emissions from diesel-powered equipment engines (e.g. crane engines, temporary generators).
	E	Light emissions from deck and navigation lights on vessels.
	W	Solid and liquid wastes from general maintenance operations, equipment replacement, etc., and domestic wastes are transported to the mainland for disposal.

4 EXISTING ENVIRONMENT

4.1 Regional setting

Pipeline licences associated with the GEP, WA-22-PL and NT/PL4, intersect the Browse and Bonaparte Basins in the waters of northern Australia. 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 pipeline licence 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 2019a). This considered the worst-case credible hydrocarbon scenarios identified for the activity for surface hydrocarbons, shoreline accumulations of oil, and entrained oil and dissolved aromatic hydrocarbons in the water column (Section 7.8). 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 B). In addition, an EPBC Act Protected Matters search was undertaken for the operational area (GEP route including a 1km buffer either side of the centreline) and is also presented in Appendix B.

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 2019a). 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 ecological sensitive receptors such as fauna and habitats (refer Section 8, Table 8-2).

The resulting PEZ and EMBA from the oil spill modelling are the sum of overlaid stochastic modelling runs for worst-case spill scenarios, 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 to facilitate their management by the Australian Government under the EPBC Act. The pipeline licence areas are located within the North-west Marine Region (NWMR) and North Marine Region (NMR). The relevant key features of the NWMR and NMR are further described in subsequent sections of this EP.

North-west Marine Region

The NWMR comprises Commonwealth waters, from the WA–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 International waters

A small portion of the northern boundary of the PEZ extends into Indonesian waters; however, there is no predicted contact with Indonesian shorelines. Indonesian waters 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 4.6.2).

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 GEP overlaps four KEFs, and a further five are located within the PEZ (Figure 4-1; Appendix B) as follows:

Operational area (along the GEP route):

- Ancient coastline at 125 m depth contour
- Carbonate bank and terrace system of the Sahul Shelf
- Continental slope demersal fish communities
- Pinnacles of the Bonaparte Basin.

PEZ:

- Ashmore Reef and Cartier Island and surrounding Commonwealth waters
- Mermaid Reef and Commonwealth waters surrounding the Rowley Shoals
- 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.

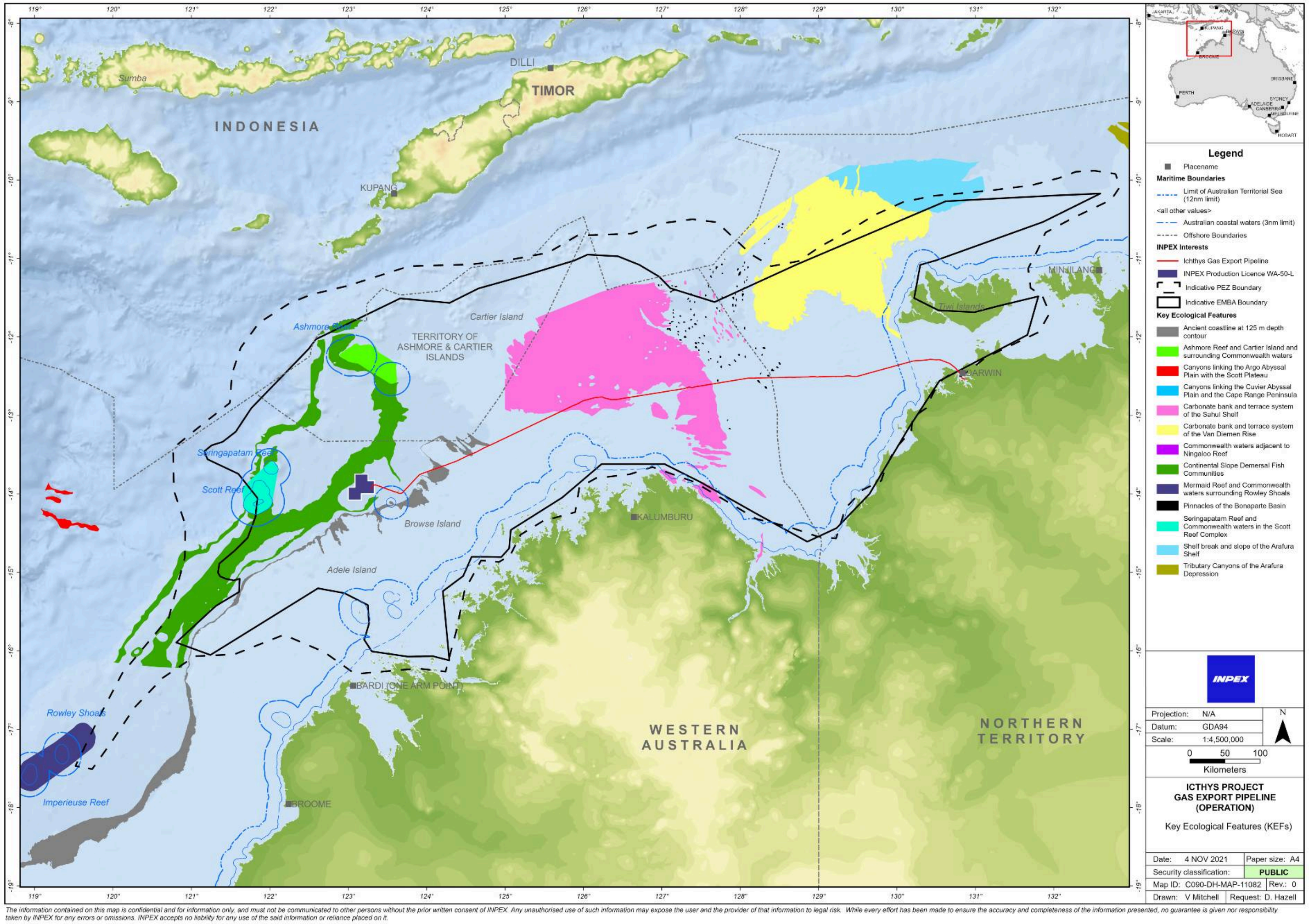

Figure 4-1: Key ecological features in north west Australia (showing PEZ and EMBA)

4.2.1 Ancient coastline at 125 m depth contour

The ancient coastline runs diagonally in a north-easterly direction and is traversed by the GEP as shown in Figure 4-1. 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 North West Shelf (DSEWPaC 2012a).

4.2.2 Carbonate bank and terrace system of the Sahul Shelf

The carbonate bank and terrace system of the Sahul Shelf is located in the western Joseph Bonaparte Gulf and is traversed by the GEP as shown in Figure 4-1. It is recognised for its biodiversity values (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 between 150 and 300 m deep. 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 provide 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.

4.2.3 Continental slope demersal fish communities

The continental slope demersal fish communities KEF, at its nearest point is approximately 20 km from the GEP (Figure 4-1). 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 2021a). 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, deepwater sharks, large squid and toothed whales (Brewer et al. 2007). Pelagic production is phytoplankton based, with hot spots around oceanic reefs and islands (Brewer et al 2007).

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 this 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 2021a).

4.2.4 Pinnacles of the Bonaparte Basin

The pinnacles of the Bonaparte Basin KEF is traversed by the GEP as shown in Figure 4-1. It should be noted that the GEP route has been designed to avoid any significant seabed features and the GEP route does not traverse any large pinnacles.

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). There are three individual pinnacles within 2km of the GEP route, the closest of which is, at its nearest point, >1.75 km from the GEP route centreline.

The pinnacles of the Bonaparte Basin represent 61% of the limestone pinnacles in the NWMR and 8% of limestone pinnacles in the Australian exclusive economic zone (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. Freshwater and green sawfish as well as humpback whales may also occur in the area (Donovan et al. 2008). However, sawfish are more likely to be found in nearshore and estuarine areas, not within the areas of the KEF that intersect the GEP (open ocean environment).

4.2.5 Ashmore Reef and Cartier Island and surrounding Commonwealth waters

This KEF is located 175 km north of the GEP at its closest point. It 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 values and sensitivities of this KEF have been described in Section 4.3, which describes AMPs and also Section 4.5 which describes the Ashmore Reef National Nature Reserve Ramsar site.

4.2.6 Carbonate bank and terrace system of the Van Diemen Rise

The carbonate bank and terrace system of the Van Diemen Rise KEF is located north-west of the Tiwi Islands (the two principal islands of which are Melville Island and Bathurst Island). This KEF is located approximately 35 km from the GEP at its closest point. This 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 over 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), and 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).

4.2.7 Mermaid Reef and Commonwealth waters surrounding the Rowley Shoals

The Mermaid Reef and the Commonwealth waters surrounding Rowley Shoals KEF is located approximately 475 km south-west of the GEP, at its closest point (Figure 4-1). 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 Seringapatam Reef and Commonwealth waters in the Scott Reef complex

This KEF comprises Seringapatam Reef, North Scott Reef and South Scott Reef and is approximately 140 km west of the GEP at its nearest point. Scott and Seringapatam reefs are part of a series of submerged reef platforms that rise steeply from the sea floor. The total area of this KEF is approximately 2418 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). North Scott Reef 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 with its lagoon covers an area of 106 km^2. South Scott Reef is a large crescent-shaped formation with a double reef crest. The reef with its lagoon covers an area of 144 km^2 (DSEWPaC 2012a).

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 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 South Scott Reef. 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).

4.2.9 Shelf break and slope of the Arafura Shelf

The shelf break and slope of the Arafura Shelf KEF is located approximately 200 km north of the GEP, at its closest point (Figure 4-1). 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).

4.3 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 Conservation of Nature (IUCN) 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.

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 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. The operational area overlaps the southern-most boundary of the Oceanic Shoals AMP in an area categorised as 'Multiple Use Zone VI' (Figure 4-2; Appendix B). The AMPs and the IUCN categories that overlap the PEZ 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)
Oceanic Shoals		X	X		X		X
Arafura					X		
Argo-Rowley Terrace					X		
Ashmore Reef	X			X			
Cartier Island	X						
Joseph Bonaparte Gulf					X	X	
Kimberley		X	X		X		
Mermaid Reef		X					

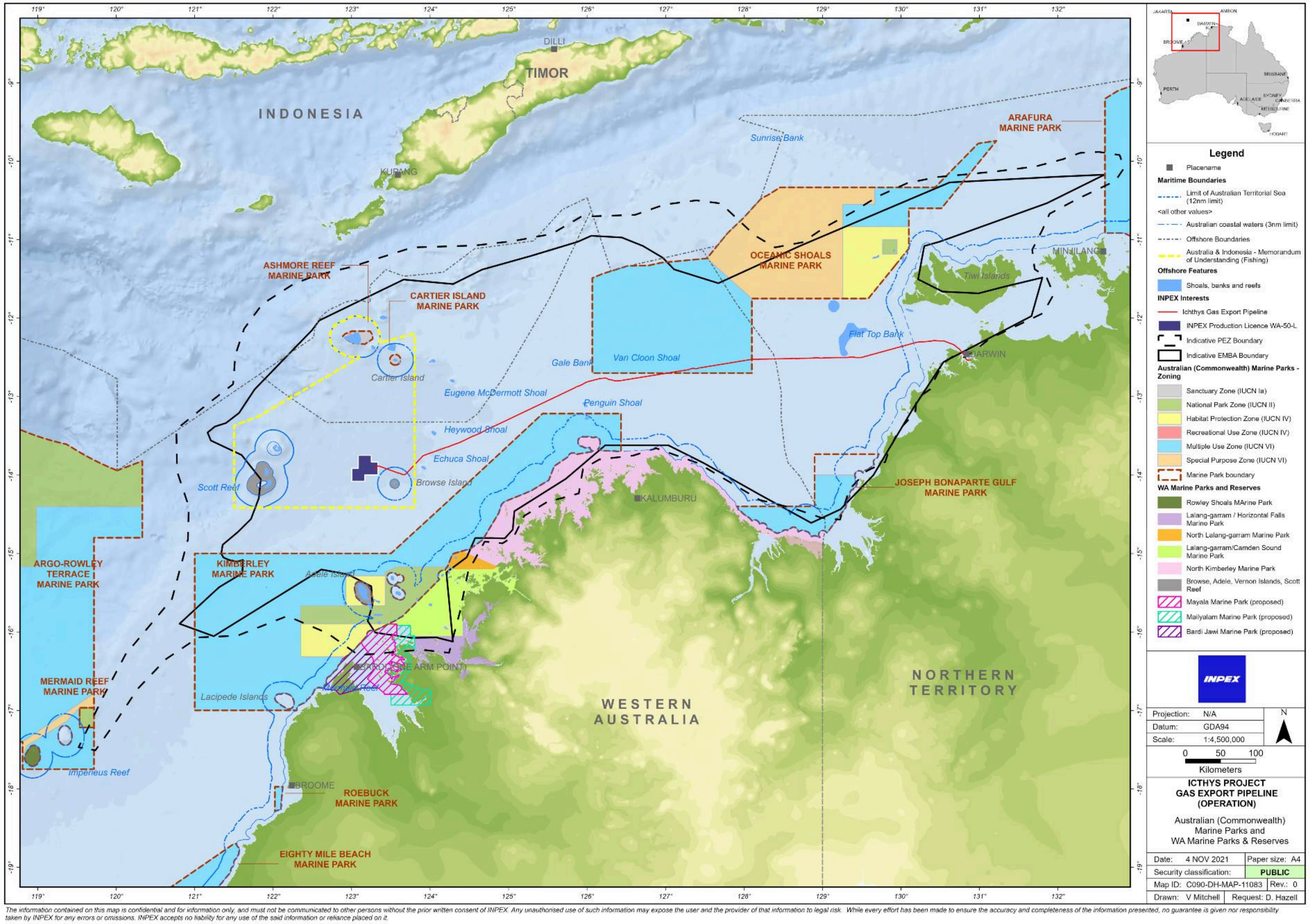

Figure 4-2: Australian and state/territory marine parks, reserves, banks and shoals

4.3.1 Oceanic Shoals MP

The GEP traverses the southern edge of the Oceanic Shoals MP in an area classified as Multiple Use Zone VI by the IUCN. The MP occupies an area of approximately 72,000 km^2 with water depths from less than 15 to 500 m (Parks Australia 2021a). The Oceanic Shoals MP is the largest marine park in the NMR and also overlaps the NWMR.

The reserve 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).

Several KEFs are present in the reserve including the carbonate bank and terrace system of the Van Diemen Rise, Pinnacles of the Bonaparte Basin and shelf break and slope of the Arafura Shelf. These KEFs are previously described in Section 4.2.

4.3.2 Arafura MP

The Arafura Marine Park in the NMR is Australia's most northerly marine park (MP) and covers an area of approximately 23,000 km^2 (Parks Australia 2021b). The boundary of Arafura MP borders Australia's EEZ and is located approximately 220 km north east of the GEP at its closest point. 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 MP (Director of National Parks 2018b).

Marine life found in the MP includes Spanish mackerel, whale sharks, sawfishes as well as marine turtles and deep-sea sponges (Parks Australia 2021b).

4.3.3 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 2021c). Its eastern boundary is approximately 375 km from the GEP.

The reserve 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). The Mermaid Reef and Commonwealth waters surrounding the Rowley Shoals KEF is contained within this AMP and is previously described in Section 4.2.7.

4.3.4 Ashmore Reef MP

Ashmore Reef MP is in the NWMR and is located 175 km north of the GEP. It covers an area of 583 km^2 and the site is also a designated "wetland of international importance" under the Convention on Wetlands of International Importance (Ramsar Convention) especially as Waterfowl Habitat (Parks Australia 2021d) (Section 4.5.1).

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 2021d; Director of National Parks 2018a).

4.3.5 Cartier Island MP

Cartier Island MP is located in the NWMR approximately 135 km north of the GEP and covers an area of 172 km^2 (Parks Australia 2021e). The reserve includes Cartier Island and the area within a 4-nautical mile-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 2021e). 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 4.2.5).

4.3.6 Joseph Bonaparte Gulf MP

The Joseph Bonaparte Gulf MP is located in the NMR, approximately 135 km south of the GEP, on the WA-NT waters border. It occupies an area of approximately 8,600 km^2 with water depths ranging from less than 15 to 100 m (Parks Australia 2021f).

Key conservation values of the reserve include (Parks Australia 2021f; 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 North West Shelf 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 (enhanced productivity, high biodiversity, and unique seafloor feature) is partly located within this AMP.

4.3.7 Kimberley MP

The Kimberley MP is located approximately 115 km to the south and east of the GEP and occupies an area of approximately 74,500 km^2 (Parks Australia 2021g).

This MP provides an important migration pathway and nursery areas for the protected humpback whale, 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 2021g).

Two KEFs are included in the AMP, namely the 125 m Ancient Coastline and the Continental slope demersal fish communities, both previously described in Section 4.2.

4.3.8 Mermaid Reef MP

The Mermaid Reef MP is located approximately 475 km south-west of the GEP and is near the edge of Australia's continental slope, surrounded by waters that extend to a depth of over 500 m. Mermaid Reef MP covers an area of approximately 540 km^2 and is the most north-easterly of three reef systems forming the Rowley Shoals (Parks Australia 2021h). 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 2021h; Director of National Parks 2018a).

4.4 State and Territory reserves and marine parks

There are no State or Territory MPs/reserves that intersect the GEP (Appendix B). However, the EPBC Act Protected Matters search identified a total of 21 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)
- Bardi Jawi (WA)
- Browse Island (WA)
- Buffalo Creek (NT)
- Casuarina (NT)
- Channel Point (NT)
- Charles Darwin (NT)
- Dambimangari (WA)
- Djukbinj (NT)
- George Brown Darwin (NT)
- Holmes Jungle (NT)
- Low Rocks (WA)
- Marri-Jabin (Thamurrurr – Stage 1) (NT)
- Shoal Bay (NT)
- Tanner Island (WA)
- Tree Point Conservation Area (NT)

- Unnamed WA28968 identified as Caffarelli Island
- Unnamed WA41775 identified as Browse Island
- Unnamed WA44669 identified as Tanner Island
- Unnamed WA44673 identified as Adele Island
- Uunguu.

Of these reserves, three are Indigenous Protected Areas (IPAs); Bardi Jawi IPA, Dambimangari IPA and the Uunguu 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 4.9.3.

Further research and investigation of the Collaborative Australian Protected Areas Database (CAPAD 2020) for the State/Territory reserves and MPs listed in Appendix B 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 BIAs have been declared.

The EPBC Act Protected Matters search report (Appendix B) 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 160 km from the GEP at its closest point.

It is a hook-shaped island off the central Kimberley coast, located around 97 km north-northwest of Cape Leveque. 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 in the Browse Basin, reported 12 species of seabird were found to breed at Adele Island in the 2014/2015 season. 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 reserve (Clarke 2015).

4.4.2 Browse Island Nature Reserve

Browse Island is the nearest landform to the GEP situated 15 km away and is a Class ‘C’ nature reserve. It is an isolated sand cay surrounded by an intertidal reef platform and shallow fringing reef. The purpose of this reserve (No. 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. The 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 surrounding the Island (Heyward et al. 2019). Benthic cover transitions to hard and soft coral communities at deeper (40-60 m) depths around the 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 on the island 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. Further, the island (inclusive of a 20 km buffer) has been classified as critical habitat for green turtles from November to March under the Recovery Plan for Marine Turtles in Australia (DEE 2017a). It is thought that 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 the island in a colony of approximately 1,000 birds (Olsen et al. 2018). Browse Island has also been recognised, through previous stakeholder consultation between INPEX and the WA DBCA, as an important location for seabirds.

4.4.3 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 (LWM). It has an approximate area of 117 km^2. This encompasses much of the South Scott Reef 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 4.2.8. 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 (DEE 2017a).

4.4.4 Lalang-garram/Camden Sound MP

The Lalang-garram / Camden Sound MP is located in the Buccaneer Archipelago of the Kimberly coast, approximately 145 km from the GEP at its closest point. The MP covers an area of approximately 7,050 km^2 (DPaW 2013a). The MP 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 WA DBCA and the Traditional Owners.

The 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 MP 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 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 MP, which are subject to the JAMBA, CAMBA and ROKAMBA migratory bird agreements and are listed as migratory species under the EPBC Act (Appendix B). 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).

4.4.5 North Kimberley MP

The North Kimberley MP is located approximately 65 km south of the GEP at its closest point. This park extends all the way from the northern boundary of the Camden Sound MP to the Northern Territory border (DPaW 2016a). The MP is the second largest marine park 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 MP with extensive seagrass habitat (Waples et al. 2019). The 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 this park. 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 park's management plan (DPaW 2016a).

4.4.6 North Lalang-garram MP

The North Lalang-garram Marine Park located 128 km south of the GEP, includes the waters from the edge of Cape Wellington (WA mainland) to the WA state waters boundary, 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. This parks geology, wide variety of habitats, ecological values and sensitivities (DPaW 2016b) are virtually identical to that described for the North Kimberley MP (Section 4.4.5).

4.4.7 Propose Mayala MP

The proposed Mayala MP is located approximately 200 km south of the GEP and will cover an area of approximately 3,150 km^2. It is located in the Buccaneer Archipelago within the Kimberley region of WA, approximately 200 km north east of Broome and it is proposed that the MP will be reserved as a 'Class A' MP providing the highest level of protection (DBCA 2020a).

The proposed 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 4.4.8 and Section 4.4.9 respectively. The proposed MP comprises an extensive network of hundreds of islands. No terrestrial areas are included within the proposed MP but intertidal areas to the high-water mark are included (DBCA 2020a).

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

4.4.8 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 220 km south of the GEP, the proposed MP covers an area of 2,040 km^2. It is proposed that the MP will be reserved as a 'Class A' MP providing the highest level of protection (DBCA 2020b).

The proposed 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 nautical miles from the territorial baseline) and includes intertidal areas to the high-water mark. The southern boundary of the proposed MP is situated approximately 160 km north of Broome (DBCA 2020b).

Similar to the adjacent proposed Mayala MP 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 marine park 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 MP also provide optimal conditions for commercial activities such as pearling, aquaculture and commercial fishing.

The proposed 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).

4.4.9 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 marine park borders the proposed Mayala MP (Section 4.4.7) 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 MP (DBCA 2020c)

Located approximately 200 km south of the GEP, the proposed MP covers an area of 470km^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 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 MP include diverse filter-feeding communities of sponges and hard and soft corals. The intertidal and subtidal habitats of the 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 Wetlands of conservational significance

4.5.1 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 PEZ and is approximately 175 km north of the GEP (Figure 4-9).

The reserve covers an area of 583 km^2 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 (DAWE 2021b; 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 above in Section 4.3.4.

4.5.2 Adelaide River floodplain system

The Adelaide River Floodplain system is a nationally important wetland which includes the entire floodplain of the Adelaide River in the coastal Darwin region (DAWE 2021c). It is located approximately 65 km to the east of the GEP at its closest point (Figure 4-9).

The site is one of the most important breeding areas in Australia for the Magpie Goose (*Anseranas semipalmata*), a major breeding area for Saltwater Crocodile (*C. porosus*), herons and allies and a major dry season refuge area for waterbirds (magpie geese, ducks, herons). The wetland also provides a significant migration stop-over area for shorebirds (DAWE 2021c).

4.5.3 Finness Floodplain and Fog Bay Systems

The Finniss Floodplain and Fog Bay System is an example of a beach-fringed curved bay with continuous intertidal mudflats (DAWE 2021d). It is located approximately 80 km to the south west of the GEP at its closest point (Figure 4-9).

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 2021d). This site is also recognised as an important bird area (IBA) with the intertidal mudflats of Fog Bay reported to support many species of shorebird and waterbird colonies (BirdLife International 2021a).

4.5.4 Port Darwin

Located south of Darwin, this site includes the entire embayment (where less than 6 m deep at low tide) of Port Darwin, to the high water mark. It covers an area of 488 km^2 which includes 160 km^2 of mangroves (DAWE 2021e). This wetland is adjacent to where the GEP enters Darwin Harbour.

The site is considered a good example of a shallow branching embayment and supports one of the largest discrete areas of mangrove swamp in the NT. In turn this supports migratory shorebirds. Additionally, the wetland is a major nursery area for estuarine and offshore fish and crustaceans (DAWE 2021e).

4.5.5 Shoal Bay – Micket Creek

The Shoal Bay - Micket Creek wetlands are situated approximately 10 km immediately north-east of the City of Darwin and includes King Creek and Noogoo Swamp. Covering an area of approximately 16 km^2 the site comprises of wetland marshes, mangrove woodlands, beaches, mudflats, creeks and estuaries (DAWE 2021f). It is located approximately 25 km to the east of the GEP at its closest point (Figure 4-9).

The spring fed coastal wetland system provides significant bird habitat. High numbers of migratory shorebirds regularly use the mudflats and intertidal feeding sites. The most common of these birds are the Little Whimbrel *Numenius minutus*, Greenshank *Tringa nebularia*, Sharp-tailed Sandpiper *Calidris acuminata*, Bar-tailed Godwit *Limosa lapponica*, Black-tailed Godwit *Limosa limosa*, Great Knot *Calidris tenuirostris*, Greater Sand Plover *Charadrius leschenaultia* and Red-necked Stint *Calidris ruficollis*. The area is also notable for the nationally endangered Little Tern *Sterna albifrons*.

4.5.6 Yampi Sound Training Area

Identified as a Nationally Important Wetland, Yampi Sound Training Area is located 140km north of Derby in the Kimberley Region of WA. The area covers approximately 5,660 km^2 and contains coastal habitats such as mangroves and low-lying coastal flood plains (DAWE 2021g). Several bird species have been recorded in the area including the Little Tern (*Sternula albifrons*) (DAWE 2021g).

4.6 Physical environment

4.6.1 Climate

Air temperature

Air temperatures recorded at Browse Island shows a maximum temperature of 33.3 degrees Celsius (°C) and a minimum of 21.6 °C (BOM 2021). 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 the north 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 northern wet 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 GEP 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 2021). Rainfall intensity at the Ichthys Field is expected to range from approximately 215 mm/h to 460 mm/h over a 5-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 GEP. 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.

4.6.2 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).

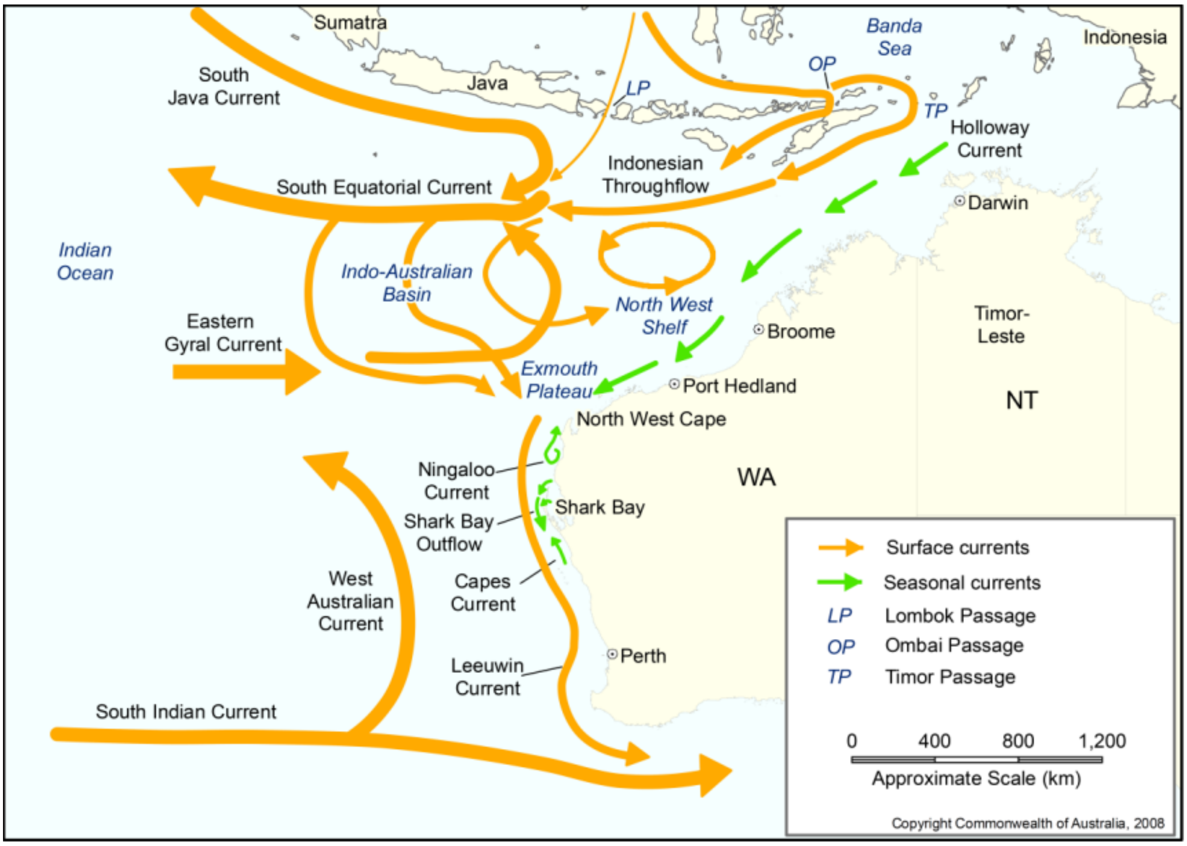

Figure 4-3: Surface currents for WA waters

Tides

The tides 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.

In the eastern section of the GEP route, closest to Darwin, the area is influenced primarily by strong diurnal tidal flows and less by ocean currents. The Joseph Bonaparte Gulf (south east of the GEP route) is subject to the highest tidal range in the region (up to 7–8 m).

Mean sea level in the vicinity of the Ichthys Field is about 2.7 m above lowest astronomical tide (LAT) with a spring tidal range of about 5.0 m.

Waves

The sea wave climate within the Ichthys Field reflects the seasonal wind regime, with waves predominantly from the west in summer and from the east in winter.

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 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.

Bathymetry and seabed habitats

Water depths along the GEP route range from 275 m at LAT in WA-50-L to 30 m at the NT coastal waters (3 nm) boundary.

Studies using sub-bottom profiling, MDES and SSS have been undertaken by INPEX at the Ichthys Field and 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.

Along the GEP route specifically, benthic habitats at 18 sites from the Ichthys Gas Field to Darwin Harbour were characterised based on results of drop-camera surveys (URS 2008). The 18 drop-camera locations were selected based on results from previous geophysical and geotechnical surveys of the GEP route undertaken in 2008 (Neptune Geomatics 2009). The drop-camera locations selected (shown in Figure 4-4) were identified areas of geological and bathymetric interests that may support notable habitat and associated biota.

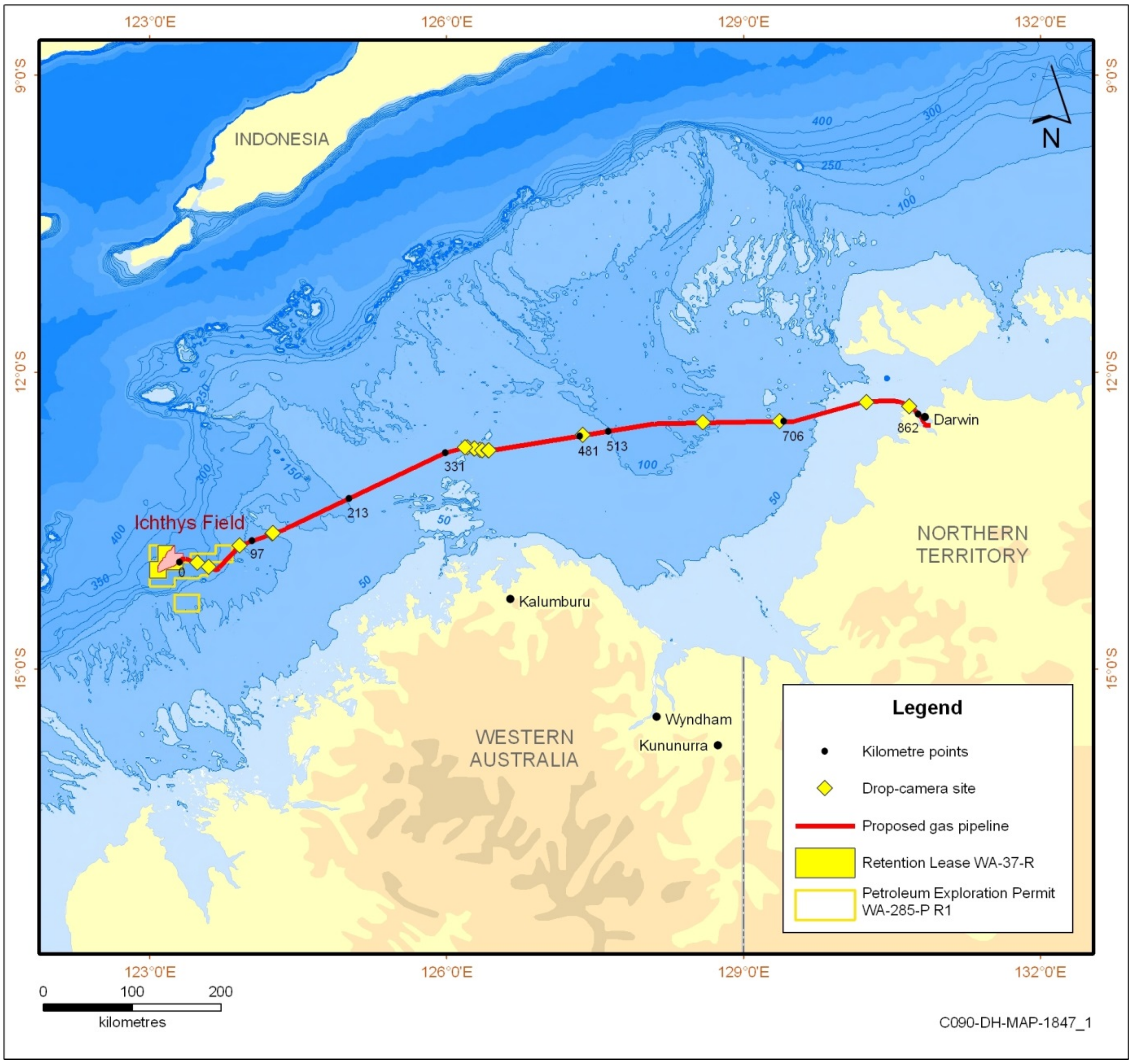

Figure 4-4: GEP route drop-camera survey locations

The majority of the GEP route (>98%) encompasses featureless, unconsolidated clay, silts and sands, with the most dominant seabed features being areas of pockmarks and sand waves. Detailed descriptions of the seabed geology (Neptune Geomatics 2009) and associated biota identified through the drop-camera survey (URS 2008) are provided below. A benthic habitat description of Darwin Harbour and nearshore areas from (Kilometre Point (KP) 862 to KP 790) has also been provided for completeness; however, this area is beyond the scope of this EP.

- KP 862 to KP 706 – The seabed along this section of the route is largely characterised by featureless clay/silt sands with areas of megaripples (KP 799–804) and sand waves up to 4.9 m high. Water depths vary from 11 m to 70 m. Drop-camera stations 1 and 2 were located at KP 848 and KP 799 respectively.
- KP 706 to KP 513 – The seabed along this section of the route is characterised by featureless clay/silt sands dominated by low (<10 per 10,000 m^2) density pockmarks (5–10 m in diameter). Water depths vary from 63 m to 110 m. Drop camera stations 3 and 4 were located KP 701 and KP 617 respectively.
- KP 513 to KP 481 – In this zone, calcarenite subcrop causes the seafloor to be very rugged in places, with a 1 km wide paleochannel between KP 483 and KP 484. Small outcrops are present either side of the paleochannel, in which water depths are typically 80–85 m. The subcrop areas are flanked by clay/silt sand, interspersed with sandy gravel patches with a few pockmarks (>5 m diameter). Drop-camera station 5 at KP 484 is located within the Oceanic Shoals AMP (refer Section 4.3.1) and within the carbonate bank and terrace system of Sahul Shelf KEF (refer Section 4.2.2).
- KP 481 to KP 331 – The seabed along this section of the route is typically comprised of gently sloping, featureless fine to coarse sands with occasional areas of ridged calcarenite subcrop up to 3.4 m high (KP 361–374.5), with scattered outcrops. A scarp slope of cemented outcrop (maximum gradient of 7.2°) around KP 379 forms the western side of a 3 km wide paleochannel, where the water depth reaches nearly 90 m. There are isolated outcrop areas within the paleochannel. Eight drop-camera stations (stations 6 to 13) were included between KP 352 and KP 379 in order to investigate the various areas of hard substrate. All eight drop-camera stations were located within the carbonate bank and terrace system of Sahul Shelf KEF (refer Section 4.2.2).
- KP 331 to KP 213 – The seabed along this section of the route is characterised by featureless fine to coarse sands with occasional patches of a gravely matrix and dense (>10 per 10,000 m^2) pockmarks. No substantial areas of outcrops or hard substrate are present, and therefore no drop-camera stations were located in this section.
- KP 213 to KP 97 – Along this section, the seabed slopes gently downwards from a depth of 84 m to 136 m. The seabed is dominated by fine to coarse sands with both low (<10 per 10,000 m^2) and high (>10 per 10,000 m^2) density pockmarks (5–10 m in diameter). An isolated area of megaripples (0.15 m crest height and 9 m wavelength) is present between KP 112–120, with some relatively small patches (1 km) of low relief subcrop evident. An area of subcrop, with small outcrops in the shallower parts (106–112 m), is present around KP 187. Drop-camera stations 14 and 15 were selected to examine this outcropping. These particular drop-camera stations are located within / adjacent to the ancient coastline at 125m Depth Contour KEF (refer Section 4.2.1).
- KP 97 to KP 0 – The majority of the gently downward sloping seabed (136 m to 250 m) is comprised of rippled fine to coarse sands with an occasional gravely matrix existing as a veneer overlying more consolidated cemented calcarenite. Areas of megaripples, up to 5 m high, are present in this zone. A single calcarenite outcrop (3 m high, approximately 600 m long and 200 m wide) at KP 36.5 is the only notable

hard substrate area recorded from the geophysical / geotechnical survey within this section. Drop-camera sites 16, 17 and 18 were located within this zone.

In summary, a range of benthic communities, linked mainly to substrate type and water depth, were identified during the drop camera survey. Feather stars were the most commonly seen species on the several rocky outcrops surveyed. Sea pens, sea fans, sea whips, soft corals, bryozoans, hydroids, and sponges were also recorded on the soft substrate in several locations. In general, benthic communities of ecological interest along the GEP route are sparsely distributed and are mainly associated with harder substrates, which are only present along 2% of the GEP route with the only substantial areas of subcrop recorded between KP 361–374 and KP 482–513. Species richness and abundance of individuals decreased with increasing distance from land and with increasing water depth (INPEX 2010).

Water quality

Offshore surface waters are typically oligotrophic. This has been confirmed by studies recording low nitrate concentrations and low phytoplankton abundance. 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. 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.
- 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.
- 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 Ichthys Project Offshore Facility (Operation) EP Liquid Effluent Management Plan, to detect changes in water quality attributable to liquid discharges from the CPF and FPSO. 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: Water quality parameters in the vicinity of the Ichthys Field and GEP route

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). Sampling undertaken in 2019, found the vertical salinity profiles of various sites sampled within and around the CPF and FPSO 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 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.

Parameter	Description
	Light attenuation coefficients calculated from photosynthetically active radiation (PAR) measurements ranged from 0.026 to 0.043 in October and December 2006, and 0.048 to 1.09 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).
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 (ADWG) 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 (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 LLR (Jacobs 2019).

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. 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 Venturer* 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, as part of the Ichthys Project Offshore Facility (Operation) EP Liquid Effluent Management Plan, to detect changes in surficial sediment quality attributable to liquid discharges from the CPF and FPSO. 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: Sediment quality parameters in the vicinity of the Ichthys Field and GEP route

Parameter	Description
Particle size distribution (PSD)	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 (Jacobs 2019).
Petroleum hydrocarbons	Concentrations of BTEX and 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 LLR 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 sediment quality guidelines values (SQGV) (ANZG 2018), with the majority also below their respective LLR (RPS 2007). Organometallics (i.e. tributyltin (TBT)) 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 SQGV indicating no significant change to sediment quality has occurred as a result of the FPSO discharges (Jacobs 2019).

Underwater noise

The Centre for Marine Science and Technology (CMST) 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 NWMR and NWR bioregion as a whole.

4.7 Biological environment

4.7.1 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 the Ichthys Field and GEP route, 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 in 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).

4.7.2 Benthic communities

Banks and shoals

There are many shoals that occur within the region (Figure 4-2). The banks and shoals located in proximity to the operational area include:

- Echuca Shoal (approximately 9 km from GEP)
- Eugene McDermott Shoals (approximately 38 km from GEP)
- Flat Top Bank (approximately 3 km from GEP)
- Gale Bank (approximately 18 km from GEP)
- Heywood Shoal (approximately 22 km from GEP)
- Penguin Shoal (approximately 25 km from GEP)
- Van Cloon Shoals (approximately 12 km from GEP).

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, located 9 km and 22 km from the GEP route respectively, 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 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. Scattered coral reefs are present on low intertidal and shallow subtidal rocky substrate along the WA and NT coastline. Some of the larger, more regionally significant coral reefs within the PEZ include:

- Ashmore Reef (approximately 175 km from GEP)
- Cartier Island (approximately 134 km from GEP)
- Seringapatam Reef (approximately 134 km from GEP)
- Scott Reef (approximately 137 km from GEP)
- Hibernia Reef (approximately 200 km from GEP)
- Outer islands of the Bonaparte and Buccaneer archipelagos (approximately 65 km from GEP).

These reefs, in particular Ashmore Reef, are recognised as having the highest richness and diversity of coral species in Western Australia (Mustoe and Edmunds 2008). The Rowley Shoals and Scott Reef support very high coral species diversity, as discussed in sections 4.2 and 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 are discussed in Section 4.4.2.

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 Northern Territory 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 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.

Seagrasses

There is no seagrass within the operational area (due to water depth and lack of suitable habitat). Seagrasses do occur in the PEZ along 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).

Important seagrass locations in the region have been reported at Ashmore Reef where a high coverage of seagrass supports a small dugong population (Whiting & Guinea 2005) and around the Buccaneer Archipelago located north of the Dampier Peninsula (Wells et al. 1995). Other important seagrass locations include Browse Island, Scott Reef and Cartier Island. In general, coastal shallow-water seagrass habitats are rare in the region, accounting for only 11.5 km or 0.2% of the total Australia coastline surveyed by Duke et al. (2010). The regionally dominant genera in Australia are *Halophila* and *Halodule*.

4.7.3 Shoreline habitats

There are no islands within the operational area. However, within the PEZ there are numerous small islands present many of which have an associated Commonwealth ot State/Territory marine park/reserve status. Some of the major islands within or adjacent to the PEZ that are typical of the diverse range of habitats present throughout the region include:

- Adele Island (approximately 161 km from GEP)
- Ashmore Reef (approximately 175 km from GEP)
- Browse Island (approximately 15 km from GEP)
- Cartier Island (approximately 134 km from GEP)
- Scott Reef (approximately 137 km from GEP)
- Tiwi Islands (approximately 66 km from GEP)
- Vernon Islands (approximately 95 km from GEP).

The values and sensitivities associated with the shorelines of these islands are described in sections 4.3 and 4.4 with the exception of the Tiwi Islands and Vernon Islands (described below), as they are not listed as State/Territory reserves (Appendix B).

Tiwi Islands

The Tiwi Island group consists of two large inhabited islands (Melville and Bathurst), and nine smaller uninhabited islands (Buchanan, Harris, Seagull, Karslake, Irritutu, Clift, Turiturina, Matingalia and Nodlaw). Melville Island is Australia's second largest island (after Tasmania), while Bathurst Island is fifth largest. Bathurst Island is approximately 2,600km^2 and Melville Island is approximately 5786 km^2. The main islands are separated by Apsley Strait, which connects Saint Asaph Bay in the north and Shoal Bay in the south. The islands have been identified as an IBA as they support populations of many migratory shorebirds (BirdLife International 2021b). The southern coast of Melville Island is predominantly characterised by sand–mud tidal flats with some mangroves and coral communities. The south-east of Melville Island has extensive tidal mudflats which provide an extensive habitat for shorebirds (INPEX 2010). The south coast of Bathurst Island has less extensive intertidal habitats than Melville Island. The islands' shorelines also feature numerous mangrove-lined bays and inlets. Melville and Bathurst islands are approximately 66 km and 95 km, respectively, from the GEP route.

Vernon Islands

The Vernon Islands are located in the Clarence Straight, north of Darwin, 95 km from the GEP at its closest point. Three major islands make up the Vernon Islands group, plus a large reef and numerous lesser reefs and sand islands (TLC 2013). The islands are low lying, with a maximum height of 4 m above mean sea level. The islands are generally fringed with mangroves and surrounded by mud flats and rocks/reefs exposed at low tides.

Sediments around the Vernon Islands are gravel-dominated, due to the very strong tidal currents, experienced every day in the Clarence Straight.

Significant coral reefs are established within the intertidal and subtidal zone of the Vernon Islands, dominated by *Acropora* and *Montipora* spp. Extensive coralline algal terraces have also developed at the Vernon Islands reef complex. Extensive mangrove forests are present along the Vernon Islands coastline (Smit et al. 2000; KBR 2003).

The Vernon Islands are also subject to a Beneficial Use Declaration under the *Water Act* (NT), for Aquatic Ecosystem Protection and Recreational Water Quality and Aesthetics.

Sandy beaches

Sandy beaches are the dominant shoreline habitat on 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 along the coastlines of the Tiwi Islands as described in sections 4.3 and 4.4.

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 that provide a valuable food source for resident and migratory sea and shorebirds (DEC/MPRA 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 NT and WA coastlines with extensive mangrove communities along the Kimberley, Joseph Bonaparte Gulf and Tiwi Islands' coastlines 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 2010a).

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.

4.7.4 Marine fauna

Species of conservational significance

Species of conservation significance within the operational area and the PEZ were identified through searches of the EPBC Act Protected Matters Database (including a 1 km buffer) both of which are presented in Appendix B. The search identified 30 "listed threatened" and 79 "listed migratory" species of marine fauna that could potentially use or pass through the PEZ. In addition, 138 "listed marine" species were identified, of which 27 were "whales and other cetaceans" that may occur at, or immediately adjacent to, the area.

Table 4-4 presents the marine species that are "listed threatened" species or "listed migratory species" that may potentially occur in the broader PEZ, which also captures those species present in the operational area search report. Note that true terrestrial species have not been listed in the table.

Table 4-4: Listed threatened and/or migratory marine 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
Megaptera novaeangliae	Humpback whale	Vulnerable	Migratory
Orcinus orca	Killer whale	N/A	Migratory
Physeter macrocephalus	Sperm whale	N/A	Migratory
Dugong dugon	Dugong	N/A	Migratory
Orcaella heinsohni	Australian snubfin dolphin	N/A	Migratory

Species	Common name	Conservation status	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
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
Carcharhinus longimanus	Oceanic whitetip shark	N/A	Migratory
Manta alfredi	Reef manta ray	N/A	Migratory

Species	Common name	Conservation status	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
Limosa Lapponica baueri	Bar-tailed Godwit	Vulnerable	Migratory
Limonsa lapponica menzbieri	Northern Siberian Bar-tailed Godwit	Critically Endangered	Migratory
Numenius madagascariensis	Eastern curlew	Critically Endangered	N/A
Papasula abbotti	Abbott’s Booby	Endangered	Migratory
Rostratula australis	Australian Painted Snipe	Endangered	N/A
Anous stolidus	Common noddy	N/A	Migratory
Apus pacificus	Forktailed swift	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

Species	Common name	Conservation status	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 dubius	Little Ringed Plover	N/A	Migratory
Charadrius veredus	Oriental Plover	N/A	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
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

Species	Common name	Conservation status	Migratory
Tringa glareola	Wood Sandpiper	N/A	Migratory
Tringa nebularia	Common Greenshank	N/A	Migratory
Tringa stagnatilis	Marsh Sandpiper, Little Greenshank	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 DAWE recovery plans and conservation advice, 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 searches 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 B.2.

Biologically important areas (BIAs)

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 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 4-9.

No marine mammal BIAs overlap the operational area. Marine turtle BIAs that overlap the operational area include the green turtle internesting buffer at Browse Island, internesting habitat for flatback and olive ridley turtles on the Melville Island/Coburg Peninsula coastlines and the Joseph Bonaparte Depression which provides foraging habitat for olive ridley, flatback and loggerhead turtles. Additionally, the operational area overlaps the whale shark foraging BIA and a seabird foraging BIA associated with the lesser frigatebird.

Table 4-5: BIAs intersecting the PEZ where * denotes overlap with operational area

Species	Migration route	Foraging	Internesting	Resting/ Breeding	Aggregation/ calving
Humpback whale	x				x
Pygmy blue whale	x	x			
Coastal dolphins: Indo-Pacific humpback dolphin, bottlenose dolphin and Australian snubfin dolphin		x		x	x
Dugong		x			
Olive ridley turtle*		x			
Loggerhead turtle*		x			
Flatback turtle*		x	x		
Green turtle*		x	x		
Hawksbill turtle			x		
Whale shark*		x			
Marine avifauna*		x		x	

Marine mammals

There are no identified BIAs for marine mammals within the operational area. However, a number of marine mammal BIAs are present within the PEZ as shown in Table 4-5, Figure 4-5 and Figure 4-6.

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). Further desktop analysis of available marine megafauna survey and satellite tracking data was undertaken as part of the Shell/INPEX ARP focussing on the Kimberley region (Ferreira et al. 2018).

Humpback whale

There are two humpback whale (*M. novaeangliae*) BIAs located within the PEZ; a migratory corridor and a breeding and calving area, as shown in Figure 4-5. 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 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.

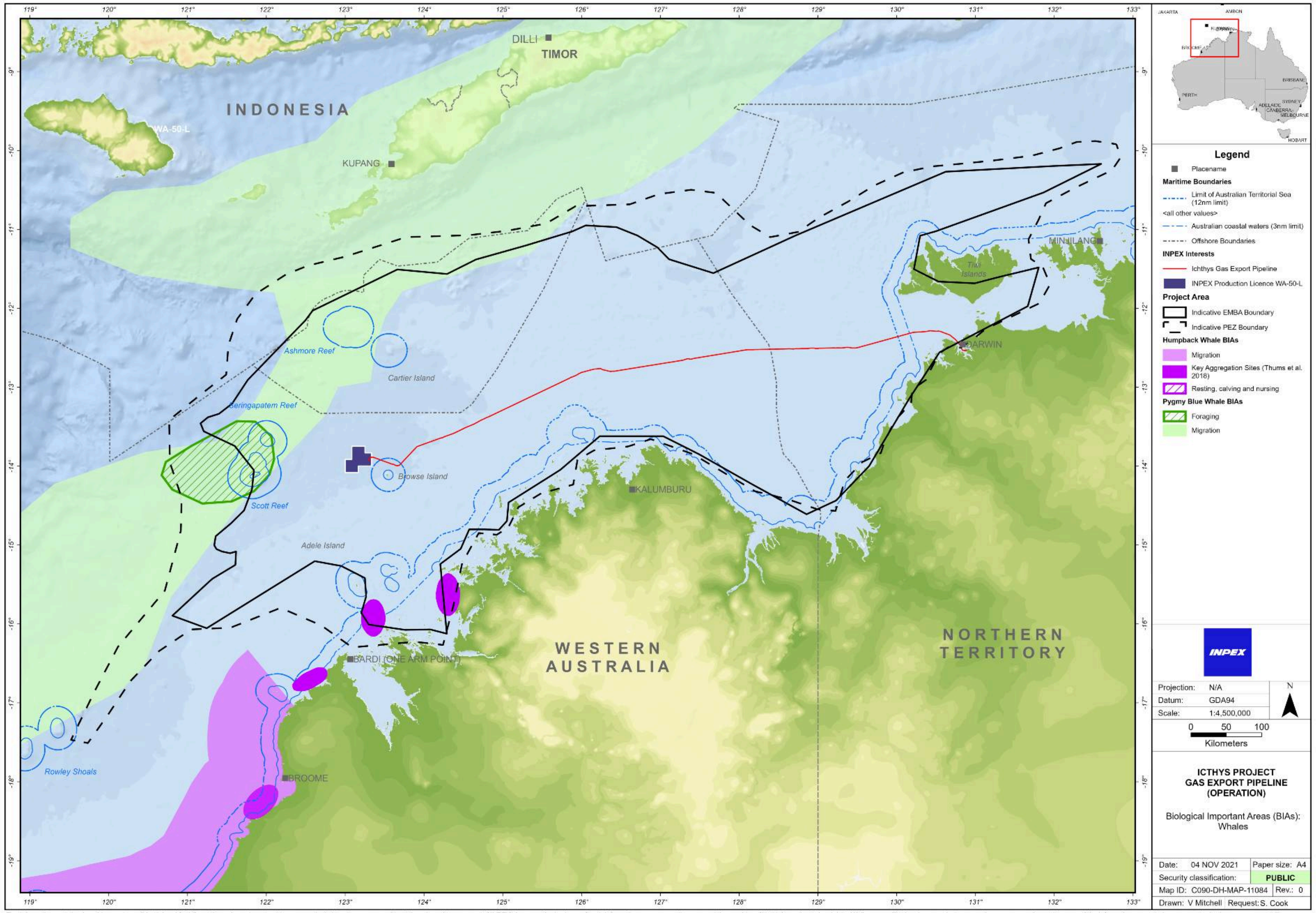

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Figure 4-5: Biologically important areas associated with whales

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). 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 operational area/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 60 km north west of the Ichthys offshore facility at its closest point, and a foraging BIA at Scott Reef, approximately 140 km west of the GEP (Figure 4-5).

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). Pygmy blue whales have been confirmed to use this region as a corridor when migrating from WA to their potential breeding grounds in Indonesian waters (Double et al. 2014).

Blue whale population structure, distribution and migration are poorly understood. However, a comparison of blue whale songs was used to monitor different acoustic populations of blue whales in the Indian Ocean, noting that song variation may be as a result of reproductive isolation and that pygmy blue whale populations described in the study are distinguishable only acoustically with no morphological differences (Leroy et al. 2021). The study suggests that there is a previously unknown pygmy blue whale acoustic population, the Chagos blue whale that migrates between the waters of the central Indian Ocean around the Chagos Archipelago and the Kimberley region in the north of WA (Leroy et al. 2021). This demonstrates that multiple acoustic populations of pygmy blue whales could be migrating over large distances within the deep waters of the PEZ.

Dugongs

Within the PEZ, there is a dugong foraging BIA at Ashmore Reef and another along the Dampier Peninsula, near Broome that is adjacent to the southern boundary of the PEZ (Figure 4-6). These BIAs correlate with seagrass habitats (refer Section 4.7.2).

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 2021h).

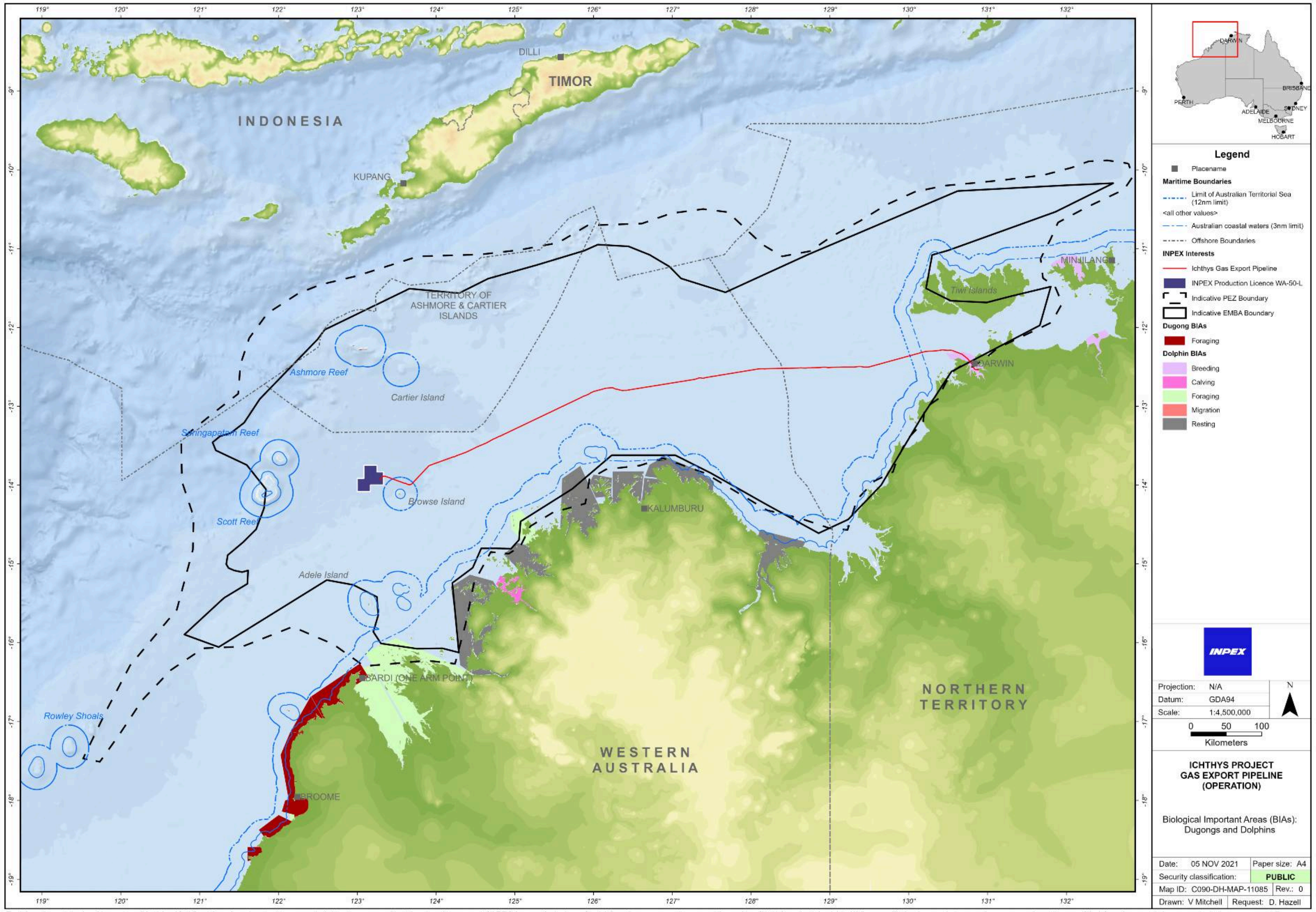

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Figure 4-6: Biologically important areas associated with dugongs and dolphins

Dolphins

Coastal dolphin BIAs for breeding, resting, calving and foraging are located within the PEZ, as shown in Figure 4-6. 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 (*T. aduncus*) is generally considered to be a warm water subspecies of the common bottlenose dolphin (*T. truncatus*) and may occur within the operational area 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 2021i).

Australian snubfin dolphin

The Australian snubfin dolphin (*O. heinsohni*) may occur within the PEZ. All available data on the distribution and habitat preferences of Australian snubfin dolphin indicate that they mainly occur in the shallow coastal and estuarine waters of the NT and north WA (Beasley et al. 2002). 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 2021j).

Indo-pacific humpback dolphin

The Indo-Pacific humpback dolphin (*S. sahulensis/S. chinensis*) may occur in the operational area and 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 (DEE 2021k).

Marine reptiles

Turtles

The EPBC Act Protected Matters search of both the operational area and the PEZ identified six species of marine turtle which may occur: the green turtle (*C. mydas*), loggerhead turtle (*C. caretta*), leatherback turtle (*D. coriacea*), flatback turtle (*N. depressus*), hawksbill turtle (*E. imbricate*) and olive ridley turtle (*L. olivacea*). A number of turtle BIAs and critical habitats for turtle breeding, foraging and internesting occur within the operational area and the PEZ (Figure 4-7).

Nesting rookeries within the PEZ include Browse Island, Ashmore Reef, Cartier Island, Cassini Island, Scott Reef and the Tiwi 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. Further, 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.

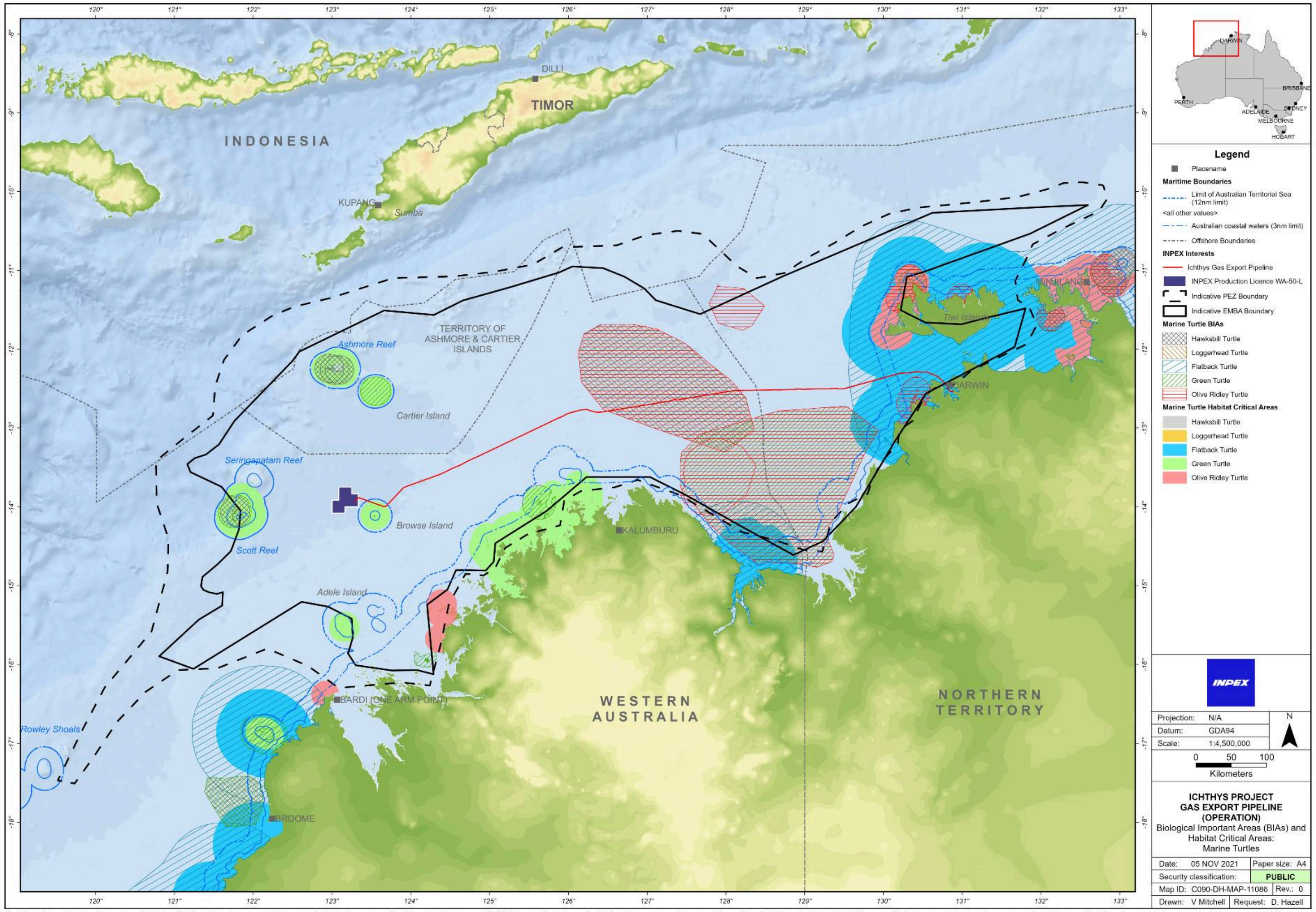

Figure 4-7: Biologically important areas associated with marine turtles

At Scott Reef there is an internesting 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, year-round internesting buffers for flatback (60 km) and olive ridley (20 km) turtles have been identified (DEE 2017a) with peak nesting occurring between June – September and April - June respectively.

As shown on Figure 4-7, the green turtle internesting buffer at Browse Island and a foraging BIA for olive ridley, flatback and loggerhead turtles at the Joseph Bonaparte Depression overlap the operational area. In addition, a flatback foraging BIA at Melville Island/Coburg Peninsula also overlaps the GEP near the NT coastal waters (3 nm) boundary. Details of each species known breeding rookeries, life-cycle, broader distribution and diet are discussed below.

Breeding rookeries / genetic stocks

Adult turtles show strong fidelity to feeding and breeding grounds, migrating long distances (up to thousands of kilometres) to return to the region where they hatched (Limpus 2009).

In Australia, there are two unique breeding populations of loggerhead turtles. The eastern Australian population nests on the southern Great Barrier Reef and adjacent mainland Queensland coastal areas. Major nesting areas for the Western Australian population include Muiron Islands, Ningaloo Coast south to about Carnarvon and islands near Shark Bay, including Dirk Hartog Island (approximately 1000 km south west of the GEP) (DEE 2017a). Loggerhead turtle breeding in WA reportedly occurs between November to May (DEE 2017a).

There are five stocks of flatback turtles currently described around Australia known as the: eastern Queensland, Arafura Sea, Cape Domett, south west Kimberley and Pilbara stocks (DEE 2017a). Additional genetic analysis is being undertaken to provide better resolution of geographic boundaries for flatback turtles in Western Australia. Flatback turtles forage across the Australian continental shelf and into the continental waters off Indonesia (DEE 2017a). Breeding occurs along the NT, Joseph Bonaparte Gulf and Kimberley coastline at all times of the year, with a reported peak between June to September, whereas the Pilbara stock reportedly has a peak breeding season between October and March (DEE 2017a).

There are two olive ridley turtle stocks in Australia, one in the NT (NT stock) and one on western Cape York near Weipa (Cape York Peninsula stock) (DEE 2017a). Low density nesting has also been described on the Kimberley coast, but genetic relatedness is currently unknown. Breeding of olive ridley turtles in the NT has been reported all year around, with peaks between April to August while the Kimberley stock nesting is reportedly year round, with a peak around May to July (DEE 2017a). Limited tagging data indicates that olive ridley turtles remain on the Australian continental shelf into waters off Indonesia (DEE 2017a).

Green turtles nesting in Australia are distributed across nine genetically distinct stocks with other green turtles known to feed in Australian waters that are part of stocks that breed in other countries (e.g. Indonesia, Papua New Guinea and New Caledonia) (DEE 2017a). Green turtles are predominantly found in Australian waters off the NT, Queensland and WA coastlines. Within the PEZ the green turtle stocks that occur include the Coburg Peninsula, North West Shelf, Ashmore Reef and Scott-Browse genetic stocks. Breeding occurs year-round at Ashmore Reef and between October and March for all other locations (DEE 2017a).

Pelagic juvenile life stage

In general, hatchlings disperse into oceanic currents and gyres where they will stay until large enough to settle in coastal feeding habitats (DEE 2017a). There is limited information on the distribution and biology of pelagic juvenile turtles for most species, with the exception of southwest Pacific loggerhead turtles whose pelagic juveniles migrate from eastern Australian rookeries to South America and back (DEE 2017a). Migrations are most likely made in conjunction with the predominant surface currents where young turtles can use the natural floating debris and biota that congregate along the current fronts to provide protection and food. There is high natural mortality during this pelagic life stage (DEE 2017a). One exception to oceanic migrations by post-hatchlings is found in the flatback turtle, whose hatchlings are thought to spend this life phase within the continental shelf waters of Australia (DEE 2017a; Limpus 2009).

Juvenile life stage

After leaving the oceanic habitat, juvenile turtles (i.e. not sexually mature) generally 'recruit' or take up residency in continental shelf waters where they inhabit sub-tidal and intertidal coral and rocky reefs and seagrass meadows, as well as deeper soft-bottomed habitats (DEE 2017a). In general, they do not form social groups, but feed as individuals. They tend to live year round in coastal waters, often displaying small home ranges. However, it has been reported that an unknown proportion of green and loggerhead turtles do not recruit to an inshore feeding ground and remain in the open ocean as until reaching adulthood. Currently, there is a knowledge gap in this regard for hawksbill, flatback and olive ridley turtles (DEE 2017a).

Internesting distribution and foraging areas

Satellite tagging of nesting female loggerhead turtles from the Ningaloo/Pilbara coast of WA 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).

A review of satellite tracking datasets for 96 adult, female green turtles from 10 rookeries and two genetic stocks reported that the spatial extent of internesting areas was encompassed by existing spatial protection for green turtles during the breeding season (i.e. 20 km internesting buffers) (Ferreira et al 2020). Green turtle foraging is known to occur in the identified BIA in the Joseph Bonaparte Gulf and the results of the study by Ferreira et al (2020) indicated that the foraging distribution of green turtles from two stocks in WA expands throughout northwest and northern Australian coastal waters, including the NT and Queensland. However, existing spatial protections (BIAs) are thought to underestimate the foraging distribution of green turtles with the study reporting previously unmapped foraging grounds (Ferreira et al 2020).

Diet

Loggerhead turtles are carnivorous, feeding predominantly on benthic invertebrates in habitats ranging from near shore to 55 m. During their post-hatchling stage, they feed on algae, pelagic crustaceans and molluscs (DEE 2017a).

Flatback turtles are primarily carnivorous, feeding on soft-bodied invertebrates. Juveniles eat gastropod molluscs, squid and jellyfish. Limited data indicate that cuttlefish, hydroids, soft corals, crinoids, molluscs and jellyfish are also eaten (DEE 2017a).

Olive ridley turtles are primarily carnivorous, feeding on soft-bodied invertebrates such as sea pens, soft corals, sea cucumbers and jellyfish in depth between 15-200m (DEE 2017a).

Green turtles are primarily herbivorous, foraging on algae, seagrass and mangroves. In their pelagic juvenile stage, they feed on algae, pelagic crustaceans and molluscs (DEE 2017a).

Abundance of marine turtles in BIA intersecting the GEP

There is insufficient data to provide a quantitative estimate of abundance or seasonal peak in abundance of these four species of turtles within the marine turtle BIAs that intersect the operational area, or of turtle foraging activity in the wider PEZ. However, to be conservative and given the above information regarding life-cycle, distribution and diet, it is probable that turtles of all life-stages, may be present, at all times of the year, on the surface and near the seabed, within the marine turtle BIAs that overlap the GEP. As discussed in Section 4.6.2 only 2% of the GEP route is substrate that would support higher densities of benthic/sessile organisms which these species of turtles forage upon at the seabed. However, pelagic foraging is expected to occur throughout the entire BIAs and possibly beyond those areas.

Sea snakes

The EPBC Act Protected Matters searches identified 25 sea snake species which may occur within the PEZ, 19 of which may also occur within the operational area. 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 broader PEZ. Therefore, although these species may be seen in the open waters along the GEP route their presence is unlikely to be common.

Crocodiles

The salt-water or estuarine crocodile (*C. 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. While this species could be sighted in the operational area, its preference for estuaries and swamps and coastal waters indicates it is uncommon and more likely to be observed in the PEZ where these preferred habitats occur. Similarly the freshwater crocodile would not occur in operational area and is highly unlikely to occur in the PEZ as it primarily occupies freshwater habitats.

Fishes and sharks

The operational area overlaps a BIA for whale sharks (foraging area) that largely follows the 125 m ancient coastline KEF as shown in Figure 4-8. There are also BIAs for sawfish (green, dwarf and freshwater) located to the south-west and north-east of Broome on the WA coastline.

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

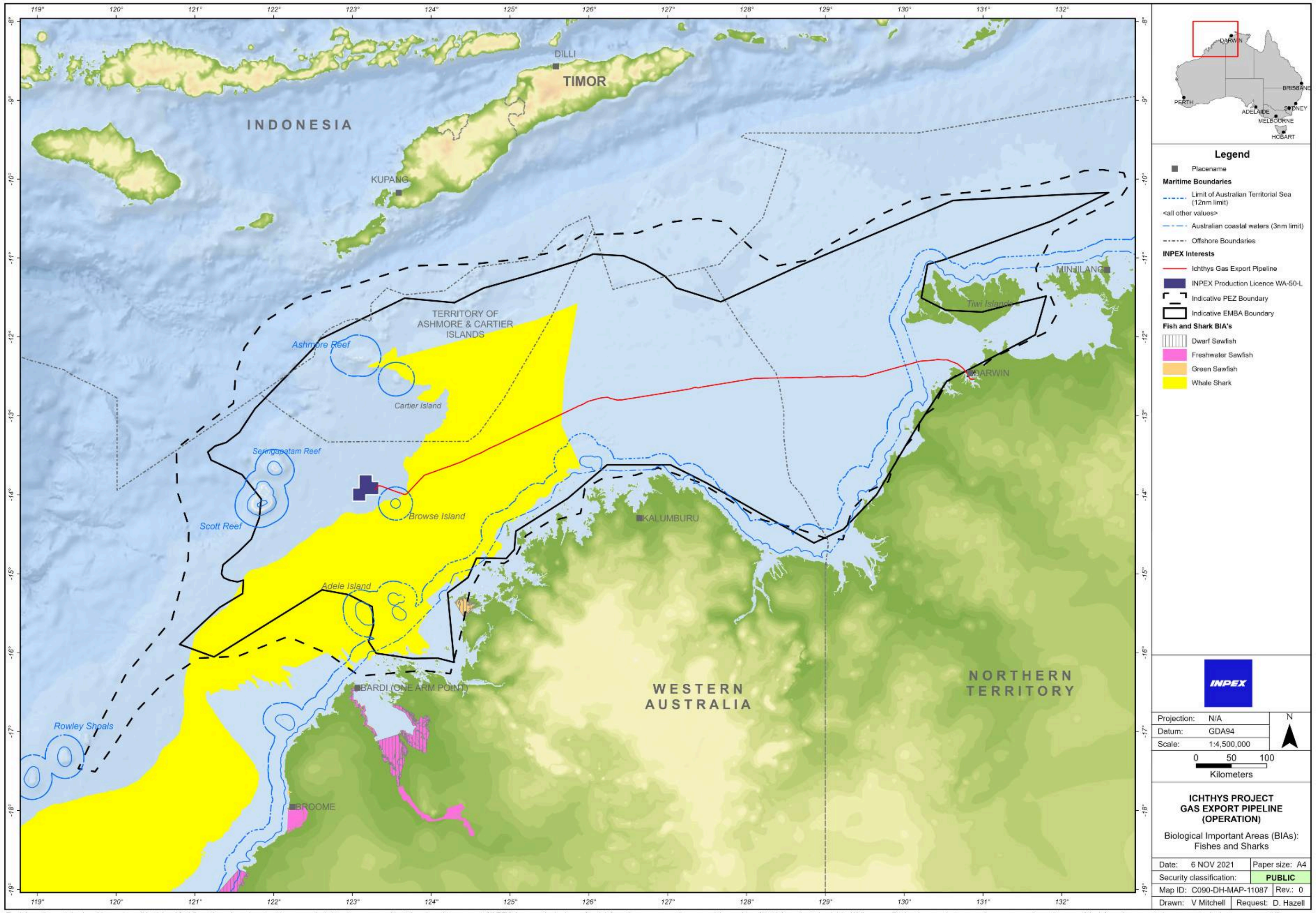

Figure 4-8: Biologically important areas associated with fishes and sharks

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).

It is however understood that 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 four 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 Indonesian 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.

Whilst Ningaloo is the nearest aggregation to the GEP, it is located over 1,300 km to the south. Research on the migration patterns of whale sharks in the western Indian Ocean, indicates that a small number of the WA (Ningaloo) population migrate through the wider vicinity of the Browse Basin region (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 foraging BIA largely follows the ancient coastline at 125 m depth contour KEF, and approximately 250 km of the GEP route overlaps of the BIA. 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 searches of the operational area and the PEZ (Table 4-4; Appendix B). While sawfish are identified as potentially occurring along the GEP route and in the broader 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 4-8).

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 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 may occur as a direct result of capture and discarding (DSEWPaC 2012b).

Pipefish and seahorses

The EPBC Act Protected Matters searches identified 30 species of the family Syngnathidae which may occur both within the operational area within the PEZ (Appendix B). Syngnathidae is 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 searches (Appendix B) 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). These habitats occur in the shallower areas of the PEZ. Along the GEP route, water depths are typically greater than 40 m and preclude the presence of seagrass. Hard bottom substrates, which can potentially support coral, macroalgae and sponge garden communities are very limited (approximately 2% of the GEP route) and occur at water depths (> 70 m) which also precludes macroalgae growth. Therefore, pipefish and seahorses are unlikely to be common along the GEP route, but will have better representation in the broader PEZ where these habitats are more abundant.

Sharks and rays

Six shark species (including whale shark described above) and two ray species were identified as having the potential to occur in the operational area (Appendix B). One additional shark species (*G. glyphis*) was identified as having the potential to occur within the PEZ (Table 4-4; Appendix B). It is considered possible that larger pelagic sharks such as the great white, oceanic whitetip, whale and mako sharks may transit through the operational area. However, sharks with known coastal habitats such as the Northern River Shark are not expected to occur within the open ocean location of the GEP route, and therefore are only likely to be present in coastal habitats on the periphery of the PEZ.

Movements of tagged grey nurse sharks on the west coast of Australia indicated a preference for water depths 20-160 m and broad use of the continental shelf (McCauley 2004). 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 2021m). The critically endangered, speartooth shark (*G. glyphis*) inhabits tidal rivers and estuaries in the NT and Queensland and is therefore only likely to be present in the PEZ (DAWE 2021n).

Listed manta rays have been observed within the PEZ, but for the same reasons as for large pelagic sharks, they are unlikely to be common or resident within the operational area as the GEP route is not considered to provide habitat that is of breeding or feeding importance. Therefore, the likelihood of these species occurring in the operational area is expected to be very low.

Marine Avifauna

The operational area is located within what is known as the East Asian–Australasian (EAA) Flyway an internationally recognised migratory bird pathway that covers the whole of Australia and its surrounding waters (Figure 4-9). '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 is one BIA for marine avifauna that overlaps the operational area, associated with the lesser frigatebird (*F. ariel*). The BIA has high usage for foraging around breeding sites. These birds are resident and partly nomadic dispersing widely between breeding seasons.

Information regarding the seasonal abundance and foraging activities of the lesser frigatebird in the Kimberley region has been investigated through the Shell/INPEX ARP, including satellite tracking of lesser frigatebirds from Adele Island during 2014 (Clarke 2015), and satellite tracking of lesser frigatebirds from the Lacepede Islands during the 2015 breeding season (Cannell et al 2016).

The majority of the lesser frigatebirds tagged who were breeding at Adele Island departed for Indonesian waters during the non-breeding months of November to April (Clarke 2015). However, Cannell et al (2015) observed that asynchronous breeding of lesser frigatebirds was occurring, based on the Adele Island 2014 data (Clarke 2015) and Lacepede Islands 2015 data (Cannell et al 2016). Lesser frigatebirds fledge at approximately 140 days old, but can still be fed by the adults at the nest for at least four months after fledging (Diamond 1975). Therefore, adults may be returning to the breeding colonies to provide parental care at both the Lacepede Islands and Adele Island (and therefore potentially any other breeding colonies along the Kimberley Coastline) throughout the entire year.

Satellite tracking of lesser frigatebirds at Adele Island during the 2014 breeding season indicated these birds normally undertake multi-day foraging trips, generally within approximately 200km but up to approximately 700 km from breeding sites (Clarke 2015). Similarly, Cannell et al (2016) reported that during the 2015 breeding season at the Lacepede Islands, some lesser frigatebird multi-day foraging trips ranged in excess of 1,000 km. Therefore, while the majority of lesser frigatebird foraging occurs within the BIAs presented in Figure 4-9, some of the reported foraging ranges are far wider than the BIAs.

Based on this recent research, peak abundance and subsequent foraging typically occurs during the breeding season (April to November). However, it is noted that some lesser frigatebirds may breed outside this period and/or utilise the region for year round foraging activity.

Lesser frigatebirds are unique among seabirds in that they cannot settle on the sea surface due to the poor waterproofing quality of their feathers. Therefore, they are highly mobile and generally feed 'on-the-wing'. This means that they must capture prey at or above the sea surface (e.g. flying fish) and while their elongated bill regularly comes into contact with the water, their feathers rarely do (Clarke 2015). Lesser frigatebirds also practice kleptoparasitism, i.e. they steal food from other species.

The PEZ overlaps a large number of BIAs for a number of different marine avifauna species (Figure 4-9).

These marine avifauna BIAs 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 Section 4.5) these sites provide important habitat for marine avifauna.

Vessel-based surveys conducted around the Ichthys 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 operational area and the PEZ.

In addition to seabirds, the search of the EPBC Act Protected Matters database identified 35 species of migratory wetland bird species potentially present within the PEZ (seven of which may also occur within the operational area). These species may migrate through the operational area/PEZ to wetland habitats on the mainland and/or larger coastal islands (DEE 2017b). It is considered unlikely that the operational area would provide any significant resources to support these species.

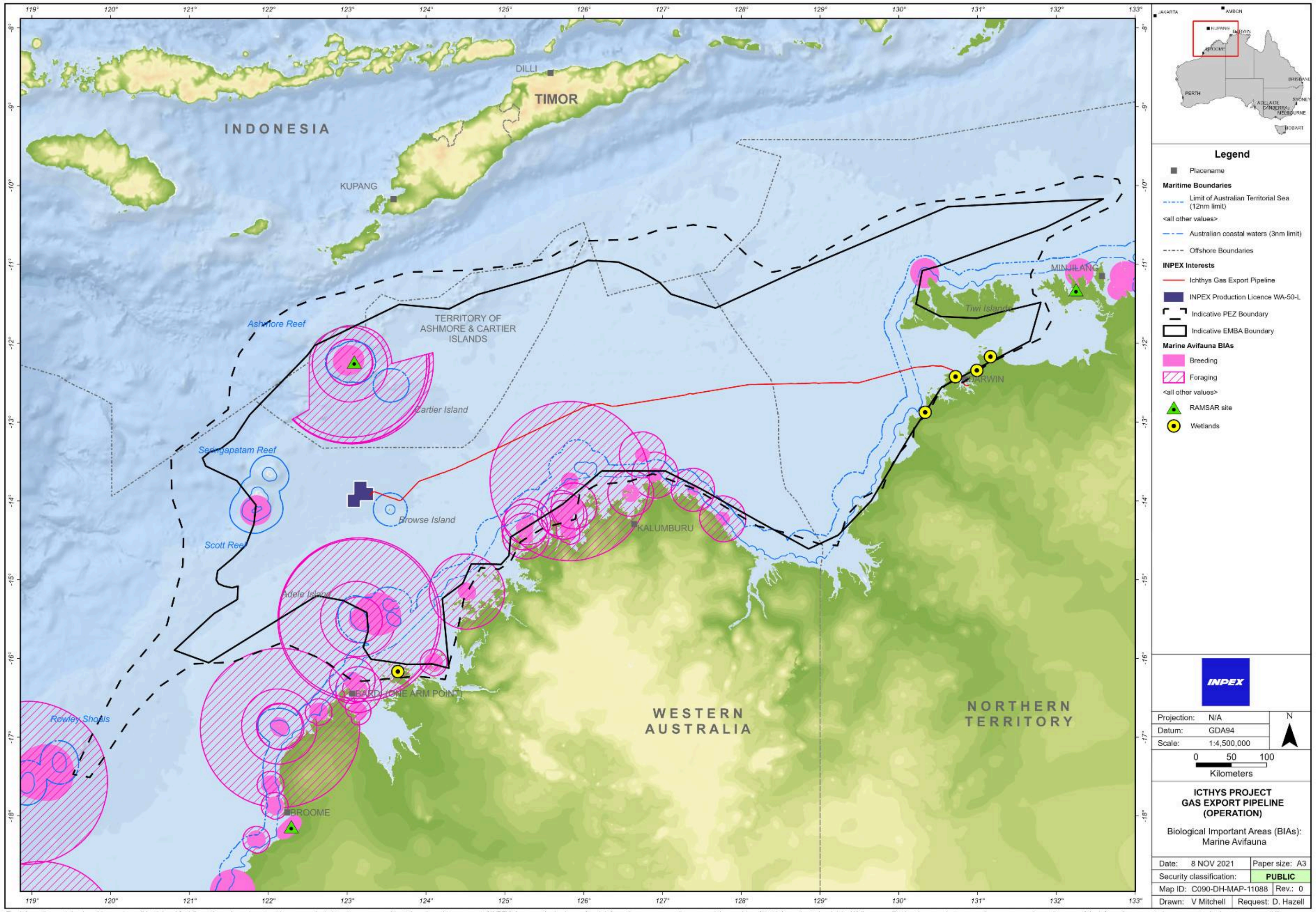

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Figure 4-9: Biologically important areas associated with marine avifauna

4.8 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 the State (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 for vessels supporting the petroleum activity are Darwin, Broome and Dampier described in Section 4.9.5 including a summary of the IMS status.

Within WA 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 WA DPIRD manages *D. perlucidum* only at the Montebello Islands where it is known to not have become established.

4.9 Socioeconomic environment

4.9.1 World heritage areas

No world heritage areas were identified as overlapping the operational area or the PEZ.

4.9.2 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 2021l). The West Kimberley is characterised by a diversity of landscapes and biological richness found in its cliffs, headlands, sandy beaches, rivers, waterfalls and islands.

4.9.3 Fishing

Commercially significant fish stocks, considered to be key indicator species, that may be present in the operational area are shown in Table 4-6, including spawning and aggregation times.

Table 4-6: Commercially significant fish species

Key commercial fish species	Spawning/aggregation times
Goldband snapper	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).
Spanish mackerel	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.
Red emperor	Red emperor typically occurs 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).

Commercial fisheries

Four Commonwealth-managed fisheries have the potential to operate within the operational area and the PEZ as summarised in Table 4-7.

In addition to the Commonwealth-managed fisheries, 28 State/Territory-managed commercial fisheries have the potential to operate within the PEZ. Of these, 17 fishery boundaries overlap with the operational area (Table 4-8). Fisheries highlighted in bold have potential fishing grounds that overlap with the operational area, it does not indicate that they are currently active; 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 operational area)	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 2021a).

Commercial fishery (BOLD denotes overlap with operational area)	Fishery summary
	There are seven fishing permits (maximum number of vessels active at one time) each with a five-year duration in the North West Slope Trawl Fishery. It has reportedly negligible trawl-fishing in the Ichthys Field. Since 2013, fishing effort has targeted waters to the west of WA-50-L and the GEP but not in the operational area itself; however, catch data is confidential for this fishery (AFMA 2021a).
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 Western Australia, to the border between Victoria and South Australia. Fishing occurs in both the Australian Fishing Zone and adjacent high seas. In the fishery there are currently 95 boats with statutory fishing rights (AFMA 2021b).
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 (AFMA 2021c).
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. The fishery occasionally operates from Cape York in Queensland to Cape Londonderry in WA. The fishery occasionally operates within the eastern half of the operational area, but it predominantly operates in the shallower waters of the PEZ, inshore of the eastern half of the GEP route. To manage the fishery, there are two fishing seasons (April—June and August—November). There are currently 52 boats with fishing rights in the fishery (maximum number vessels at one time) and bottom trawl fishing gear is used in this fishery (AFMA 2021d).

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

Commercial fishery (BOLD denotes overlap with operational area)	Fishery summary
Northern Demersal Scalefish Managed Fishery (WA) Area 2 Zone A, B & C (Area 1 & 2 overlaps PEZ)	The Northern Demersal Scalefish Managed Fishery is primarily a trap-based fishery which targets red emperor and gold band snapper. The fishery operates off the north-west coast of WA in the waters east of longitude 120°E and overlaps the operational area and 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 operational area)	Fishery summary
Mackerel Managed Fishery (WA) Area 1 (Area 2 overlaps PEZ)	The Mackerel Managed Fishery uses near-surface trolling gear from vessels in coastal areas around reefs, shoals and headlands as found in the PEZ (WAFIC 2021a). The fishery targets 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	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. Target species of the northern shark fisheries included the sandbar, hammerhead, blacktip and lemon sharks (AFMA 2021e). The Joint Authority Northern Shark Fishery has not been active since 2008/2009 to enable recovery of shark species (AFMA 2021e).
Pearl Oyster Managed Fishery (WA) Zone 3	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 2021b). 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 with the majority sold live to Asian markets (Gaughan & Santoro 2021). The majority of the GEP crosses through the area of the fishery denoted as "prohibited fishing" (i.e. landward of the 150m isobath).
Kimberley Prawn Managed Fishery (WA)	The Kimberley Prawn Managed Fishery predominantly target banana prawns (*P. merguiensis*) and catch also includes tiger prawns (*P. esculentus*), endeavour prawns (*M.endeavouri*) and western king prawns (*P. latisulcatus*). The fishery operates from the north eastern boundary of the Exmouth Gulf Prawn Fishery to Cape Londonderry, in the PEZ (WAFIC 2021c). In 2019 the total prawn landings were 100 tonnes the lowest catch on record (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 (*P. latisulcatus*) (Gaughan & Santoro 2021). The operational area and PEZ overlap an area of the fishery closed to trawling.

Commercial fishery (BOLD denotes overlap with operational area)	Fishery summary
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 four 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.
South West Coast Salmon Managed Fishery (WA)	South West Coast Salmon Managed Fishery targets Western Australian 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 in the Pilbara (the Pilbara Crab Managed Fishery) and mud crabs 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).
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).

Commercial fishery **(BOLD denotes overlap with operational area)**	**Fishery summary**
Abalone Managed Fishery (WA) Area 8	The Abalone Managed Fishery includes the West Coast Roe's Abalone resource and the South Coast Greenlip / Brownlip Abalone resource. Roe's abalone is found in commercial quantities from the SA 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 2021d). The fishery operates in shallow coastal waters coinciding with abalone distributions (Gaughan & Santoro 2021). Although the area of the fishery overlaps the operational area, limited fishing effort occurs given the water depth, water temperature and lack of suitable habitat.
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 2021f). The fishery operates from north-east of Darwin to the WA/NT border and to the outer limit of the Australian Fishing Zone (NTSC 2021a).
Demersal (multigear) Fishery (NT)	The Demersal Fishery targets mainly red snappers (*L. 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 2021f). The fishery extends 15 nm from the low water mark to the outer boundary of the Australian Fishing Zone (NTSC 2021b).
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 Marine Parks (NTSC 2021c).
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 low water mark but excluding Darwin Harbour and Shoal Bay. The fishery is limited to the nearshore waters adjacent to the GEP route and does not overlap the operational area. The fishery is currently restricted to two licences which are both allocated (NTG 2021a).

Commercial fishery **(BOLD denotes overlap with operational area)**	**Fishery summary**
Coastal Net Fishery (NT)	The Coastal Net Fishery targets a range of species, particularly mullet, blue threadfin (*Eleutheronema tetradactylum*), shark and queenfish (*S. 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 2021b).
Coastal Line Fishery (NT)	The Northern Territory's 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 low water mark (NTG 2021c). The western zone extends from the WA border to the Cobourg Peninsula but does not overlap the operational area. 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 2021c)
Trepang Fishery (NT)	The 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 2021d).
Aquaculture (NT)	The two major aquaculture activities include Pearl Oyster (*Pinctada maxima*) culture and Barramundi farming (*L. 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 2021e).
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 three boats active. (NTSC 2021f).
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 2021d).

Commercial fishery (BOLD denotes overlap with operational area)	Fishery summary
Mud Crab Fishery (NT)	The Mud Crab Fishery targets mud crabs. The fishery operates in NT tidal waters year-round but most activity stops during the wet season (NTSC 2021g). As of 2016, 49 licences were active across 35 operators, with most working from a single dinghy (NTSC 2021g).
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 2021f). The fishery extends from the NT high water mark out to the Australian Fishing Zone and overlaps the operational area and PEZ. However, most fishing occurs in the coastal zone within 12 nm of the coast, and immediately offshore in the Gulf of Carpentaria (NTG 2021e). The 2018 landings comprised of 42 and 499 tonnes of blacktip sharks and grey mackerel respectively (AFMA 2021f).
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 2021f). There are currently five licences in the fishery.
Spanish Mackerel Fishery (NT)	The Spanish Mackerel Fishery targets Spanish mackerel (*S. 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 found within the PEZ. 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 2021g).

Recreational fishing

A wide range of recreational activities 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 populations of Darwin, Broome and Wyndham. 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, mangrove jack, jewfish 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. Generally, there is little recreational fishing that occurs within the operational area because of its distance from land, lack of features of interest and deep waters.

Traditional fishing

Australian traditional fishing

Traditional fishing occurs along the majority of the Kimberley coastline. The practice of traditional fishing includes taking turtles, dugong, fish and other marine life (DAWE 2021m). The EPBC Act Protected Matters Search of the PEZ (Appendix B; NIAA 2021) identified the following three IPAs:

- Bardi Jawi IPA (located on Dampier Peninsula)
- Dambimangari IPA (located in the Buccaneer Archipelago/Prince Regent area)
- Uunguu IPA (600 km north-east of Derby on the far north-west coast of the Kimberley).

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 NT Government. 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 a portion of the operational area falls 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 marine parks contain places of cultural and spiritual importance. The establishment of such places within the reserves and marine parks 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.

4.9.4 Aquaculture

Aquaculture development in the region is dominated by the production of pearls from the species *P. maxima.* A large number of pearl oysters for seeding is obtained from wild stocks and supplemented by hatchery-produced oysters with major hatcheries operating around Broome (Gaughan & Santoro 2021) close to the southern boundary of the PEZ. The wild shell collection occurs in shallow coastal waters (WAFIC 2021b). All the leases are within 35 m diving depth. Pearl farm sites are located mainly along the Kimberley coast, particularly in the Buccaneer Archipelago adjacent to the PEZ, or further away in Roebuck Bay and at the Montebello Islands.

Developing marine aquaculture initiatives in the Kimberley region include farming barramundi in the Kimberley Aquaculture Development Zone located in Cone Bay, situated approximately 200 km north-east of Broome, and comprising an area of 2,000 hectares that was declared in 2014 (Gaughan & Santoro 2021). Another focus is the Broome Tropical Aquaculture Park where a commercial pearl oyster hatchery is located along with the Kimberley Training Institute aquaculture facility (Gaughan & Santoro 2021). Located on the Dampier Peninsula at One Arm Point, adjacent to the southern boundary of the PEZ, is the Ardyaloon Hatchery established to address the declining stocks of the *Trochus niloticus* shell and seek 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 requirements of capital and material inputs, and short production cycles. However, by value, domestically consumed species such tilapia and milkfish, together with export-orientated commodities such as shrimp and tuna, are of greater importance (Phillips et al. 2015).

4.9.5 Shipping and ports

Vessel tracking data from AMSA's Craft Tracking System (CTS) for September 2021 is presented in Figure 4-10. CTS collects vessel traffic data from a variety of sources, including terrestrial and satellite shipborne Automatic Identification System (AIS) data sources. Figure 4-10 highlights the presence of commonly used transit routes in the vicinity of the operational area, generally used by supply vessels routinely supporting offshore developments in the Browse Basin including INPEX's Ichthys offshore facility within WA-50-L itself, and the nearby Shell Prelude FLNG facility. The major shipping lanes linking WA to Indonesia are situated over 180 km to the west of the operational area at its closest point.

The closest ports to WA-50-L are Derby 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.

As stated in Section 4.8, the main supply bases for vessels supporting the petroleum activity are Darwin, Broome and Dampier. As all vessels, including Project 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.

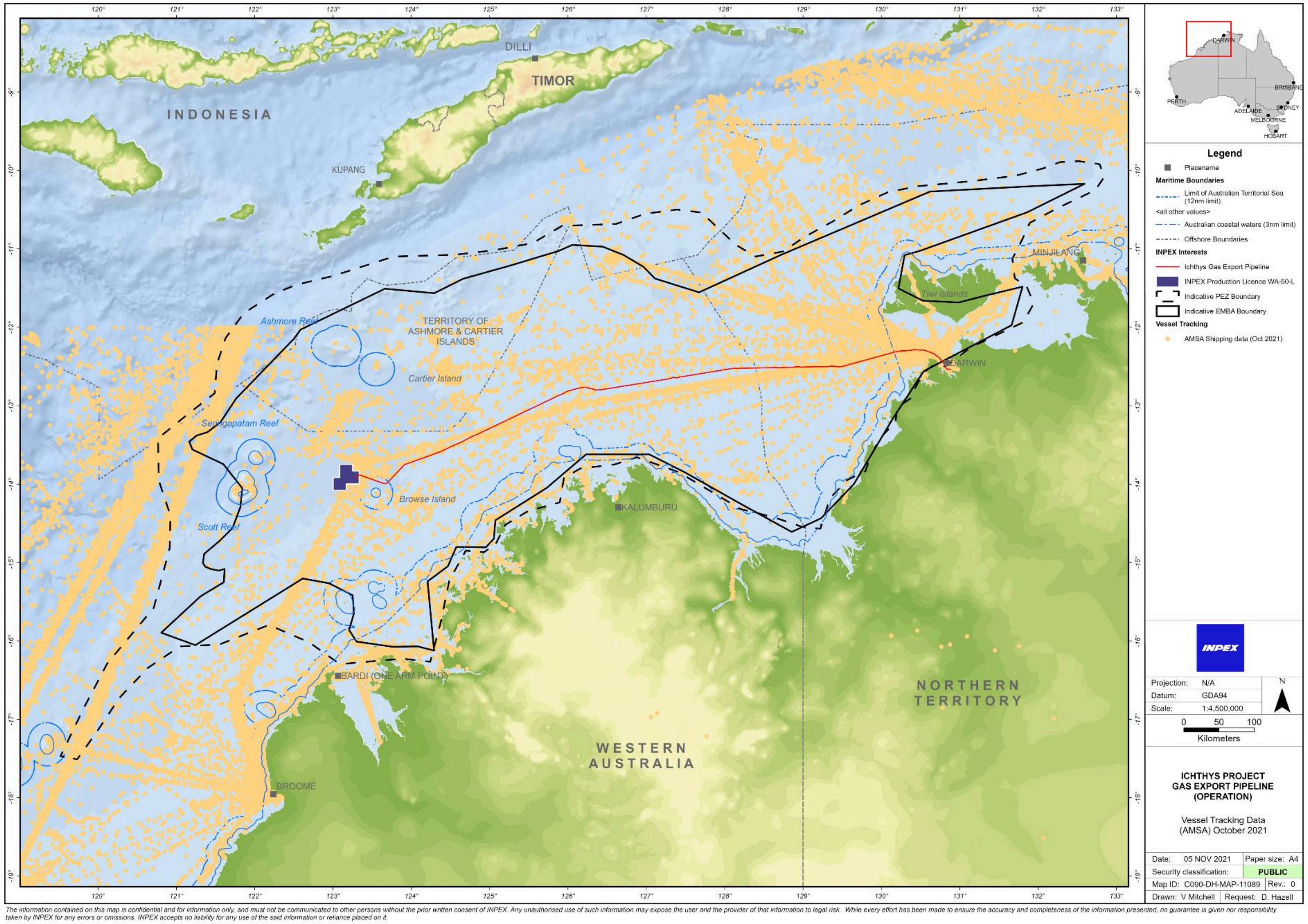


Figure 4-10: Vessel tracking data in the Browse Basin (October 2021)

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, rig tenders, tankers and bulk-cargo vessels.

A number of targeted marine pest monitoring programs have been executed in Darwin Harbour since 2010 (Cardno 2015, Golder Associates 2010), and through the course of these programs the following marine pest species have been detected; however, none of these are listed as noxious species by the NT Government: *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 Harbour. *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 onoing. Artificial settlement units are located throughout the Harbour, including on the INPEX LNG and 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 Harbour marinas. Following, a national response to the outbreak this species was successfully eradicated from invaded locations (Ferguson 2000).

In summary, numerous marine pest monitoring studies have been undertaken at Darwin Port with species of marine pests 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. The 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 2020).

Broome Port waters are dominated by the tidal regime of the region, with spring tidal range in excess of 9.5 m. Substrates within the 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 the port, particularly in Dampier Creek to the north-east of the port, and in Willie Creek directly to the north (Bridgwood and McDonald 2014).

At Broome Port, the presence of invasive marine pests is monitored through the WA DPIRD's State-wide Array Surveillance Program (SWASP) (Kimberley Ports Authority 2020). 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. Over eight years, participation in SWASP has grown from 3 to 11 ports, spanning over 11,000 km, from the tropical north to temperate south of WA (McDonald et al. 2019). The programme has proven to be highly effective as a means of fostering stakeholder involvement and, importantly for invasive marine pest surveillance. The growth and success of SWASP has continued primarily because of the commitment and farsightedness of the ports involved.

Adverse impacts from marine pests may not occur until decades after the initial introduction and establishment, and previous incursions of marine pests 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 marine pests that may be present in Broome Port. However, from the information presented it can be concluded that species of marine pests 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 the port are influenced by clearer oceanic waters and rougher seas. With its variety of conditions, the 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.

4.9.6 Oil and gas industry

No existing oil and gas facilities or pipelines overlap the operational area. The existing INPEX offshore facility (subsea and on the surface) is present within WA-50-L consisting of an interlinked facility comprising SPS, CPF (*Ichthys Explorer*) and FPSO (*Ichthys Venturer*).

The next closest operational production facility to WA-50-L, is the Shell Prelude FLNG facility located approximately 17 km to the north-east. Other operational production facilities include the Montara facilities in the Vulcan sub-basin, approximately 80 km from the GEP at its closest point.

4.10 Summary of values and sensitivities

4.10.1 Operational area

Table 4-9: Particular values and sensitivities potentially within the operational area (Appendix B)

Value and sensitivity	Description
Receptors that are considered socially important as identified during stakeholder engagement (including social and cultural heritage).	Fisheries (traditional and commercial).
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.	None identified within the operational area.
Regionally important areas of high diversity (such as shoals and banks).	None identified along the GEP route. However, the operational area overlaps the following: AMPs • Oceanic Shoals. KEFs • ancient coastline at 125 m depth contour • continental slope demersal fish communities • the carbonate bank and terrace system of the Sahul Shelf • the pinnacles of the Bonaparte Basin.
World heritage values of a declared World Heritage property within the meaning of the EPBC Act.	None identified within the operational area.
National heritage values of a National Heritage place within the meaning of the EPBC Act.	None identified within the operational area.
Ecological character of a declared Ramsar wetland within the meaning of the EPBC Act.	None identified within the operational area.
Presence of a listed threatened species or listed threatened ecological community within the meaning of the EPBC Act.	A number of threatened species or migratory species have been identified as having the potential to transit through the operational area. These have been categorised as marine fauna: • marine mammals
Presence of a listed migratory species within the meaning of the EPBC Act.	

<table>
<tr><th colspan="2">Value and sensitivity</th><th>Description</th></tr>
<tr><td colspan="2"></td><td>• marine reptiles
• fishes and sharks
• marine avifauna.
Also refer to Appendix B (EPBC Act Protected Matters Report – operational area).</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 the operational area.</td></tr>
<tr><td colspan="2">BIAs associated with EPBC-listed species.</td><td>The following BIAs overlap the operational area:
Marine turtles
• foraging (Joseph Bonaparte Gulf and Joseph Bonaparte Depression)
• internesting (Browse Island, Melville Island/Coburg Peninsula)
Fish and sharks
• whale sharks foraging
• KEFs associated with increased species diversity and abundance (i.e. continental slope demersal fish communities and the ancient coastline at 125 m depth contour).
Marine avifauna
• foraging adjacent to breeding area associated with the lesser frigatebird.</td></tr>
</table>

4.10.2 PEZ

Table 4-10: Particular values and sensitivities potentially within the PEZ (Appendix B)

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).

Value and sensitivity	Description
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 4.7.2 and include the Commonwealth and state marine reserves and KEFs listed below.
Regionally important areas of high diversity (such as shoals and banks).	KEFs: • Ancient coastline at 125 m depth contour • Carbonate bank and terrace system of the Sahul Shelf • Continental slope demersal fish communities • Pinnacles of the Bonaparte Basin • Ashmore Reef and Cartier Island and surrounding Commonwealth waters • Carbonate bank and terrace system of the Van Diemen Rise • Mermaid Reef and Commonwealth waters surrounding the Rowley Shoals • Seringapatam Reef and Commonwealth waters in the Scott Reef complex • Shelf break and slope of the Arafura Shelf. Benthic habitats: • Various banks and shoals, and coral reefs (Section 4.7.2) • Seagrasses (Ashmore Reef, Buccaneer Archipelago, dugong foraging BIA north of Broome). Shoreline habitats: • Islands, mangroves and sandy beaches (Section 4.7.3).
World heritage values of a declared World Heritage property within the meaning of the EPBC Act.	None identified within this area.
National heritage values of a National Heritage place within the meaning of the EPBC Act.	The West Kimberley is identified as natural National Heritage Places (Section 4.9.2).
Ecological character of a declared Ramsar wetland within the meaning of the EPBC Act.	One Ramsar site (Section 4.5): • Ashmore Reef National Nature Reserve

<table>
<tr><th colspan="2">Value and sensitivity</th><th>Description</th></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 4.7.4):
marine mammals
marine reptiles
fishes and sharks
marine avifauna.
Also refer to Appendix B (EPBC Act Protected Matters 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 Yampi Sound Training Area (Section 4.5.6).
Other sites were also identified (Appendix B); 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:
Marine mammals
humpback whale migration route and aggregation/calving areas
pygmy blue whale foraging and migration route
dugong foraging at Ashmore Reef and near Broome
coastal dolphins breeding, calving and foraging areas.
Marine reptiles
Turtle nesting, internesting and foraging areas including Browse Island, Ashmore Reef, Cartier Island, Sandy Islet (Scott Reef), Joseph Bonaparte Depression, Joseph Bonaparte Gulf, Tiwi Islands, Coburg Peninsula).
Fish and sharks
whale shark foraging area
sawfish BIAs
KEFs associated with increased species diversity and abundance (i.e. continental slope demersal fish communities and the ancient coastline at 125 m depth contour).</td></tr>
</table>

Value and sensitivity	Description
	Marine avifauna • 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) and nearshore waters and islands of the WA and NT coastline) including nationally important wetlands (Section 4.5) • 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 petroleum activity ('relevant persons') are informed about the activity and have the opportunity to advise INPEX of any functions, interests or activities that could be impacted by the petroleum 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 petroleum 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 further described in this section.

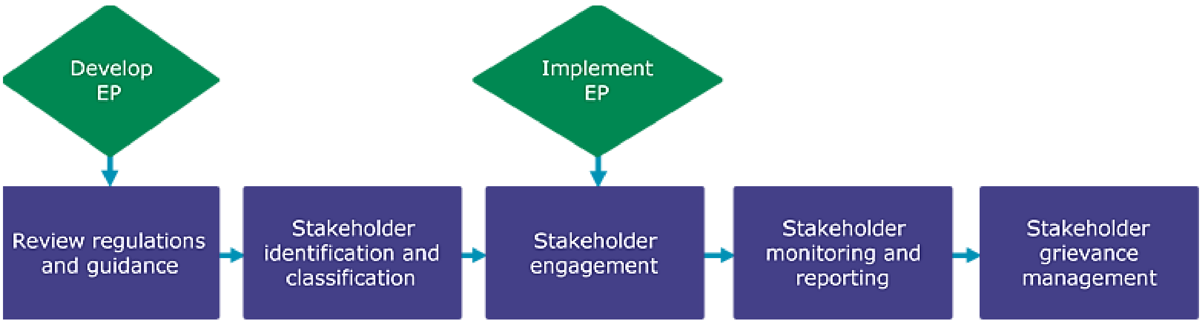


Figure 5-1: Process for stakeholder engagement (consultation) for development and implementation of an EP

5.1 Regulatory requirements and guidelines

Since 2013 and prior to operations commencing, INPEX has undertaken extensive and ongoing stakeholder consultation for several EPs throughout the development, construction, start-up and early operations phases of the Ichthys LNG Project. For the development of this 5-year EP revision, INPEX reviewed the following documents to prepare for further stakeholder consultation on the petroleum activity:

- OPGGS (E) 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 - Rev 2 - February 2021

  - GN1785 – Petroleum activities and Australian marine parks - 3 June 2020
  - IP1764 – Considerations for a five-year environment plan revision – 14 January 2021
  - IP1411 - Consultation requirements under the OPGGS Environment Regulations 2009 - Rev 2 - 2014
  - A696998 – Bulletin #2 Clarifying statutory requirements and good practice consultation – Rev 0 – November 2019.
- 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 Department of Primary Industry and Regional Development (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, stakeholders previously identified as relevant to the petroleum activity were reviewed and assessed to ensure their continued relevance. Additionally, any new 'relevant persons' were identified and 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 continuing petroleum activity, 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), IP1764 (NOPSEMA 2021a) and Bulletin #2 A696998 (NOPSEMA 2019b).

INPEX treats stakeholder identification (and subsequent activities) as an iterative process whereby the company 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 petroleum activity.

5.2.1 Definition of 'relevant persons'/relevant stakeholders

In identifying relevant persons to be consulted on the petroleum 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 relation to – or have a function, activity or interest that may be impacted by – the planned, physical petroleum activity.

The planned activity for this EP, to be undertaken in Commonwealth waters, is the operation of the GEP to transport GEP gas from the offshore facility to the Ichthys LNG Plant in Darwin, IMR activities on the GEP and vessel activities within the operational area. Therefore, in determining who is a relevant person for engagement on the petroleum activity, INPEX sought to identify and engage with stakeholders whose functions, interests or activities could be affected by the activity.

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 petroleum 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 the EP revision and 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 (physical) petroleum 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 petroleum activity and potential unplanned emergency conditions during the preparation of the EP and INPEX Browse 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 petroleum 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 petroleum activity and potential unplanned emergency conditions during the preparation of the EP and INPEX Browse Regional OPEP.	As determined during stakeholder identification and classification process (Section 5.2)
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 and classification process (Section 5.2)

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 petroleum activity; and
- fisheries that overlap the PEZ but not the location of the planned petroleum 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 operational area (location) of the planned petroleum 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 DITT) were engaged regarding the petroleum 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 petroleum activity (e.g. WAFIC, Commonwealth Fisheries Association, NTSC etc.) were consulted regarding the petroleum 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 planned petroleum activity <u>were considered to be relevant stakeholders</u> and were accordingly engaged during the development of this 5-year EP revision.
  - Licence holders in commercial fisheries that overlap or are close to the planned petroleum activity, but whose activities or interests are not expected to be affected by the planned petroleum activity <u>are not considered to be relevant stakeholders</u>. Such licence holders were not engaged during the development of this 5-year EP revision, 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 planned petroleum activity <u>are not considered affected parties/relevant stakeholders</u> and were therefore not informed during the development of this 5-year EP revision.

Licence holders that are not considered to be relevant to the planned petroleum 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 petroleum activity or an unplanned emergency condition.

Table 5-2: Classification of commercial fishery licence holders

Fishery	Relevance and process of engagement
Commercial fisheries overlapping or close to the planned petroleum activity area and with licence holder activities or interests that may be affected by the planned petroleum activity.	
North West Slope Trawl Fishery (Cwlth)	Relevant. Licence holders directly consulted.
Western Tuna and Billfish Fishery (Cwlth)	
Northern Prawn Fishery (Cwlth)	
Northern Demersal Scalefish Managed Fishery – Area 2 (WA)	
Mackerel Managed Fishery (WA) Area 1	
North Coast Shark Fishery (Cwlth/WA) Northern Zone	
Pearl Oyster Managed Fishery - Zone 3 (WA)	
West Coast Deep Sea Crustacean Fishery (WA)	
Kimberley Prawn Managed Fishery (WA)	
Demersal (multigear) Fishery (NT)	
Aquarium Fishery (NT)	
Coastal Line Fishery (NT)	
Mollusc Fishery (NT)	
Mud Crab Fishery (NT)	
Offshore Net and Line Fishery (NT)	
Spanish Mackerel Fishery (NT)	
Trepang Fishery (NT)	
Pearl Oyster Fishery (NT)	
Commercial fisheries overlapping the planned petroleum activity area, but licence holder activities or interests are not expected to be affected by the planned petroleum activity.	
Western Skipjack Tuna Fishery (Cwlth)	Not affected. Licence holders not consulted during the development of this 5-year EP revision; however, representative industry associations were informed, and each fishery's interests considered in the development of the EP.
Broome Prawn Managed Fishery (WA)	
Specimen Shell Managed Fishery (WA)	
South West Coast Salmon Managed Fishery (WA)	
Marine Aquarium Fish Fishery (WA)	

Abalone Managed Fishery (WA) Area 8	Licence holders to be informed in the event of an unplanned emergency condition.
Commercial fisheries overlapping the PEZ but not the planned petroleum activity area.	
North Coast Crab Fishery (Including Kimberley Crab and Pilbara Crab) (WA)	Not affected. Licence holders not consulted during the development of this EP 5-year revision, 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.
Hermit Crab Fishery (WA)	
Timor Reef Fishery (NT)	
Barramundi Fishery (NT)	
Bait Net Fishery (NT)	
Coastal Net Fishery (NT)	
Aquaculture (NT)	

5.2.4 Stakeholder classification

Stakeholders were then classified based on their level of interest in/potential impact by, and influence over, the petroleum 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.
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 in 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 on the offshore Ichthys Project activities as a whole for the next five years. The information sheet included the following information:

- description of the activities, 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, where applicable. 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 petroleum 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 petroleum 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 petroleum activity, comprises a request to INPEX for further relevant information, or provides information to INPEX that is relevant to the petroleum activity or the EP.
- not a relevant matter – Correspondence does not relate to the planned petroleum activity or the stakeholder's functions; interests or activities being affected by the petroleum 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 for this EP are provided in Appendix C. The actual records of correspondence are provided in a 'Sensitive Matters Report' that is submitted to the Regulator 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 material inputs to the EP from stakeholder consultation

Stakeholder	Summary of material stakeholder feedback	Summary of INPEX action
Petroleum activity engagement		
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 notify AHO and JRCC prior to IMR activities (refer to Section 9.8.3). Vessel navigational lighting is managed in accordance with the *Navigation Act 2012* and associated Marine Orders, which align with COLREGS requirements (refer to Table 7-6, Table 7-16 and Table 8-5)
Department of Agriculture, Water and Environment (DAWE) – Fisheries	DAWE-Fisheries raised no concerns with proposed activities and requested that they (and other stakeholders i.e. AFMA and fishing industry representatives) were updated on any future developments associated with Project.	INPEX will notify DAWE-Fisheries, AFMA and fishing industry representatives of any future developments associated with the Project, as required (Refer to Section 9.8.3).
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	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:

Stakeholder	Summary of material stakeholder feedback	Summary of INPEX action
	• Notification process for oiled wildlife response	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 during its assessment of impacts and identification of controls (refer to Table 7-6) 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).
Director of National Parks	The stakeholder raised no concerns with the proposed activity and requested the following: • Ensure the EP identifies how INPEX will manage all impacts and risks on AMPs so these are consistent with associated AMP management plans • Notification of oil/gas pollution incidents that occur within or are likely to impact on an AMP.	INPEX has described all relevant AMPs and associated objectives and values of these in Section 4.3. The GEP intersects the Oceanic Shoals AMP. No other AMPs overlap the planned petroleum activity. Where unplanned activities have the potential to impact on AMPs these have been considered in Section 8 of the EP. Requested notification to DNP of oil/gas pollution incidents, which have the potential to impact on AMPs, has been included in the BROPEP.
Specific activity/aspect engagement – Domestic vessel biosecurity risk assessment		
WA DPIRD and NT DITT (Aquatic Biosecurity)	DPIRD and DITT accepted the information INPEX provided on existing best practice IMS controls. DPIRD and DITT asked for INPEX to consider utilising "vessel check". It was confirmed that vessels assigned either a 'Low' or 'medium' risk (within vessel check) are acceptable.	INPEX provided evidence that opportunistic IMS survey reports from the last four years had not identified any IMS of concern and that the PSVs and OSV had no indication they are acting as significant vectors for *D. perlucidum.* INPEX provided a draft modification to the Domestic vessel risk assessment process (i.e. remove assessment for short term vessels arriving domestically) for discussion; and provided a draft amendment to the IMS monitoring program (i.e. to replace the routine annual review by a specialist with a 5 yearly review cycle).

Stakeholder	Summary of material stakeholder feedback	Summary of INPEX action
	In addition, both stakeholder representatives, noted that actual marine pest biofouling risk posed by a vessel does not change if the vessels are travelling between Broome – Darwin – and offshore production facilities. This is because there have not been marine pests of concern detected at any of these locations, as such vessel movements between these locations is a low risk.	INPEX also described existing 'best practice' controls for managing biofouling being implemented and sought confirmation that if 'Vessel check' assessments were requested to be provided to INPEX, to inform an assessment, it would be acceptable if the vessel (within vessel check) returned either' 'medium' or 'low' risk ranking. INPEX has retained the existing best practice biofouling management controls, updated the domestic biofouling risk assessment process, amended the IMS monitoring program and where vessel check data is available for contracted vessels INPEX will accept 'low' or 'medium' risk reports as evidence the vessel pose a low biofouling risk.
Specific activity/aspect engagement – BROPEP		
Australian Maritime Safety Authority (AMSA) -Marine Environment Pollution Response (Cwth) Department of Transport (WA DoT) – Marine Safety NT Department of Environment, Parks and Water Security (EPaWS) - Marine Pollution WA DBCA DAWE	Stakeholders were engaged to explain the shift from single OPEPs to Regional OPEP concepts. Jurisdictional authority and control agency responsibilities were verified and expectations between INPEX and government agencies in regard to spill response notification, first strike actions, and spill response capabilities and arrangements were verified.	INPEX has incorporated stakeholder feedback throughout the BROPEP and the supporting documents.

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 5-year EP revision, all stakeholder enquiries were either dealt with as outlined above or are ongoing due to the iterative process of engagement being applied.

No grievances have been recorded in relation to the engagement process nor to the offshore activities undertaken by INPEX in the last 5 years.

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 during the conduct of a petroleum activity.

Ongoing consultation for the petroleum activity 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, 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 have been identified. In the preparation of this 5-year EP revision for a long-term activity, additional considerations have also been incorporated into the impact and risk assessment methodology, in accordance with NOPSEMA's Information Paper (NOPSEMA 2021a) and other guidance (NOPSEMA 2020b, 2020c). A summary of the outcomes from this process are included in Section 7 *Impact and Risk Assessment* and Section 8 *Impact and Risk Assessment – Emergency Conditions* of this EP.

As this is a 5-year EP revision, several additional sources of information and data have been reviewed and used during the preparation of the EP. These sources have been assessed/reviewed to ensure that knowledge accrued by INPEX, over the last five years of activities, has been used as the basis for ensuring that appropriate and effective controls are in place to manage the activities covered by this EP. Assessed/reviewed sources of information and data included:

- outcomes of quarterly risk reviews undertaken during recent years of operation
- outcomes of audits and inspections undertaken during recent years of operation
- new information assessments/Management of Change (MoCs) updates
- annual and monthly performance reporting undertaken during recent years of operation
- incident reports, investigations and lessons learned during recent years of operation
- environmental monitoring data gathered during recent years of operation.

Several HAZID (environmental hazard identification) workshops were also undertaken for this EP revision. These workshops involved the review and update of the original HAZID, which considered changes to the activity description and any accrued information and data (refer above). The workshops involved small, targeted focus groups including environmental, engineering, compliance, health, safety, and emergency response personnel. Each workshop focussed on a specific topic e.g. IMR activities, emergency conditions etc.

The HAZID workshops were undertaken in accordance with INPEX health, safety and environment (HSE) Risk Management processes. The approach generally aligned to the processes outlined in 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:

1. the establishment of context
2. the identification of aspects, hazards and threats (and evaluation of interaction to determine an impact pathway)
3. the identification of potential consequences (severity)
4. the identification of existing design safeguards and control measures
5. the proposed additional safeguards (ALARP evaluation)
6. an assessment of the likelihood

7. an assessment of the residual risk
8. an assessment of the acceptability of the residual risk
9. 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*). A review of the scope and activities to be covered by the EP for the next five years was then undertaken (Section 3 *Description of the activity*). This was achieved through a series of meetings and discussions with relevant HSE, project teams, operations, engineering and emergency response personnel. Lessons learned from previous years of operational activities and IMR activities were also considered.

A review of the existing environment, and confirmation and identification of the particular values and sensitivities was also undertaken. This included a revised and updated EPBC Act Protected Matters report (Appendix B) and the incorporation of information and data collected by INPEX (and other published literature sources) during environmental monitoring undertaken in recent years in the Browse Basin.

The outcome of these exercises is presented in Section 2 *Environmental management framework*, Section 3 *Description of the activity* and Section 4 *Existing environment*, of this EP.

6.2 Identification of aspects, hazards and threats

The aspects associated with the petroleum activities covered by this EP revision were grouped to align with the INPEX BMS environment standards. An aspect is defined as

"An element or characteristic of an activity, product, or service that interacts or can interact with the environment" (ISO 14001 2015).

A summary of the aspects identified are as follows:

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

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.

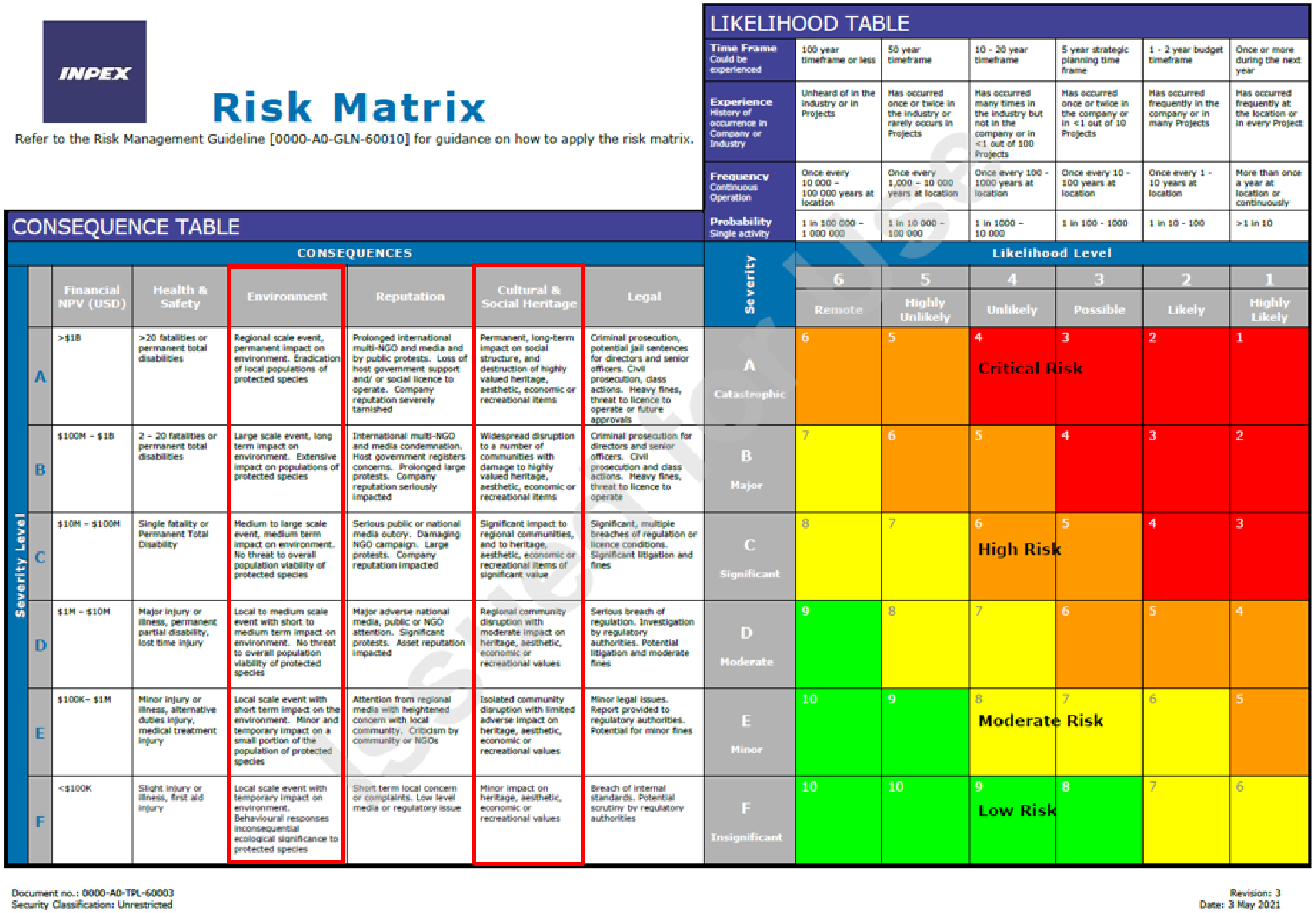
For the purposes of the evaluation, environmental values and sensitivities to be considered include the following:

- 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:
    - 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.
- BIAs associated with EPBC-listed species.

Outcomes from previous and existing risk assessments were reviewed against the revised activity description (Section 3) and existing environment description (Section 4) to ensure all hazards and threats were captured in this EP revision.

6.3 Identify potential consequence

In Section 7 *Impact and risk assessment* and Section 8 *Emergency conditions*, for each aspect, the greatest consequence (or potential impact) of an activity, is evaluated with no additional safeguards or control measures in place for the activities as described in Section 3. This allows the assessment to be made on the maximum foreseeable exposure of identified values and sensitivities to the hazard from the activities, taking into account the extent and duration of potential exposure. The consequence is defined using the INPEX risk matrix (Figure 6-1).



INPEX

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

CONSEQUENCES

Severity Level	Financial NPV (USD)	Health & Safety	Environment	Reputation	Cultural & Social Heritage	Legal
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
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
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
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
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
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

Likelihood Level

Severity	6 Remote	5 Highly Unlikely	4 Unlikely	3 Possible	2 Likely	1 Highly Likely
A Catastrophic	6	5	4 Critical Risk	3	2	1
B Major	7	6	5	4	3	2
C Significant	8	7	6 High Risk	5	4	3
D Moderate	9	8	7	6	5	4
E Minor	10	9	8 Moderate Risk	7	6	5
F Insignificant	10	10	9 Low Risk	8	7	6

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Figure 6-1: INPEX risk matrix

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 the existing design are then identified to prevent or mitigate the threat and/or its consequence(s). These controls may relate to the implementation strategy 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.

The level of performance of existing controls currently being implemented was also reviewed in a series of meetings and discussions with relevant HSE, project teams, operations, engineering and emergency response personnel. The objective of these discussions was to ensure that current controls are effective and to identify any new additional controls that may now be available, where they may not have been during previous years of operation. The outcomes of these discussions are documented in ALARP review/new information assessment logs and a summary is present in the relevant sections of this EP revision (Sections 7 & 8 and INPEX *Browse Regional OPEP*).

Preference	Control		Description
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

6.6 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

Where additional controls/safeguards are identified, the residual risk is then evaluated and ranked.

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 2019b), 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

Principles of Ecological Sustainable Development	**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 9.1) 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 Ichthys Project. 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. Energy efficiency and emissions reduction technologies have been developed and incorporated into the design of the Ichthys Project.
(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 petroleum 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.

Throughout operations to date, INPEX has undertaken regular environmental monitoring resulting in subsequent reviews and updates to various management plans. In preparation of this 5-year EP revision, a review of recent environmental monitoring data has been used to confirm the effectiveness of the control measures in place and to ensure that the adaptive management process and ongoing improvements are resulting in maintaining an acceptable level of environmental impact.

6.9 Definition of performance outcomes, standards and measurement criteria

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

EPOs, EPSs and measurement criteria that relate to the management of the identified environmental impacts and risks are defined as follows:

- 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.
- 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

7.1 GEP hazard overview

7.1.1 Rupture and depressurisation

The GEP (downstream of the GERB to the beach valve) has a total internal volume of ~710,000 m^3. In order to transfer GEP gas, the GEP is expected to have an inlet pressure (from the GERB) of approximately 210 bar and an outlet pressure, into the Ichthys LNG Plant, typically between 65 bar and 130 bar.

The GEP inventory during operation is up to 5,900 MMscf. However, prior to a planned maintenance shut-downs, the GEP will be allowed to 'settle-out', where the pressure between the CPF and Ichthys LNG Plant beach-valve become effectively equal. The GEP inventory at maximum settle-out pressure is up to 6,200 MMscf. The chemical composition of the GEP gas is presented in Table 3-2.

Dense phase exists when a pure compound or mixture (e.g. GEP gas) is heated and/or compressed beyond a critical temperature and pressure, such that it becomes a dense, highly compressed product that typically exhibits a viscosity similar to that of gas but a density closer to a liquid. Dense phase within the GEP will be achieved through pressurisation alone, as the dense phase gas will travel through the GEP at approximately ambient seabed temperature.

In the event of a GEP rupture, GEP gas in dense phase would escape. It would undergo rapid expansion due to a drop in pressure, which would in turn result in a large drop in temperature. The escaping GEP gas would then rapidly mix with the surrounding seawater and rise through the water column, warming as it mixes and dropping in pressure as it rises.

In the event of a rupture, the GEP gas inside the pipeline would transition from dense phase to two-phase (due to the pressure drop) and liquid hydrocarbon (condensate droplets) would form inside the GEP.

Close to the rupture location (within tens of metres of the rupture), the liquid condensate droplets are expected to escape with the high-velocity GEP gas into the marine environment with a proportion becoming entrained and some ultimately entering the atmosphere as a mist of condensate in a gas cloud.

Further from the rupture, the velocity of gas and condensate droplet movement inside the GEP is far slower and the remaining condensate droplets are predicted to collect as liquid pools in the low points along the GEP route. As depressurisation continues, gas will flow through the GEP over the top of these pockets of liquid hydrocarbons/condensate, leaving liquid pools in the depressions of the GEP. At some point, as the pressure continues to drop, the condensate will start to re-evaporate into a gas phase.

Following a GEP rupture, equilibrium between the internal GEP pressure and ambient seawater pressure will ultimately be reached, at which point gas, condensate and seawater will remain in the GEP. The equilibrium state of the GEP should prevent further release of gas and condensate.

Predicative simulations including recent OLGA modelling using Ichthys GEP production data have forecast that depressurisation from a full-bore rupture event may take between approximately 2 and 4 days, depending on the location and size of the rupture. Depressurisation from a smaller hole, or controlled depressurisations, would be expected to take longer.

After a rupture event, once the GEP internal pressures had reached equilibrium with the ambient seawater pressure at the rupture location, GEP passivation would be undertaken to protect the integrity of the GEP from corrosion. Following this step, a major repair would be initiated. In the case of a major repair, the activity of depressurising the GEP, including pigging/dewatering and discharges of GEP contents into the marine environment is within the scope of this EP (Section 7.2.1). Spool replacement and re-commissioning of the GEP will be managed under another EP, to be submitted to NOPSEMA for review/acceptance, prior to undertaking the activity.

7.1.2 Gas and condensate in the environment

The rate of entrainment of hydrocarbons (i.e. gas and condensate) into the water column will increase with water depth. This is due to a range of factors (RPS APASA 2016) including:

- assuming equal pressure of release, a greater depth results in a greater contact time between a gas/condensate plume and the water column, resulting in greater rates of dissolution
- colder water (present at greater depths) increases the rate of dissolution of hydrocarbons into the water column due to greater solubility of hydrocarbons with decreasing water temperature
- colder water (from a deep-water release) rising within a gas/condensate plume will result in the plume having higher density than the ambient seawater (through which the plume is rising). Consequently, there will be a point in the water column where equilibrium occurs and the plume becomes neutrally buoyant and stops rising. The entrained plume fluids, which will include condensate droplets emitted at the rupture location, become 'density-trapped' and will then detrain from the gas bubbles and intrude horizontally into the water column (RPS APASA 2016).

The scenario with the greatest potential volume of hydrocarbons becoming entrained in the water column is a GEP rupture occurring in the deepest water (250 m). A detailed evaluation of the fate of condensate released during a rupture in 250 m water depth is presented in the impact and risk assessment of a GEP rupture scenario in Section 8.3.

Smaller volumes of gas and residual condensate liquid are expected to remain in the GEP following a rupture in shallower water, as more GEP gas would be released before the GEP internal pressure reached equilibrium with the shallower ambient seawater pressure. However, releases of GEP gas in shallower water will result in less hydrocarbon entrainment in the water column than a deep-water release. This is due to warmer temperatures, shorter duration of travel-time through the water column, and larger difference in pressure between the water column and the rupture location, all resulting in more of the plume reaching the atmosphere, rather than entraining in the water column. Modelling of a release scenario in 25 m water depth (similar to the water depth near the Cwlth waters/NT waters boundary) predicted that 99.9% of all gas and condensate molecules would immediately enter the atmosphere with insignificant quantities of entrainment occurring. (RPS APASA 2015a pers. comm.).

During the initial stages of a GEP rupture event, there is the potential for a flammable gas cloud above the ocean surface, which would contain gas and a mist of condensate droplets. The results of modelling a release of 10,000 m^3 of condensate liquid onto the ocean surface at a decreasing release rate over five days, predicted that 99% of the released condensate would evaporate within minutes, regardless of wind speed (RPS APASA 2016). Therefore any condensate 'mist' associated with a gas cloud settling onto the ocean surface before evaporating would not result in a significant accumulation of hydrocarbons on the sea surface (RPS APASA 2016).

7.1.3 GEP internal corrosion risk

Figure 7-1 illustrates the corrosion environments expected to occur in a free-flooded pipeline. As the pipeline initially starts with dry gas with an internal pressure well above seabed ambient, the gas and condensate will escape until the GEP internal pressure drops to seabed ambient. At this point, raw seawater will enter the line (1) and (as the GEP generally angles upwards towards shore) will flood the majority of the pipeline from the rupture location to the GERB. The pipeline will eventually settle to the local hydrostatic pressure at the rupture location. For context, the GEP water depth profile is presented in Figure 7-2.

The shallow angle of the pipeline in most places means that the interface between the raw seawater and the gas at the level of the hole/rupture is expected to stretch for hundreds of metres, even kilometres. A skin of residual condensate will sit on top of the raw seawater (2). The gas above the interface will quickly become water saturated (3). Depending upon the rapidity of the flooding, and the location and bathymetry, there may be trapped wet gas caps at high spots along the pipeline (4). The onshore section will remain filled with trapped gas. Far enough from the water/gas interface, the limits of diffusion are likely to allow the gas at the shore-end of the pipeline to remain dry (5).

A significant proportion of the pipeline may be exposed to raw seawater. The main determinant of the corrosivity of raw seawater is the oxygen content. A secondary corrosion threat in the bulk flooded region would be microbial corrosion. If corrosive bacteria enter the pipeline with the raw seawater, they may form corrosive colonies. In extreme cases, microbial corrosion can lead to localised corrosion of up to ~7 mm/yr, though there would be a period of lag before the colony life cycle proceeded to the fully formed sessile colony able to manifest this sort of corrosion rate. The raw seawater in the interface region will also form a complicated corrosion environment. Firstly, acid gases (principally CO_2) will dissolve from the production gas into the seawater at the surface, giving a problematic combination of oxygenated water, salt and CO_2. As the pipeline will be open to the ocean, the pressure will vary according to the hydrostatic pressure, which will vary slightly by wave action, and more significantly by tidal changes. Tides in the Darwin region can reach 7.8 m, which will cause the gas/water interface to rise and fall significantly within the pipeline. The pipe wall/field joint areas in the intertidal region in Darwin Harbour will therefore be exposed to a cycle of acidified seawater, followed by wet gas. In summary, following a rupture and seawater ingress into the GEP, a complex combination of corrosion risks exists inside the GEP.

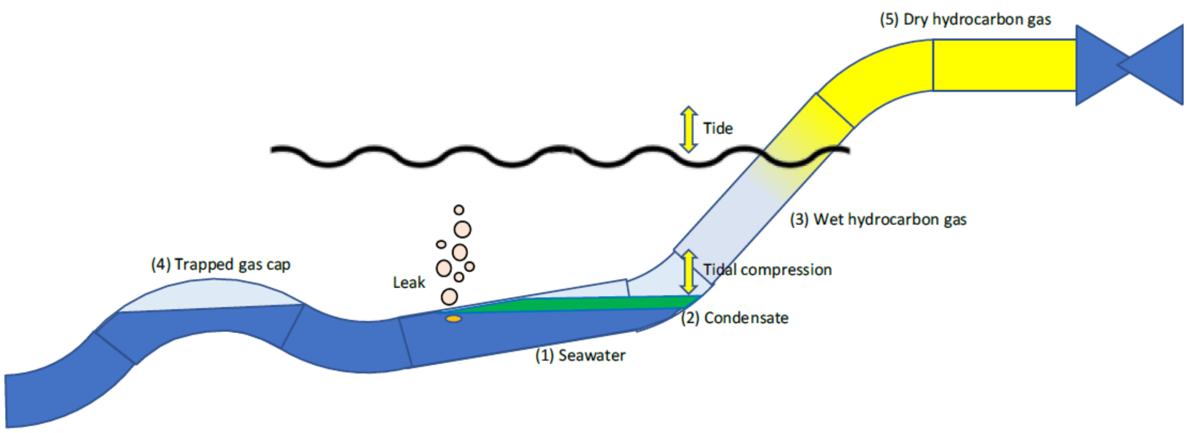

Figure 7-1: Illustration of GEP rupture depressurisation and seawater ingress

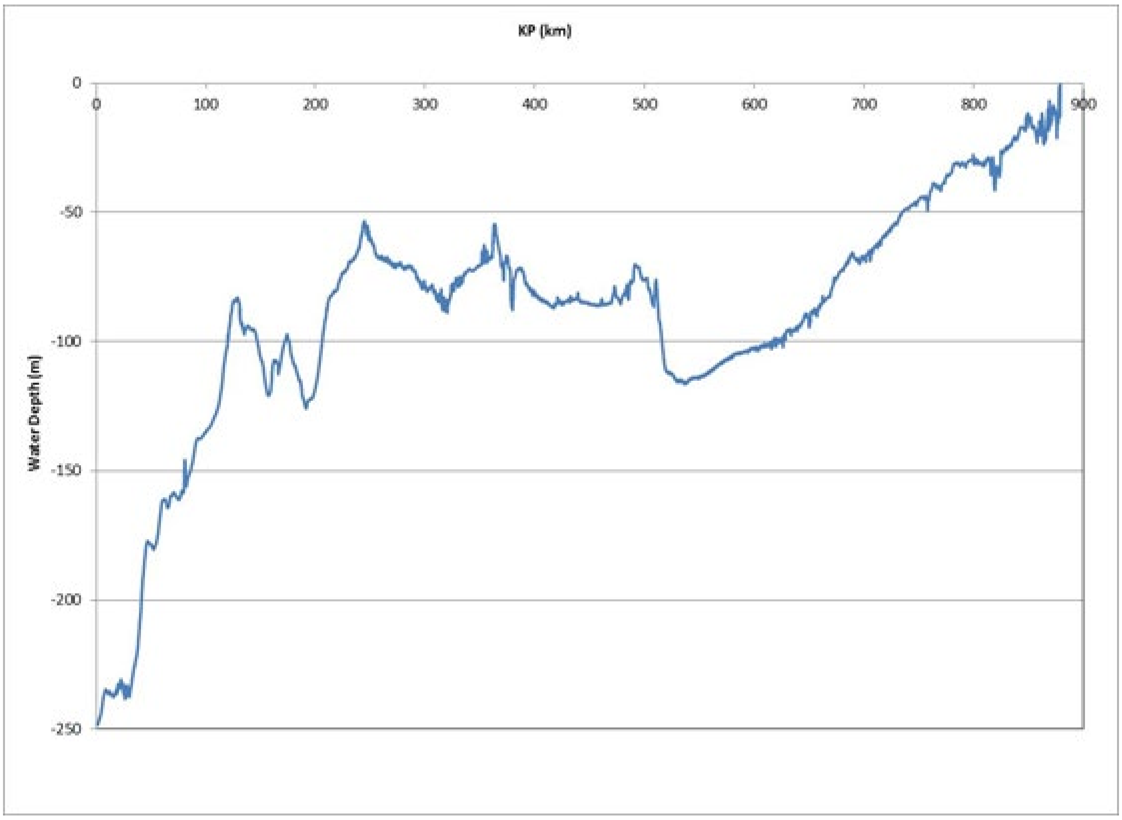

Figure 7-2: GEP water depth profile

7.2 Emissions and discharges

Activities supporting the operation of the GEP infrastructure and IMR will result in several emissions and discharges to the environment. These can be split into the following categories:

- IMR discharges
- vessel emissions (atmospheric and light)
- vessel liquid discharges.

7.2.1 IMR discharges

Marine growth and limescale removal chemicals

Marine growth and limescale (calcium) deposits can occur on the GEP infrastructure. Deposits along the surface of the GEP are not of concern; however, where they impede the ability to conduct inspections (such as at hot-tap-tees or at the mid-line-dummy-spool), or for the replacement of cathodic protection etc., they need to be removed. It should be noted that the vast majority of the GEP will never be subjected to marine growth removal.

Initially, physical removal with high-pressure or cavitation jets, or physical brushing, may be used to remove as much as possible. If this is unsuccessful, marine growth and limescale removal chemicals are needed. An evaluation of the potential impacts and risks associated with the discharge of these chemicals is included in Table 7-1.

Table 7-1: Impact and risk evaluation – Marine growth/limescale removal chemicals

<table>
<tr><th colspan="2">Identify hazards and threats</th></tr>
<tr><td colspan="2">If physical removal is unsuccessful, weak acids such as acetic acid (vinegar), sulfamic acid, or similar, may be used to remove residual marine growth and limescale deposits on the GEP and associated infrastructure such as hot-tap tees or the mid-line dummy spool. A temporary reduction in pH has the potential to expose marine flora and fauna to a change in water quality that may result in reduced ecosystem productivity and/or diversity.</td></tr>
<tr><th>Potential consequence</th><th>Severity</th></tr>
<tr><td>In the event of the need to use removal chemicals, the particular values and sensitivities identified as having the potential to be impacted are:
• planktonic communities
• KEFs
• benthic communities
• EPBC-listed species (turtle foraging BIA).
Typically, a shroud is installed over the area to be treated and the acid is injected and left to react inside the shroud. The shroud is then removed, and any residual acid is released to the environment, where it rapidly reacts and neutralises due to the natural buffering capacity of seawater. Volumes would be <1 m^3 and are typically expected to be only a few litres.
Marine growth and limescale removal chemicals are weak acids and are typically classified as 'posing little or no risk to the environment' (PLONOR) whereby there are no bioaccumulation or biodegradation concerns with their use (OSPAR 2012).
The effect of discharges with elevated pH on the identified values and sensitivities will be influenced by the buffering capacity of the seawater at the point of discharge, which may affect the ionisation and neutralisation of the chemicals. A significant decrease of the pH of the receiving water is not expected, and changes in pH of the receiving water should stay within the natural range of the pH as the marine growth and limescale removal chemicals are of small volume (<1 m^3) and will likely be rapidly neutralised due to the large buffering capacity of seawater.
Reductions in pH can result in impacts to plankton due to the weakening of their calcium skeletons. Plankton in the immediate vicinity of the discharge could be exposed to decreased pH levels; however, it is not likely to elicit a toxic response given the expected rapid neutralisation. The potential consequence on planktonic communities is a localised impact on plankton abundance at the point of discharge with inconsequential ecological significance (Insignificant F).</td><td>Insignificant (F)</td></tr>
</table>

Any effects to benthic communities (including KEFs and benthos associated with the turtle foraging BIA) from highly localised, low-level, very short-duration changes in pH are not expected to be ecologically significant or to affect productivity. The closest submerged banks and shoals to the GEP route are Flat Top Bank and Echuca Shoal located 3 km and 9 km away respectively. Therefore, based on these distances, no impacts are expected due to the rapid neutralisation of the small volumes of (<1 m^3) marine growth/limescale removal chemicals. The benthic communities within the operational area and in close proximity to the location of the removal chemical discharges have limited ecological significance and are well represented throughout the region, with 98% of the GEP route consisting of featureless, unconsolidated clay or silty sands (INPEX 2010). In areas of rocky outcropping increased density and diversity of epibenthic fauna has been reported (Neptune Geomatics 2009). Geophysical survey data and drop camera surveys identified that the only substantial areas of subcrop were between KP 361–374.5 and KP 482–513 (both areas located within the carbonate bank and terrace system of Sahul Shelf KEF). The only exposed outcrop were small areas at KP 36.5, KP 187 (which is located within the ancient coastline at 125 m depth contour KEF), and between KP 379 (located within the carbonate bank and terrace system of Sahul Shelf KEF).

The entire GEP route traverses four KEFs (the ancient coastline 125 m depth contour, the carbonate bank and terrace system of the Sahul Shelf, the pinnacles of the Bonaparte Gulf and continental slope demersal fish communities), and turtle foraging BIA. The environmental values and sensitivities of the KEFs/BIA i.e. rocky outcropping, high topographic relief or complexity, resulting in increased benthic diversity and marine fauna aggregations 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 incidental nature of this disturbance (localised, temporary elevation in pH) is not expected to affect regional diversity and productivity of benthic communities. Therefore, the potential consequence associated with the use of marine growth removal chemicals is considered insignificant (F).

There is the potential for individual fishes, directly adjacent to the discharges to be exposed to elevated pH. Such exposure is not expected to result in any significant impacts to fishes based on the low volume and high dilution levels; also, 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).

Due to the high buffering capacity of the surrounding seawater, infrequent application of the chemicals, rapid neutralisation and dispersion of the marine growth/limescale removal chemicals by prevailing currents, there is no potential for cumulative impacts to arise from the repeated application of such chemicals along the GEP.

No other aspects of seasonality relating to sensitive biological processes have been identified that pose a higher potential for ecological impact from multiple IMR discharges. This is to be expected given that in the operational area no submerged banks or shoals eg benthic primary producer habitat (BPPH) have been identified, such as macroalgae or corals which are reported to exhibit seasonal changes in biomass and reproduction (Woodside 2014).

Identify existing design safeguards/controls

- *INPEX Chemical Assessment and Approval Procedure* for selection of marine growth and limescale removal chemicals 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	No use of marine growth and limescale removal chemicals	No	The GEP and subsea infrastructure need to be appropriately maintained. Physical removal of marine growth and lime scale will be used as a primary marine growth removal technique. If insufficient marine growth removal is achieved using physical removal such as jetting, chemicals will be used as an alternative option to remove deposits.
Substitution	Replace marine growth and limescale removal chemicals (weak acids) with alternative products.	No	Weak acids are a cost-effective and environmentally benign method for the removal of marine growth and limescale deposits from subsea infrastructure. No alternative chemicals with lower environmental hazard ratings have been identified.
Engineering	Recover spent chemicals to the surface for onshore disposal.	No	Chemicals will be mostly spent following their reaction with the calcium deposits, and therefore of very limited risk to the marine environment. The additional time and cost associated with recovery, storage, transportation and disposal of seawater with residual quantities of marine growth and limescale removal chemicals is considered grossly disproportionate, given the low risk of impact from this activity.
Procedures and administration	None identified	N/A	N/A

Identify the likelihood	
Likelihood	Due to the very small volumes and weak acidity of products, such as acetic and sulfamic acid; the fact that the acid will have already reacted with the calcium deposits; and naturally high buffering capacity of the marine environment to rapidly neutralise any residual acid upon release, the likelihood of the consequences occurring is considered to be Highly Unlikely (5).
Residual risk	Based upon a consequence of Insignificant (F) and likelihood of Highly Unlikely (5) the residual risk is Low (10).

Residual risk summary		
Consequence	Likelihood	Residual risk

Insignificant (F)	Highly Unlikely (5)	Low (10)

Assess residual risk acceptability

Legislative requirements

There are no relevant Australian environmental legislative requirements that relate specifically to the discharge of marine growth and limescale removal chemicals. They are widely used in the industry and subsea discharges to the marine environment are considered to be standard practice. Chemicals to be discharged have been selected because they present an acceptable environmental hazard using the *INPEX Chemical Assessment and Approval Procedure.*

Stakeholder consultation

No stakeholder concerns have been raised regarding potential impacts and risks from discharges to the marine environment.

Conservation management plans / threat abatement plans

Several conservation management plans have been considered in the development of this EP (refer Appendix B) and chemical discharge has been listed as a threat for marine turtles (DEE 2017). Actions relating to chemical discharge involve the minimisation of discharges and adherence to best practice guidelines. The management of marine growth and limescale removal discharges is consistent with the intent of the actions identified in the conservation management plan.

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 acceptable 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

Refer to Table 9-5

Grout/concrete, asphalt and steel shavings discharges

Grout is a cement-based adhesive and will be used during GEP repair clamping, and in grout bags for span correction.

Grout may be released to the marine environment during the following:

- sealing clamps – minor losses could occur (typically <1 m^3)
- filling grout bags used for span support – minor losses could occur (typically <0.5 m^3).

During maintenance or repair activities on the GEP, high-pressure water blasting would be required to remove the concrete weight coating and asphalt enamel. During this activity approximately 0.3 m^3 of asphalt enamel and 2.5 m^3 of concrete may be released over approximately 48 hours. This activity may also result in very fine steel shavings being released to the marine environment in the immediate location of the repair. Very fine steel shavings, in the order of a few kilograms of <1 mm strips, may be deposited on the seabed in the area of the repair.

An evaluation of the potential impacts and risks associated with these discharges is presented in Table 7-2.

Table 7-2: Impact and risk evaluation – Grout/concrete/asphalt and steel shavings discharges

<table>
<tr><th colspan="2">Identify hazards and threats</th></tr>
<tr><td colspan="2">During various maintenance and repair activities, discharges of grout, asphalt enamel, concrete weight coating and steel shavings may be released to the marine environment. Anticipated volumes of various discharges include; grout (<1 m^3), asphalt enamel (~0.3 m^3), concrete weight coating (~2.5 m^3), very fine (<1 mm) steel shavings (~3 kg). These discharges have the potential to result in changes in water and sediment quality through seabed disturbance which may result in reduced ecosystem productivity and/or diversity.</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 are:
• KEFs
• benthic communities
• EPBC-listed species (turtle foraging BIA).
As described in Section 4.6.2, the majority of the GEP route (>98%) is comprised of featureless, unconsolidated clay, silts and sands, with the most dominant seabed features confirmed as pockmarks and sand waves. However, geophysical survey data and drop camera surveys identified that the only substantial areas of subcrop were between KP 361–374.5 and KP 482–513 (both areas located within the carbonate bank and terrace system of Sahul Shelf KEF). The only exposed outcrop were small areas at KP 36.5, KP 187 (which is located within the ancient coastline at 125 m depth contour KEF), and between KP 379 (located within the carbonate bank and terrace system of Sahul Shelf KEF). Although the GEP route traverses four KEFs (i.e. the ancient coastline 125 m depth contour, the carbonate bank and terrace system of the Sahul Shelf, pinnacles of the Bonaparte Gulf and the continental shelf demersal fish communities), the environmental values of these KEFs (rocky outcropping, high topographic relief or complexity, resulting in marine fauna aggregations) are generally not present within the operational area. However, turtle foraging in the Joseph Bonaparte Depression BIA, which overlaps the operational area may occur throughout the year both at the sea surface and on the seabed.
Grout used will typically be a type A-cement, or high-sulfate-resisting Portland cement (type D cement in accordance with Australian Standard AS 1315:1982 Portland cement) mixed with small amounts of friction reducer, defoamer and retarder additives. Portland cement forms an alkaline slurry when mixed with water. When set, it is persistent, stable and does not decompose into hazardous by-products.
Grout discharged to the marine environment is expected to harden quickly into small inert solid lumps that will settle to the seabed adjacent to the infrastructure within the operational area. Grouting maintenance and repair activities are not anticipated during the life of the EP, and are therefore considered to be infrequent. Activities will also be of short duration and at specific isolated locations only, as required. The only anticipated impacts associated with grout discharges would be highly localised, minor seabed disturbance and smothering of individuals of sessile benthic fauna immediately adjacent to the GEP.</td><td>Insignificant (F)</td></tr>
</table>

Asphalt enamel, concrete weight coating and steel shavings are all inert substances. When removed from the GEP, these particles are expected to sink to the seabed adjacent to the GEP. These discharges would only occur in the event of a repair, and therefore, other seabed disturbances associated with mud-mats, pipe-lifting frames etc. may also be occurring. Therefore, the seabed disturbance associated with these discharges are likely to occur within an already disturbed footprint (refer to Table 7-15). The only anticipated impacts associated with asphalt enamel and concrete weight coating discharges would be highly localised, minor seabed disturbance and smothering of individuals of sessile benthic fauna immediately adjacent to the GEP. The very thin (<1 mm) steel shavings will corrode in seawater within a short period. Negligible alterations to seabed sediments would occur as a result of steel shavings discharges. Any physical damage to benthic habitat would be limited in area and is not expected to occur due to the very limited physical area of seabed disturbance associated with these discharges, any impacts to benthic communities are not expected particularly in relation to the broader KEFs/BIAs where large areas of similar habitat exist. Therefore, EPBC-listed species, including fish, sharks and turtles dependent on these benthic ecosystems are also not expected to be impacted from these discharges and the consequence is considered Insignificant (F). There is little understanding of the cumulative impact of several seabed-based activities in one area and the ability of species or habitats to recover once a pressure (i.e. physical loss of habitat or damage) has been removed (Foden et al 2011). Habitats that require long recovery periods are considered to be more sensitive than those with rapid recovery rates, and the resilience of marine environments to cumulative interactions of multiple pressures is considered to be poorly understood. Seabed disturbance from concrete, asphalt and steel shavings discharges, although not planned over the life of this EP, may occur as a result of a requirement to repair the GEP. Small particles may lead to smothering, but areas of soft sediments are typically highly mobile with high associated levels of natural disturbance. Therefore, impacts to benthic communities are expected to be temporary with rapid rates of recovery due to the resilience of the benthic communities from natural disturbances associated with hydrodynamic process at or near the seabed (Insignificant F). The presence of foraging marine turtles may occur throughout the year (BIA overlaps the operational area) however the nature of the concrete, asphalt and steel shavings discharges are not expected to result in any impacts to turtles. During any repair activities, marine turtles would be alert to the presence of the structures and equipment through underwater lights and sounds generated. Potential impacts are expected to be highly localised and the potential consequence associated with discharges of concrete, asphalt and steel shavings has been evaluated as Insignificant (F).	

Identify existing design safeguards/controls			
• *INPEX Chemical Assessment and Approval Procedure* for selection of grouting chemicals in accordance with Section 9.6.1 and Table 9-5. • Engineering analysis / environmental assessment of possible repair techniques considering alternatives to minimise discharges to sensitive receptors at the repair location on the GEP and seasonal variability.			
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	Recovery of grout, concrete weight coating, asphalt enamel and steel shavings to surface during maintenance and repair activities.	No	Given the very limited environmental impact of these discharges, the time and costs associated with recovery of these products is not considered warranted.
Procedures and administration	None identified	N/A	N/A

Identify the likelihood	
Likelihood	Due to the small volumes released into the dispersive marine environment in the operational area, the limited spatial extent of any seabed disturbance during these maintenance and repairs activities, and the limited ecological significance of benthic habitats in the operational area, the likelihood of the identified consequence occurring to the identified values and sensitivities is considered to be Highly Unlikely (5).
Residual risk	Based upon a consequence of Insignificant (F) and likelihood of Highly Unlikely (5) the residual risk is Low (10).

Residual risk summary		
Consequence	Likelihood	Residual risk
Insignificant (F)	Highly Unlikely (5)	Low (10)
Assess residual risk acceptability		

Legislative requirements

There are no relevant Australian environmental legislative requirements that relate specifically to the discharge of grout, concrete and asphalt enamel coatings or steel shavings. However, the use of grout is widely accepted in the industry as are the discharges associated with pipeline repairs.

Stakeholder consultation

No stakeholder concerns have been raised regarding potential impacts and risks from discharges to the marine environment.

Conservation management plans / threat abatement plans

Several conservation management plans have been considered in the development of this EP (refer Appendix B). Habitat degradation and/or modification from anthropogenic disturbance have been identified as threatening processes. Additionally, several documents identify a need to contribute to the long-term prevention of the incidence of harmful marine debris. Through the implementation of the controls for the activity it should limit any impacts to habitats.

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 acceptable 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 IMR activities and locations.	GEP repair options assessment will include an environmental assessment prior to selection of repair techniques.	GEP repair options assessment documentation. Records of repair activities demonstrate activities were conducted in accordance with engineering design.

Controlled release during GEP passivation

As described in Table 3-4 (GEP dewatering - step 1), in the event of a rupture of the GEP, the GEP line-pack would be reduced by flaring onshore at the Ichthys LNG Plant. As described in Section 7.1, seawater would flow into the defect opening and the GEP would naturally depressurise to ambient levels over several days to weeks. The combination of seawater and residual liquid/aqueous condensate including carbon dioxide, is predicted to form carbonic acid.

Carbonic acid results in a lowering of pH and if left over time, can result in corrosion of steel. Stress corrosion cracking can occur in tubing containing residual tensile stresses from welding or manufacturing. Cathodic depolarizers such as oxygen (present in seawater) in conjunction with the presence of carbonic acid will increase the corrosion rate of steel. Oxygen also increases the susceptibility of mild steel to stress corrosion cracking.

To protect the integrity of the GEP and minimise the risk of internal corrosion / stress corrosion cracking, GEP passivation activities would be required. Specifically, this would involve pushing a flooding PIG train from the GERB and the Ichthys LNG Plant towards the rupture location to displace the seawater (Table 3-4; GEP dewatering - step 2). This process would also displace residual gas and condensed hydrocarbons remaining in the GEP towards the defect opening and result in a controlled release during the GEP passivation.

The potential field of effect from the discharge of condensed hydrocarbons into the marine environment during GEP passivation has been assessed (RPS 2020).

As described in Section 7.1, a worst-case scenario would involve a full-bore rupture at 250 m water depth. OLGA modelling was conducted and calculated that following a rupture and natural depressurisation of the GEP at 250 m water depth, the residual gas and condensed liquids remaining in the GEP would be 675 MMscf (19.07 Mm^3) and 1,665 m^3 respectively. A release at shallower water depths would result in less residual liquids in the GEP, due to reduced seabed ambient pressure. The distribution of condensed fluids within the pipeline will vary spatially in a manner that is predictable by the local slope of the pipeline.

During GEP passivation the PIG train would operate at speeds ranging from 0.4 to 1 m/s to displace the GEP contents. Gas would flow over the top of condensed fluids at a rate dependent upon the pigging speed.

Due to the bathymetric variation along the GEP route, pigging operations would tend to push forward and gradually gather up the condensed liquids as the PIG train is rising upslope. The gathered liquids would then run downhill along local down-slopes after being pushed over local peaks. For the rupture scenario at 250 m water depth, the last 125 km of the pipeline route (~ 3.6 days travel at the lower PIG speed) to KP0 (CPF end) is generally downslope (170 m increase in depth). In the modelling study (RPS 2020), based on pigging rates, it has been assumed that the total volume of condensed fluids would run down this slope to begin seeping from the rupture opening over the last three days (Table 7-3), with the largest slug (approximately 40% of total volume) of condensed fluids being discharged out over the last two hours of the pigging operation.

Table 7-3: Estimated discharge rates of condensed liquid over four periods covering the last three days of pigging operations used as modelling input

Period	Assumed duration (hours)	Volume (m^3) [% of total]
1	24	166.5 [10%]
2	24	416.25 [25%]
3	22	416.25 [25%]
4	2	666 [40%]

The potential field of effect for both the lowest and highest pigging speeds from the modelling study are shown in Figure 7-3.

An evaluation of the potential impacts and risks associated with discharges from the depressurisation of the GEP is included in Table 7-4.

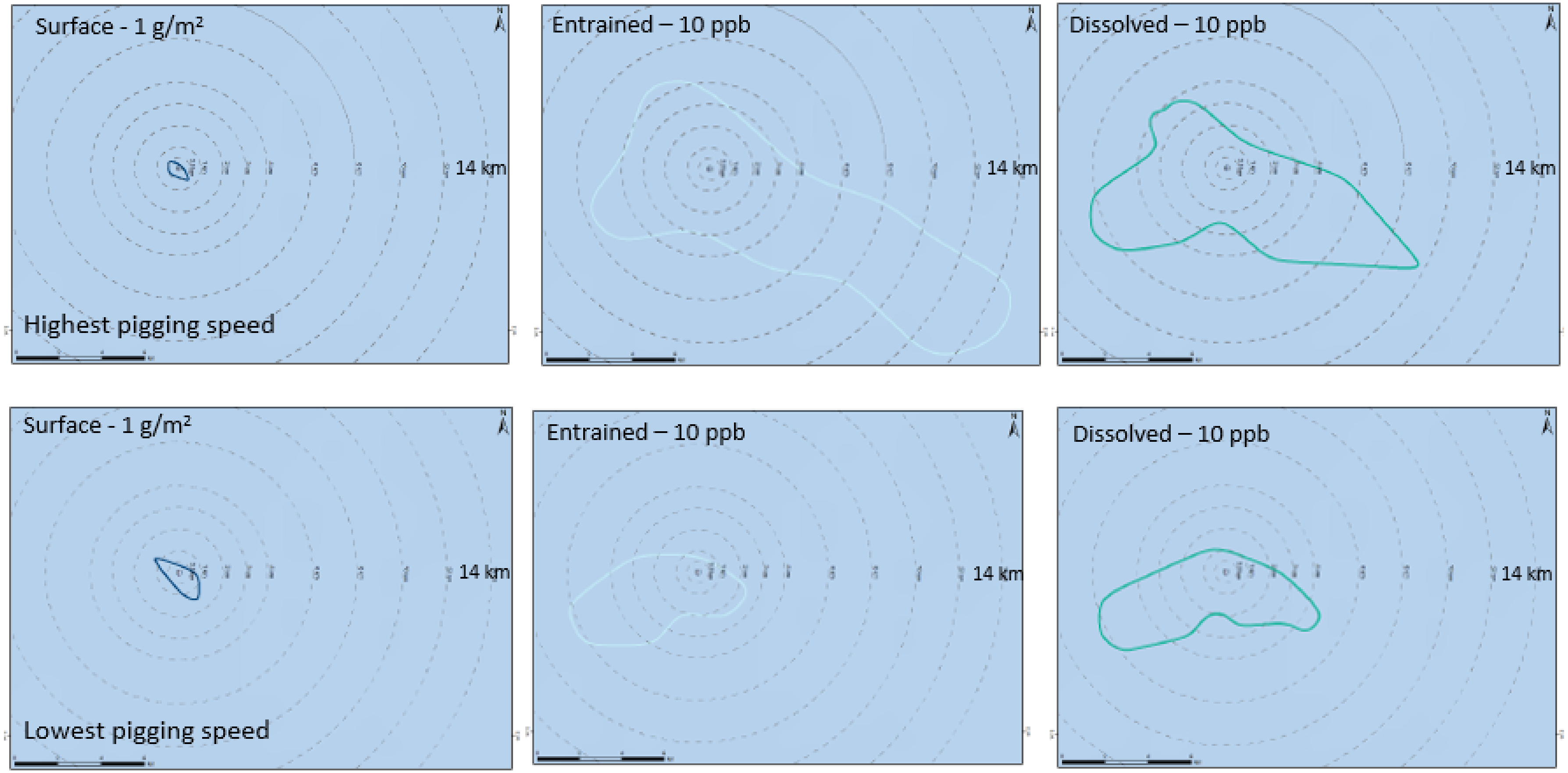

Figure 7-3: Calculations for the potential field of effect for surface, entrained and dissolved components at concentrations exceeding thresholds given discharge at the highest and lowest pigging speeds.

Table 7-4: Impact and risk evaluation – Controlled release GEP passivation

<table>
<tr><th colspan="2">Identify hazards and threats</th></tr>
<tr><td colspan="2">All controlled discharges associated with GEP passivation would occur at the rupture location, which could occur anywhere along the GEP route and will be released within one metre of the seabed. The worst-case scenario would release 1,665 m^3 of condensed liquid hydrocarbons. OLGA modelling confirmed that the condensed hydrocarbons within the GEP would include alkanes in the range C5 to C12, as well as BTEX compounds. This data was used in the modelling study (RPS 2020) which took into consideration the physical and chemical properties of condensed liquids and the range of transport and weathering processes that could affect the liquids when discharged subsea in the presence of natural gas. Pigging speed was shown to alter the transport and weathering processes. However, the area of potential effect (PEZ), where floating, entrained and dissolved components exceeded low threshold concentrations (Table 8-2) was predicted to be localised, to a potential range of 10-15 km across the range of possible pigging speeds. While at EMBA exposure thresholds for ecological sensitive receptors such as fauna and habitats (10g/m^2 floating oil, 100ppb entrained oil, 50ppb dissolved oil), the potential range of impact was limited to 1 km (floating oil), and 6 km (dissolved/entrained oil).

Calculations for the area that may be affected by floating oil concentrations >1 g/m^2 and >10g/m^2 indicated highly localised effect areas, for both discharge cases (highest and lowest pigging rates), before the liquids flash off to the atmosphere. The area calculated for the slower discharge rate was predicted to be larger than that for the highest discharge rate because liquids could drift a marginally longer distance before surfacing at concentrations greater than the threshold (representative of silver sheen) (Figure 7-3). The areas that may potentially be contacted by entrained and dissolved concentrations exceeding the thresholds were also predicted to be relatively small. A larger effect area was calculated for the highest discharge rate because concentrations of these components would be decreasing, due to dispersion, on the slower rise to the surface for the slower discharge rate. Higher initial concentrations would be at the surface layer for the fastest discharge rate, requiring further dispersion at the surface to lower concentrations below threshold.

The controlled release of condensed hydrocarbons within the GEP have the potential to result in changes to water quality. A decline in water quality has the potential to result in impacts to marine flora and fauna and may result in behavioural changes and reduced ecosystem productivity or diversity.</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 are:
• commercial, recreational and traditional fisheries (within 15 km of the rupture location)
• KEFs (within 1-6 km of the rupture location)
• planktonic communities (within 1-6 km of the rupture location)
• benthic communities (within 1-6 km of the rupture location)
• EPBC-listed species including turtle, marine avifauna, whale shark foraging BIAs (within 1-6 km of the rupture location).
A consequence assessment for a major loss of containment from the GEP (worst-case spill scenario) is presented in Table 8-8.</td><td>Minor (E)</td></tr>
</table>

The values and sensitivities associated with commercial, traditional and recreational fisheries (seafood quality and employment) could be impacted due to entrained/dissolved/dispersed oil. Generally, there is little recreational fishing that occurs within the operational area because of its distance from land, lack of features of interest and the deep waters. Recreational day-fishing is concentrated around the population centres of Broome, Derby, Wyndham and Darwin, as well as other readily accessible coastal settlements which are in excess of the maximum predicted field of effect (15 km). The closest features to the GEP route that may attract recreational fishers are Flat Top Bank and Echuca Shoal located 3 km and 9 km away respectively and may be affected if the GEP rupture occurred in that location. Commercial fisheries predominantly operate in the shallower waters of the PEZ with generally low levels of fishing activity reported (Section 4.9.3). Traditional fishing at Browse Island (15 km from the GEP at its closest point), including on intertidal reef platforms, could be affected by impacts to fish from entrained oil if the rupture occurred in this location. The socioeconomic impacts on commercial, traditional and recreational fisheries are expected to be limited with isolated disruption (Minor E). The continental slope demersal fish communities KEF overlaps the GEP. As the majority of condensate will become entrained/dissolved near the surface, deeper demersal fish communities, such as those associated with KEFs (i.e. continental slope demersal fish communities, the 125 m ancient coastline, the pinnacles of the Bonaparte Basin and the carbonate bank and terrace system of the Sahul Shelf), are less likely to be affected. Therefore impacts to demersal fish would be expected to occur at shallower benthic habitats within 6 km of the rupture location along the GEP route, such as Flat Top Bank. Pelagic fish may be at risk if transiting the entrained/dissolved hydrocarbon plume and they may also ingest smaller/juvenile fish affected by the entrained/dissolved plume. However, due to their mobile nature, they may avoid the entrained plume. A study by Meador et al. (1995) reported that PAHs are typically rapidly metabolised and excreted by fish which may lead to tainting of flesh. Due to their mobile nature, it is considered that pelagic fish may avoid entrained plumes. Based on the above risk assessment, the potential consequence of an entrained hydrocarbon plume on fish and sharks is considered to be localised with short-term impact (Minor E). 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 be exposed to surface expressions. Therefore, under most circumstances, impacts on plankton from entrained/dissolved oil is expected to be localised, with short-term impacts; however, if an entrained/dissolved spill reached a coral-spawning location, such as Browse Island during a spawning event, localised short-to-medium term impacts could occur. Therefore, the consequence is considered to be Minor (E).	

Benthic communities, including benthic primary producers, such as coral reefs and deeper water filter-feeding communities, within 6 km of the rupture location could be exposed to entrained/dissolved hydrocarbons from GEP passivation discharges. Studies undertaken on benthic communities have found a wide range of variation in their associated toxicity threshold levels (Tsvetnenko 1998; NRC 2005). This is to be expected, as benthic communities are made up of a large variety of different organisms. In some cases, little to no impact is observed on benthic communities. For example, in the case of the Montara oil spill, where impacts were assessed at locations such as Ashmore Reef, Cartier Island, Barracouta Shoal and Vulcan Shoal, there was no observed impact on benthic communities (Heyward et al. 2010a, 2010b, 2011, 2013). Several filter-feeding communities are close to, or within the operational area (e.g. the 125 m ancient coastline KEF, the pinnacles of the Bonaparte Basin KEF and the Oceanic Shoals AMP) as described in Section 4.7.2. However, due to the buoyant nature of the plume, impacts to deeper seabed features will potentially be less severe than impacts to shallow benthic primary producer habitats. Therefore, benthic communities, particularly shallow banks, shoals and islands within 6 km of the GEP route, such as Flat Top Bank may be exposed to entrained/dissolved hydrocarbons from a GEP rupture with impacts expected to be of a local scale and temporary (Minor E). Whale sharks (including those in the whale shark foraging BIA that overlaps the operational area) have the potential for exposure to entrained/dissolved hydrocarbons within 6 km of the rupture location. Potential effects include damage to the liver and lining of the stomach and intestine, as well as toxic effects on embryos (Lee 2011). As whale sharks are filter-feeders they are expected to be highly vulnerable to entrained hydrocarbons (Campagna et al. 2011). In the event that a GEP rupture occurred during whale shark foraging, there is the potential for a proportion of the local population to be affected. Based on the location of the discharge (in close proximity to the seabed) exposure to whale sharks foraging at or near the surface is not anticipated especially given the low abundance of whale sharks throughout the year in the foraging BIA that overlaps the operational area. Given the distance to the closest whale shark aggregation (1,000 km to the Ningaloo Reef aggregation), the overall population viability is not expected to be threatened. Therefore, the consequence is considered to be Minor (E). Seasonal variability with respect to the abundance of marine turtles within turtle BIAs overlapping the GEP, is poorly understood and as a basis for this assessment it has been assumed that marine turtles could be present in the BIAs at any time of the year either at the surface or on the seabed. Turtles can be exposed to hydrocarbon or chemical spills as they surface, resulting in direct contact with the skin, eyes, and other membranes, as well as the inhalation of vapours or ingestion (NOAA 2010b). Other aspects of turtle behaviour, including a lack of avoidance behaviour, indiscriminate feeding in convergence zones, and large pre-dive inhalations, make them vulnerable. A marine avifauna BIA (lesser frigatebird foraging) overlaps a portion of the GEP route, with peak seabird foraging reported during April to November. Marine avifauna may be affected if a surface slick is encountered by birds resting at the sea surface and surface-plunging birds are considered particularly vulnerable to surface hydrocarbons. They may suffer from damage to external tissues, including skin and eyes, and internal tissue irritation in the lungs and stomach (Clark 1984). Impacts to seabirds that do not spend time resting on the sea surface, such as the lesser frigatebird are not expected. Subsea releases would be unlikely to result in direct impacts to marine avifauna.	

<table>
<tr><td colspan="4">The lack of any significant surface slick (< 1 km floating) and the very light (non-sticky) nature of the GEP residual hydrocarbons will significantly limit surface slick-associated impacts for air-breathing EPBC-listed species. Turtle, whale shark and marine avifauna foraging BIAs overlap the GEP route and these species may be present throughout the year. Marine mammals, reptiles and avifauna could also be impacted through entrained hydrocarbons, primarily through ingestion while foraging. Given the field of effect is limited to approximately 6 km from the rupture location, impacts are expected to be short-term and localised with Minor (E) consequence.</td><td></td></tr>
<tr><th colspan="5">Identify existing design safeguards/controls</th></tr>
<tr><td colspan="5">• Preventative controls for a GEP rupture are described in Table 8-8.</td></tr>
<tr><th colspan="5">Propose additional safeguards/control measures (ALARP evaluation)</th></tr>
<tr><th>Hierarchy of control</th><th>Control measure</th><th>Used?</th><th colspan="2">Justification</th></tr>
<tr><td>Elimination</td><td>Conduct repair without GEP passivation, then following the successful completion of the repair, dewater the GEP via Ichthys LNG plant, to treat and dispose of gas, seawater and residual condensate without discharge to the marine environment.</td><td>No</td><td colspan="2">A major repair involving a spool replacement requires extensive planning, engineering design, and complex subsea repair activities. Emergency repair schedules indicate that from the time of rupture, to successful completion of repair is predicted to take 140 – 180 days. However, INPEX GEP repair plan corrosion assessment report (Wood Group Kenny, 2020) determined that seawater ingress into the GEP would trigger multiple corrosion mechanism, including corrosion from oxygenated seawater, microbial induced corrosion, and formation of carbonic acid. This combination of corrosion mechanisms could generate corrosion on the internal GEP walls at rates of up to 10 mm per year. The GEP has a conservative corrosion tolerance of only 0.5 mm. Corrosion >0.5 mm would likely require the down-rating of maximum allowable operational pressure of the GEP. This would likely result in significant production impacts and potentially threaten the ongoing viability of the overall Ichthys Project. Minimising the time the GEP is exposed to corrosion risks is critical to maintaining integrity of the GEP. Therefore, leaving the seawater/residual condensate liquids mix inside the GEP until after a repair is conducted is not considered ALARP, given the very limited area of effect associated with the GEP passivation discharges.

In addition, the discharge of residual gas, seawater and condensate from the GEP, for treatment at the Ichthys LNG plant, is not technically feasible due to the very significant infrastructure modifications that would be required to safely conduct the operation and also the significant corrosion risks to the LNG plant from the residual GEP contents.</td></tr>
</table>

	During GEP passivation, utilise downlines, attached between a floating tanker and the GEP rupture location, to capture residual GEP condensate/seawater mix, preventing/eliminating the discharge to the marine environment.	No	Whilst GEP passivation is occurring, a significant volume of gas will also be discharged with the residual GEP condensate/seawater mix. The safety hazards presented by the residual GEP gas prevent the safe capture of condensate/seawater mix directly into a tanker. To facilitate this operation, a MODU would also be required, to also flare the residual gas. Technical complexities associated with safety (under Safety Case), installing downlines and safely connecting to a tanker and MODU is not considered ALARP, given the very limited area of effect associated with the GEP passivation discharges.
Substitution	None identified	N/A	N/A
Engineering	Reduce GEP line pack	Yes	Reduce hydrocarbon volumes potentially entering marine environment at the GEP rupture location by stopping production on the CPF and maximized production/flaring at the Ichthys LNG Plant as the initial response to a major rupture of the GEP.
Procedures and administration	Engineering analysis / environmental assessment of controlled discharges	Yes	A controlled discharge engineering analysis, prior to the discharge occurring, will examine all practical controls (such as pigging speed and GEP blowdown etc.) and will evaluate options to protect sensitive receptors from changes in water quality associated with releases from the GEP during passivation.

Identify the likelihood	
Likelihood	In the event of a controlled release of residual hydrocarbons following a GEP rupture, the potential volumes of hydrocarbons entering the marine environment can be limited by reducing the GEP line-pack during the initial rupture/depressurisation event – to limit the residual composition in the line. In conjunction with the prevailing currents and metocean conditions along the GEP route, the likelihood of the identified consequence occurring to the identified values and sensitivities is considered to be Highly Unlikely (5). Furthermore, the INPEX *Detailed Design Quantitative Risk Analysis (QRA) the Ichthys Gas Export Pipeline* indicates that the highest likelihood events with the potential to damage the pipeline are associated with anchor interaction. The analysis calculates a pipeline failure frequency (and therefore controlled releases) within Commonwealth waters, as <1 × 10–5 per kilometre, per year. Therefore, in accordance with the INPEX Risk Matrix, the likelihood of the above described consequence occurring to the identified values and sensitivities is considered to be Highly Unlikely (5).
Residual risk	Based upon a consequence of Minor (E) and likelihood of Highly Unlikely (5) the residual risk is Low (9).

Residual risk summary		
Consequence	Likelihood	Residual risk
Minor (E)	Highly Unlikely (5)	Low (9)
Assess residual risk acceptability		

Legislative requirements

There are no relevant Australian environmental legislative requirements that relate specifically to the discharge of residual condensed hydrocarbons during pipeline repair activities. All reasonable means to minimise loss of containment events occurring from integrity failures have been taken during the design, route selection and installation of the GEP infrastructure.

Stakeholder consultation

No stakeholder concerns have been raised regarding potential impacts and risks from discharges to the marine environment.

Conservation management plans / threat abatement plans

Several conservation management plans have been considered in the development of this EP (refer Appendix B) and chemical discharge has been listed as a threat for marine turtles (DEE 2017). Actions relating to chemical discharge involve the minimisation of discharges and adherence to best practice guidelines.

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 acceptable 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
Impacts to identified values and sensitivities from controlled discharges associated with GEP passivation are limited to a localised area.	Volumes of GEP contents discharged to the marine environment will be limited through the reduction of GEP line-pack.	Records of flaring at Ichthys LNG Plant to reduce GEP line-pack.
	In the event of a GEP rupture, an environmental impact assessment will be undertaken to determine the short-term and long-term potential impacts of controlled discharges to the environment. The environmental assessment will include: • an evaluation of controls to reduce discharge volumes and optimization of discharge rates • an assessment of the potentially affected environmental values and sensitivities.	Records of control evaluation Records of assessment of potential short-term and long-term impacts to values and sensitivities. Records of determination of incident level against INPEX risk matrix.

7.2.2 Atmospheric emissions

IMR vessels will generate atmospheric emission from routine power generation engine exhausts and from the incineration of waste on board. Table 7-5 defines the control measures, environmental performance outcomes and standards and measurement criteria relating to atmospheric emissions from IMR vessels.

Impacts and risk associated with greenhouse gas (GHG) emissions, including the consideration of indirect consequences (Section 527E EPBC Act 1999) are assessed for the Ichthys Project as a whole in the INPEX Ichthys Project Offshore Facility (Operation) EP and are not discussed further in this EP.

Table 7-5: Impact and risk evaluation – atmospheric emissions from IMR vessels

Identify hazards and threats	
Routine combustion emissions will be produced by IMR vessels from routine power generation engine exhausts and from the incineration of waste on board from time to time. Atmospheric emissions generated by vessels have the potential to result in localised changes in air quality and subsequent exposure of marine avifauna to air pollutants including CO, NO_X, SO_2, VOCs, and particulates. A range of vessels may be used during the activity depending on the nature of the required IMR activity. HLVs that may be required in the event of a pipeline repair typically consume up to 50 m^3 of fuel per day whereas inspection vessels used for conducting inspection surveys typically consume up to 15 m^3 of fuel per day. In general, vessels are only present in the operational area on a temporary, short-term basis for the duration of the IMR activity.	
Potential consequence	**Severity**
The particular values and sensitivities identified as having the potential to be impacted by atmospheric emissions are: • marine avifauna. As described in Section 4.7.4, the operational area is located within the East Asian–Australasian 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). The GEP route overlaps one BIA for marine avifauna associated with lesser frigatebird foraging. Research by Cannell et al (2016) and Clarke (2015) reported peak abundance and subsequent foraging typically occurs during the breeding season (April to November). However, it is noted that some lesser frigatebirds may breed outside this period and/or utilise the region for year round foraging activity. Other important habitat for marine avifauna include several RAMSAR sites and nationally important wetlands (Section 4.5 & Figure 4-9). The closest RAMSAR site is approximately at 175 km away at Ashmore Reef. While not an identified BIA the closest habitat for seabirds is Browse Island (15 km away from the GEP at its closest point). Previous surveys have reported a lack of diversity of seabirds breeding there (Clarke 2010) and colonies of nesting crested terns (>1,000 birds) have been observed (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 and potential impacts to marine avifauna. The outcome of such assessments typically undertaken for offshore facilities rather than vessels operating offshore have concluded that NO_2 concentrations may typically exceed long term (annual average) concentrations within a few kilometres 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). As these modelled predictions are based on operating facilities with significantly larger sources of emissions including combustion engines and flaring, it can be assumed vessels operating offshore will have a much smaller field of effect with respect to potential impacts on receptors within the airshed. This indicates that changes in air quality are expected to be highly localised and limited to the immediate vicinity of the emissions release with atmospheric emissions from vessels in the operational area quickly dispersed into the surrounding atmosphere.

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, NOX, SO2, 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). Overall, the consequence of temporary, localised changes in air quality that may result in short-term, sublethal effects to a small number of transient marine avifauna individuals is considered Insignificant (F).

Identify existing design safeguards/controls

- Vessels will comply with the air emission requirements of Marine Order 97 (as applicable to vessel and engine size, type and class)
- Vessels waste incineration practices will comply with the requirements of Marine Order 97
- Vessels (as applicable to vessel and engine size, type and class) will comply with ODS requirements of Marine Order 97
- 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	No incineration of waste	No	Cost associated with transporting waste to shore for landfill and/or incineration outweighs onboard incineration. Health implications for storage of waste onboard, exposure to pathogens etc.
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	Marine avifauna deterrent devices on IMR vessels	No	Marine avifauna are expected to avoid emissions sources before atmospheric pollutants result in any significant or discernible effect, without the need for further protection measures. Therefore, bird deterrent devices are expected to provide limited, if any, additional or discernible benefit. Given the insignificant worst-case consequences to marine avifauna predicted from atmospheric emissions with the other control measures in place, the costs associated with deterrents are grossly disproportionate to the low level of risk and limited benefits.
Procedures and administration	Preventative maintenance system	Yes	Vessel contractors have a preventative maintenance system in place to ensure diesel powered, power generation equipment is maintained.
Identify the likelihood			
Likelihood	The likelihood of marine avifauna approaching and/or resting on vessels in close proximity to emissions sources/exhaust vents and remaining close enough to be exposed to concentrations of air pollutants that result in symptoms such respiratory failure or impaired immune response is considered Highly Unlikely (5). Although marine avifauna may pass near vessels, they are unlikely to remain close enough for discernible symptoms of exposure develop. It is considered likely that they would move away from any emissions source if they began to experience discomfort. Given the temporary nature of IMR activities and the control measures described above in place, the potential for changes to localised air quality and associated impacts to marine avifauna are reduced. Therefore, the likelihood of the described consequences to marine avifauna occurring is considered Highly Unlikely (5).		

Residual risk	Based on a consequence of Insignificant (F) and likelihood of Highly Unlikely (5) the residual risk is Low (10).	
Residual risk summary		
Consequence	Likelihood	Residual risk
Insignificant (F)	Highly Unlikely (5)	Low (10)
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.

Emissions, energy consumption and energy production data will be reported annually to the Clean Energy Regulator in accordance with NGER requirements. INPEX will comply with the requirements of the National Greenhouse and Energy Reporting (Safeguard mechanism) Rule 2015 which applies to all facilities with Scope 1 emissions of more than 100,000 tonnes of CO_2-e per year. NPI emissions data will be reported annually to the NT EPA in accordance with NPI NEPM requirements.

Stakeholder consultation

No specific stakeholder concerns have been raised regarding potential impacts and risks associated with atmospheric emissions from vessels in Commonwealth waters.

Conservation management plans / threat abatement plans

Several conservation management plans have been considered in the development of this EP (refer Appendix B), none of the recovery plans or conservation advices have specific threats or actions relating to atmospheric emissions.

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 other 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 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 outcome	Environmental performance standards	Measurement criteria
Planned emissions and discharges from vessels undertaking the petroleum activity are in accordance with MARPOL requirements and industry good practice.	Vessels annual verification audits undertaken by a registered organisation confirm that marine diesel engines on board ASVs 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 IEE certificate Ship Energy Efficiency Management Plan
	Fuel oil and marine diesel with 0.5% m/m sulfur content will be used.	Records confirm that fuel provided to vessels has 0.5% m/m sulfur content
	Where present, equipment or systems on board 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
	Vessels have a preventative maintenance system to ensure diesel powered, power generation equipment is maintained.	Preventative maintenance system records

7.2.3 Light

Light emissions associated with navigational lighting on IMR vessels have the potential to increase ambient light levels. An evaluation of the potential impacts and risks are presented in Table 7-6.

Table 7-6: Impact and risk evaluation – change in ambient light levels from navigational lighting on IMR vessels

<table>
<tr><th colspan="2">Identify hazards and threats</th></tr>
<tr><td colspan="2">Light emissions associated with vessel lighting (for navigational and safe working condition requirements) have the potential to expose light-sensitive marine fauna, specifically marine turtles and seabirds and migratory birds, to changes in ambient light levels that could lead to behavioural changes.

Vessel activities along the GEP route are expected to be sporadic, short term and, in most cases, are not expected to be static. Unless specifically required to support over-the-side activities or for navigational purposes, lighting on the vessels is directed over the work area, which aids in limiting light spill to the marine environment. During IMR activities, underwater lighting may be generated over short periods of time while ROVs are in use. Light emissions from typical IMR vessels will be far lower in intensity than light emissions from offshore facilities.</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 vessel lighting are:
• marine turtles (including internesting and foraging BIAs)
• marine avifauna (including foraging BIA)
• planktonic communities
• fish communities (KEF).

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 15 km from the GEP at its closest point) and is surrounded by a 20 km internesting BIA buffer for green turtles between November and March (DEE 2017a) as described in Section 4.7.4. Other marine turtle BIAs that overlap the operational area include internesting habitat for flatback and olive ridley turtles on the Melville Island/Coburg Peninsula and the Joseph Bonaparte Depression which provides foraging habitat for olive ridley, flatback and loggerhead turtles (Figure 4-7). Satellite tracking data reviewed by Ferreira et al (2020) concluded that the spatial extent of internesting areas was covered by the defined internesting buffers affording an appropriate level of protection. However, the spatial extents of foraging BIAs was considered to underestimate the distribution of foraging turtles. Therefore in this assessment is has been assumed that marine turtles may be present on a year-round basis in the operational area.</td><td>Minor (E)</td></tr>
</table>

Once turtle hatchlings have reached the ocean, they normally maintain seaward headings by using wave propagation direction as an orientation cue. This is because waves and swells generally reliably move towards shore in shallow coastal areas, therefore swimming into waves usually results in movement towards the open sea (Lohmann & Fittinghoff-Lohmann 1992). Although light emissions from IMR vessels may be visible within internesting buffers, significant exposure or changes in ambient light levels are not expected to affect the behaviour of the adult turtle population as adult turtles undertaking internesting, migration, mating or foraging activities do not use light cues to guide these behaviours (Woodside 2020). This assessment was confirmed by the Department of Sustainability, Environment, Water, Population and Communities (DSEWPaC 2008) through the formal environmental assessment process, indicating that the risk of light spill adversely impacting any listed threatened species is low. The offshore light emissions generated from IMR vessel lighting is not expected to have a discernible effect on adult turtles or turtle hatchlings abilities to orientate to water and the potential for light from vessels to attract marine turtles once they are at sea is not expected. Any impacts are considered to be at a local scale, with short-term, temporary impact on a small portion of a population (Minor E). It is stated in the Recovery Plan for Marine Turtles in Australia (DEE 2017a) that 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 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 4.7.4, the operational area is 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). Lighting from vessels has been found to attract seabirds, particularly those that are nocturnally active (BirdLife International 2012). Artificial light can disorient seabirds, disrupt foraging and potentially cause injury and/or death through collision with infrastructure (DEE 2020). Fledgling seabirds may also become grounded as a result of attraction to offshore vessel lighting (Rodríguez et al. 2017). 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). A study by Poot et al. (2008) of offshore oil platforms in the North Sea, found that large flocks of migrating seabirds can be attracted to the lights of offshore oil platforms, particularly on cloudy nights and between the hours of midnight and dawn. Poot et al. (2008) hypothesised that when such offshore platforms are located on long-distance bird migration routes, the impact of this attraction could be considered highly significant, as many birds cross the ocean with only small additional fat reserves than required for the transit. Any delay (e.g. resting on a platform or circling around them) may decrease the bird's resilience and potential survival. Studies conducted in the North Sea indicate that migratory birds may be attracted to offshore lights when travelling within a radius of 3 to 5 km from the light source. Outside this area their migratory paths are likely to be unaffected (Marquenie et al. 2008). There is no published literature of these impacts occurring for vessels operating in Australian waters. 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. The closest RAMSAR site is approximately at 175 km away at Ashmore Reef and therefore will not be affected by light spill from IMR vessels operating along the GEP. While not an identified BIA, the closest habitat for seabirds from the GEP is Browse Island (15 km). 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).	

A foraging BIA for marine avifauna overlaps the operational area, associated with the Lesser Frigatebird (Figure 4-9). Lesser frigatebirds generally forage close to breeding colonies (DSEWPaC 2012c) and remain further out to sea during the day and in inshore waters during rough weather or in the late evening (Chatto 2001). Therefore, these birds are not expected to be exposed to vessel lighting during night-time IMR activities. Migratory shorebirds travelling the EAA Flyway may fly over the operational area, 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 vessels or facilities to rest. However, the possibility of this occurring on IMR vessels operating along the GEP route is considered low due to the temporary and intermittent nature of IMR activities and the presence of alternative habitat for resting and foraging at Browse Island and other offshore islands such as Ashmore Reef/Cartier Island. Where there is important habitat for migratory shorebirds 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. In the case of IMR activities along the GEP route in Commonwealth waters, the closest habitat is at Browse Island located 15 km away. However, minimal deviation from migratory pathways and limited potential for behavioural disruption is expected from vessel lighting. Therefore, any impact to seabirds or migratory birds from temporary and intermittent light emissions associated with IMR vessel lighting is considered to be of inconsequential ecological significance (Insignificant F). Planktonic and fish communities may be attracted to sources of underwater light or light spill at the sea surface from vessel decks (Meekan et al. 2001). Any species attracted to light spill can be considered a food source for larger marine predatory species such as tuna (Shaw et al. 2002). However, any increased levels of predation are not expected to reduce the abundance of plankton or fish populations in the operational area or the wider region given the short-term, intermittent nature of IMR activities. Therefore, any impacts are considered to be localised and of inconsequential ecological significance (Insignificant F).	

Identify existing design safeguards/controls
• 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.

Substitution	Exclude vessel lighting during sensitive periods for marine avifauna and turtles (internesting November – April and foraging year-round)	No	In general, bird migrations occur over six months of the year: between March - May (northward) and between August - November (southward) (Bamford et al., 2008). Internesting at Browse Island (20 km buffer) occurs between November to March for green turtles and flatback turtles (60 km buffer June to September) and olive ridley turtles (20 km buffer April to June) on the Melville Island/Coburg Peninsula respectively between (DEE 2017a). Lighting of 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 IMR 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.
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 vessel/facility 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 the IMR 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 and administration	Limit the duration and frequency of planned night-time-based vessel activities such as IMR during key sensitive periods for marine turtles and avifauna.	No	IMR vessels operate on a 24/7 basis and IMR activities use ROVs for inspection and maintenance work including deploying and recovering infrastructure between seabed and deck, and therefore require safe levels of lighting on decks. The consequence of light impacts for all identified receptors at all times of the year has been assessed as Minor (E). External vessel lighting during routine night-time activities will not result in additional light impacts. In general, routine IMR activities are already as short in duration as possible (5 – 60 days). Therefore, this control is not considered to be warranted.
	Premobilisation review and planning of vessel lighting to be undertaken prior to IMR activities commencing.	No	Vessels will maintain the minimum navigational and deck lighting to provide safe working conditions. The consequence of light impacts for all identified receptors at all times of the year has been assessed as Minor (E). Given artificial light sources in proximity to the operational area, such as the offshore facility permanently located in WA-50-L and the lighthouse on Browse Island (Section 4.4.2), external vessel lighting will not result in additional light impacts. Therefore, this control is not considered to be warranted.
	Implementation of a seabird management plan to prevent seabird landings on IMR vessels due to attraction from artificial lighting.	No	A seabird management plan to prevent seabird landings on 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). Vessel activities along the GEP route are expected to be sporadic, short term and, in most cases, are not expected to be static. Lesser frigatebirds generally forage close to breeding colonies (DSEWPaC 2012c) and remain further out to sea during the day and in inshore waters during rough weather or in the late evening (Chatto 2001). Therefore, these birds are not expected to be exposed to vessel lighting during night-time IMR activities and based on this assessment this control is not considered to be warranted. In the previous years of GEP operation, there have been no reports of seabird landings on vessels.

<table>
<tr><td></td><td>Implementation of a light management plan to prevent impacts to marine turtles from artificial lighting on IMR vessels.</td><td>No</td><td>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 GEP is approximately 15 km from Browse Island and overlaps the 20 km internesting buffer. This is considered to be the worst-case scenario, as although the operational area overlaps other turtle internesting buffers (flatback and olive ridley), the distances to nesting beaches is greater than 15 km.

Although light from IMR vessels may be visible to turtles in internesting BIAs, research has indicated that turtles generally stay within 10 km of their nesting beaches and given the short duration of IMR activities they are not expected to be impacted vessel lighting.

Adult turtles may be present in foraging areas along the GEP route (Joseph Bonaparte Depression). Large aggregations of turtles are not expected; however, they may be present at low levels throughout the year. Vessel activities along the GEP route are expected to be sporadic, short term and, in most cases, are not expected to be static. Therefore, any exposure to vessel lighting is considered to be short-term with potential temporary impact on a small portion of a population (Minor E).</td></tr>
<tr><td colspan="4">Identify the likelihood</td></tr>
<tr><td>Likelihood</td><td colspan="3">Although light emissions from IMR vessels may be visible to marine avifauna and turtles present in BIAs, impacts are considered to be Highly Unlikely (5). While impacts to seabirds from lighting of offshore platforms and vessels have been reported in the industry there have been no reports from Ichthys operations to date. This may be due to the presence of alternative resting/foraging habitat such as Browse Island, Ashmore Reef and Cartier Island. 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 IMR vessels is considered Highly Unlikely (5).

Vessel activities along the GEP route are expected to be sporadic, short term and, in most cases, are not expected to be static. Therefore, it is considered Highly Unlikely (5) that marine turtles present in BIAs along the operational area will be attracted to IMR vessel lighting.</td></tr>
<tr><td>Residual risk</td><td colspan="3">Based upon a consequence of Minor (E) and likelihood of Highly Unlikely (5) the residual risk is Low (9).</td></tr>
<tr><td colspan="4">Residual risk summary</td></tr>
<tr><td>Consequence</td><td>Likelihood</td><td colspan="2">Residual risk</td></tr>
</table>

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 facility has 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, published in 2020 (DEE 2020), has been used to ensure that the assessment for activities covered by this EP align with the guideline (see below conservation management plans/threat abatement plans).

Stakeholder consultation

During stakeholder consultation, the WA DBCA recommended that INPEX refer to the DAWE'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 facility and vessel lighting.

Conservation management plans / threat abatement plans

Several conservation management plans have been considered in the development of this EP (refer Appendix B). The National Light Pollution Guidelines for Wildlife Including marine turtles, seabirds and migratory shorebirds was published in 2020 (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 assessment for 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 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 acceptable 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
Refer to Table 9-3.		

7.2.4 Routine vessel liquid discharges

As described in Section 3, vessels will be used to conduct IMR activities. All vessels shall comply with the relevant MARPOL 73/78 requirements and are each provided with a range of auxiliary and marine systems in support of their activities. Routine vessel liquid discharges to the marine environment include:

- desalination brine (Table 7-7)
- sewage, grey water and food waste (Table 7-8)
- oily water from deck drainage and bilge (Table 7-9)
- cooling water (Table 7-10).

Table 7-7: Impact and risk evaluation – vessel discharges desalination brine

<table>
<tr><td colspan="4">Identify hazards and threats</td></tr>
<tr><td colspan="4">Potable water will be generated on IMR vessels using a reverse osmosis (RO) unit which is supplied with seawater. 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 to the marine environment has the potential to cause changes in water salinity. RO units on board vessels is estimated to be in the order of approximately 150 m^3 per day per vessel. The salinity of the discharge is expected to be approximately 45–50 parts per thousand (ppt) in comparison to ambient seawater with a salinity of 35 ppt (Section 4.6).</td></tr>
<tr><td colspan="3">Potential consequence</td><td>Severity</td></tr>
<tr><td colspan="3">Particular values and sensitivities with the potential to be impacted are:

• planktonic communities.

Discharging desalination brine from 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) indicate that effects on planktonic communities in areas of high mixing and dispersion, such as those found in the operational area, are generally limited to the point of discharge only.

Given water depths along the GEP range from 30 to 250 m and the dynamic marine environment (i.e. tides and currents) it is expected that vessel brine discharges would rapidly disperse relatively close to the point of discharge. The effects of a temporary and highly localised increase in salinity from IMR vessel desalination brine discharges are not expected to result in any significant ecological impacts to planktonic communities. Therefore, the consequence is considered to be Insignificant (F).</td><td>Insignificant (F)</td></tr>
<tr><td colspan="4">Identify existing design safeguards/controls</td></tr>
<tr><td colspan="4">None identified</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>
</table>

Elimination	Eliminate brine discharges from vessels	No	The significant financial cost and health risks associated with providing fresh water to 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 could be up to approximately 18 - 24 hours depending on the location along the GEP route. This would also generate additional environmental impacts in terms of air emissions and increased demands to onshore supplies.
Substitution	None identified	N/A	N/A
Engineering	Use of a diffuser on vessels to increase mixing in the receiving environment.	No	Given the oceanic currents in the operational area and the small volumes of discharges, retrospective installation of a diffuser on all IMR vessels is not considered practicable, given the insignificant consequence from brine discharges.
Procedures & administration	None identified	N/A	N/A
Identify the likelihood			
Likelihood	Direct effects on plankton from support vessel brine discharges may occur in the operational area 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 Unlikely (4).		
Residual risk	Based on a consequence of Insignificant (F) and likelihood of Unlikely (4) the residual risk is Low (9).		
Residual risk summary			
Consequence	Likelihood	Residual risk	
Insignificant (F)	Unlikely (4)	Low (9)	
Assess residual risk acceptability			

<table>
<tr><td colspan="3">
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 B), 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 other 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 acceptable 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.

</td></tr>
<tr><th>Environmental performance outcome</th><th>Environmental performance standard</th><th>Measurement criteria</th></tr>
<tr><td colspan="3">N/A no controls identified</td></tr>
</table>

Table 7-8: Impact and risk evaluation – vessel discharges sewage, grey water and food waste

<table>
<tr><th colspan="2">Identify hazards and threats</th></tr>
<tr><td colspan="2">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.

Intermittent discharges associated with the petroleum activity will occur in the operational area, which is predominately located in the open ocean and more than 12 nm from the nearest land, with the exception of a small portion of the GEP in proximity to Browse Island (approximately 15 km at its closest point). The average volume of sewage and greywater expected from vessels (including domestic wastewater) generated by a person per day is approximately 230 L (based on calculations in Hänninen & Sassi 2009). Therefore, based on an assumption that there could be two vessels present in the operational area, each with 50 POB, the combined rate of discharge of sewage, grey water and food waste is conservatively considered to be approximately 25 m^3 per day.</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 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 proximity to the vessels in the operational area. The potential consequence on planktonic communities is a localised impact on plankton abundance in the vicinity of the point of discharge. Given the oceanic currents in the operational area, rapid dilution and dispersion of these discharges is expected to occur. Therefore, the consequence is considered to be of inconsequential ecological significance (Insignificant F).</td><td>Insignificant (F)</td></tr>
<tr><th colspan="2">Identify existing design safeguards/controls</th></tr>
<tr><td colspan="2">• Vessels will manage the discharge of sewage effluent and grey water in accordance with Marine Order 96 (as appropriate to class)
• Vessels will manage the discharge of garbage in accordance with Marine Order 95 (as appropriate to class)
• Vessels will macerate food waste to a particle size of <25 mm before disposal in the operational area. If macerator is not operational, food waste will either be frozen and stored onboard (for onshore disposal) or manually macerated to <25 mm prior to disposal.</td></tr>
</table>

Propose additional safeguards/control measures (ALARP evaluation)			
Hierarchy of control	Control measure	Used?	Justification
Elimination	Eliminate discharges from 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 and transporting it to the mainland for disposal 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.
Substitution	None identified	N/A	N/A
Engineering	Sewage treatment plant installed and used on all vessels	No	The 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	None identified	N/A	N/A

Identify the likelihood	
Likelihood	Sewage and garbage discharges for the vessels will be in accordance with legislative requirements (MARPOL Annex IV & V, Marine Orders 95 & 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 and is a requirement of the INPEX Ichthys EIS (2010). 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 operational area are unlikely to cause toxic effects, especially considering the rapid dilution provided by ocean currents. Based on the expected high dispersion, localised impacts to plankton at the point of the planned intermittent discharge are considered to be Unlikely (4).
Residual risk	Based on a consequence of Insignificant (F) and likelihood of Unlikely (4) the residual risk is Low (9).
Residual risk summary	

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 of 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 B). 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 other 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 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 outcome	Environmental performance standards	Measurement criteria
Planned emissions and discharges from vessels undertaking the petroleum activity are in accordance with MARPOL requirements and industry good practice.	Comply with Marine Order 96 including: • Current International Sewage Pollution Prevention Certificate (ISPPC).	ISPPC
	Comply with Marine Order 95 including: • Garbage that has been ground or comminuted to particles <25 mm: >3 nm from the nearest land. • Garbage disposal record book maintained.	Garbage disposal record book
	Vessels will not dispose of unmacerated food waste in the operational area.	Garbage disposal record book

Table 7-9: Impact and risk evaluation – vessel oily water, bilge discharges & firefighting foam (deck drainage)

<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 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 oily water separators (OWS) on vessels range from 100–1000 litres per hour. Therefore, conservatively based on maximum rates, each vessel present in the operational area could potentially discharge 24 m^3 per day.

Vessels are equipped with fire suppression systems, which may include firefighting foam systems, as a safety critical requirement. The foam systems generally supply 3% alcohol resistant aqueous film forming foam and 3% film forming fluoroprotein foam to be used in the event of an incident. No maintenance testing of vessel foam systems will occur in the operational area during the activity; therefore, any foam discharges to sea will be the result of an incident and not a planned discharge.</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 deck drainage, bilge and firefighting foam discharges are:
• EPBC-listed species
• planktonic communities
• fish (demersal fish communities KEF and commercial species).

Discharges of oily water from all vessels 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, etc.) into the water column and at the sea surface, albeit in low concentrations. In turn, this could result in a reduction in water quality, and impacts to transient, EPBC-listed species, plankton and other pelagic organisms such as fish species (demersal fish community KEF or those species targeted by commercial fisheries).

As described in Section 4.7.4, marine turtle, whale shark and marine avifauna (lesser frigatebird) BIAs overlap parts of the operational area. A significant portion of the BIAs provide foraging habitat, with these highly mobile marine fauna species potentially present throughout the year. Potential exposure to these species is likely to be limited to individuals close to the vessel discharge point at the time of the discharge.</td><td>Insignificant (F)</td></tr>
</table>

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). Turtles can be exposed to hydrocarbons through direct contact with the skin, eyes, and other membranes, as well as the inhalation of vapours or ingestion (Milton et al. 2003). Whale sharks reportedly spend 40% of their time in the upper 15 m of the water column and therefore may be exposed to entrained and dissolved hydrocarbons. Potential effects include damage to the liver and lining of the stomach and intestines, as well as toxic effects on embryos (Lee 2011). As described in Section 4.7.4, there are no whale shark aggregations (such as the Ningaloo Reef aggregation) within the operational area and reported low abundance in the foraging BIA, with no specific seasonal pattern of migration. Although many seabirds spend time resting on the sea surface, lesser frigatebirds are unique in that they do not settle on the sea surface due to the poor waterproofing quality of their feathers (Clarke 2015). Therefore, impacts to this species from direct contact with oily water and bilge discharges are not considered credible as they do not rest on the sea surface. As the operational area overlaps foraging habitat, rather than nesting or breeding, marine avifauna are not expected to be spend a significant time on the sea surface. Considering the low concentrations of oil (<15 ppm(v)) within discharge 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 transient, 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 fish 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 is typically only associated with prolonged or frequent exposures, such as on land and in watercourses near firefighting training areas (McDonald et al. 1996; Moody & Field 2000). As toxicological effects from foams are associated with frequent or prolonged exposures, and any discharges during the activity are expected to be as a result of an incident only (infrequent) and rapidly disperse, it is not expected that any impacts will occur to transient, 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.	

Identify existing design safeguards/controls

- Vessels are equipped with OWS which remove traces of oil from the bilge and drainage water prior to discharge to sea.
- Vessels will have equipment to ensure oily water discharges meet <15 ppm(v) 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 vessels.
- Vessel crew will receive an induction/training to inform them of deck spill response requirements in accordance with Table 9-3.

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 vessels. Space limitations onboard vessels and the significant financial cost and health risks associated with storing deck drainage and bilge on board and transporting it to the mainland for disposal 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.
	No discharge of firefighting foam solutions to sea.	No	Firefighting foams on board vessels 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. Therefore, the availability of firefighting foams cannot be eliminated. Therefore, drainage and discharge of foam solution to the sea also cannot be eliminated.
Substitution	None identified	N/A	N/A

Engineering	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 (emergency event only), implementing separate drainage systems for firefighting foams is not considered practicable. The cost of implementing such measures is grossly disproportionate to the limited environmental benefit that could be achieved, and during an emergency event. 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 the vessel.
Procedures & administration	Vessels will not test firefighting foam systems when in the operational area.	Yes	To avoid unnecessary discharges of firefighting foams all vessels in the operational area will not perform tests of their firefighting foam systems.

Identify the likelihood	
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. Impacts to the abundance of plankton or fish 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. Although some BIAs for mobile, transient EPBC-listed species overlap the operational area, the likelihood of impacts from the discharge after treatment by the OWS 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	Based on a consequence of Insignificant (F) and likelihood of Unlikely (4) the residual risk is Low (9).

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

Assess residual risk acceptability		
Legislative requirements Vessel oil–water separators (OWS) meet relevant international regulatory requirements, including MARPOL; Marine Order 91: Marine Pollution Prevention - Oil. The discharge of oil in water of <15 ppm (v) is permitted under MARPOL. Stakeholder consultation No stakeholder concerns have been raised regarding potential impacts and risks from deck drainage, bilge 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 B). 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/firefighting foam discharges. Managing oily water 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 other 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 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 vessels undertaking the	Vessel contractors will comply with the *Navigation Act 2012* – Marine Order 91 including:	Record of current IOPP certificate.

petroleum activity are in accordance with MARPOL requirements and industry good practice.	• Vessels (of appropriate class) to have IOPP certificate to show that vessels 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.
	Liquids from vessel drains will only be discharged if the oil in water content does not exceed 15 ppm(v).	Documented use of oil record book to record all oil disposal.
	Firefighting foams will only be deployed in the event of an emergency.	Incident log.
	Spill kits will be located on vessels to allow clean-up of any spills to the deck.	Inspection records confirm spill kits are available and stocked.

Table 7-10: Impact and risk evaluation – vessel discharges cooling water

<table>
<tr><th colspan="2">Identify hazards and threats</th></tr>
<tr><td colspan="2">Seawater is used as a heat exchange medium for the cooling of machinery engines on vessels. It is pumped aboard and may be treated with biocide (e.g. hypochlorite) before circulation through heat exchangers. It is subsequently discharged to the sea surface on a continuous basis.

Vessel cooling water 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.

Cooling water (CW) discharge rates vary largely depending on the vessel type and size. Maximum discharge rates based on equipment capacities and specifications range from approximately 20,000 m^3 per day for a typical offshore support vessel to approximately 100,000 m^3 per day for a heavy-lift vessel. 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 4.6).</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 cooling water discharges are:
• EPBC-listed species
• planktonic communities.

Effects of elevation in seawater temperature may include a range of behavioural responses in transient, EPBC-listed species including attraction and avoidance behaviour.

As described in Section 4.7.4, marine turtle, whale shark and marine avifauna (lesser frigatebird) BIAs overlap parts of the operational area. A significant portion of the BIAs provide foraging habitat, with these highly mobile marine fauna species potentially present throughout the year. Potential exposure to these species is likely to be limited to individuals close to the vessel discharge point at the time of the discharge. As the operational area overlaps foraging habitat, rather than nesting or breeding grounds, marine fauna are expected to be transient rather than resident in these areas for long periods of time. The vessels will be operating in a water depths of approximately 30 to 250 m in a dispersive, high current environment and any increases in seawater temperature above ambient levels will be localised and short-term. Therefore, potential consequences to transient, 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>

<table>
<tr><td colspan="3">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.</td><td></td></tr>
<tr><td colspan="4">Identify existing design safeguards/controls</td></tr>
<tr><td colspan="4">None identified</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>
</table>

Elimination	No discharges of CW to sea	No	Engines and machinery require cooling to safely and efficiently operate, so cooling water cannot be eliminated. Storage and containment of cooling water to allow the water to cool on board the vessels prior to discharge is not considered practicable given the size/space requirements, i.e. large surface areas required to sufficiently cool the water in a timely manner. 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			
Likelihood	Vessel CW discharges are expected to rapidly disperse in the open-ocean environment of the operational area. This may result in temporary, localised and ecologically insignificant avoidance behaviour in transient, EPBC-listed species in response to elevated water temperatures. However, this is not expected to result in a threat to population viability of protected species and the likelihood of CW discharges resulting in a localised, avoidance behaviour 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	Based on a consequence of Insignificant (F) and likelihood of Unlikely (4) the residual risk is Low (9).		
Residual risk summary			

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

Legislative requirements

The discharge of return seawater from CW 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 of cooling water. Ichthys offshore facility CW discharge modelling (using a higher discharge temperature and significantly greater volumes of CW discharged) predicted a maximum 1.6 ^{o}C at 100 m from discharge point. Therefore, the CW discharge plume from any IMR vessels operating along the GEP route is expected to be considerably lower than the IFC requirement (no more than 3 °C above the ambient seawater temperature at 100 m from the discharge point) based on the lower CW temperature and smaller volumes discharged from vessels.

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 B), none of the recovery plans or conservation advice documents have specific threats or actions relating to CW 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 other 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 acceptable 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 outcome	Environmental performance standards	Measurement criteria
N/A no controls identified		

7.3 Waste management

Operation of vessels will generate a range of non-hazardous and hazardous waste, and may include:

- domestic waste, e.g. paper, plastics, glass, packing materials
- maintenance/repair waste, e.g. scrap metal offcuts, scrap rubber and hoses, packing materials, synthetic ropes
- ash from vessel incinerators
- waste oil and filters, oily rags, degreasers, batteries, paints and solvents.

If inappropriately handled, stored or transferred, waste may be accidentally lost overboard. Any equipment or materials lost overboard will be reported as waste. An evaluation of the potential impacts and risks associated with waste is included in Table 7-11.

Table 7-11: Impact and risk evaluation – inappropriate waste handling and disposal

Identify hazards and threats	
Vessels undertaking IMR activities 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 (through the leaching of chemicals from wastes such as ash from incinerators, spilt chemicals, paints and solvents), 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.	
Potential consequence	Severity
The particular values and sensitivities identified as having the potential to be impacted by improper waste management are: • planktonic communities • EPBC-listed species (marine fauna). 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 in the operational area. 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).	Insignificant (F)
Identify existing design safeguards/controls	
• Spill containment and recovery equipment • Implementation of offshore waste/garbage management plan	

• Vessels manage waste in accordance with MARPOL Annex V, specifically the requirement to have a garbage management plan.
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	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 lost to sea	Yes	Any equipment or materials and waste lost to the marine environment will be reported.

Identify the likelihood	
Likelihood	During recent years of operation of the GEP and associated IMR vessel activities, no accidental release/loss of waste overboard incidents have occurred. Impacts to transient, EPBC-listed species and planktonic communities from the unplanned release of waste to the ocean are considered Unlikely (4).
Residual risk	Based on a consequence of Insignificant (F) and likelihood of Unlikely (4) the residual risk is Low (9).

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

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. Waste disposal procedures are outlined in a waste management plan, as a requirement of Condition 7 of the EPBC Act referral decision 2008/4208 and MARPOL, Annex V, meaning that waste disposal pathways are clearly outlined for appropriate waste handling, storage, transfer, and disposal.

Stakeholder consultation

No stakeholder concerns have been raised regarding potential impacts and risks from operational and general wastes.

Conservation management plans / threat abatement plans

Several conservation management plans have been considered in the development of this EP (refer Appendix B). 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 in this EP 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 other 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 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.	Implementation of garbage management plan.	Incident report of waste lost overboard.
	Spill kits will be available on board vessels	Inspection records confirm spill kits are available and stocked.
	Waste management plans will be provided on each vessel in accordance with condition 7 of EPBC Act 2008/4208 (Appendix A) and Marine Order 95; Annex V of MARPOL (garbage), and 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 waste incinerators (if present on vessels) • the use of food waste macerators/comminuters • garbage record keeping requirements, including discharges, incinerations and disposals of waste in a Garbage Record Book • Communication of waste management practices and awareness materials for crew.	Inspection records confirm waste management plans is implemented on vessels.
	Onshore transfer/disposal of facility/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.

7.4 Noise and vibration

Although operation of the GEP will not result in the generation of any noise emissions, vessels and helicopters involved in IMR activities will generate noise emissions from a range of sources. Examples include vessel engines and propulsion systems (underwater), underwater acoustic inspection techniques such as MBES and SSS, and also undertaking maintenance or repair activities. An evaluation of potential impacts and risks are presented in Table 7-12.

Table 7-12: Impact and risk evaluation – noise and vibration

<table>
<tr><th colspan="2">Identify hazards and threats</th></tr>
<tr><td colspan="2">Marine fauna may be exposed to several sources of noise emissions during the petroleum activity, as summarised below:
• Vessels undertaking in IMR activities have the potential to expose sound sensitive marine fauna to localised changes in underwater noise levels with vessel engines and dynamic positioning thrusters capable of generating continuous (non-impulsive) 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; Erbe et al. 2013). Higher sound levels are typically associated with the use of thrusters (Jiménez-Arranz et al. 2017), such as when a vessel is using dynamic positioning on station.
• A range of inspections may be undertaken during the activity (Section 3.2) that will use underwater acoustic techniques including MBES and SSS. The use of such acoustic equipment has 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 SSS transmit at high frequencies (approximately 70 – 400 Hz) and produce a highly focussed beam of sound down towards the seabed, due to this there is very limited horizontal sound propagation. Indicative ranges of sound outputs at source are 163 - 221 dB re 1 μPa at 1 m and 137 - 200 dB re 1 μPa at 1 m, for MBES and SSS respectively.</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 underwater noise emissions are:
• transient, EPBC-listed species (cetaceans, turtles and sharks)
• fish (including continental slope demersal fish communities KEF and commercial species).
Sudden exposure of noise-sensitive marine fauna to very high sound levels or exposure for prolonged periods to high sound levels can result in injury or a permanent threshold shift (PTS) or temporary threshold shift (TTS) in hearing. Sound level thresholds above which PTS/TTS or behavioural disturbance may occur vary widely between species and potentially between individuals of the same species. A range of behavioural changes can occur in marine fauna in response to sound pressure levels. Onset of behavioural disturbance to cetaceans has been reported to occur for sound levels 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 (Southall et al. 2007). The US National Marine Fisheries Service 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 2014).
Marine turtles are not reported to use sound for communication; however, it is suggested 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 for impulsive sounds, 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 to impulsive sound by turtles (McCauley et al. 2000; NSF 2011).</td><td>Insignificant (F)</td></tr>
</table>

As described in Section 4.7.4, marine turtle and whale shark BIAs overlap parts of the operational area. A significant portion of the BIAs provide foraging habitat, with these highly mobile marine fauna species potentially present throughout the year. Gradual exposure to continuous noise sources, such as vessel engines, is 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). Based on the expected noise emissions associated with the operation of vessels during IMR activities in the operational area, the source levels (ranging from 108 to 182 dB re 1 µPa SPL at 1 m) are too low to result in injury, PTS or TTS impacts to marine fauna. Measured sound levels reported for medium-sized vessels comparable to the vessels that may be used during the activity indicate that behavioural disturbance to cetaceans from continuous sound above the 120 dB re 1 µPa SPL threshold is limited to within less than 1 km (Jiménez-Arranz et al. 2017). Popper et al. (2014) also indicate that behavioural impacts to turtles and fish will generally be limited to within tens or hundreds of metres. Therefore, when vessels are using DP, temporary avoidance or other changes in the behaviours of cetaceans, turtles, whale sharks and fish may occur within the waters immediately surrounding the vessel. Any impacts are considered to be Insignificant (F) given the expansive open ocean environment of the operational area and ability for marine fauna to move away. MBES and SSS are high-frequency, low-energy acoustic instruments, which are significantly less intrusive than high-energy seismic instruments. Sound source levels produced by these different instruments range from 137–221 dB re 1 µPa at 1 m. The high operating frequencies places the dominant sound frequencies above the auditory range of most marine fauna species (Zykov 2013). The propagation of the very high frequency sounds from MBES and SSS cannot be reliably estimated using normal sound propagation equations. Modelling of MBES equipment has been undertaken by Zykov (2013) and McPherson & Wood (2017). The studies indicate that the single pulse and accumulated sound exposures outside of the MBES beam are below the threshold levels for injury, PTS or TTS to cetaceans, turtles, fish and sharks. It is not expected that marine fauna would persist in close proximity to the MBES and SSS long enough for impacts to occur. Based on the relative risk criteria proposed by Popper et al. (2014) and recognising the rapid attenuation of high-frequency sound, behavioural effects (in animals that can detect the high-frequency signals) are likely limited to within tens of metres. Therefore, no impacts to these species' groups are expected. Hearing impairment or significant behavioural impacts to marine fauna from MBES surveys have not been reported previously. Therefore, the consequence is considered to be Insignificant (F). A limited number of commercially significant fish stocks, considered as key indicator species may be present in the operational area (Section 4.9.3) along with the continental slope demersal fish communities KEF. These species may be exposed to underwater noise emissions. Although these fish species may be present, given the deep waters and absence of suitable habitats, the operational area is not considered to offer spawning or aggregation habitat. Therefore, exposure to noise from intermittent IMR activities is not expected to affect fish spawning habitats. Pelagic fish species are highly mobile and belong to a group of fish with limited sensitivity to sound (Popper et al. 2014). Pelagic and demersal fish may avoid waters immediately surrounding the acoustic equipment, but no impacts to these stocks are expected. Therefore, disturbance to commercially important fish species may occur; however, any impact would be localised to individuals and would not result in any detrimental impacts in stock levels or the KEF (Insignificant F).	

<table>
<tr><td colspan="3">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 and of higher energy than MBES and SSS. 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. Therefore, the effect of MBES and SSS on scampi (targeted by the North West Slope Trawl Fishery overlapping the operational area) is not expected to result in any mortality or impacts to their eggs or larvae. If disturbed, it is likely that scampi will move to avoid the immediate area with any effects of sound to scampi considered to be Insignificant (F).</td><td></td></tr>
<tr><th colspan="4">Identify existing design safeguards/controls</th></tr>
<tr><td colspan="4">• Controls for marine fauna disturbance including implementation of EPBC Regulations 2000 – Part 8 Division 8.1 (Regulation 8.05) Interacting with cetaceans (modified to include turtles), and other controls relating to whale sharks are described in Table 7-14.</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>
<tr><td rowspan="3">Elimination</td><td>Eliminate vessels</td><td>No</td><td>Vessels are the only form of transport that can undertake the IMR activities (required to ensure the integrity of the GEP) that is practicable and cost efficient.</td></tr>
<tr><td>Eliminate the use of DP vessels</td><td>No</td><td>The use of thrusters to maintain vessel position is known to generate increased noise emissions. However, IMR activities occurring along the GEP may potentially result in damage to the GEP if vessels did not maintain accurate positioning. This would present an unacceptable risk and therefore the requirement for DP vessels cannot be eliminated.</td></tr>
<tr><td>Eliminate the use of acoustic equipment for inspections</td><td>No</td><td>Inspection of the GEP is required. Other acoustic instrumentation does not typically provide the same resolution as is required from MBES and SSS inspections. Given that the potential risk is already low, it is not practicable to eliminate (or substitute) the use of MBES and SSS.</td></tr>
</table>

Substitution	Only undertake MBES and SSS inspections outside of sensitive periods for marine turtles (internesting November – April and foraging year-round)	No	The ability to undertake inspections using acoustic equipment is required year-round. Foraging turtles may be present year-round in the Joseph Bonaparte Depression BIA and between November and April each year in internesting buffers. There is insufficient data to provide a quantitative estimate of abundance or seasonal peak in abundance of marine turtle BIAs that intersect the operational area. However, noise emissions from MBES and SSS are low frequency and short term in duration with no predicted impacts to marine fauna (Insignificant F). Therefore, the implementation of this control is not considered to be practicable.
Engineering	None identified	N/A	N/A
Procedures & administration	Marine fauna observations and shut-down procedures during MBES and SSS inspections	No	Shut-down procedures are typically applied during some noise generating activities to prevent injury/PTS or reduce the risk of TTS effects in marine fauna. Given that MBES and SSS will not result in injury or hearing impairment from sudden exposures, and behavioural effects will be localised, this control does not provide any significant environmental benefit.
	Routine marine fauna observations to inform commencement of planned night-time IMR activities	No	IMR vessels may operate on a 24/7 basis and IMR planned activities general use ROVs for inspection, and maintenance work. As described in Section 4.7.4, there are BIAs for marine turtles and whale sharks that overlap the operational area. The closest cetacean BIAs are located 120 km away (humpback whales resting/calving) and 60 km away (blue whale migration) and 98 km away (blue whale foraging) at Scott Reef).

			Given that IMR vessel engines/activities will not result in injury or hearing impairment from sudden exposures, implementing this control does not provide any significant environmental benefit. The costs to have MFOs onboard all IMR vessels is grossly disproportionate.
	Implement EPBC Regulations 2000 - Part 8 Division 8.1 (Regulation 8.07 - aircraft) specifically maintaining separation distances for helicopters.	No	As described in Section 4.7.4, no BIAs for cetaceans overlap the operational area. Given the distances to the nearest cetacean critical habitats and that helicopter approaches to IMR vessels will not result in injury or hearing impairment implementing this control does not provide any significant environmental benefit.
	Soft start procedures	No	MBES and SSS instruments do not have the capability for soft-starts (ramp up of noise levels). In addition, MBES and SSS will not result in injury or hearing impairment, and behavioural effects will be highly localised.

Identify the likelihood	
Likelihood	Given the presence of marine fauna BIAs that overlap the operational area, marine turtles, whale sharks and fish may be present along the GEP route on a year-round basis. Due to the increased sound source levels and expected propagation distances associated with presence of the IMR vessels and associated acoustic inspection equipment, noise emissions may be audible; however, impacts to marine fauna are considered Unlikely (4) due to the open-ocean environment and their ability to move away from any sources of noise.
Residual risk	Based on a consequence of Insignificant (F) and likelihood of Unlikely (4) the residual risk is Low (9).

Residual risk summary		
Consequence	Likelihood	Residual risk
Insignificant (F)	Unlikely (4)	Low (9)
Assess residual risk acceptability		
Legislative requirements		

EPBC Regulations 2000 – Part 8, Division 8.1 will be implemented with regards to separation distances and vessel speeds.

Stakeholder consultation

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

Conservation management plans / threat abatement plans

Several conservation management plans have been considered in the development of this EP (Appendix B). Anthropogenic noise has been identified as a threat to pygmy blue whales in the Conservation Management Plan for the Blue Whale (DoE 2015). Noise interference has also been identified as a threat to marine turtles (DEE 2017a). The above listed controls to be adopted during the petroleum 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 other 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 impact is acceptable 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 outcome	Environmental performance standards	Measurement criteria
Refer to Table 7-14		

7.5 Biodiversity and conservation protection

7.5.1 Introduction of invasive marine species

Vessels used for IMR activities covered in this EP have the potential to introduce invasive marine pests (IMS) through the discharge of ballast water and through biofouling on vessels and/or subsea IMR equipment.

An evaluation of the potential impacts and risks associated with the introduction and establishment of IMS is included in Table 7-13.

Table 7-13: Impact and risk evaluation – Invasive marine species

Identify hazards and threats	
IMS are non-native 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). The main pathway for the introduction and spread of IMS of concern associated with the petroleum activity is the mobilisation of IMR vessels from international and domestic waters. During adverse sea conditions or cyclone events, vessels may seek shelter in the lee of offshore islands and if unmanaged, this may also 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 identified as having the potential to be impacted are: • benthic communities – associated with KEFs, BPPH and shallow water coastal environments marine parks and reserves, the closest of which to the GEP is Browse Island (15 km at its closest point), however 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 including aquaculture. The GEP route overlaps four KEFs. The environmental values and sensitivities of three of these KEFs include rocky outcropping and high topographic relief or complexity that may result in associated increases in diversity and marine fauna aggregations. The GEP route has been selected to avoid as much as possible, any areas of rocky outcropping, with 98% of the GEP route consisting of featureless, unconsolidated clay or silty sands – an environment that is common and well represented in the region (INPEX 2010). Therefore, these values and sensitivities are generally absent from the operational area. Therefore, benthic habitats within the operational area (1 km either side of the GEP centreline) are not considered to provide appropriate habitat for the establishment of IMS.	Significant (C)

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). Aside from ports and harbours, other shallow water, pristine environments also at risk include offshore islands and shoals such as those found in State/Territory marine parks and reserves as presented in Figure 4-2. Many of these marine parks and reserves contain sensitive benthic habitats with a potential to be impacted by invasive populations. Information regarding IMS status in WA-50-L is available through the monitoring undertaken by INPEX at the Ichthys Facility (CPF and FPSO). The IMS, *D. perlucidum* was the only IMS detected on the offshore facility during post-arrival sampling and is thought to have been recruited locally once the facility had arrived in WA-50-L. The presence of *D. perlucidum* in WA waters was first documented in 2010 (Smale & Childs 2012) and following its first detection in Australia, monitoring programs supported by molecular analysis have documented the distribution of *D. perlucidum* throughout WA and NT waters (Dias 2016). There is no active management of *D. perlucidum* in WA with the exception of targeted management undertaken by DPIRD at the Montebello Islands (Section 4.8). 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. There is a potential for the transfer of viable IMS propagules to sensitive benthic communities that may survive, find suitable habitat and establish a self-sustaining population within the shallow water benthic habitats of WA/NT waters. This may result in impacts, such as altering the ecosystem health within benthic communities. Vessels undertaking IMR activities will not remain stationary in proximity to any known sources of IMS e.g. the CPF/FPSO, and therefore would not be exposed to a source 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 vessels. IMS propagules may however 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. Based on the habitat preferences of IMS (shallow water environments), the closest shallow water habitat to the operational area is Browse Island, located approximately 15 km away at its closest point. However, it is neither disturbed nor contains artificial structures that IMS prefer. Dias et al. (2016) reported in a global mapping study of *D. perlucidum* distribution that the majority of *D. perlucidum* colonies were found on artificial structures within ports, harbours and marinas. In WA, with the exception of the Swan River, *D. perlucidum* has not been recorded in natural habitats such a marine reefs, which is consistent with previous studies that have only identified the species at sites under anthropogenic influence both in Australia and overseas (Dias et al. 2016). Relevant ports related to the petroleum activity are Broome, Darwin and Dampier. The high frequency of vessels visits from a range of destinations, and habitat preference for IMS (artificial substrate, disturbed habitats, shallow coastal waters) have resulted in these ports having a confirmed presence of certain IMS (Section 4.9.5). IMS originating from these ports may present a potential impact to sensitive habitats in WA/NT waters that has the potential to result in medium to large scale 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 offshore infrastructure 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 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 4.9.3) and recreational fishing that is known to occur around at Flat Top Bank, Broome, Wyndham and Darwin (Section 4.9.3). In the event an IMS is translocated via an IMR vessel, 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 safeguards/controls

- Vessel 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).
- Vessels will have an approved ballast water management plan and valid ballast water management certificate, unless an exemption applies or is obtained.
- 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: 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 vessels that use ballast water will comply with the Regulation D2 discharge standard of the Ballast Water Management Convention.
- Complete a biofouling risk assessment (including immersible equipment) for vessels 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 in accordance with Figure 9-5.
- Implement the adaptive IMS risk-based monitoring program (IMSMP) in accordance with Section 9.6.2 and Table 9-6.
- 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 vessels.	No	Vessels are the only form of transport that can undertake the IMR activities (required to ensure the integrity of the GEP) that is practicable and cost efficient.
Substitution	Only use local vessels.	No	Using only locally available vessels could result in delays when sourcing an appropriate vessel. Local vessels are not always capable of meeting the specific requirements of the activity. The potential cost and time needed to source a capable vessel locally is disproportionate to the minor environmental gain potentially achieved.
Engineering	None identified	N/A	N/A
Procedures & administration	Complete a domestic biofouling risk assessment for IMR 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.	Yes	The completion of a biofouling risk assessment and the implementation of any required mitigations will reduce the risk of IMS incursions. The operational profile of IMR vessels that are likely to spend prolonged periods (i.e. >7 days) in the operational area will be assessed as they potentially are more likely to act as a vector for IMS if any are present. IMS monitoring of supply vessels has been undertaken by INPEX and has confirmed that these vessels are not acting as significant vector for IMS. During consultation with NT DITT – Aquatic Biosecurity Unit and WA DPIRD, it was confirmed that the movement of short-term vessels between these locations was considered to pose a low biosecurity risk.

<table>
<tr><td></td><td>Vessels will have biofouling management plans and record books.</td><td>Yes</td><td>Biofouling management plan that includes 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) enables the capture of management controls to be recorded by the vessel. It is a prudent control that can be implemented with little additional cost and is considered ALARP.</td></tr>
<tr><td colspan="4">Identify the likelihood</td></tr>
<tr><td>Likelihood</td><td colspan="3">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) are described in Sections 4.8 and 4.9.5. The offshore facility (CPF and FPSO) permanently moored in WA-50-L is considered to have an IMS risk status of Low as confirmed by independent IMS experts and relevant stakeholders based on the results of opportunistic monitoring undertaken over the last three years (2018-2020) since arrival in WA-50-L in 2017. Therefore, the likelihood of IMR vessels being colonized by IMS in WA-50-L is considered Remote (6) as the vessels will not spend time alongside the facility. Additionally, monitoring completed for the INPEX Ichthys support vessels, routinely supporting operations in WA-50-L, undertaken between 2019 and 2021, confirmed the absence of any IMS of concern on vessel hulls. Therefore, it is considered that through adherence to the above-described controls for biofouling and ballast water management, IMR vessels are not likely to pose a risk of spreading of IMS from mainland ports (Remote 6).</td></tr>
</table>

	Vessel masters will select appropriate transit routes between mainland ports and the IMR activity location along the GEP 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 *D. perlucidum* (or other IMS of concern) via domestic conveyances during unplanned operations is considered to be Remote (6). Based on ongoing controls such as using a risk-based approach in the adaptive IMSMP to manage the pathways and vectors that are responsible for the establishment of an IMS, the likelihood of an IMS becoming established is Remote (6)		
Residual risk	Based on a consequence of Significant (C) and likelihood of Remote (6) the residual risk is Moderate (8).		
Residual risk summary			
Consequence		Likelihood	Residual risk
Significant (C)		Remote (6)	Moderate (8)
Assess residual risk acceptability			
Legislative requirements			

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 2020d).

Stakeholder consultation

The annual reports and vessel inspection reports were provided to WA DPIRD, DAWR Aquatic Biosecurity Unit and NT DITT, for information. A summary of proposed changes to the IMS monitoring program and domestic risk assessment process were provided for discussion. The stakeholders acknowledged (in the context of the controls applied by INPEX) that actual marine pest biofouling risk posed by support vessels operating vessel between Broome – Darwin – and WA-50-L is a low risk and that no IMS of concern have been identified to date from these activities.

Conservation management plans / threat abatement plans

Several conservation management plans have been considered in the development of this EP (refer Appendix B). 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

Given 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 other 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 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 outcome	Environmental performance standard	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.	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).	Current International Anti-fouling Systems certificate or a Declaration on Anti-fouling Systems for each vessel/facility.
	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. • 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).	Vessel premobilisation inspection and annual verification audit reports confirm through ballast water records that an approved ballast water management option has been used.
	Vessels that use ballast water will comply with the Regulation D2 discharge standard in accordance with the Ballast Water Management Convention.	Records confirm vessels meet D2 discharge standard.

	All 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.	Approved 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.
	A biofouling risk assessment will be completed by an independent IMS expert for all 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.	Vessel-specific biofouling risk assessment and any records of mitigation measures implemented confirming the vessel presents a low risk.
	Domestic biofouling risk assessment for 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.	Domestic biofouling risk assessment.
	Vessels will have a biofouling management plan that includes 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.

7.5.2 Interaction with marine fauna

The presence of vessels operating within the operational area has a potential to result in the injury or mortality of marine fauna from vessel strike. Table 7-14 provides a summary of the risk assessment and defines the control measures, environmental performance outcomes and standards and measurement criteria relating to vessel strike.

Table 7-14: Impact and risk evaluation – interaction with marine fauna (vessel strike)

Identify hazards and threats	
The physical presence and use of vessels in the operational area 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**
Particular values and sensitivities with the potential to be impacted are: • transient, EPBC-listed species; specifically, marine mammals, whale sharks and turtles. Vessels supporting the petroleum activity have the potential to interact with transient, EPBC-listed species; specifically, marine mammals, whale sharks and turtles. In a worst-case, this may result in death of marine fauna from vessel strike, where interactions are non-fatal marine fauna may suffer and potentially have reduced fitness (DEE 2017c). 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 fauna when vessel speeds are greater than 14 knots (Laist et al. 2001; Vanderlaan & Taggart 2007; Hazel et al. 2007; Cates et al. 2017). The potential for vessel strike applies to all marine mammals, whale sharks and turtle species within the region; however, humpback whales have a potentially higher likelihood due to their extended surface time. This higher likelihood of collision is reduced however, as the operational area is located offshore, away from marine mammal BIA areas as shown in Figure 4-5 including the humpback BIA migration and calving located approximately 100 km south of the GEP at its closest point. In addition, there is a blue whale migration corridor located approximately 60 km north west of the Ichthys offshore facility and a foraging BIA at Scott Reef, approximately 140 km west of the GEP at its closest point.	Minor (E)

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. Humpback whales and blue whales are subject to DEE Conservation Advices (Appendix B) which requires the assessment of vessel strike on whales and encourages the implementation of mitigation measures and vessel strike incident reporting to the National Ship Strike Database. As such, control measures are included below, to align with the DEE Conservation Advices and address vessel strike on whales. 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. Given the expansive open ocean environment of the operational area the potential for the displacement of cetaceans by IMR activities is considered to be low. While there is potential for a small number of individual marine mammals to be impacted by vessels associated with the activity, any potential vessel strike is likely to be limited to isolated incidents.

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) overlaps a portion of the GEP route. Whale sharks are also subject to a DEE Conservation Advice (Appendix B) which notes that the threat to the recovery of the species includes strikes from vessels. While the DEE 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 DEE 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 (3–6%) of their time is spent at the surface, with routine dive times lasting anywhere between 15 and 20 minutes. 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; Hazel et al. 2007). The operational area overlaps marine turtle foraging and internesting BIAs. Large aggregations of turtles are not expected, however foraging turtles may be present at low levels throughout the year, noting that there is uncertainty and potential underestimation of foraging distribution of green turtles reported by Ferreira et al (2020). 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). Impacts to marine turtles from visual attraction to vessels are expected to be localised and of minor consequence at the population level for these mobile and broad-ranging species. 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. 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.

In the event of the death of an individual marine mammal, whale shark or turtle, it would not be expected to have a significant effect at the population level (Minor E).			
Identify existing design safeguards/controls			
• 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).			
Propose additional safeguards/control measures (ALARP evaluation)			
Hierarchy of control	Control measure	Used?	Justification
Elimination	Eliminate the use of vessels	No	Vessels are the only practicable means of conducting IMR activities along the length of the GEP.
	Reduce the frequency of IMR activities	No	Reducing the number of IMR activities would decrease the potential for vessel interactions with marine fauna; however, the frequency of IMR activities on the GEP is governed by the risk-based inspection schedule and therefore this control cannot be implemented.
Substitution	Use smaller vessels for IMR activities	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 may have space and weight limitations for equipment required for larger maintenance or repair activities. Vessels undertaking routine pipeline inspection are already generally small and travel at slower speeds (<10 knots) while towing acoustic instruments or conducting visual inspections (ROV).
Engineering	None identified	N/A	N/A

Procedures and administration	Vessel speed restrictions or separation distances maintained for turtles	Yes	Vessels undertaking IMR activities are generally traveling at slower speeds while conducting visual inspections (ROV) or towing acoustic instruments (<10 knots). The existing control of implementation of EPBC Regulations 2000 – Part 8, Division 8.1 (Regulation 8.05) *Interacting with cetaceans* has modified to include turtles to reduce potential harm from IMR vessels operating in marine turtle BIAs.
	Dedicated marine fauna observers on vessels	No	Based on the distances to key marine mammal sensitive habitats (BIAs) the use of dedicated MFO's onboard IMR vessels is not considered warranted. Additionally, it is not 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.

Identify the likelihood			
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 and 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 and gas related vessels. Given that IMR vessels within the operational area will generally be travelling at very slow speeds (<10 knots) during IMR activities, and the open-ocean environment allows for vessel/threat avoidance, the likelihood of a vessel strike causing injury or death to a transient, EPBC-listed species or foraging whale sharks/turtles is Highly Unlikely (5). There have been no incidents of vessel strike during Ichthys operational activities to date.		
Residual risk	Based on a consequence of Minor (E) and likelihood of Highly Unlikely (5) the residual risk is Low (9).		
Residual risk summary			
Consequence	Likelihood	Residual risk	
Minor (E)	Highly Unlikely (5)	Low (9)	

<table>
<tr><th colspan="3">Assess residual risk acceptability</th></tr>
<tr><td colspan="3">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 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 B). Actions identified in the Blue Whale Conservation Management Plan and conservation advice documents for humpback whales and 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 other 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 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.</td></tr>
<tr><th>Environmental performance outcome</th><th>Environmental performance standards</th><th>Measurement criteria</th></tr>
</table>

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* (modified to include turtles): • 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). • 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.

7.6 Seabed disturbance

7.6.1 Seabed intervention IMR activities

Undertaking seabed intervention IMR activities has the potential to disturb the seabed in the operational area along the GEP route. In the event that seabed interventions are required for example, to stabilise and protect subsea infrastructure or enable access to subsea infrastructure for repairs, physical disturbance of the seabed and/or localised generation of sedimant plumes could affect the surrounding benthic communities. An evaluation of the potential impacts and risks are presented in Table 7-15.

Table 7-15: Impact and risk evaluation – seabed intervention activities

<table>
<tr><th colspan="2">Identify hazards and threats</th></tr>
<tr><td colspan="2">Over the life of this EP, seabed intervention activities may be required; for example, to stabilise and protect the GEP or enable access to the GEP for repairs within the operational area. Activities may include:
• physical seabed intervention/excavation alongside the GEP to adjust sand levels to gain access to, or enable repairs
• jetting or mass-flow excavation
• use of mud-mats/skirts to support the EPRS
• installation of grout bags, concrete mattresses, rock placement, or other physical structures to stabilise and protect the GEP on the seabed
• temporary set-down of ROV tooling, baskets and equipment on the seabed.
The area of seabed disturbance is directly related to the nature of the repair or inspection being performed and, therefore, cannot be confirmed. However, a range of reasonably foreseeable activities, such as ROV set-downs may occur for a matter of hours and disturb an area approximately 2 to 4 m^2. Potential excavations may vary in length, from a few metres to 100 m, and may be in the order of 2 to 4 m wide. Sand wave remediation along the GEP could potential disturb an area of up to 400 m^2. Installation of other physical structures, such as grout bags, mud-mats or mattresses, or temporary items, such as tooling baskets, may vary from <1 m^2 up to approximately 50 m^2.

Undertaking such seabed intervention activities has the potential to physically disturb the seabed close to the GEP in the operational area. Disturbance to benthic communities has the potential to result in reduced ecosystem productivity or diversity. In addition to physical disturbance, seabed intervention activities may also result in the localised generation of sediment plumes which could affect the surrounding benthic communities. It should be noted that the GEP route is a previously disturbed site, as GEP construction activities have already occurred in the operational area.</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 these activities are:
• benthic communities
• KEFs
• turtle foraging BIA (Joseph Bonaparte Depression).
As described in Section 4.6.2, the majority of the GEP route (>98%) is comprised of featureless, unconsolidated clay, silts and sands, with the most dominant seabed features confirmed as pockmarks and sand waves. Geophysical survey data and drop camera surveys identified that the only substantial areas of subcrop were between KP 361–374.5 and KP 482–513 (both areas located within the carbonate bank and terrace system of Sahul Shelf KEF). The only exposed outcrops were small areas at KP 36.5, KP 187 (which is located within the ancient coastline at 125 m depth contour KEF), and KP 379 (located within the carbonate bank and terrace system of Sahul Shelf KEF).</td><td>Insignificant (F)</td></tr>
</table>

The entire GEP route traverses four KEFs (the ancient coastline 125 m depth contour, the carbonate bank and terrace system of the Sahul Shelf, the pinnacles of the Bonaparte Gulf and continental slope demersal fish communities), and turtle foraging BIA. The environmental values and sensitivities of the KEFs/BIA i.e. rocky outcropping, high topographic relief or complexity, resulting in increased benthic diversity and marine fauna aggregations 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). Physical disturbance of the seabed may cause temporary disturbance to benthic habitats and loss of associated infauna and epifauna. There is a potential for impacts to benthic communities particularly in areas of rocky outcropping with higher densities of epibenthic fauna such as sea pens (Pteroeidae), sea fans (Gorgonians), sea whips (Junceela), feather stars (Crinoidea), bryozoans, hydroids, and sponges. Such impacts may include damage from the direct placement of physical structures such as grout bags, concrete mattresses, or mud-mats if the use of the EPRS is required. Physical disturbance of benthic communities may occur if these activities were undertaken in areas of increased benthic diversity such as KEFs/BIAs where mortality of sessile fauna and benthic infauna associated with the habitat could occur. Aside from the loss of physical habitat albeit limited in relation to the entire GEP route (disturbance ranging from <1 m^2 up to approximately 400 m^2), no further impacts to benthic communities are anticipated particularly in relation to the broader KEFs/BIAs where large areas of similar habitat exists and associated biota are well represented in the region. Following removal of the temporarily positioned equipment e.g. ROV tooling or baskets, the soft sediments will be left disturbed; however, benthic habitats would remain viable and are expected to recolonise through the recruitment of new colonists from planktonic larvae in adjacent undisturbed areas (Guerra-Garcia & Garcia-Gomez 2006). The potential consequence on benthic communities is a localised impact from physical disturbance within the footprint of the seabed intervention IMR activities in the operational area. Any impact is expected to be limited given the sparse cover of benthic communities due to the predominantly featureless seabed (>98%) reported along the GEP route and expected recovery through recolonisation. Therefore, it is assessed to be of inconsequential ecological significance (Insignificant F). Displacement of sediments may occur during equipment deployment, and through sediment jetting or excavation. This 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. In general, the seasonally naturally high turbidity (resulting from mobile sediments and strong currents) of near seabed waters along the GEP route (INPEX 2010) indicates that the benthic communities are accustomed to pulses of increased suspended sediment in the water column. Rapid dispersion of any suspended sediment plumes generated through seabed intervention activities is expected to occur naturally due to high seabed currents. Therefore, seabed intervention generated suspended sediments are anticipated to dilute to near background levels by the outer edge of the operational area and not result in any overall reduction in productivity of benthic communities. The closest submerged banks and shoals/BPPH to the GEP route that fall within the operational area are Flat Top Bank and Echuca Shoal located 3 km and 9 km away respectively, based on these distances they are not expected to be impacted. Overall, localised and infrequent increases in turbidity or rates of sedimentation resulting from seabed intervention activities are unlikely to affect the local benthic environment significantly, as species present in, or adjoining, unconsolidated sediments in high current environments are well adapted to high rates of mortality and natural disturbance (Diesing et al 2013) such as increased turbidity and sedimentation.	

Seabed intervention for span correction, such as jetting and mass-flow excavation would only be necessary in areas where mobile sediments, such as sand waves are present. Low density and high natural variability in benthic communities would occur in areas of highly mobility sediments. Also, in areas of highly mobile sediments, natural turbidity is likely to be higher and, therefore, the benthic organisms in these areas would likely be more tolerant of silt plume generated through these types of seabed intervention activities. In areas where hard substrate is present, such as KEFs/BIAs, higher density/diversity of benthic organisms is anticipated. However, as span correction requiring jetting/mass-flow excavation is most likely not to be needed in areas of hard substrate, the values and sensitivities of KEFs/BIAs are not likely to be exposed to silt plumes or disturbance from these types of activities. Seasonal variability with respect to the abundance of marine turtles within the turtle foraging BIA overlapping the operational area, is poorly understood and as a basis for this assessment it has been assumed that marine turtles could be present at any time of the year. The presence of marine turtles foraging in the operational area is not likely to be affected by seabed intervention activities. The placement of structures will be a slow and controlled process, to avoid damage to GEP infrastructure, with ROVs monitoring the controlled touch-down of such structures. Mass-flow-excavation and jetting are techniques which eliminate the risk of entrainment of turtles, a risk commonly associated with trailing-suction-hopper-dredging and therefore, no direct impacts to turtles within the foraging BIA at the Joseph Bonaparte Depression are expected. In addition, any permanent or temporary loss of habitat associated with seabed intervention activities would not affect the food availability for marine turtles, given the vastly larger areas of similar habitats which exist adjacent to the GEP route. There is little understanding of the cumulative impact of several seabed-based activities in one area and the ability of species or habitats to recover once a pressure (i.e. physical loss of habitat or damage) has been removed (Foden et al 2011). Habitats that require long recovery periods are considered to be more sensitive than those with rapid recovery rates, and the resilience of marine environments to cumulative interactions of multiple pressures is considered to be poorly understood (Foden et al 2011). Seabed intervention activities, although not planned over the life of this EP, may occur as a result of a requirement to stabilise and protect the GEP. Locations along the GEP route most susceptible to requiring jetting or mass-flow excavation will be areas of soft sediments with sparse epibenthic fauna present representing approximately 98% of the GEP route (Neptune 2009). These areas are typically highly mobile with high associated levels of natural disturbance; therefore, rapid recovery rates are expected. Activities such as jetting and mass-flow excavation would not be required in areas along the GEP route characterised by hard substrate (approximately 2%). These rocky, hard substrate areas however, may be impacted through the placement of physical structures such as grout bags, concrete mattresses, or mud-mats if the use of the EPRS is required. Any damage to benthic communities or habitats is expected to be localised to the direct footprint of the physical structures, with loss of habitat considered permanent. Although epifauna directly under the footprint would be impacted, after such disturbances processes of recolonisation followed by successional dynamics can re-establish the structure of the benthic community that has been damaged. This would be aided by the presence of the physical structures providing additional hard substrate for recolonisation, which can occur through settlement from the water column or lateral movement of juveniles or adults inside sediments (Guerra-Garcia & Garcia-Gomez 2006). It is also reported that recolonisation can occur over relatively short time frames (weeks to months) and rates are faster in tropical waters due to higher water temperatures (Guerra-Garcia & Garcia-Gomez 2006).	

Overall, any impacts to soft sediment benthic communities are expected to be temporary with rapid rates of recovery due to the resilience of the benthic communities from natural disturbances associated with hydrodynamic process at or near the seabed. In contrast, in the small areas of hard substrate, impacts from direct placement of physical structures may result in the permanent loss of benthic habitat potentially within KEFs/BIA. This loss would be limited to the footprint of the physical structures however recolonisation is expected to occur by adjacent epifauna relatively rapidly given the presence of alternative hard substrate. In a regional context, any losses are expected to be of inconsequential ecological significance given the vastly larger areas of similar habitats which exist adjacent to the GEP route. In the event that seabed intervention is required, potential impacts are expected to be highly localised and the potential consequence associated with seabed disturbance from seabed intervention activities/emergency anchoring has been evaluated as Insignificant (F). Several commercially significant fish stocks, considered as key indicator species (Table 4-6); and the continental shelf demersal fish community KEF overlap waters of the operational area. Although these fish species may be present, given the deep waters and absence of suitable habitats, disturbance to seabed habitats from the activity is not expected to affect fish spawning habitats (Insignificant F).	

Identify existing design safeguards/controls

- Dynamic positioning (DP) vessels used to ensure no planned anchoring
- Differential Global Positioning System (DGPS) or other subsea positioning equipment used to ensure subsea activities conducted at the correct locations
- ROV inspection before and after seabed intervention activities in areas of hard substrate
- Engineering analysis/ environmental assessment of possible seabed intervention techniques when planning maintenance/repair scenario except for small scopes such as placing a basket on the seabed.

Propose additional safeguards/control measures (ALARP evaluation)

Hierarchy of control	Control measure	Used?	Justification
Elimination	No seabed intervention IMR activities	No	Seabed intervention along the GEP may be necessary to ensure the integrity and operability of the pipeline.
Substitution	Use divers for inspections	No	The use of divers to perform inspections of the GEP can present unacceptable health and safety risks.
Engineering	None identified	N/A	N/A

Procedures & administration	Subsea infrastructure inspection process	Yes	Using a Risk Based Inspection (RBI) approach all subsea assets have an Inspection Maintenance and Monitoring (IMM) plan and an Ichthys Field subsea inspection work instruction manual. Each task in the IMM plan is entered into SAP to ensure tasks are actioned and tracked to be completed within the specified timeframes.

Identify the likelihood	
Likelihood	Given the controls in place, the likelihood of impacting of benthic communities localised to the operational area, as a result of seabed intervention activities is considered to be Possible (3). Given the mobile sediments, associated sparse coverage of benthic communities along 98% of the GEP route (INPEX 2010), and the small area potentially impacted, i.e. the total disturbance footprint relative to the widespread available habitat, any potential impacts are considered to be ecologically insignificant to the wider diversity and productivity of benthic communities in the region.
Residual risk	Based on a consequence of Insignificant (F) and likelihood of Possible (3) the residual risk is Low (8).

Residual risk summary		
Consequence	Likelihood	Residual risk
Insignificant (F)	Possible (3)	Low (8)

Assess residual risk acceptability

Legislative requirements

Although there is no specific environmental legislation or guideline regarding the environmental management of seabed intervention activities with respect to impacts on benthic communities, these activities align with INPEX corporate policies through the reduction of environmental impacts and risks to ALARP. During the planning for maintenance/repair scenarios an engineering analysis undertaken includes an environmental assessment.

Stakeholder consultation

No stakeholder concerns have been raised regarding potential impacts and risks from seabed intervention IMR activities.

Conservation management plans / threat abatement plans

Several conservation management plans have been considered in the development of this EP (Appendix B). The draft 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 in the operational area and therefore no specific actions relating to seabed intervention 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 other 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 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 outcome	Environmental performance standards	Measurement criteria
Seabed disturbance is limited to planned IMR activities and locations.	DP vessels will be used as required to eliminate the need for anchoring.	Pre-mobilisation inspection records confirm DP vessels contracted for work scope.
	Accurate positioning of vessels will be maintained using DGPS or other subsea positioning equipment to ensure seabed intervention IMR activities are undertaken within the pre-designed disturbance area.	Pre-mobilisation inspection records (OVID / Marine Warranty Survey) confirm DGPS and subsea positioning equipment is present and appropriately maintained.
	Within areas of hard substrate an ROV survey will be completed to confirm the disturbance footprint does not exceed the predesigned disturbance area.	ROV survey records.

	Seabed intervention options assessment will include an environmental assessment prior to selection of seabed intervention IMR techniques.	Seabed intervention options assessment documentation.
		Records of seabed intervention activities demonstrate activity conducted in accordance with engineering design.
	Subsea infrastructure inspection process implemented using a RBI approach with an IMM in place for all subsea assets.	SAP records demonstrate IMM tasks completed within the specified timeframes.

7.7 Social and cultural heritage

7.7.1 Physical presence – disruption to other marine users

The physical presence of vessels operating within the operational area has a potential to result in disruption to other marine users of the area, such as shipping operators or fisheries that operate along the GEP route. An evaluation of the potential impacts and risks are presented Table 7-16.

Table 7-16: Impact and risk evaluation – disruption to other marine users

Identify hazards and threats	
The intermittent physical presence of vessels undertaking IMR activities in the operational area has the potential to cause temporary disruption to other marine users, including shipping operators and fisheries through the reduction of space available to conduct shipping and fishing activities. There is no requirement for a petroleum safety zone (PSZ) along the GEP route which further limits potential disruption or exclusion of other users from the operational area.	
Potential consequence	Severity
The particular values and sensitivities identified as having the potential to be impacted by temporary disruption from the physical presence of IMR vessels are: • Shipping operators and commercial, traditional, and recreational fisheries. Other marine users in the vicinity of the operational area may be impacted by intermittent IMR vessel presence 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. A review of AMSA's vessel traffic data for the Browse and Bonaparte Basin's confirmed the absence of any major shipping lanes in the vicinity of the operational area (Section 4.9.5 & Figure 4-10). Although in some areas of WA-50-L heavy vessel traffic may occur, the marine traffic density along the GEP route is low with existing marine vessel movements in the area dominated by vessels servicing petroleum industry operations. Given the distance to shipping lanes, and relatively small area of the operational area in the Indian Ocean, the consequence of reduced navigable space is considered to be Insignificant (F). Several Commonwealth and State/Territory managed fisheries overlap the operational area and PEZ (Section 4.9.3). In many instances, although the area of the fishery overlaps the GEP route, no fishing effort actually occurs due to water depth, water temperature and lack of suitable habitat. The GEP is marked on the Australian Hydrographic Service (AHS) navigation charts and there is no limitation or exclusion zone around the GEP that precludes fishing activities along the GEP route. Based on the relatively low levels of identified fishing activity associated with commercial fishing and the very small spatial area occupied by IMR vessels temporarily operating in the operational area, in comparison to the entire fishing ground available to commercial operators, the potential loss of navigable space in which a fishing operator could conduct their activities is considered to be Insignificant (F). The operational area is situated within the MoU Box for Indonesian traditional fishing (DSEWPaC 2012a) as shown on Figure 4-2. Therefore, Indonesian fishing vessels may be present in the area when transiting between fishing grounds at Scott Reef and Browse Island. Impacts to traditional fishers from the presence of IMR vessels may include minor deviations in transiting routes; however, interference and disruption are not likely to extend travel times significantly. Given the relatively small size of the development where support vessels will be operating in relation to the total size of the MoU Box, impacts are expected to be Insignificant (F).	Insignificant (F)

<table>
<tr><td colspan="3">Recreational fishing may also operate off the WA and NT coast during certain times of the year, with the closest location to the operational area being Flat Top Bank in the east, and Scott Reef in the west. Generally, there is little recreational fishing that occurs within the operational area because of its distance from land, lack of features of interest and deep waters. Therefore, the potential consequence associated with economic losses in the recreational fishing industry as a result of vessel presence is considered to be Insignificant (F).</td><td></td></tr>
<tr><td colspan="4">Identify existing design safeguards/controls</td></tr>
<tr><td colspan="4">• Ongoing stakeholder consultation with relevant stakeholders as per Section 9.8.3 and Table 9-9.
• 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).</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>Elimination</td><td>Eliminate the use of vessels</td><td>No</td><td>Vessels are the only practicable means of conducting IMR activities along the length of the GEP.</td></tr>
<tr><td>Substitution</td><td>None identified</td><td>N/A</td><td>N/A</td></tr>
<tr><td>Engineering</td><td>None identified</td><td>N/A</td><td>N/A</td></tr>
<tr><td>Procedures and administration</td><td>Annual stakeholder fact sheet</td><td>No</td><td>As required by the OPGGS (E) Regulations 2009, INPEX has implemented a stakeholder engagement plan and to date has provided consultation factsheets on an annual basis to inform stakeholders of the Project status and activities. The frequency of the factsheets (annual) was considered appropriate during the initial construction of the Ichthys offshore infrastructure. However, now that the Project is in the operations phase an annual factsheet is not deemed necessary and likely to be of limited effectiveness due to stakeholder fatigue. Ongoing stakeholder consultation is still undertaken on an as required in accordance with Section 5.6 and Section 9.8.3.</td></tr>
<tr><td colspan="4">Identify the likelihood</td></tr>
</table>

Likelihood	IMR vessels will be present within the operational area on an intermittent basis and will have an insignificant (F) impact by reducing the navigable space available to shipping and fishing operators. The likelihood of the insignificant loss of space in the open ocean causing an economic loss or reduction in employment levels is considered to be Remote (6). 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 and will continue to be informed and updated on operational activities being undertaken by INPEX. On this basis, 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 Remote (6).
Residual risk	Based on a consequence of Insignificant (F) and likelihood of Remote (6) the residual risk is Low (10).

Residual risk summary		
Consequence	Likelihood	Residual risk
Insignificant (F)	Remote (6)	Low (10)
Assess residual risk acceptability		

Legislative requirements

Vessels will be equipped with navigation equipment as required by the *Navigation Act 2012*. In accordance with the OPGGS (E) Regulations 2009, consultation with relevant authorities of the Commonwealth, a state or territory, and other relevant interested persons or organisations has been undertaken to inform and update other marine users of the Project including a description of the nature of the activities and timeframe/schedule.

Stakeholder consultation

No stakeholder concerns have been raised regarding potential impacts and risks from the physical presence of IMR vessels associated with the petroleum activity. AMSA 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 have been considered in the development of this EP (Appendix B) none of the recovery plans or conservation advices are relevant to the physical presence of 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 other 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 proposed control is 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 outcome	Environmental performance standard	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.*

7.8 Loss of containment

Undertaking the petroleum 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 8-9 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*."

A summary of the loss of containment events (and emergency conditions) associated with this EP, together with their characterisation and classification, is included in Table 7-17. 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 8-9).

An evaluation of the environmental impacts and risks associated with potential emergency conditions is included in Section 8 of this EP. The remaining loss of containment events are evaluated in sections 7.8.1 and 7.8.2.

Table 7-17: Loss of containment events

Scenario		**Basis of volume calculation**	**Type**	**Indicative incident level**	**EP Section**
Source	Threat				
Accidental release from vessels and subsea IMR equipment	Onboard chemical and hydrocarbon handling and storage	Failure or drop during transfer of an intermediate bulk container estimated to be in the order of 1 m^3. Failure of subsea IMR equipment resulting in release of hydraulic fluid. The entire volume of the hydraulically activated pipe-lifting frames of the EPRS is 2 m^3, and therefore represents a conservative maximum estimate for losses from typical subsea IMR equipment.	Various	1	Table 7-18

Scenario		**Basis of volume calculation**	**Type**	**Indicative incident level**	**EP Section**
Source	Threat				
GEP minor loss of containment	Minor GEP infrastructure integrity failure (e.g. minor corrosion issue or dropped object)	A loss of containment of the GEP infrastructure would result in a leak of GEP gas to the marine environment. Depending on water depth and release rate, some of the lost product may rise through the water column to the surface and rapidly evaporate; however, some GEP gas will become entrained or dissolve into the water column.	Group 1- GEP gas/ condensate	1	Table 7-19
Emergency conditions (refer to Section 8)					
Vessel collision	Third-party intervention or simultaneous operations (SIMOPS)	AMSA (2015a) guidance on calculating maximum credible spill volumes for non-oil-tanker vessel collisions recommends the volume of the largest fuel tank of the vessel. 250 m^3 is the single largest fuel-tank volume of vessels that would typically be used for routine GEP IMR activities. These vessels will use Group II fuels.	Group II- MGO	2/3	Table 8-5
GEP major loss of containment/ rupture	Major integrity failure, most likely from external interference (e.g. large anchor drag) resulting in a rupture of the GEP	OLGA modelling was conducted for a GEP full-bore rupture at three water depths: -250 m (Ichthys Field water depth), -150 m and -70 m (Cwlth/NT waters boundary water depth). The outcomes of the OLGA modelling calculated total condensate release volumes of ~12,600 m3 (-250m water depth) to ~9,700 m3 (-70m water depth).	Group I - GEP gas/ condensate	2/3	Table 8-8

7.8.1 Accidental release

Vessel operations and the use of IMR equipment, including ROVs, EPRS and seabed intervention equipment require the handling, use and storage of chemicals and hydrocarbon materials. These materials may include, but are not limited, to the following:

- MGO/diesel (for use in deck cranes, winches, etc.)
- hydraulic fluid from vessel deck equipment or subsea IMR equipment
- grease and other lubricants
- paint/solvents
- process chemicals, such as oxygen scavengers, biocides and MEG.

Worst-credible volumes for loss of containment are provided in Table 7-17.

An evaluation of the potential impacts and risks associated with a loss of containment of these materials is included in Table 7-18.

Table 7-18: Impact and risk evaluation – loss of containment accidental release from vessels and submerged IMR equipment

<table>
<tr><th colspan="2">Identify hazards and threats</th></tr>
<tr><td colspan="2">Chemicals and hydrocarbons will be present on board vessels and within IMR subsea equipment during IMR activities. Although there are no planned discharges associated with these chemicals and hydrocarbons, there is the potential during handling, use and storage on board the vessels for spill events to reach the marine environment. There is also the potential for leaks to occur subsea from hydraulic systems on IMR equipment used within operational area. The largest credible accidental release scenario is a 2 m^3 release, based on the hydraulic fluid volumes of largest piece of subsea IMR equipment (EPRS). Chemical spills, such as paints/solvents, or other process chemicals, are expected to be of smaller volume, and therefore, the worst-credible scenario is defined by the hydraulic fluid spill. No bunkering will be undertaken as part of the activities covered by this EP.

An accidental release that reaches the marine environment or loss of containment event has the potential to result in changes to water quality. A decline in water quality has the potential to result in impacts to marine flora and fauna and may result in reduced ecosystem productivity and/or diversity.</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 are:
• commercial, recreational and traditional fisheries
• fish and sharks (associated with KEFs that overlap the operational area)
• planktonic communities
• benthic communities
• EPBC-listed species including turtle, marine avifauna, whale shark foraging BIAs

Both the concentration and exact nature of chemicals will only be known after an unplanned loss. Light hydrocarbons are more toxic (Group I) but volatilize more quickly. In contrast, heavier hydrocarbons (Group II, IV), while generally less toxic, may be more persistent in the environment, resulting in greater chronic exposure.</td><td>Insignificant (F)</td></tr>
</table>

The values and sensitivities associated with commercial, traditional and recreational fisheries (seafood quality and employment) could be impacted from exposure to chemicals or hydrocarbons in the marine environment. Generally, there is little recreational fishing that occurs within the operational area because of its distance from land, lack of features of interest and the deep waters. Recreational day-fishing is concentrated around the population centres of Broome, Derby, Wyndham and Darwin, as well as other readily accessible coastal settlements. The closest features to the GEP route that may attract recreational fishers are Flat Top Bank and Echuca Shoal located 3 km and 9 km away respectively. Commercial fisheries predominantly operate in the shallower waters of the PEZ with generally low levels of fishing activity reported (Section 4.9.3). Traditional fishing occurs at Browse Island (15 km from the GEP at its closest point). Given the small volumes associated with accidental release (1 – 2 m^3) and the open ocean environment, rapid dilution and dispersion is expected. The socioeconomic impacts on commercial, traditional and recreational fisheries are expected to be short-term and limited (Insignificant F). The continental slope demersal fish communities KEF overlaps the GEP. For an accidental release at the sea surface, deeper demersal fish communities, such as those associated with KEFs (i.e. continental slope demersal fish communities, the 125 m ancient coastline, the pinnacles of the Bonaparte Basin and the carbonate bank and terrace system of the Sahul Shelf), are less likely to be affected. Therefore, exposure to demersal fish would only be expected for subsea releases that occur at or near the seabed. Pelagic fish may also be at risk; however, due to their mobile nature, they are not expected to be encounter any surface expression. Given the relatively small volumes (1 -2 m^3) and the open ocean environment of the operational area, rapid dilution is expected with any impacts considered to be of inconsequential ecological significance (Insignificant F). Planktonic communities may be exposed to accidental releases of chemicals or hydrocarbons particularly at the sea surface. Due the anticipated small volumes of releases (1 -2 m^3), impacts would be expected to be localised in scale, temporary in nature, and not result in any loss of productivity in the Commonwealth marine area (Insignificant F). Benthic communities, particularly those associated with banks and shoals and KEFs, may be impacted by exposure to a subsea hydrocarbon release. Benthic communities within the operational area have limited environmental values and sensitivities, with 98% of the GEP route consisting of featureless, unconsolidated clay or silty sands (INPEX 2010). Examples of such benthic communities in proximity to the GEP (within 10 km) include Echuca Shoal and Flat Top Bank. However, given the small volumes associated with accidental releases, rapid dilution and dispersion is expected and any impacts considered to be of inconsequential ecological significance (F). Seasonal variability with respect to the abundance of marine turtles within turtle BIAs overlapping the GEP, is poorly understood and as a basis for this assessment it has been assumed that marine turtles could be present in the BIAs at any time of the year either at the surface or on the seabed. Turtles can be exposed to hydrocarbon or chemical spills as they surface, resulting in direct contact with the skin, eyes, and other membranes, as well as the inhalation of vapours or ingestion (NOAA 2010b). Other aspects of turtle behaviour, including a lack of avoidance behaviour, indiscriminate feeding in convergence zones, and large pre-dive inhalations, make them vulnerable.	

A marine avifauna BIA (lesser frigatebird foraging) overlaps a portion of the GEP route, with peak seabird foraging reported during April to November. Marine avifauna may be affected by the release of hydraulic fluid if a surface slick is encountered by birds resting at the sea surface and surface-plunging birds are considered particularly vulnerable to surface hydrocarbons. They may suffer from damage to external tissues, including skin and eyes, and internal tissue irritation in the lungs and stomach (Clark 1984). Impacts to seabirds that do not spend time resting on the sea surface, such as the lesser frigatebird are not expected. Subsea releases would be unlikely to result in direct impacts to marine avifauna. Whale sharks (including those in the whale shark foraging BIA that overlaps the operational area) have the potential for exposure to hydrocarbons. Potential effects include damage to the liver and lining of the stomach and intestine, as well as toxic effects on embryos (Lee 2011). As whale sharks are filter-feeders they are expected to be highly vulnerable to entrained hydrocarbons (Campagna et al. 2011). In the event of an accidental release during whale shark foraging, there is a potential for individual whale sharks to be affected. However, based on the small volumes ((1 -2 m^3), open ocean environment and the low abundance of whale sharks throughout the year in the foraging BIA, the overall population viability is not expected to be threatened. Given the minor volumes (<2 m^3) associated with loss of containment events, the nature and scale of exposure is expected to be limited due to the influence of physical oceanic processes, such as currents, tides and waves in the operational area. As such, there is the potential that foraging whale sharks, turtles, marine avifauna, fish, and other transient, EPBC-listed species could be exposed to these events but only if they are present in the immediate vicinity at the time of the event. Any potential impacts to the values and sensitivities described above are expected to be limited to individuals and not local populations, and of inconsequential ecological significance (Insignificant F).	

Identify existing design safeguards and controls
• Appropriate storage of hydrocarbons and chemicals including their associated waste constituents • All vessels >400 GT will have a SOPEP (or SMPEP) in accordance with Marine Order 91. • Vessel crew will receive an induction/training to inform them of deck spill response requirements in accordance with Table 9-3 • Spill kits will be available on-board vessels • INPEX lifting standard and cargo transfer procedures • Implementation of the *INPEX Chemical Assessment and Approval Procedure* in accordance with Section 9.6.1 and Table 9-5.

Propose additional safeguards and/or control measures (ALARP evaluation)			
Hierarchy of control	Control measure	Used?	Justification

Elimination	Eliminate the use of chemicals and hydrocarbons from IMR activities.	No	Chemicals and hydrocarbons are required for safe and efficient operation of vessels and IMR equipment and cannot be eliminated.
	Eliminate cargo transfers between vessels.	No	Cargo transfers cannot be eliminated, as this may be the only practicable option for supplying vessels during more complex/longer duration maintenance and repair activities.
Substitution	None identified	N/A	N/A
Engineering	Premobilisation servicing/inspection of submersible IMR equipment.	Yes	Servicing/inspection of equipment before mobilisation to ensure it is fit for purpose is a standard industry practice to reduce spill risks to ALARP.
	Preventative maintenance system (PMS) of external equipment, such as winches and cranes, to minimise the risk of leaks.	Yes	PMS is a standard industry practice to reduce spill risks to ALARP.
Procedures and administration	None identified	N/A	N/A
Identify the likelihood			
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 IMR equipment reduces the likelihood of spills during the operation of IMR equipment. The likelihood of an accidental release overboard, or from IMR equipment, is further reduced by the infrequent mobilisation and short duration of vessel activities completing IMR activities.		

	In the event of an overboard spill from a vessel or a release from submerged IMR equipment, localised impacts to the abundance of plankton or benthic communities (for any releases near the seabed/banks or shoals) within the vicinity of the release are considered to be Possible (3). However for plankton, this is ecologically insignificant based on the naturally high spatial and temporal variability of plankton distribution in Australian tropical waters. Based on the mobile nature of sediments and associated sparse coverage of benthic communities along 98% of the GEP route (INPEX 2010) the likelihood of impacts on benthic communities, although Possible (3), are not expected to affect the wider diversity and productivity of benthic communities which are well represented in the region (KEFs). Accidental releases may result in localised impacts to individuals of transient, EPBC-listed species, fish and sharks, and associated BIAs; however, the likelihood of these impacts is considered Highly Unlikely (5). Any impacts are not expected to result in a threat to population viability of protected species.		
Residual risk	Based on a consequence of Insignificant (F) and worst-case likelihood of Possible (3) the residual risk is Low (8)		
Residual risk summary			
Consequence		Likelihood	Residual Risk
Insignificant (F)		Possible (3)	Low (8)
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.

Conservation management plans / threat abatement plans

Several conservation management plans have been considered in the development of this EP (refer Appendix B). Emissions and discharges, including accidental discharges of chemicals or oil, are listed as threatening processes through both direct/acute impacts and indirect impacts through habitat degradation. Preventative controls avoid accidental discharges 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.

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	**Performance standards**	**Measurement criteria**
No loss of containment of hydrocarbons or chemicals to the marine environment.	Bunded areas or other secondary containment will be available and used for the storage and handling of hydrocarbons and chemicals (including waste constituents).	Inspection records confirm bunding or other secondary containment is available and used for the storage of hydrocarbons and chemicals (including waste constituents).
	Premobilisation inspections and annual verification audits undertaken by a registered organisation will confirm that all vessels >400 GT have SOPEPs (or SMPEP) compliant with Marine Order 91.	Inspection confirms SOPEP/SMPEP is available on board.
	Spill kits will be available on board 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 retained in SAP.
	Submersible IMR equipment will be subject to servicing/inspection prior to mobilisation to ensure it is fit for purpose.	Premobilisation inspection records confirm submersible IMR equipment has been subject to servicing/inspection to ensure it is fit for purpose.
	Vessel topsides hydraulic equipment will be subject to routine servicing/inspection in accordance with the vessel PMS.	Vessel PMS records confirm vessel topsides hydraulic equipment has been subject to routine servicing/inspection.

7.8.2 Minor loss of containment from GEP infrastructure

An integrity failure of the GEP infrastructure during operations would result in the loss of GEP gas to the marine environment. The rate of loss would be dependent on the size of the hole and the operational pressure inside the GEP, rather than the controlled release described during GEP passivation (Table 7-4).

The operating pressures will vary with operational status and location along the GEP but typically range from approximately 200 bar (near the GERB) to approximately 65 bar (near the Ichthys LNG Plant in Darwin).

The percentage of GEP gas that enters the marine environment – as opposed to rapidly rising through the water column and evaporating into a gas cloud above the sea surface (RPS Group 2015), or becoming entrained in the surface water layers (RPS APASA 2016) – is dependent on:

- the rate of loss of gas (dependent on the size of the hole and the operating pressure at the release location)
- water depth and temperature at the release location (greater ambient seawater pressure and cooler water at depth results in an increase in the percentage of hydrocarbons which become entrained/dissolved in the water column).

A range of systems are in place to enable detection of a potential leak from the GEP.

The flow of GEP gas into the GEP will be controlled from the CPF. The inlet and outlet pressures of the GEP will be monitored from the CPF and Ichthys LNG Plant CCRs, respectively.

In addition to CCR GEP pressure monitoring, INPEX will use a 'best available technology' (DNV 2010) leak detection system – the pipeline management system (PLMS). Among other functions, it can detect potential leaks by using field-measured values of pressure and flow and compare them to model-calculated values to determine the size and location of a potential leak. If it detects a potential leak, alarms are raised in the CCRs.

The accuracy of the leak detection model is dependent on a number of factors, including pipeline geometry and length, flow rates and the fluid used. Rather than pinpoint the exact location of a leak based on the above mentioned methods, the PLMS is able to provide a region of the pipeline in which a leak may exist, decreasing the time required to take remedial action.

A large leak, such as a full-bore rupture of the GEP (major loss of containment), is expected to be detected by the PLMS almost instantly. Drops in GEP inlet/outlet pressure, monitored at the CPF/Ichthys LNG Plant CCRs, would also indicate a possible GEP rupture.

The PLMS also has the ability to detect a small hole in the GEP. The smaller the hole, the greater the timeframe needed for the PLMS to detect the potential leak. PLMS leak detection timeframes for various hole diameters are estimated as follows:

- 100 mm leak – approximately 1 hour
- 50 mm leak – approximately 8 hours
- 25 mm leak – approximately 24 hours.

A very small hole may never be detected by the PLMS.

A small hole or leak may result in a bubble signature on the ocean surface, and therefore, INPEX activities, such as platform supply vessels (PSVs) transiting between Darwin and WA-50-L, or other third-party shipping and aircraft activities, may detect or verify leaks along the GEP route (safety risks permitting).

In the absence of a visible bubble signature on the ocean surface, i.e. due to a very small hole/leak, the leak is unlikely to be detected through surface visual inspection/verification using aircraft or vessels. In this case, a leak would only be detected and/or verified through routine/scheduled visual inspections of the GEP infrastructure by ROVs or AUVs.

In the unlikely event of an anchor drag, (e.g. by a mobile offshore drilling unit (MODU) or large ship), the MODU/ship would most likely report to either AMSA and/or INPEX and trigger an investigation for possible leaks.

An evaluation of the potential impacts and risks associated with a minor loss of containment of the GEP is presented in Table 7-19. It should be noted that potential impacts and risks associated with a major loss of containment of the GEP (GEP rupture) are evaluated in Table 8-8.

Table 7-19: Impact and risk evaluation – minor loss of containment from GEP

<table>
<tr><th colspan="2">Identify hazards and threats</th></tr>
<tr><td colspan="2">A leak or spill of GEP gas has the potential to result in changes to water quality through entrained and dissolved hydrocarbon exposure. RPS APASA (2014) modelling of a GEP gas release indicates that even with slow release rates (i.e. release rates comparable to a minor GEP leak), condensate droplets (heavier components of GEP gas) are expected to be lifted vertically through the water column by a plume of expanding gas. Depending on water depth and pressure of the release, condensate droplets could become entrained or dissolve into the water column during their rise towards the surface, or the condensate droplets may rise through the water column and become displaced at the surface, and either evaporate, or become a shallow entrained/dissolved plume (increasing entrainment at the surface occurs with increasing wind speed). The deeper and lower pressure the release, the greater the portion of condensate droplets become entrained/dissolved into the water column. Under all circumstances, limited surface plumes are expected from a GEP gas release, due to the high evaporation rates of condensate droplets on the surface. The entrained/dissolved components of a plume would be expected to disperse under the influence of oceanographic processes and decay due to microbiological processes (RPS APASA 2014).

The minor loss of containment of hydrocarbons from the GEP have the potential to result in changes to water quality. A decline in water quality has the potential to result in impacts to marine flora and fauna and may result in behavioural changes and reduced ecosystem productivity or diversity.</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 exposed to hydrocarbons from a loss of containment of the GEP infrastructure include:
• commercial, recreational and traditional fisheries
• KEFs
• planktonic communities
• benthic communities
• EPBC-listed species including turtle, marine avifauna and whale shark foraging BIAs.

Impacts to these values and sensitivities from exposure hydrocarbons from the GEP are described and evaluated in Table 7-4 for a controlled release of GEP contents following a rupture. Given the similarity in hydrocarbon properties, location and receptors, the consequence assessment is applicable to this minor loss of containment scenario and is not repeated here.</td><td>Minor (E)</td></tr>
<tr><th colspan="2">Identify existing design safeguards/controls</th></tr>
<tr><td colspan="2">• INPEX lifting standard.</td></tr>
</table>

- GEP integrity management plan with RBI schedule of IMR in accordance with Section 9.6.4 and Table 9-7.
- Inspection of CPF/FPSO mooring system in accordance with Section 9.6.4 and Table 9-7.
- Ichthys Field Management Plan, SIMOPS and CONOPS procedures for GEP IMR activities outside of the Ichthys Field management area (FMA).
- GEP pressure monitoring using the PLMS.

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	GEP pipeline repair plan.	Yes	In the event of a small leak or other potential integrity issue being detected, a pipeline repair decision process, in accordance with the GEP Pipeline Repair Plan, will determine the most appropriate response to ensure the ongoing integrity and operability of the GEP infrastructure, while ensuring the risk to the environment remains ALARP and acceptable.
	GEP leak verification inspection.	Yes	In the event of credible leak detection, depending on the nature of the leak, visual inspections of the possible leak will be undertaken. Visual inspections can include aerial or vessel-based visual inspection to check for a bubble signature on the ocean surface, or for smaller leaks (where a bubble signature is not likely on the surface), ROV/AUV visual inspections of the GEP on the seabed will be undertaken.

Procedures and administration	Environmental assessment of GEP loss of containment events.	Yes	Determining the potential environmental impacts associated with a GEP gas release is a complex issue involving many factors including: • location • water depths • GEP gas release rate (i.e. factor of hole diameter and GEP pressure) • distance to values and sensitivities • susceptibility of receptors to hydrocarbon exposure. Leak evaluation or plume modelling to assess the potentially affected environmental values and sensitivities will be conducted to assess the potential for short-term and long-term impacts and inform the pipeline repair decision process, conducted in accordance with the GEP pipeline repair plan.
Identify the likelihood			
Likelihood	The GEP was designed in accordance with the Australian Standard AS 2885.4:2010 *Pipelines—Gas and liquid petroleum—Submarine pipeline systems*, including the concrete weight coating to provide protection against dropped objects and the GEP location is marked on navigational charts. The condition of the GEP infrastructure will be assessed through the IMR program to pre-empt any possible defects and ensure the integrity is maintained. Furthermore, the INPEX *Detailed Design Quantitative Risk Analysis (QRA) the Ichthys Gas Export Pipeline* indicates that the highest likelihood events with the potential to damage the pipeline are associated with anchor interaction. The analysis calculates a pipeline failure frequency within Commonwealth waters, as $<1 \times 10^{-5}$ per kilometre per year. Given the proposed safeguards in place and the dispersive open-ocean environment in the operational area, impacts to transient, EPBC-listed species, associated BIAs, fish and sharks (KEFs), plankton and benthic communities from a minor loss of containment of GEP infrastructure are not expected occur; however, in the event of a release of GEP gas, localised impacts to plankton or benthic communities present at the release point are considered Possible (3) while impacts on other receptors are considered Highly Unlikely (5).		
Residual risk	Based on a consequence of Minor (E) and likelihood of Possible (3) the residual risk is Moderate (7).		
Residual risk summary			

Consequence	Likelihood	Residual risk
Minor (E)	Possible (3)	Moderate (7)
Assess residual risk acceptability		

Legislative requirements

The *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* in Commonwealth waters is in place to prevent the accidental loss of contaminants from vessels. The controls described are designed to ensure compliance with this Act.

Stakeholder consultation

No concerns have been raised by stakeholders regarding potential impacts and risks from emissions and discharges to the marine environment.

Conservation management plans / threat abatement plans

Emissions and discharges, including accidental discharges of chemicals or oil, are listed as threatening processes through both direct/acute impacts and indirect impacts through habitat degradation. Preventative controls avoid accidental discharges is consistent with the intent of the conservation management documents.

ALARP summary

As 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.

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 loss of containment of hydrocarbons to the marine environment from the GEP infrastructure.	Any vessel-based lifting for large infrastructure ('critical lifts') in the operational area will be managed under a procedure which is compliant with the INPEX *Lifting Standard*.	Records of all critical lifts conducted in the operational area are in accordance with procedures, approved under the INPEX *Lifting Standard*.
	A field management plan will be implemented, specifically: The INPEX field manager will identify, coordinate and manage activities which are deemed to constitute SIMOPS and CONOPS associated with the GEP infrastructure within the Ichthys FMA through a permit to work and associated risk assessment.	Permit to work and associated risk assessment for any vessel activities interacting with the GEP infrastructure in the Ichthys FMA. SIMOPs documentation for any MODU movements within the Ichthys Field.
	All relevant GEP maintenance and repair activities associated with the GEP outside of the Ichthys FMA will be conducted in accordance with a CONOPS procedure.	Records demonstrate GEP maintenance and repair activities conducted in accordance with a CONOPs procedure.
	GEP inlet/outlet pressure monitoring using the PLMS will be undertaken on the CPF and Ichthys LNG Plant.	Records of GEP PLMS data and inlet/outlet pressure data.
	A GEP pipeline repair plan will be developed in the event of a leak or integrity issue to determine response options to ensure ongoing integrity of the GEP.	GEP pipeline repair plan.

	A GEP leak detection program will be implemented during GEP operations. This includes: • Detection of potential GEP leaks via the PLMS and the GEP inlet/outlet pressure monitoring in CCRs on the CPF and in the Ichthys LNG Plant. • Confirmation of credible leak scenarios via GEP visual inspection (e.g. aerial, vessel-based, ROV or AUV). • In the event an alarm is raised in the CPF and/or Ichthys LNG Plant CCRs, indicating a potential pressure drop in the GEP, pressures at the CPF and Ichthys LNG Plant will be investigated to determine if the pressure drop is a credible GEP leak scenario. • If the data indicates a potential credible leak, a visual inspection (e.g. aerial, vessel-based, ROV or AUV) will be conducted to confirm the GEP infrastructure integrity status.	Records of GEP PLMS data and inlet/outlet pressure data. Records of evaluation of CPF and Ichthys LNG Plant pressure data, in event of CCR alarms indicating a potential leak scenario in the GEP. Records of visual inspections to verify GEP integrity status.
	In the event of any loss of containment of the GEP, an environmental impact assessment will be undertaken to determine the short-term and long-term potential impacts of the leak to the environment. The environmental assessment will include: • leak evaluation and, where appropriate, plume modelling • an assessment of the potentially affected environmental values and sensitivities.	Records of leak evaluation/plume modelling. Records of assessment of potential short-term and long-term impacts to values and sensitivities. Records of determination of incident level against INPEX risk matrix.
	The environmental impact assessment will be taken into consideration during the engineering assessment to determine the engineering response to the pipeline leak. The engineering assessment will be undertaken using a pipeline repair decision process defined in the GEP Pipeline Repair Plan. The engineering response will take into consideration escalation factors and monitoring and escalation mitigation controls.	Records demonstrate engineering assessment undertaken in accordance with pipeline repair decision process and taking into consideration the environmental assessment of the leak. Records demonstrate the environmental risk associated with the proposed response to a GEP loss of containment is ALARP and acceptable.

8 EMERGENCY CONDITIONS

An evaluation of potential spill sources and worst-case spill scenarios (WCSS) identified two potential emergency conditions related to the petroleum activity (Table 7-17). The emergency conditions are summarised in Table 8-1.

Table 8-1: Potential emergency conditions

Scenario		**Hydrocarbon type**	**Release location**
Source	Threat		
IMR vessels	Collision	Group II – MGO/ marine diesel	Surface
GEP loss of containment	Major integrity failure	Group I - GEP gas	Subsea

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 risk assessment and oil spill scientific monitoring purposes using low thresholds described in NOPSEMA bulletin #1 (NOPSEMA 2019a). The low thresholds used may not be ecologically significant because 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 spill scenarios as outlined above.

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 (2019a). 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 (2019a).
	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 polycyclic aromatic hydrocarbon (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 (2019a).
	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 (2019a). 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 Protected Matters Database search (Appendix B), 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 WCSS (Table 7-17) including a vessel collision (MGO surface release) and GEP loss of containment (subsea release of condensate), during all seasons (summer, winter and transitional) and under different hydrodynamic conditions (e.g. currents, winds, tides, etc.) were overlaid and is presented in Figure 8-1. The furthest extent of the PEZ and EMBA within this EP is driven by the outer extent of entrained oil and shoreline contacts. The geographic locations of the various releases for a vessel collision and GEP rupture WCSS are presented in Figure 4-2 of the INPEX *Browse Regional OPEP Basis of Design and Field Capability Assessment Report*.

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 search identifies 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 8-9).

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*.

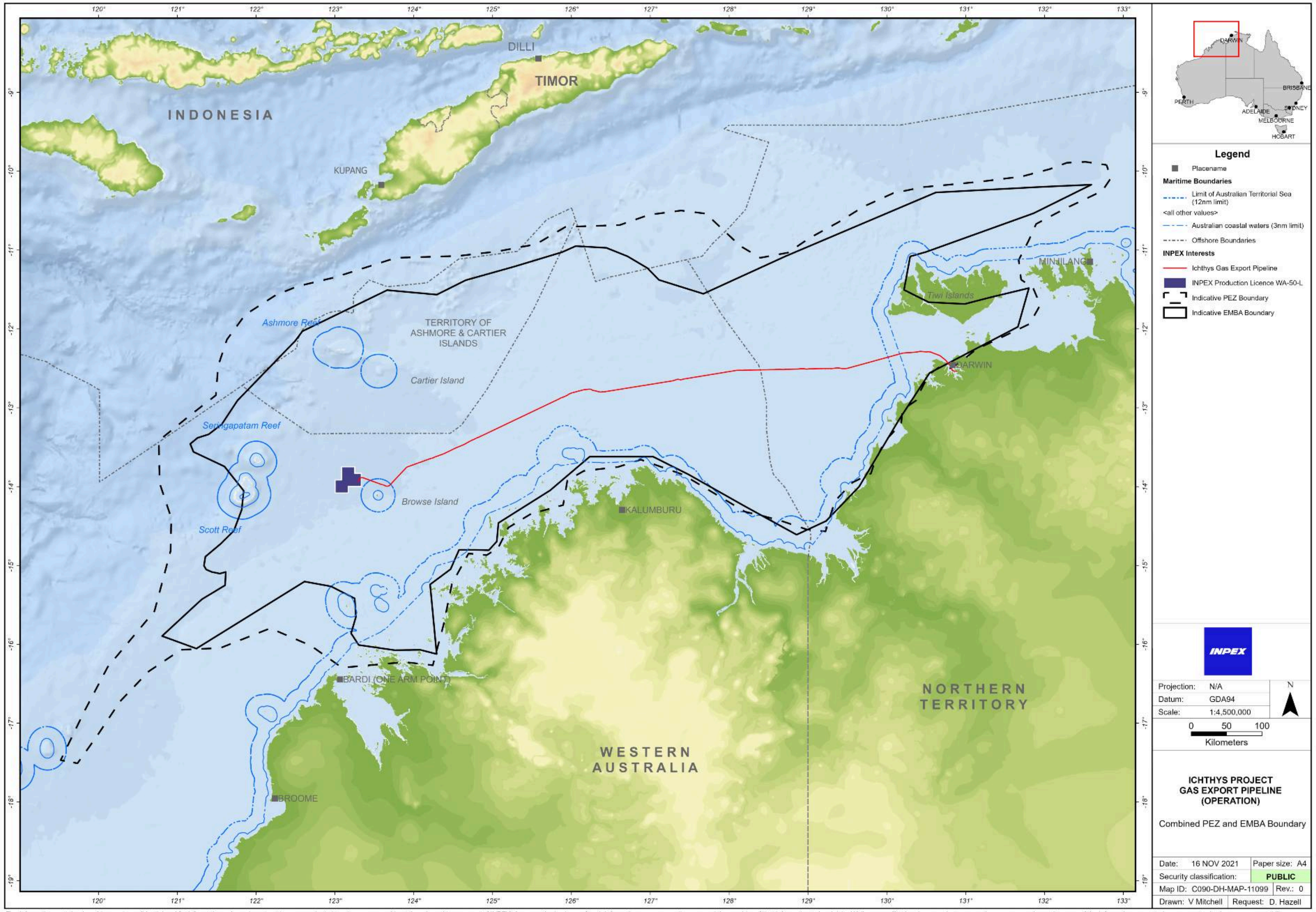

Figure 8-1: Combined PEZ and EMBA for all credible spill scenarios

8.2 Vessel collision

8.2.1 Location

The petroleum activities associated with this EP are limited to operational area. It is not practicable to evaluate every potential spill location along the entire GEP route due to its length. Thus, the release locations to model potential scenarios were identified based on locations that:

- would have the greatest potential consequence to the receiving marine environment
- where values and sensitivities would be most at risk if a spill event occurred
- would enable the full extent of potential environmental impacts to be assessed.

Based on these considerations, five locations were identified and modelled to provide an indication of the PEZ and EMBA from a vessel-based hydrocarbon spill. These locations are shown in Figure 4-2 of the INPEX *Browse Regional OPEP Basis of Design and Field Capability Assessment Report* and are listed below:

- adjacent to the INPEX FPSO in WA-50-L (Location A)
- adjacent to a section of the GEP route closest to Browse Island (Location H)
- adjacent to a section of the GEP route that traverses closest to the Kimberley AMP (Location I)
- adjacent to a section of the GEP route that traverses the Oceanic Shoals AMP (Location J)
- adjacent to a section of the GEP route closest to the NT coastal waters boundary (3 nm) (Location K).

8.2.2 Volume and duration

The modelled scenarios used a spill volume of 250 m^3 of Group II (MGO) to represent a vessel collision scenario. The justification for this volume is provided in Table 7-17.

Modelling was undertaken based on an instantaneous release of 250 m^3 of MGO at the sea surface for 14 days at each of the five locations. The simulation duration was selected based on findings of a previous study, where maximum floating oil concentrations anywhere in the spill impact mapping and analysis program (SIMAP) model domain were predicted to fall below the lowest threshold of 1 g/m^2 after approximately 14 days (RPS APASA 2015b).

8.2.3 Hydrocarbon properties

Hydrocarbon properties associated with the vessel collision scenario used for the modelling study are presented in Table 8-3. MGO is a general purpose fuel that is free from residual fuel oils that may be present in diesel or other heavy fuel oils. In terms of fate and transport, and potential impacts to the marine environment, Group II oils such as marine diesel and MGO will behave in the same manner and pose similar levels of risk to values and sensitivities.

Table 8-3: Group II (MGO) properties

Hydrocarbon type	Density at 15 ˚C (g/cm^3)	Viscosity – centipoise (cP) – at 25 ˚C	Characteristic	Volatile (%)	Semi-volatile (%)	Low volatility (%)	Residual (%)
			Boiling point (˚C)	<180	180–265	265–380	>380
MGO	0.829	4	% of total	6	34.6	54.4	5

8.2.4 Modelling results

The precited PEZ and EMBA for all modelled spill scenarios (locations, seasons and volumes) is presented in Figure 8-1, which identifies the outer extent of possible exposure (PEZ) and potential impact (EMBA). Table 8-4 provides a summary of the spill modelling results in relation to a vessel collision scenario.

Table 8-4: Vessel collision spill modelling results summary

Hydrocarbon exposure	MGO (250 m^3) Source: RPS 2021a
Surface	From all modelled release locations along the GEP, worst-case concentrations of hydrocarbons at the sea surface, greater than the impact threshold of 10 g/m^2 were predicted to occur at distances ranging from 57 to 138 km from the source. Floating hydrocarbons at the sea surface are predicted to evaporate and weather within a few days.
Entrained and dissolved	Entrained oil concentrations >100 ppb were shown to dictate the outer extent of the EMBA for all modelled scenarios. The furthest distance was predicted to be up to 417 km from the source. Worst-case instantaneous entrained oil concentrations predicted was 4,887 ppb in the vicinity of the release Location I (Kimberley AMP). Other concentrations predicted were 4,336 ppb at release Location A (FPSO in WA-50-L), 2,207 ppb at Browse Island, 1,279 ppb at the Maret Islands, 439 ppb on the Darwin Coast and 226 ppb at Bathurst Island. Cross-sectional transects in the vicinity of the release locations indicated that entrained oil concentrations at or greater than the 100 ppb threshold were predicted to range from 25 to 45 m depth. Worst-case dissolved aromatic hydrocarbon concentrations were calculated as 137 ppb in the vicinity of the release Location I (Kimberley AMP),127 ppb at release Location K (turtle BIA), 118 ppb at release Location A (FPSO in WA-50-L) and 54 ppb at Browse Island. Cross-sectional transects in the vicinity of the release site indicated that dissolved aromatic hydrocarbon concentrations at or greater than the 50 ppb threshold were predicted to range from 15 to 40 m depth.

Hydrocarbon exposure	**MGO (250 m^3)** **Source: RPS 2021a**
Shoreline	From all modelled release locations along the GEP, the greatest potential volumes on shorelines was predicted for Browse Island (50 m^3), Joseph Bonaparte Gulf coastline (51 m^3), and Bathurst Island (3 m^3). The highest potential concentration of oil on shore, through accumulation, was calculated as 3,000 g/m^2 for Browse Island, 1,679 g/m^2 at Peron Island and 134 g/m^2 at Bathurst Island. In the worst-case replicate, the shortest elapsed time before exposure could occur at any shoreline was predicted as five hours for Browse Island. With shortest times to contact at Bathurst Island calculated as 94 hours and Roche Islands (reefs) calculated as 41 hours.

8.2.5 Impact and risk evaluation

An evaluation of the impacts and risks associated with a Group II oil spill resulting from a vessel collision event is presented in Table 8-5.

Table 8-5: Impact and risk evaluation - vessel collision

<table>
<tr><th colspan="2">Identify hazards and threats</th></tr>
<tr><td colspan="2">A vessel collision and subsequent surface release of Group II-MGO has the potential to result in changes to water quality and impacts to marine flora and fauna through surface, entrained, dissolved, and shoreline hydrocarbon exposure that may result in reduced ecosystem productivity and/or diversity.</td></tr>
<tr><th>Potential consequence – surface (floating) hydrocarbons</th><th>Severity</th></tr>
<tr><td>The values and sensitivities with the potential to be affected by surface (floating) hydrocarbon exposures are listed below, noting that the spill would not represent a continuous surface expression and would evaporate and weather within a few days:
• commercial, traditional and recreational fisheries (within 57 to 138 km from the release location)
• planktonic communities (within 57 to 138 km from the release location)
• emergent benthic communities (within 57 to 138 km from the release location)
• EPBC-listed species including marine mammals, turtle and marine avifauna and whale shark foraging BIAs (within 57 to 138 km from the release location).
The values and sensitivities associated with commercial, traditional and recreational fisheries (seafood quality and employment) could be impacted due to floating oil following a vessel collision, predominantly from the possible oiling of nets and lines and exclusion zones (ITOPF 2011). Generally, there is little recreational fishing that occurs within the operational area because of its distance from land, lack of features of interest and the deep waters. Recreational day-fishing is concentrated around the population centres of Broome, Derby, Wyndham and Darwin, as well as other readily accessible coastal settlements which are in generally at the edge of or outside of the PEZ and therefore not expected to be impacted by this spill scenario. The closest features to the GEP route that may attract recreational fishers, and may be affected by floating oil is Flat Top Bank (3 km) and Echuca Shoals (9 km). Commercial fisheries predominantly operate in the shallower waters of the PEZ with generally low levels of fishing activity reported (Section 4.9.3). Traditional fishing including on intertidal reef platforms at Browse Island (15 km from the GEP at its closest point) and along the Kimberley and NT coastlines including the Tiwi Islands, could be expected to be affected where worst-case predicted concentrations accumulate above the impact threshold (100 g/m^2). The socioeconomic impacts on commercial, traditional and recreational fisheries are expected to be limited with isolated disruption (Minor E).</td><td>Moderate (D)</td></tr>
</table>

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 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). Recently spawned gametes and larvae would be particularly vulnerable to oil spill effects, since they are generally positively buoyant and would be exposed to floating hydrocarbons at the sea surface expressions. Therefore, under most circumstances, impacts on plankton from floating oil is expected to be localised, with short-term impacts; however, if a surface slick reached a coral-spawning location, such as Browse Island during a spawning event, localised short-to-medium term impacts could occur. Therefore, the consequence is considered to be Minor (E). Emergent benthic communities, such as coral reefs at Browse Island, Scott Reef and the outer islands of the Kimberley and NT coastline, may be impacted by exposure to floating hydrocarbons. Shallow-water communities are at a greater risk of exposure than deep-water communities (NRC 1985). Physical oiling of coral tissue can cause a decline in metabolic rate and may cause varying degrees of tissue decomposition, which can lead to death (Negri & Heyward 2000). Additional impacts from entrained/dissolved hydrocarbons on corals are discussed in the subsection below. Seagrasses and macroalgae are generally not emergent, and therefore impacts and risks are similarly discussed in the entrained/dissolved subsection below. Mangrove communities within the EMBA present along the Kimberley and NT coastlines are also susceptible to surface oiling, with potential impacts including defoliation and mortality (Burns et al. 1993; Duke et al. 2000). Mangrove recovery from disturbance would be expected over the short-to-medium term. Therefore, emergent benthic communities, within 57 to 138 km of the release location may be exposed to surface hydrocarbons from a vessel collision with impacts expected to be localised with short-to-medium term impacts (Minor E). EPBC-listed species such as marine mammals, reptiles, avifauna and whale sharks could also be impacted through exposure to surface hydrocarbons, primarily through ingestion, including through foraging activities. Several marine mammal BIAs overlap the EMBA including blue whale foraging at Scott Reef and migration to the west of WA-50-L (Figure 4-5), humpback whale aggregation at the southern boundary of the EMBA along the Kimberley coast (Thums et al 2018) and dugong and dolphin foraging areas (Figure 4-6). As air-breathers, marine mammals 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). Given the expected weathering of the slick the consequence is considered to be Minor (E).	

Seasonal variability with respect to the abundance of marine turtles within turtle BIAs overlapping the GEP and EMBA, is poorly understood and as a basis for this assessment it has been assumed that marine turtles could be present in the BIAs at any time of the year either at the surface or on the seabed. Turtles can be exposed to hydrocarbon or chemical spills as they surface, resulting in direct contact with the skin, eyes, and other membranes, as well as the inhalation of vapours or ingestion (NOAA 2010b). Other aspects of turtle behaviour, including a lack of avoidance behaviour, indiscriminate feeding in convergence zones, and large pre-dive inhalations, make them vulnerable. In the event of a surface slick from a vessel collision there is the potential for individuals turtles to be affected. However, given the expected weathering, the presence of the slick would be short-term (several days) and therefore the overall population viability is not expected to be threatened and the consequence is considered to be Minor (E). Marine avifauna have the potential to directly interact with oil on the sea surface, in the course of normal foraging activities. A marine avifauna BIA (lesser frigatebird foraging) overlaps a portion of the GEP route, with peak seabird foraging reported during April to November. A Ramsar site (Ashmore Reef) and several wetlands of conservational significance are present within the EMBA (refer to Section 4.6 and Figure 4-9), these sites provide important habitat for marine avifauna. Marine avifauna may be affected if a surface slick is encountered by birds resting at the sea surface and surface-plunging birds are considered particularly vulnerable to surface hydrocarbons. They may suffer from damage to external tissues, including skin and eyes, and internal tissue irritation in the lungs and stomach (Clark 1984). Toxic effects may also result where hydrocarbons are ingested, as birds attempt to preen their feathers (Jenssen 1994). Weathering of hydrocarbons on the sea surface will reduce the levels of toxicity that seabirds may be exposed to and, over time, the hydrocarbons on the surface will become patchy rather than continuous. Impacts to seabirds that do not spend time resting on the sea surface, such as the lesser frigatebird are not expected. Given the expected weathering, the presence of the slick would be short-term (several days) and therefore the overall population viability is not expected to be threatened and the consequence is considered to be Minor (E). Whale sharks (including those in the whale shark foraging BIA that overlaps the operational area) have the potential for exposure to floating hydrocarbons at the sea surface. Potential effects include damage to the liver and lining of the stomach and intestine, as well as toxic effects on embryos (Lee 2011). In the event that a spill from a vessel collision occurred during whale shark foraging, there is the potential for individuals of the local population to be affected. However, given the expected weathering, low abundance of whale sharks throughout the year in the foraging BIA that overlaps the operational area and the distance to the closest whale shark aggregation (1,000 km to the Ningaloo Reef aggregation), the overall population viability is not expected to be threatened. Therefore, the consequence is considered to be Insignificant (F). Based on the predicted limited extent of the surface hydrocarbons (within 57 to 138 km noting that the spill would not represent a continuous surface expression), limited surface area affected at any time 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). In summary, the potential extent of surface hydrocarbon with a concentration >10 g/m^2 may result in widespread exposure to marine fauna (including EPBC-listed species) and emergent benthic habitats, such as coral reefs. 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 surface expression of hydrocarbons from the identified spill events is considered to be Moderate (D).	

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 417 km from the release location) • KEFs (within 417 km from the release location at depths ranging from 15 to 45 m) • planktonic communities (within 417 km from the release location) • benthic communities (within 417 km from the release location at depths ranging from 15 to 45 m) • EPBC-listed species including marine mammals, turtles, marine avifauna and whale shark BIAs (within 417 km from the release location at depths ranging from 15 to 45 m). The values and sensitivities associated with commercial, traditional and recreational fisheries (seafood quality and employment) could be impacted due to dissolved/entrained oil predominantly through toxicity impacts to fish affecting seafood quality and catches. Generally, there is little recreational fishing that occurs within the operational area because of its distance from land, lack of features of interest and the deep waters. Recreational day-fishing is concentrated around the population centres of Broome, Derby, Wyndham and Darwin, as well as other readily accessible coastal settlements which are generally at the edge of or outside of the PEZ and therefore not expected to be impacted by this spill scenario. Commercial fisheries predominantly operate in the shallower waters of the PEZ with generally low levels of fishing activity reported (Section 4.9.3). Traditional fishing at Browse Island (15 km from the GEP at its closest point) 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. Based on the extent and relatively shallow depth of the dissolved/entrained plume and the predicted worst-case concentrations, the socioeconomic impacts on commercial, traditional and recreational fisheries from the presence of dissolved/entrained oil are expected to be short term and with a Minor consequence (E). The continental slope demersal fish communities KEF overlaps the GEP and a number of KEFs are present within the EMBA (Section 4.2). Several filter-feeding communities associated with these KEFs such as the 125 m ancient coastline KEF, the pinnacles of the Bonaparte Basin KEF, and the carbonate bank and terrace system of the Sahul Shelf may be exposed to dissolved and entrained oil above impact threshold values. Modelling predicted exposures ranging from 15 to 45 m water depths. Therefore, exposure is expected to be limited to pelagic and site-attached fish on coral reefs, such as those at Echuca Shoal and Browse Island. Demersal fish and deeper water communities not expected to be exposed to dissolved/entrained concentrations from a surface release of MGO. Juvenile fish and larvae may experience increased toxicity because of the sensitivity of these life stages. Adult fish exposed to low entrained hydrocarbon thresholds 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 & Figelli 1987).	Moderate (D)

Whale sharks (including those in the whale shark BIA) have the potential for exposure to dissolved/entrained hydrocarbons. Potential effects include damage to the liver and lining of the stomach and intestine, as well as toxic effects on embryos (Lee 2011). As whale sharks are filter-feeders they are expected to be highly vulnerable (Campagna et al. 2011). In the event that a vessel collision occurred during whale shark foraging activities, there is the potential for a proportion of the local population to be affected; given the reported low abundance in the Browse Basin (Jenner et al. 2008; RPS 2011) and the distance to the closest whale shark aggregation (1,000 km to the Ningaloo Reef aggregation), the overall population viability is not expected to be threatened. The potential consequence of exposure to dissolved/entrained hydrocarbons on KEFs and associated filter-feeding and fish communities (including whale sharks) is considered to be localised with short term impact (Minor E). As described for surface hydrocarbon exposure, the effects of oil on plankton have been well studied with different life stages of a species often shown to have different tolerances and reactions to oil pollution. Eggs, larval and juvenile stages will be more susceptible than adults (Harrison 1999). Recently spawned gametes and larvae are also considered to be particularly vulnerable to oil spill effects. Modelling predicted that dissolved/entrained oil would be present within the water column at depths of 15 to 45 m. As plankton are generally positively buoyant and remain near the sea surface (top 5 to 10 m) they are not predicted to be exposed to dissolved/entrained hydrocarbons from a vessel collision. Benthic communities, including benthic primary producers, such as coral reefs, seagrass and mangroves, and shallow water filter-feeding communities, could be exposed to entrained/dissolved hydrocarbons within 15 to 45 m water depths following a vessel collision scenario. Studies undertaken on benthic communities have found a wide range of variation in their associated toxicity threshold levels (Tsvetnenko 1998; NRC 2005). This is to be expected, as benthic communities are made up of a large variety of different organisms. In some cases, little to no impact is observed on benthic communities. For example, in the case of the Montara oil spill, where impacts were assessed at locations such as Ashmore Reef, Cartier Island, Barracouta Shoal and Vulcan Shoal, there was no observed impact on benthic communities (Heyward et al. 2010a, 2010b, 2011, 2013). Exposure of entrained and dissolved hydrocarbons to corals 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), 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). Lethal and sublethal effects of dissolved and entrained oils have been reported for coral gametes at much lesser concentrations than predicted for adult colonies (Heyward et al. 1994; Harrison 1999; Epstein, Bak & Rinkevich 2000, Negri et al. 2020). 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. However, a spill that occurs outside of a coral-spawning period would not affect coral planktonic stages. Browse Island was predicted to receive concentrations of dissolved/entrained hydrocarbons above the respective impact threshold values (50 ppb and 100 ppb). More significant coral reef structures, such as Scott Reef, Ashmore Reef and Cartier Island are less likely to be significantly impacted due to their distance from the GEP and lower concentrations of dissolved/entrained hydrocarbon exposure. The potential consequence to BPPH may result in a local to medium scale event, with short to medium term impacts and is considered to be Moderate (D).	

Dissolved and entrained hydrocarbons have the potential to affect seagrasses and macroalgae, through toxicity impacts. The hydrophobic nature of oil 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. 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, Miller & Farrington 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). Seagrass locations are distant from the GEP route (i.e. Ashmore Reef and the Kimberley coastline); therefore, the probability of contact with entrained/dissolved plumes is lower and associated received concentrations are expected to be lower; however, still potentially above impact thresholds. Based on the above impact assessment, the consequence is considered to be minor and temporary (Minor E). Mangrove communities within the EMBA present along the Kimberley and NT coastlines, are also susceptible to dissolved/entrained oil exposure, with potential impacts including defoliation and mortality. However, as the use of dispersant on surface expressions (resulting in entrainment of oils) shows a positive benefit to mangroves, the impacts of entrained/dissolved oil on mangroves is expected to be less than the impacts predicted from surface oiling (Burns et al. 1993; Duke et al. 2000). Therefore, based on the above impact assessment, the consequence is considered to be minor and temporary (Minor E). EPBC-listed species such as marine mammals, reptiles and avifauna could also be impacted through exposure to dissolved and entrained hydrocarbons, primarily through ingestion, including through foraging activities. Several marine mammal BIAs overlap the EMBA including blue whale foraging at Scott Reef and migration to the west of WA-50-L (Figure 4-5), humpback whale aggregation at the southern boundary of the EMBA along the Kimberley coast (Thums et al 2018) and dugong and dolphin foraging areas (Figure 4-6). A Ramsar site (Ashmore Reef) and several wetlands of conservational significance are present within the EMBA (refer to Section 4.6 and Figure 4-9), these sites provide important habitat for marine avifauna. Small proportions of populations of protected species could be impacted from a spill arising from a vessel collision scenario, therefore the consequence is considered to be Moderate (D). In summary, the potential extent of dissolved/entrained hydrocarbons with concentrations >50 ppb and 100 ppb respectively may result in widespread exposure to marine fauna (including EPBC-listed species) and benthic habitats, such as coral reefs, seagrass and mangroves. There would likely also be cumulative impacts through bioaccumulation up the food chain. Fish and fishing activities would also be affected. On this basis, the potential consequence associated with dissolved/entrained plumes from a vessel collision is considered to be Moderate (D).	
Potential consequence – shoreline hydrocarbons	Severity

Modelling outputs have predicted shoreline contact above the impact threshold (100 g/m^2) at Browse Island, Peron Island and Bathurst Island in the EMBA. Shoreline accumulations were also predicted for a number of other locations including the Joseph Bonaparte Gulf coastline and the Roche Islands (reefs). Intertidal habitats and marine fauna known to use shorelines are most at risk from these exposures as these concentrations have the potential to smother intertidal habitats (such as emergent coral reefs) and coat marine fauna. The particular values and sensitivities with the potential to be exposed to shoreline hydrocarbons are: • BPPH (intertidal habitats, including emergent coral reefs and mangroves) • EPBC-listed species including turtle and marine avifauna BIAs. Intertidal BPPH communities exposed at spring low tides, such as the coral reef platforms of Browse Island 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 and 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). It is considered that there is the potential for a local to medium scale event with short to medium term effects (Moderate D). Turtles can be exposed to hydrocarbons externally, through 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 nests and make their way over the intertidal area to the water (Milton et al. 2003). There are a number of BIAs for turtles that overlap the EMBA with the potential to be exposed to shoreline accumulation, therefore potential impacts on nesting populations could affect species recruitment at a local population level. The fastest predicted time for shoreline contact to occur at Browse Island is five hours. Overall, it is considered that there is the potential for a local to medium scale event with short to medium term effects and no threat to overall turtle population viability (Moderate D).	Moderate (D)

As described in Section 4.7.4, the EMBA is located within the East Asian–Australasian 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). A marine avifauna BIA (lesser frigatebird foraging) overlaps a portion of the GEP route, with peak seabird foraging reported during April to November. Within the EMBA a Ramsar site (Ashmore Reef) and several wetlands of conservational significance are present (refer to Section 4.6 and Figure 4-9), these sites provide important habitat for marine avifauna. Marine avifauna have the potential to directly interact with hydrocarbons on the sea surface, in the course of 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). It is also possible that birds exposed to MGO from a surface (floating) slick may be displaced (i.e. fly away) and use nearby shorelines to recover, thereby, potentially increasing their exposure to shoreline hydrocarbons. Overall, it is considered that there is the potential for a local to medium scale event with short to medium term effects and no threat to overall marine avifauna population viability (Moderate D).			
Identify existing design safeguards/controls			
• Vessel fitted with lights, signals an automatic identification system (AIS) and navigation equipment as required by the *Navigation Act 2012* and associated Marine Orders (consistent with COLREGS requirements). • Implement Ichthys field management plan.			
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 IMR activities in a fashion that is practicable and cost efficient.
	Eliminate simultaneous operations by using only one vessel.	No	It is not possible to completely avoid numerous vessel operations for GEP IMR activities. Standard collision avoidance techniques required under the *Navigation Act* 2012 and standard industry procedures ensure that simultaneous operations can be safety managed.

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, MGO fuel is less persistent than alternative heavier fuels such as HFO and IFO. Therefore this control has been adopted.
Engineering	None identified	N/A	N/A
Procedures and administration	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.
Identify the likelihood			

Likelihood	During IMR activities, the likelihood of a vessel collision is considered Highly Unlikely as generally only a single vessel is typically required for most activities. In addition, these activities are expected to be infrequent in nature with an estimated 5 to 60 days per year for inspection and maintenance activities. Reported industry statistics indicate vessel failures are considered rare with 37 collisions reported out of a total of 1200 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).
Residual risk	Based on the worst-case consequence for all hydrocarbon exposure mechanisms (surface/entrained/shoreline) of Moderate (D) and likelihood of (Highly Unlikely 5) the residual risk is 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 Order 30: Prevention of Collisions, Issue 8* (Order No. 5 of 2009). 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, AMSA). AMSA 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 (Appendix B) 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 other 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 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 vessel collision.	Vessels will be fitted with lights, signals, AIS transponders and navigation equipment, as required by the *Navigation Act 2012.*	Records confirm that required navigation equipment is fitted to all vessels to ensure compliance with the *Navigation Act 2012*.
	A field management plan will be implemented, specifically: The INPEX Field Manager will identify, coordinate and manage activities which are deemed to constitute SIMOPS and CONOPS within the Ichthys FMA for GEP IMR vessel activities.	500 m checklists related to GEP IMR vessels activities in the Ichthys FMA.
	Only vessels using Group II/MGO/marine diesel will undertake activities described in this EP.	Vessel selection records
Refer to the INPEX *Browse Regional OPEP* for environmental performance outcomes, standards and measurement criteria related to mitigative controls.		

8.3 Major loss of containment from GEP infrastructure

As described in Table 3-2 of the INPEX *Browse Regional OPEP Basis of Design and Field Capability Assessment Report*, the GEP inventory at maximum settle-out pressure is up to 6,200 MMscf.

Therefore, the WCSS modelled for the major loss of containment from the GEP was conducted based on a situation when the GEP is at 'settle-out' pressure and has maximum gas/condensate inventory.

8.3.1 Location

It is not practicable to evaluate every potential rupture location along the entire GEP route due to its length. Thus, the release locations to model potential scenarios were identified based on locations that:

- would have the greatest potential consequence to the receiving marine environment
- where values and sensitivities would be most at risk if a spill event occurred
- would enable the full extent of potential environmental impacts to be assessed.

Based on these considerations, five locations were identified and modelled to provide an indication of the PEZ and EMBA from a GEP rupture worst-case spill. These locations are shown in Figure 4-2 of the INPEX *Browse Regional OPEP Basis of Design and Field Capability Assessment Report* and are listed below:

- adjacent to the INPEX FPSO in WA-50-L (Location A)
- adjacent to a section of the GEP route closest to Browse Island (Location H)
- adjacent to a section of the GEP route that traverses closest to the Kimberley AMP (Location I)
- adjacent to a section of the GEP route that traverses the Oceanic Shoals AMP (Location J)
- adjacent to a section of the GEP route closest to the NT coastal waters boundary (3 nm) (Location K).

8.3.2 Volume and duration

Predictive oil spill modelling for the worst-case spill from a GEP rupture/loss of containment event was based on the GEP being at maximum settle-out pressure (up to 6,200 MMscf) as this results in the maximum possible gas/condensate inventory.

OLGA modelling was conducted for a GEP full-bore rupture at three water depths: 250 m (Ichthys Field water depth), 150 m and 70 m (Commonwealth/NT waters boundary water depth). The outcomes of the OLGA modelling calculated total condensate release volumes of ~12,600 m^3 (250m water depth) to ~9,700 m^3 (70m water depth).

A full-bore rupture of the GEP at the CPF end (250 m water depth) is considered a worst-case spill, due to the greatest condensate release volume, but also due to the additional 25 bar of pressure at seabed, which results in a slower rise-time for the gas/condensate from the GEP to the ocean surface, resulting in the greatest level of entrainment of condensate in the water column during the release event. A shallower depth of the release will result in less condensate entrainment in the water column.

At a 250 m water depth, the modelled simulation was a four day release at the seabed. This was an exponentially decreasing release rate ranging from 3,030 to 0.225 m^3 per hour, resulting in a total condensate release volume of approximately 12,600 m^3.

For a shallower water depth (70 m), a two day release at seabed was modelled, with an exponentially decreasing release rate ranging from 3,804 to 0.003 m^3 per hour. This resulted in a total condensate release volume of approximately 9,700 m^3.

8.3.3 Hydrocarbon properties

Hydrocarbon properties associated with the GEP loss of containment scenario used for the modelling study are presented in Table 8-6.

Table 8-6: Group I (GEP gas/condensate) properties

Hydrocarbon type	Density at 15 °C (g/cm³)	Viscosity – centipoise (cP) – at 25 °C	Characteristic	Volatile (%)	Semi-volatile (%)	Low volatility (%)	Residual (%)
			Boiling point (°C)	<180	180–265	265–380	>380
GEP condensate	0.690	0.5	% of total	97.9	2.1	-	-
			% of aromatics	12.1	0.5	-	-

8.3.4 Modelling results

The precited PEZ and EMBA for all modelled spill scenarios (locations, seasons and volumes) is presented in Figure 8-1, which identifies the outer extent of possible exposure (PEZ) and potential impact (EMBA). Table 8-7 provides a summary of the spill modelling results in relation to a worst-case GEP rupture/major loss of containment event.

Table 8-7: GEP major loss of containment spill modelling results summary

Hydrocarbon exposure	GEP gas/condensate (12,600 m³) Source: RPS 2021b
Surface	From all modelled release locations along the GEP, worst-case concentrations of hydrocarbons at the sea surface, greater than the impact threshold of 10 g/m² were predicted to occur at distances ranging from 3 to 7 km from the source. Floating hydrocarbons at the sea surface are predicted to evaporate and weather within a few days.
Entrained and dissolved	For all modelled locations during all seasons, entrained oil concentrations greater than the impact threshold of >100 ppb were predicted to extend up to a maximum of 290 km from the source. The worst-case instantaneous entrained oil concentration was predicted as 98,991 ppb in the vicinity of release Location A (FPSO in WA-50-L). Other receptors were predicted to receive the following worst-case entrained oil concentrations: Browse Island (409 ppb), whale shark BIA (233,913 ppb), Oceanic Shoals AMP (236,349 ppb), and Joseph Bonaparte Depression marine turtle BIA (5,454 ppb).

Hydrocarbon exposure	**GEP gas/condensate (12,600 m^3)** **Source: RPS 2021b**
	Cross-sectional transects in the vicinity of the release locations indicated that entrained oil concentrations at or greater than the 100 ppb threshold may occur at depths ranging from 200 m (Location A) to 20 m (Location K). For all modelled locations during all seasons, dissolved aromatic hydrocarbon concentrations greater than the impact threshold of >50 ppb were predicted to extend up to a maximum of 270 km from the source. The worst-case dissolved aromatic hydrocarbon concentration was calculated as 12,643 ppb in the vicinity of release Location I (adjacent to Kimberley AMP). Other receptors were predicted to receive the following worst-case dissolved aromatic hydrocarbon concentrations: continental slope demersal fish communities KEF (4,206 ppb), Browse Island (1,912 ppb) and Joseph Bonaparte Depression marine turtle BIA (8,878 ppb). Cross-sectional transects in the vicinity of the release locations indicated that dissolved aromatic hydrocarbon concentrations at or greater than the 50 ppb threshold may occur at depths ranging from 240 m (Location A) to 40 m (Location K).
Shoreline	For all modelled locations during all seasons, the highest probability of floating oil contacting shorelines was 1%. No shoreline accumulation >1 m^3 was predicted for any of the modelled scenarios. The highest potential concentration of oil on shore, through accumulation, was below the 100 g/m^2 impact threshold and was calculated as 23 g/m^2 for Browse Island (Location A; FPSO in WA-50-L). In this instance contact was predicted to occur within 17 hours.

8.3.5 Impact and risk evaluation

An evaluation of the impacts and risks associated with major loss of containment/rupture from the GEP is presented in Table 8-8.

Table 8-8: Impact and risk evaluation - GEP major loss of containment

<table>
<tr><td colspan="2">Identify hazards and threats</td></tr>
<tr><td colspan="2">A major loss of containment/rupture of the GEP infrastructure has the potential to result in changes to water quality, predominantly through entrained and dissolved hydrocarbon exposure. Limited floating oil is predicted at the sea surface and no shoreline accumulations are predicted.</td></tr>
<tr><td>Potential consequence – surface (floating) hydrocarbons</td><td>Severity</td></tr>
<tr><td>The values and sensitivities with the potential to be affected by surface (floating) hydrocarbon exposures are:
• commercial, traditional and recreational fisheries (within 3 to 7 km from the release location)
• planktonic communities (within 3 to 7 km from the release location)
• emergent benthic communities (within 3 to 7 km from the release location)
• EPBC-listed species including turtle and marine avifauna and whale shark foraging BIAs (within 3 to 7 km from the release location).
The values and sensitivities associated with commercial, traditional and recreational fisheries (seafood quality and employment) could be impacted due to floating oil following a GEP rupture, predominantly from the possible oiling of nets and lines and exclusion zones (ITOPF 2011). Generally, there is little recreational fishing that occurs within the operational area because of its distance from land, lack of features of interest and the deep waters. Recreational day-fishing is concentrated around the population centres of Broome, Derby, Wyndham and Darwin, as well as other readily accessible coastal settlements which are in excess of the maximum predicted field of effect (3 to 7 km from the release location). The closest feature to the GEP route that may attract recreational fishers, and may be affected by floating oil from a GEP rupture is Flat Top Bank. Commercial fisheries predominantly operate in the shallower waters of the PEZ with generally low levels of fishing activity reported (Section 4.9.3). Traditional fishing at Browse Island (15 km from the GEP at its closest point), including on intertidal reef platforms, is not expected to be affected as the worst-case concentration of floating oil accumulations (23 g/m^2) are below impact thresholds (100 g/m^2). The socioeconomic impacts on commercial, traditional and recreational fisheries from the presence of floating hydrocarbons are expected to be limited to a local scale and temporary (few days) impact (Insignificant F).</td><td>Insignificant (F)</td></tr>
</table>

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 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). Recently spawned gametes and larvae would be particularly vulnerable to oil spill effects, since they are generally positively buoyant and would be exposed to floating hydrocarbons at the sea surface expressions. Given the limited potential area covered by floating oil (3 to 7 km from the release location) and temporary duration (slick present for a few days due to evaporation and weathering) impacts on plankton from surface hydrocarbons is expected to be localised, with short-term impacts resulting in an Insignificant (F) consequence.

Benthic communities, including benthic primary producers, such as emergent coral reefs within 3 to 7 km of the rupture location could be exposed to floating hydrocarbons at the sea surface. Studies undertaken on benthic communities have found a wide range of variation in their associated toxicity threshold levels (Tsvetnenko 1998; NRC 2005). This is to be expected, as benthic communities are made up of a large variety of different organisms. In some cases, little to no impact is observed on benthic communities. For example, in the case of the Montara oil spill, where impacts were assessed at locations such as Ashmore Reef, Cartier Island, Barracouta Shoal and Vulcan Shoal, there was no observed impact on benthic communities (Heyward et al. 2010a, 2010b, 2011, 2013). Several filter-feeding communities are close to, or within the operational area (e.g. the 125 m ancient coastline KEF, the pinnacles of the Bonaparte Basin KEF, Echuca Shoal, Heywood Shoal, and the Oceanic Shoals AMP) as described in Section 4.7.2. However, for floating hydrocarbons, impacts to deeper seabed features will be less severe than impacts to shallow or emergent benthic primary producer habitats. Seagrasses and macroalgae are generally not emergent, and therefore impacts and risks are discussed in the entrained/dissolved subsection below. Similarly, mangrove communities in the PEZ present along the Australian coastline are not predicted to be contacted by the localised floating oil (3 to 7 km). Therefore, emergent benthic communities, within 3 to 7 km of the GEP route, such as Flat Top Bank may be exposed to surface hydrocarbons from a GEP rupture with impacts expected to be of a local scale and temporary (Insignificant F).

Whale sharks (including those in the whale shark foraging BIA that overlaps the operational area) have the potential for exposure to floating hydrocarbons at the sea surface within 3 to 7 km of the rupture location. Potential effects include damage to the liver and lining of the stomach and intestine, as well as toxic effects on embryos (Lee 2011). In the event that a GEP rupture occurred during whale shark foraging, there is the potential for individuals of the local population to be affected. However, given the expected weathering, low abundance of whale sharks throughout the year in the foraging BIA that overlaps the operational area and the distance to the closest whale shark aggregation (1,000 km to the Ningaloo Reef aggregation), the overall population viability is not expected to be threatened. Therefore, the consequence is considered to be Insignificant (F).

Seasonal variability with respect to the abundance of marine turtles within turtle BIAs overlapping the GEP, is poorly understood and as a basis for this assessment it has been assumed that marine turtles could be present in the BIAs at any time of the year either at the surface or on the seabed. Turtles can be exposed to hydrocarbon or chemical spills as they surface, resulting in direct contact with the skin, eyes, and other membranes, as well as the inhalation of vapours or ingestion (NOAA 2010b). Other aspects of turtle behaviour, including a lack of avoidance behaviour, indiscriminate feeding in convergence zones, and large pre-dive inhalations, make them vulnerable. In the event of a surface slick from a GEP rupture there is the potential for individuals turtles to be affected. However, given the expected weathering, the presence of the slick would be short-term (several days) and therefore the overall population viability is not expected to be threatened and the consequence is considered to be Insignificant (F). Marine avifauna have the potential to directly interact with oil on the sea surface, in the course of normal foraging activities. A marine avifauna BIA (lesser frigatebird foraging) overlaps a portion of the GEP route, with peak seabird foraging reported during April to November. Marine avifauna may be affected if a surface slick is encountered by birds resting at the sea surface and surface-plunging birds are considered particularly vulnerable to surface hydrocarbons. They may suffer from damage to external tissues, including skin and eyes, and internal tissue irritation in the lungs and stomach (Clark 1984). Toxic effects may also result where hydrocarbons are ingested, as birds attempt to preen their feathers (Jenssen 1994). Weathering of hydrocarbons on the sea surface will reduce the levels of toxicity that seabirds may be exposed to and, over time, the hydrocarbons on the surface will become patchy rather than continuous. Impacts to seabirds that do not spend time resting on the sea surface, such as the lesser frigatebird are not expected. Given the expected weathering, the presence of the slick would be short-term (several days) and therefore the overall population viability is not expected to be threatened and the consequence is considered to be Insignificant (F). The relatively small extent of the predicted surface slick (3 to 7 km) and the very light (non-sticky) nature of the GEP residual hydrocarbons will significantly limit surface slick associated impacts for airbreathing EPBC-listed species. Turtle, whale shark and marine avifauna foraging BIAs overlap the GEP route and these species may be present throughout the year. Marine mammals, reptiles and avifauna could also be impacted through entrained hydrocarbons, primarily through ingestion while foraging as described 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 270 to 290 km from the release location) • KEFs (within 270 to 290 km from the release location at depths ranging from 20 to 240 m) • planktonic communities (within 270 to 290 km from the release location) • benthic communities (within 270 to 290 km from the release location at depths ranging from 20 to 240 m) • EPBC-listed species including marine mammals, turtles, marine avifauna and whale shark BIAs (within 270 to 290 km from the release location at depths ranging from 20 to 240 m).	Significant (C)

The values and sensitivities associated with commercial, traditional and recreational fisheries (seafood quality and employment) could be impacted due to dissolved/entrained oil predominantly through toxicity impacts to fish affecting seafood quality and catches. Generally, there is little recreational fishing that occurs within the operational area because of its distance from land, lack of features of interest and the deep waters. Recreational day-fishing is concentrated around the population centres of Broome, Derby, Wyndham and Darwin, as well as other readily accessible coastal settlements which are generally at the edge of or outside of the PEZ and therefore not expected to be impacted by this spill scenario. Commercial fisheries predominantly operate in the shallower waters of the PEZ with generally low levels of fishing activity reported (Section 4.9.3). Traditional fishing at Browse Island (15 km from the GEP at its closest point) and along the Kimberley coastline, including on intertidal reef platforms, could be affected by impacts to fish and benthic habitats from entrained oil, discussed below. Given the extent and depth of the dissolved/entrained plume and the predicted worst-case concentrations, the socioeconomic impacts on commercial, traditional and recreational fisheries from the presence of dissolved/entrained oil are expected to be short-to-medium term, and with a Moderate consequence (D). The continental slope demersal fish communities KEF overlaps the GEP and a number of KEFs are present within the EMBA (Section 4.2). Several filter-feeding communities associated with these KEFs such as the 125 m ancient coastline KEF, the pinnacles of the Bonaparte Basin KEF, and the carbonate bank and terrace system of the Sahul Shelf may be exposed to dissolved and entrained oil above impact threshold values. Modelling predicted exposures ranging from 20 to 240 m water depths. Due to the potential for dissolved/entrained hydrocarbons to be present at all depths of the water column from a GEP rupture, all fish and sharks within the EMBA, including pelagic fish, demersal fish communities and site-attached fish on coral reefs, such as those at Echuca Shoal and Browse Island, have the potential to be exposed. Chronic impacts to juvenile fish, larvae, and planktonic organisms, may occur if exposed to dissolved/entrained hydrocarbon plumes. Juvenile fish and larvae may experience increased toxicity because of the sensitivity of these life stages. Adult fish exposed to low entrained hydrocarbon thresholds 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 & Figelli 1987). Impacts to demersal fish would be expected to occur at shallower benthic habitats closer to the GEP route, such as Flat Top Bank, Browse Island, Echuca Shoal and Van Cloon Shoal. Pelagic fish may also be at risk if transiting the entrained/dissolved hydrocarbon plume and may ingest smaller/juvenile fish affected by the entrained/dissolved plume with a potential for acute impacts. However, due to their mobile nature, they may avoid the entrained plumes. Whale sharks (including those in the whale shark BIA) have the potential for exposure to dissolved/entrained hydrocarbons. Potential effects include damage to the liver and lining of the stomach and intestine, as well as toxic effects on embryos (Lee 2011). As whale sharks are filter-feeders they are expected to be highly vulnerable (Campagna et al. 2011). In the event that a GEP rupture occurred during whale shark foraging activities, there is the potential for a proportion of the local population to be affected; given the reported low abundance in the Browse Basin (Jenner et al. 2008; RPS 2011) and the distance to the closest whale shark aggregation (1,000 km to the Ningaloo Reef aggregation), the overall population viability is not expected to be threatened. The potential consequence of exposure to dissolved/entrained hydrocarbons on KEFs and associated filter-feeding and fish communities (including whale sharks) is considered to be local to medium scale with short to medium term impact (Moderate D).	

As described for surface hydrocarbon exposure, the effects of oil on plankton have been well studied with different life stages of a species often shown to have different tolerances and reactions to oil pollution. Eggs, larval and juvenile stages will be more susceptible than adults (Harrison 1999). Recently spawned gametes and larvae are also considered to be particularly vulnerable to oil spill effects. Modelling predicted that dissolved/entrained oil would be present within the water column at depths of 20 m to 240 m. As plankton are generally positively buoyant and remain near the sea surface they are not predicted to be exposed to dissolved/entrained hydrocarbons from a GEP rupture. Benthic communities, including benthic primary producers, such as coral reefs, seagrass and mangroves, and deeper water filter-feeding communities, could be exposed to entrained/dissolved hydrocarbons in the event of a GEP rupture. Studies undertaken on benthic communities have found a wide range of variation in their associated toxicity threshold levels (Tsvetnenko 1998; NRC 2005). This is to be expected, as benthic communities are made up of a large variety of different organisms. In some cases, little to no impact is observed on benthic communities. For example, in the case of the Montara oil spill, where impacts were assessed at locations such as Ashmore Reef, Cartier Island, Barracouta Shoal and Vulcan Shoal, there was no observed impact on benthic communities (Heyward et al. 2010a, 2010b, 2011, 2013). Exposure of entrained and dissolved hydrocarbons to corals 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), 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). Lethal and sublethal effects of dissolved and entrained oils have been reported for coral gametes at much lesser concentrations than predicted for adult colonies (Heyward et al. 1994; Harrison 1999; Epstein, Bak & Rinkevich 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. However, a spill that occurs outside of a coral-spawning period would not affect coral planktonic stages. Browse Island and Echuca Shoal, the closest coral reef/BPPH receptors to the GEP route were predicted to receive concentrations of dissolved/entrained hydrocarbons above the respective impact threshold values (50 ppb and 100 ppb). More significant coral reef structures, such as Scott Reef, Ashmore Reef and Cartier Island are less likely to be significantly impacted due to their distance from the GEP and lower concentrations of dissolved/entrained hydrocarbon exposure. However, as a single rupture scenario could impact several receptors, including deeper filter-feeding communities and shallower benthic primary producer habitats, resulting in a medium to large scale event, with medium term impacts, the potential consequence of a GEP rupture to benthic communities is considered to be Significant (C). Dissolved and entrained hydrocarbons have the potential to affect seagrasses and macroalgae, through toxicity impacts. The hydrophobic nature of oil 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. 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, Miller & Farrington 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). Seagrass locations are distant from the GEP route (i.e. Ashmore Reef and the Kimberley coastline); therefore, the probability of contact with entrained/dissolved plumes is lower and associated received concentrations are expected to be lower; however, still potentially above impact thresholds. Based on the above impact assessment, the consequence is considered to be minor and temporary (Minor E). Mangrove communities within the EMBA present along the Kimberley and NT coastlines, are also susceptible to dissolved/entrained oil exposure, with potential impacts including defoliation and mortality. However, as the use of dispersant on surface expressions (resulting in entrainment of oils) shows a positive benefit to mangroves, the impacts of entrained/dissolved oil on mangroves is expected to be less than the impacts predicted from surface oiling (Burns et al. 1993; Duke et al. 2000). Therefore, based on the above impact assessment, the consequence is considered to be minor and temporary (Minor E). EPBC-listed species such as marine mammals, reptiles and avifauna could also be impacted through exposure to dissolved and entrained hydrocarbons, primarily through ingestion, including through foraging activities. Several marine mammal BIAs overlap the EMBA including blue whale foraging at Scott Reef and migration to the west of WA-50-L (Figure 4-5), humpback whale aggregation at the southern boundary of the EMBA along the Kimberley coast (Thums et al 2018) and dugong and dolphin foraging areas (Figure 4-6). A Ramsar site (Ashmore Reef) and several wetlands of conservational significance are present within the EMBA (refer to Section 4.6 and Figure 4-9), these sites provide important habitat for marine avifauna. Small proportions of populations of protected species could be impacted from a GEP rupture, therefore the consequence is considered to be Moderate (D). In summary, the potential extent of dissolved/entrained hydrocarbons with concentrations >50 ppb and 100 ppb respectively may result in widespread exposure to marine fauna (including EPBC-listed species, such as marine mammals, turtles, avifauna and whale sharks); benthic habitats, such as coral reefs, seagrass and mangroves; and deeper filter-feeding communities, such as the continental slope demersal fish community KEF, the 125 m ancient coastline KEF, pinnacles of the Bonaparte Basin KEF and the carbonate bank and terrace system of the Sahul Shelf KEF. There would likely also be cumulative impacts through bioaccumulation up the food chain. Fish and fishing activities would also be affected. On this basis, the potential consequence associated with dissolved/entrained plumes from a GEP rupture is considered to be Significant (C).	
Potential consequence – shoreline hydrocarbons	Severity
Spill modelling outputs have reported that for all five modelled locations along the GEP route, during all seasons that no oil accumulations were predicted at any shorelines above the impact threshold (100 g/m^2).	-
Identify existing design safeguards/controls	

<table>
<tr><td colspan="4">

- GEP infrastructure will be inspected, maintained and repaired in accordance with Section 9.6.4 and Table 9-7.
- Implement the GEP Incident Management Guide (contained in the INPEX *CPF Facility Emergency Response Plan*) which describes the process that will be taken in the event of detection of a GEP rupture. Key controls to be implemented include steps to immediately stop the flow of GEP gas from the CPF into the GEP infrastructure; and to depressurise the GEP from the Ichthys LNG Plant.
- Verification of competency (VOC) of CPF and Ichthys LNG Plant CCR Operators.

</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>Elimination</td><td>None identified</td><td>N/A</td><td>N/A</td></tr>
<tr><td>Substitution</td><td>None identified</td><td>N/A</td><td>N/A</td></tr>
<tr><td>Engineering</td><td>None identified</td><td>N/A</td><td>N/A</td></tr>
<tr><td>Procedures and administration</td><td>Implement Browse Regional OPEP</td><td>Yes</td><td>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.</td></tr>
<tr><td colspan="4">Identify the likelihood</td></tr>
<tr><td>Likelihood</td><td colspan="3">INPEX's Detailed Design Quantitative Risk Analysis (QRA) of the GEP indicates that the highest likelihood events with the potential to damage the pipeline are associated with anchor interaction. The analysis calculates a pipeline failure frequency within Commonwealth waters, as $<1 \times 10^{-5}$ per kilometre per year.

Therefore, in accordance with the INPEX Risk Matrix, the likelihood of a GEP rupture resulting in the above described consequences occurring to the identified values and sensitivities is considered to be Remote (6).</td></tr>
<tr><td>Residual risk</td><td colspan="3">Based on the worst-case consequence for all hydrocarbon exposure mechanisms (surface/entrained/shoreline) of Significant (C) and likelihood of (Remote 6) the residual risk is Moderate (8).</td></tr>
<tr><td colspan="4">Residual risk summary</td></tr>
<tr><td>Consequence</td><td colspan="2">Likelihood</td><td>Residual risk</td></tr>
</table>

Significant (C)	Remote (6)	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 Order 30: Prevention of Collisions, Issue 8* (Order No. 5 of 2009). 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, AMSA). Conservation management plans / threat abatement plans Several conservation management plans (Appendix B) 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 other 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 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 major loss of containment /rupture of the GEP.	In the event a GEP rupture, the GEP incident management guide will be implemented, specifically: • immediately stop the flow of GEP gas from the CPF into the GEP infrastructure • continue production at the Ichthys LNG Plant, and flare the residual gas, when onshore production can no longer continue to reduce line pressure within the GEP.	Records demonstrate that in the event of a GEP rupture, the GEP Incident Management Guide was implemented.
	All CPF/Ichthys LNG Plant CCR Operators will demonstrate VOC in accordance with the INPEX Operations Assessment Strategy Specification.	Records of verification of competency for CPF/Ichthys LNG Plant CCR Operators.
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 the *Browse Regional OPEP* for the Browse Basin which applies to the petroleum activity described in this EP. The INPEX *Browse Regional OPEP* consists of a suite of documents as shown in Figure 8-2 and described in Table 8-9. The *Browse Regional OPEP* covers all INPEX Australia's exploration and production activities in the Browse Basin.

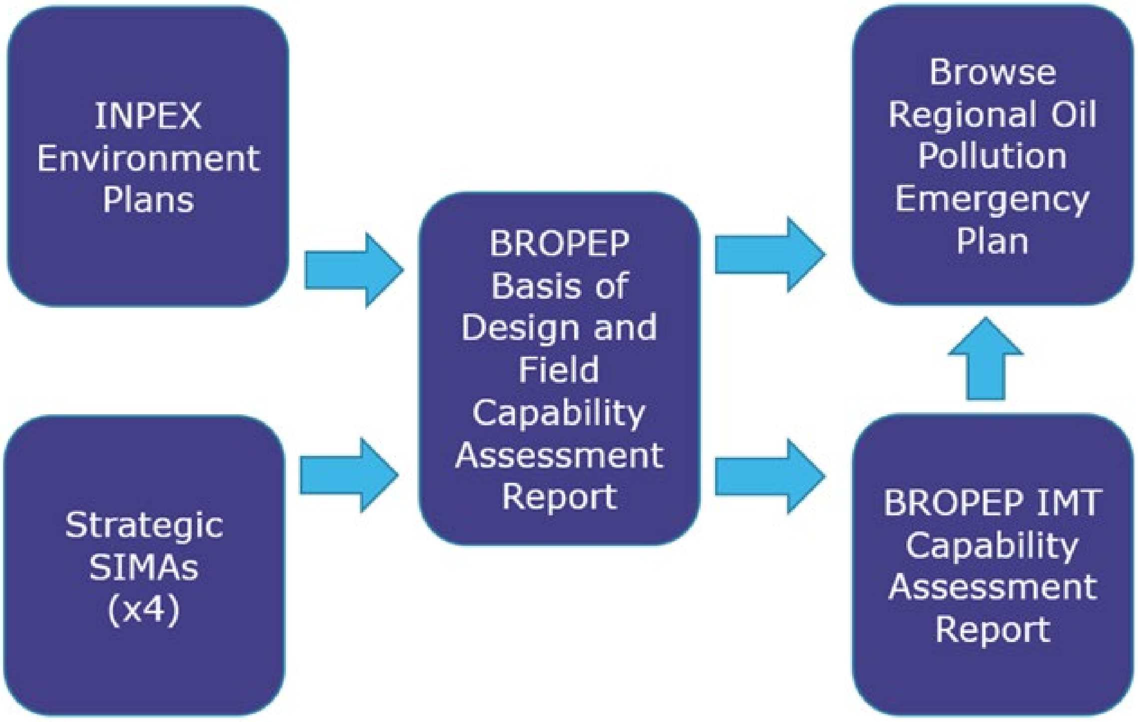

Figure 8-2: Browse regional OPEP document structure

Table 8-9: 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 • evaluations of controls to prevent oil pollution from the specific activity.

Document title	Document number	Purpose
		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 IMT capability and arrangements.
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 (IAP) development, and mobilisation of field response capabilities.

Document title	Document number	Purpose
		The BROPEP outlines the EPOs and EPSs related to the implementation of response strategies.

The various applicable WCSS used as the basis of design for the *Browse Regional OPEP* are based on the same predictive oil spill modelling outputs as described in Section 8.1. However, where Table 8-2 describes thresholds for impact that have been used to define the PEZ and EMBA, the *Browse Regional OPEP* has used thresholds appropriate for spill response planning and field/IMT capability assessments. Therefore, all the controls that relate to spill response planning and field/IMT capability elements are described in the suite of *Browse Regional OPEP* documents, not in this EP.

9 ENVIRONMENTAL MANAGEMENT IMPLEMENTATION STRATEGY

This section provides a description of the INPEX Australia Business Management System (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:

- OPGGS (E) Regulations
- National Offshore Petroleum Safety and Environmental Management Authority Guidance note N04750-N1344, Environment plan content requirements
- 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.

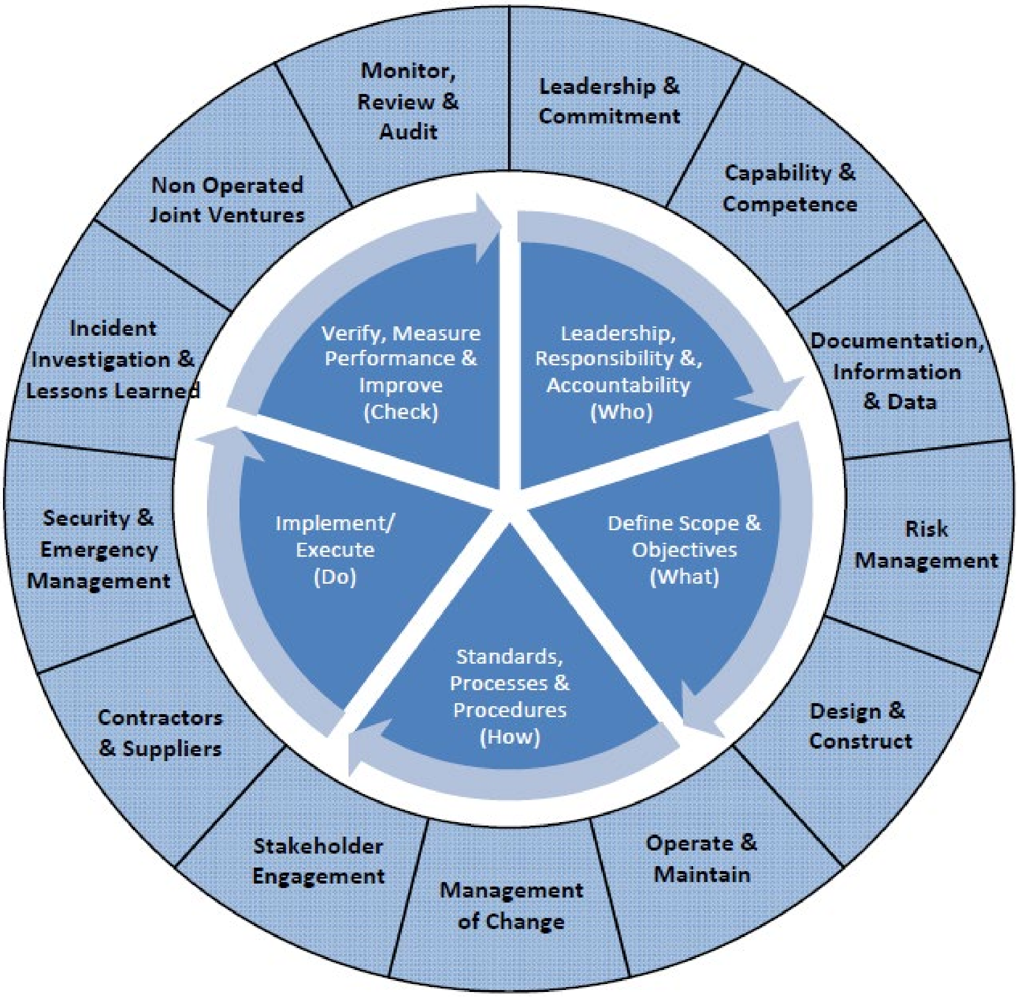

Figure 9-1: INPEX BMS: HSE requirements

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. 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

Responsibility for the offshore assets including the GEP rests with the Vice-president (VP) Operations who is based onshore, together with a support team. The VP Operations consults the HSE and logistics support teams for all aspects relating to implementation of the BMS HSE requirements at the offshore and onshore facilities including the GEP.

The Offshore Operations General Manager (also based onshore) is responsible for the day-to-day safe operation of the CPF and FPSO and operational oversight of the GEP. They delegate field-based responsibilities and control of the GEP to the Field Manager who is positioned offshore and has a functional reporting line to the VP Operations/Offshore Operations General Manager.

The Onshore Operations General Manager is responsible for the day-to-day safe operation of the Ichthys LNG Plant and delegates field-based responsibilities and control of the GEP to the production manager. The point of responsibility and control delineation between the offshore and onshore operations is the GEP Beach valve. The offshore and onshore operations general managers have a joint responsibility to safely manage the operation of the GEP and both report directly to the VP Operations.

In relation to scopes of work associated with this EP, the onshore support team will report to the Offshore Operations General Manager for operational oversight of the activities. A client representative (on board or onshore) will be assigned to manage the vessel based IMR scopes of work, and to ensure implementation of the INPEX BMS requirements for any contractor vessels required to perform the work under this EP. The client representative maintains a functional reporting line to the Field Manager and the onshore based support team principal subsea engineer.

The organisational structure is shown in Figure 9-3.

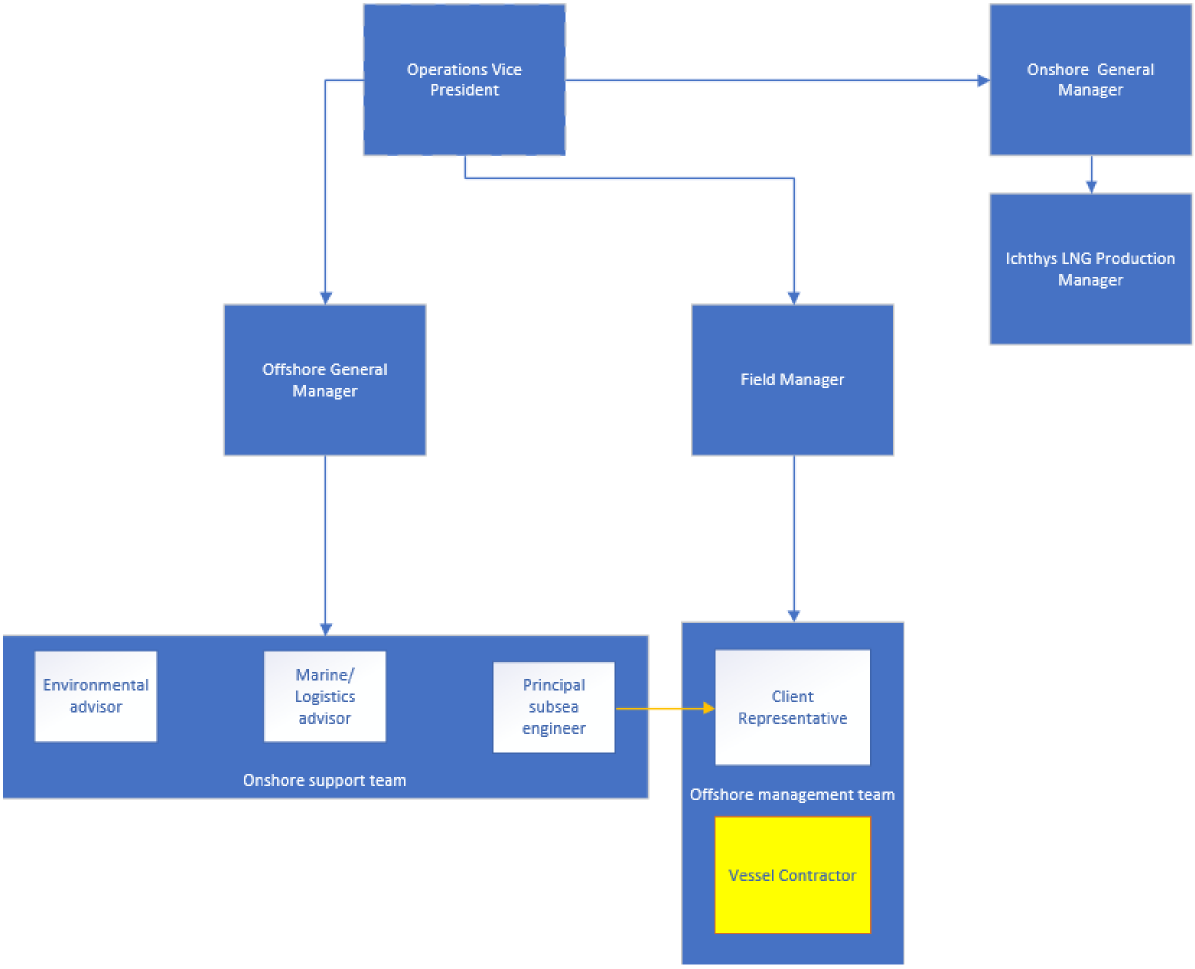

Figure 9-3: Organisation structure

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 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.

INPEX conducts training-needs analysis for each of the key roles listed in Table 9-1 in order 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.

Key responsibilities in respect of environmental performance outcomes described in this EP are listed in the tables in Sections 7, 8 and 9. Additional roles and responsibilities related to the implementation of HSE requirements are also listed in Table 9-1.

Table 9-1: Key personnel and support roles and responsibilities

Key role	Responsibilities
Vice President Operations (may delegate to Offshore Operations General Manager or Drilling Vice President)	Accountable to ensure INPEX BMS HSE requirements are monitored and implemented, and participates in management reviews and as per relevant performance standards stated within this EP. Final decision making authority regarding IMR activities on the GEP.
Offshore Operations General Manager	Responsible for the day to day safe operation of the CPF/FPSO and GEP. Ensures the INPEX BMS HSE requirements are implemented at the CPF/FPSO and for IMR scopes of work associated with this EP.
Ichthys LNG Plant Operations Manager	Monitors GEP outlet pressure (into the Ichthys LNG Plant). Implements the GEP Incident Management Guide in the event of a GEP rupture.
Onshore Operations General Manager	Responsible for the day-to-day safe operation of the Ichthys LNG Plant and GEP. Ensures the INPEX BMS HSE requirements are implemented at the Ichthys LNG Plant.
Field manager (CPF OIM)	Maintains records of communications between vessels and the INPEX field manager (or delegate) when vessels arrive within the field management area. Ensures that task-specific risk assessments are recorded and maintained for all vessels working close to each other. Ensures compliance with INPEX and regulatory health, safety and environmental requirements for all activities conducted within the field management area. Manages emergency response operations in the event of an incident within the field management area. Implements relevant performance standards stated within this EP. Monitors GEP inlet pressure (from the CPF). Implements GEP Incident Management Guide in event of GEP rupture.
Principal subsea engineer	Consults with the Offshore Operations General Manager regarding GEP IMR activities. Develops and implements the GEP IMR program. Provides support to the client representatives implementing the GEP IMR program. Implements relevant performance standards stated within this EP.

Key role	Responsibilities
Client representative	Coordinates GEP IMR activities with the principal subsea engineer and field manager (when required). Responsible for the oversight of the implementation of the INPEX BMS HSE requirements onboard the contractor IMR vessels during GEP IMR activities. Implements relevant performance standards stated within this EP.
Vessel masters	Implement relevant performance standards stated within this EP.
Logistics/marine adviser	Support GEP IMR activities through provision of vessels that comply with the relevant performance standards stated within this EP.
Environmental advisor	Provides support to the subsea engineer, client representative and logistics/marine advisor, to ensure GEP IMR activities are implemented in accordance with the relevant performance standards stated within this EP. Implements the HSE requirements of the INPEX BMS specifically: • ensure events are recorded and reported in accordance with Section 9.11.3 • ensure that the contractor selection process is completed in accordance with INPEX standards • audit compliance against the INPEX BMS HSE requirements • participate in review of recordable/reportable events • participate in assessments/management of change.

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 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 under accepted EPs 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
INPEX Australia Browse Basin Environment Plans Support Vessels Induction	All personnel working onboard a support vessel in the Ichthys Field and along the GEP route.	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 • management measures to avoid harm to marine fauna including EPBC Regulations 2000.
Offshore Leadership EP/OPEP Awareness Training	All CPF/FPSO senior leadership personnel including OIMs, Superintendents, OTLs and MTLs.	Comprehensive training in the Offshore Facility and GEP Operations EPs, including: • environmental values and sensitivities • environmental aspects/risk from offshore activities • controls associated with managing all emissions, discharges and wastes • management of change • reporting requirements • spill response leadership/command & control requirements from offshore and interface with the INPEX IMT.
INPEX Australia Browse Regional Oil Pollution Emergency Plans Induction	All support vessel ERT personnel working in the Ichthys Field and along the GEP route.	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 support vessel bridge personnel working in the Ichthys Field and along the GEP route.	Overview of the marine fauna management requirements (which are consistent throughout INPEX EPs).

Table 9-3: Environmental performance outcome, standards 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 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 such as Plant Historian (Pi), Energy Components (EC) and Laboratory Information Management System (LIMS). 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 operation and maintenance of the offshore facility are detailed in Section 7 and Section 8. Additional risk assessments are undertaken on an ongoing basis when triggered by any of the following circumstances:

- when there is a proposed change to the design or method of operation and maintenance to the GEP, as identified by an INPEX new information assessment or management of change (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 are 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 operation of the offshore facility are systematically identified, assessed, evaluated and controlled.

An environmental risk register for the petroleum 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

The purpose of the *INPEX Chemical Assessment and Approval Procedure* is to establish and communicate the process for the assessment and approval of chemicals for use on INPEX sites or facilities. The procedure has been developed to ensure compliance with relevant Australian legislation and to assess chemicals based on toxicity, bioaccumulation and biodegradation potential. By implementing the procedure, exposure to chemicals by personnel and/or the environment resulting from INPEX activities are assessed and controlled. This procedure promotes the use of chemicals that present low health and/or environmental hazard levels.

All operational chemicals discharged into the marine environment must undergo an environmental assessment. The assessment considers the following:

- chemical’s toxicity, bioaccumulation, and biodegradation potentials
- discharge concentration
- frequency of discharge
- maximum credible volume of chemical anticipated to be discharged in 24 hours
- if the chemical is listed on the AICS
- if the chemical contains ozone-depleting substances or synthetic greenhouse gases
- if the chemical or component of the chemical is registered on either the OSPAR priority action or possible concerns lists.

As part of the above assessment, a chemical assessment tool is used (Table 9-4) to determine the chemicals’ inherent environmental hazard potential, which can be determined by considering toxicity in conjunction with bioaccumulation and biodegradation potentials. Chemicals falling within the “Green” range are considered to present a low inherent hazard potential.

Table 9-4: 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.

Category 3 chemicals in the *INPEX Chemical Assessment and Approval Procedure*, are considered to present a low environmental hazard if they meet all of the following criteria:

- they are listed on AICS
- they do not contain ozone-depleting substances or synthetic greenhouse gases for which a license is required
- they are not registered on either the OSPAR priority action or possible concerns lists
- they are in the "green" range (Table 9-4)
- the maximum credible discharge volume is less than 10 m^3 a day.

Chemicals regarded as Category 3 are considered to present inherently low potential environmental harm, and therefore are regarded as ALARP and acceptable and do not require further environmental assessment.

Category 1 chemicals, with regards to liquid effluent discharges, are chemicals which are not listed on the AICS, and therefore cannot be used in Australia. As such, the use of Category 1 chemicals is not permitted by INPEX. Category 1 chemicals are not acceptable but may be ALARP. Should a Category 1 chemical be required, the chemical vendor must have the chemical listed on AICS before INPEX considers its use. Once a Category 1 chemical is listed on AICS, it is reclassified as a Category 2 or 3 depending on its characteristics and maximum daily discharge volumes.

Category 2 chemicals are those which are neither, Category 1 or Category 3 chemicals. Category 2 chemicals are required to undergo an additional environmental assessment to ensure they are ALARP and acceptable. The additional environmental assessment incorporates five criteria:

1. Potential environmental consequence of the discharge:

- the potential environmental hazard and impact pathways based on the chemical’s fate, toxicity, bioaccumulation and biodegradation potential (chemical characteristics provided by the chemical vendor)
- comparison of the proposed chemical discharge concentration against the Safety Data Sheet (SDS) toxicity value and adjusted NEC to obtain the severity of the potential hazard
- use of the SDS toxicity data and adjusted NEC to predict distances for the chemical to reach threshold dilutions (if not already reached at the point of discharge)

2. Potential likelihood of the negative environmental consequence occurring:
   - Whether the chemical will be spent (i.e. partially/completely used in the process) before discharge, neutralised and or have no potential to reach the marine environment (e.g. does not partition with the water during processing) and the likelihood of the identified environmental consequences being realised.
3. Risk level (using the INPEX risk matrix Figure 6-1) based on the consequence and likelihood determined above
4. Alternative chemicals:
   - the identification of viable alternative options
   - identification of the reasons why the alternatives were not selected (such as environmental characteristics, fate, volume and concentration of discharges, overall efficacy, practicality of use/storage, compatibility with other chemicals, health and safety risks, and costs)
5. Alternative techniques:
   - identification of other non-chemical (engineering) solutions considered
   - identification of the reasons why other alternative techniques were not selected (such as environmental costs/benefits, practicality of implementation, track record – proven and/or efficient technology, health and safety risks, and costs).

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 Adaptive IMS monitoring program

INPEX’s IMS monitoring program (IMSMP) has been implemented since 2018. It was developed in consultation with relevant stakeholders (DPIRD, NT DITT and DAWE) and in the context of the Ichthys offshore facility’s low risk status and management controls. Although the IMSMP was predominantly developed for the offshore facility in WA-50-L, it also covers support vessels and ports and is therefore relevant to the scope of this EP with respect to IMR activities.

The IMSMP is an adaptive process that employs routine and risk-based monitoring to identify potential/confirmed increases in IMS risk, and where applicable leads to the initiation of appropriate response actions. The process recognises that every scenario is different and as such will be treated on a case-by-case basis to determine the most appropriate response action, whether that may be additional monitoring/inspection and/or management controls.

An overview of the proposed process is shown in Figure 9-4 and includes consultation with IMS experts and commitments to consult with stakeholders as a key component of any response. An EPS related to the ongoing monitoring and adaptive management of IMS is presented in Table 9-6.

Aspects and triggers

The IMSMP relies on routine and risk-based monitoring aspects and associated triggers for the facility, support vessels and the relevant operating ports (Broome/Darwin) as illustrated in Figure 9-4. Facility-based risks are associated with a potential increase in the IMS risk profile related to the occurrence of a specific incident. This includes the discharge of high-risk ballast water within the PSZ or a high-risk vessel (with regards to biofouling risk) enters the PSZ. Conversely, port-based risks are associated with the IMS status of the port and may instigate a response where the regulator/port authority has provided an alert regarding the confirmed establishment of a new IMS of concern.

Responses

In the event of a trigger breach as stated in Figure 9-4, a response will be initiated. As each scenario is different, the appropriate response actions to be implemented will be treated on a case-by-case basis.

Where there is a “suspected” presence of IMS or a “potential” for a change in risk profile, additional monitoring and/or inspection will be implemented to confirm the “actual” risk as part of the response. Examples of additional monitoring/inspections may include a dedicated survey for the collection of samples for genetic analysis/taxonomic identification or DNA water sampling to confirm the identification of suspected IMS. During this process, IMS experts and relevant stakeholders will be consulted with regard to the sampling design of any additional monitoring to ensure it is appropriately robust and fit-for-purpose.

Where an increase in IMS risk is confirmed, a review of the adequacy and efficacy of the existing controls will be completed in consultation with independent IMS experts. Any additional controls deemed necessary, in context of the IMS risk status and ALARP, will be identified discussed with relevant stakeholders. Examples of additional controls may range from increased personnel training in environmental awareness to vessel cleaning.

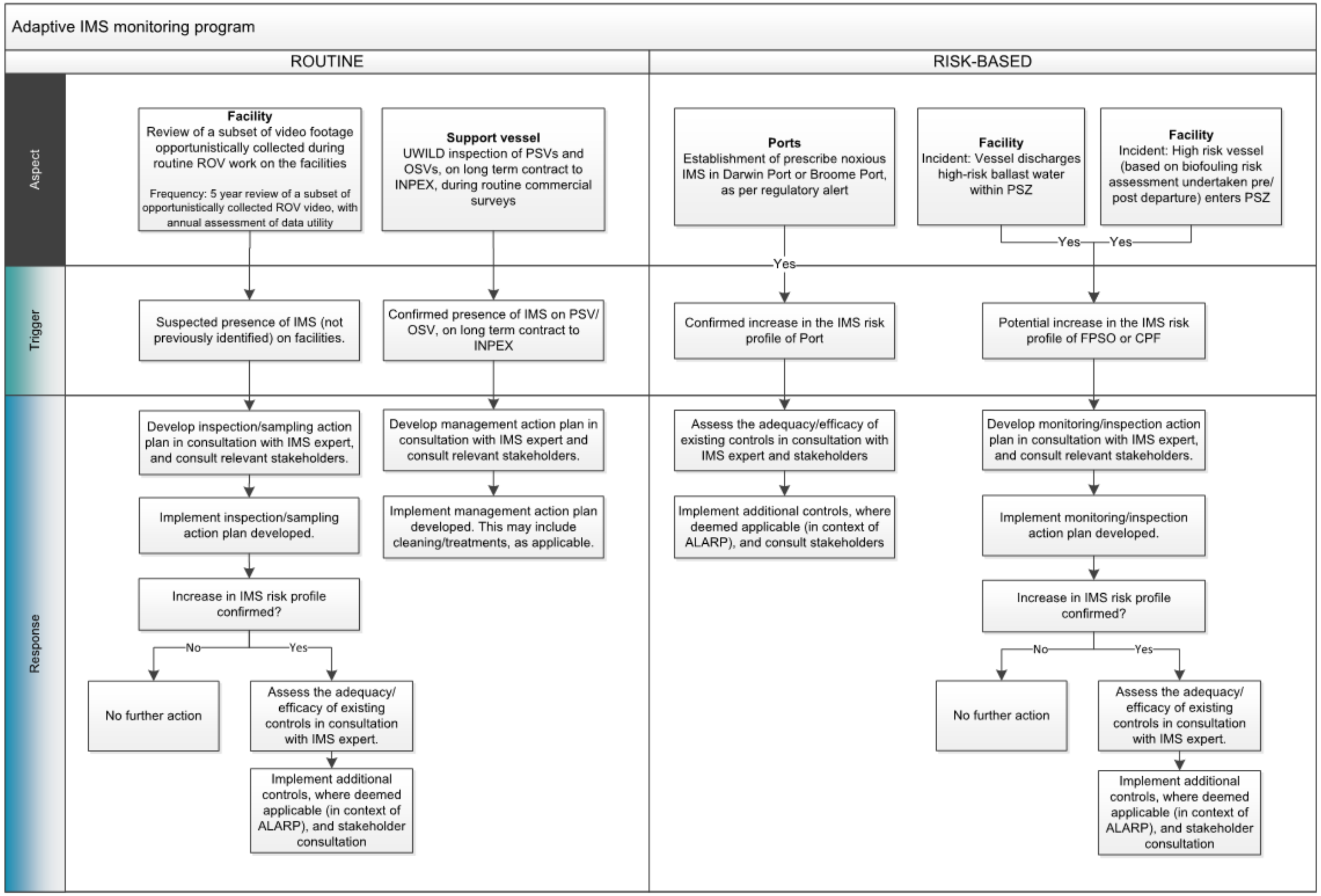

Figure 9-4: Adaptive IMS monitoring program

Implementation timeframes

In the event a trigger has been breached, an IMS expert and relevant stakeholders will consulted within three business days. Following initial notification, an event specific action plan will be developed in consultation with the IMS expert, following the process outlined in Figure 9-4. The relevant response will then be implemented, with the timing for the implementation being event dependant, as guided by IMS experts. Relevant stakeholders will be consulted and kept informed of the status throughout the investigation and response.

Table 9-6: Environmental performance outcome, standards and measurement criteria for implementation of adaptive IMS monitoring program

Environmental performance outcome	Environmental performance standard	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.	Any breach of triggers detailed in the IMSMP will initiate the adaptive management response	Records of IMSMP implementation.

9.6.3 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.

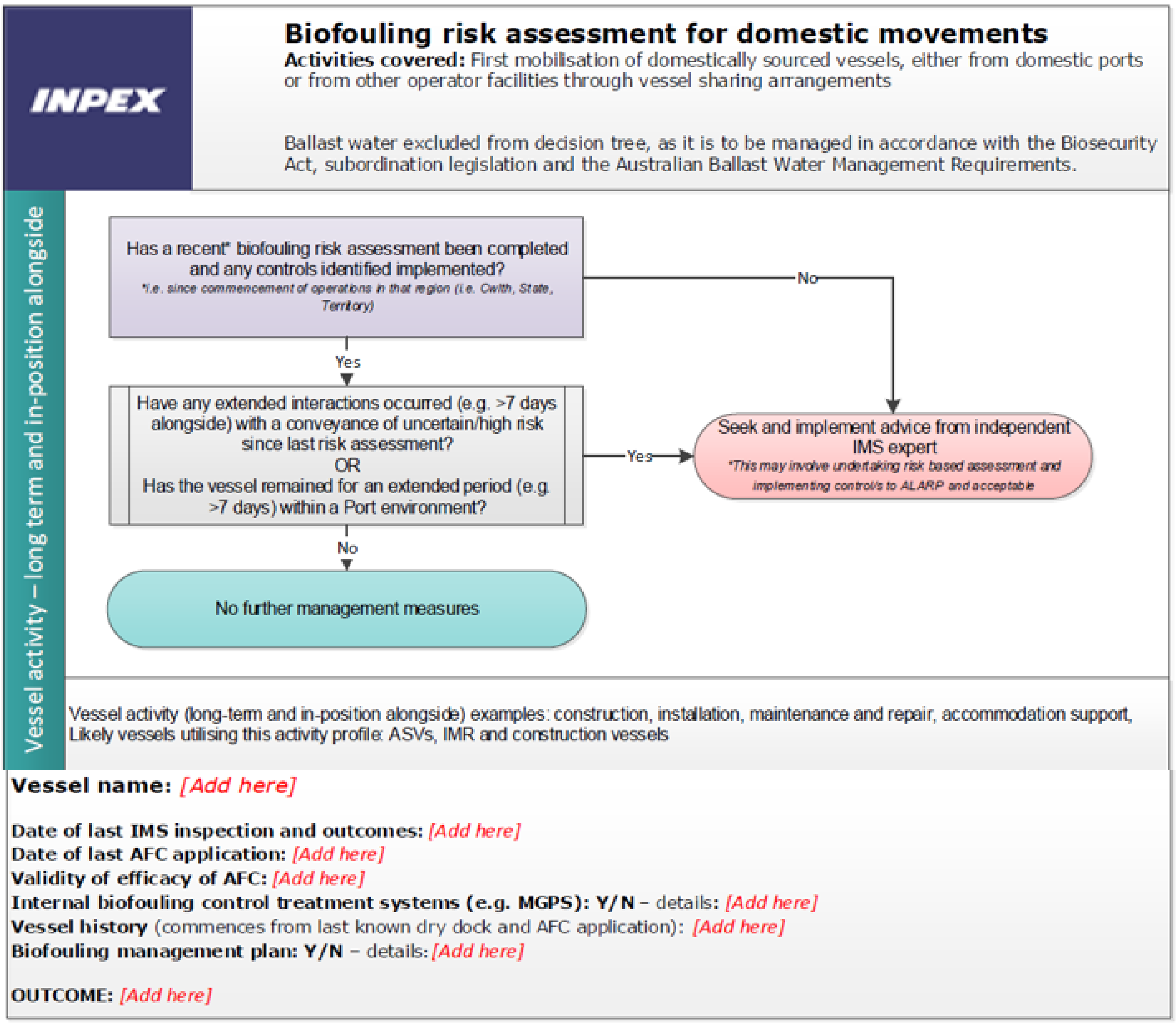

Figure 9-5: INPEX biofouling risk assessment for domestic movements

9.6.4 Asset integrity

INPEX defines asset integrity as the ability of an asset to perform its required functions effectively and efficiently whilst protecting health, safety and the environment. Asset integrity is described in the INPEX Asset Integrity Standard which provides for the development of suitable operating manuals and procedures to ensure that the safe operating parameters and limits of all control measures, the steps required to prevent any excursion from these limits and the actions to be taken upon an excursion from these limits are clearly defined.

Asset integrity management (AIM) is the means of ensuring that the people, systems, processes and resources which deliver asset integrity are in place, fit for purpose and measurable over the whole lifecycle of the asset. INPEX recognises that AIM does not only relate to the physical condition of facilities, but also to elements involving people, activities or business processes and AIM is a key contributor to managing the risk of incidents to ALARP.

An AIM plan covering the Ichthys facility also includes the GEP and is reviewed by INPEX technical authorities and approved by INPEX Technical Authorities (TAs). The AIM plan defines the objectives, requirements and techniques for ensuring the through-life integrity of the facility's structure and equipment and demonstrating compliance with the business rules defined in the Asset Integrity Standard.

An operations assurance plan is developed on an annual basis in accordance with the operations assurance strategy. The operations assurance plan incorporates activities addressing requirements of the AIM plan. To achieve this, the operations assurance plan establishes a program of periodic reviews, self-assessment processes, and peer reviews by relevant discipline personnel.

The ongoing integrity of the GEP is assured through application of the AIM process outlined above and in the Subsea IMM Strategy. The AIM process for the GEP aligns with the integrity management requirements of AS2885.3 and the DNV design code for pipeline systems (DNV-GL 2019). The main activities include:

- RBI – risk assessment and integrity management planning including identification of threats to the integrity of the system, risk assessment and planning for inspection monitoring and testing
- execution of inspection, monitoring and testing activities
- regular integrity assessment based on inspection monitoring and testing results and any other relevant operational information;
- planning and execution of required mitigation, intervention and repair activities as a result of the integrity assessment.

Maintenance and inspection

The GEP is designed to be maintenance free for its design life. Maintenance requirements for components in the GEP are detailed in the Maintenance Strategy Guideline and the GEP IMM Plan defines the required review intervals to be able to assess and trend the performance ensuring that system integrity is maintained. Any rectification work identified as a result of inspections is managed under a rectification plan.

GEP process monitoring and inspection data, including corrosion monitoring data, inline inspection surveys and other NDT techniques, are recorded to provide a prediction of the condition of the GEP at all points, including:

- Continuous monitoring:
  - export gas dew point at the CPF
  - export gas characteristics (temperature, pressure, flowrate)
  - monitoring of the onshore ICCP unit
- Periodic monitoring / testing:
  - gas sampling (H_2S/CO_2)
  - intelligent PIG inspections
  - valve testing
  - ultrasonic surveys
  - CP surveys
  - subsea and onshore visual inspections.
- Event triggered monitoring:
  - events log (e.g. time and duration of shut-in and upset conditions)

– corrosion modelling of process upset events.

Maintenance management system

Inspection, maintenance and repair tasks and activities are developed from the basis of the AIM plans and strategies along with good industry practices. Planned and corrective maintenance is programmed and recorded in the Computerised Maintenance Management System (CMMS) which is subject to periodic audits and monitoring. All maintenance scheduling and recording is in undertaken in SAP.

An EPS related to the ongoing inspection and maintenance of the GEP and associated subsea infrastructure is presented in Table 9-7.

Table 9-7: Environmental performance outcome, standards and measurement criteria for implementation of INPEX maintenance system

Environmental performance outcome	Environmental performance standard	Measurement criteria
GEP and associated infrastructure will be maintained to ensure efficiency and reduce impacts to identified values and sensitivities.	GEP integrity inspections are implemented in accordance with the Subsea Integrity Maintenance Management Plan (SIMMP), specifically the frequency specified in RBI schedule	SAP records demonstrate inspections completed in accordance with the RBI schedule.
	GEP and associated subsea infrastructure inspection process implemented using a RBI approach with an IMM in place.	SAP records demonstrate IMM tasks completed within the specified timeframes.
	Conduct inspections of the CPF/FPSO moorings, in accordance with the Mooring IMM Plan; specifically, the frequency specified in the RBI schedule.	SAP records confirm that inspections have been completed in accordance with the Mooring IMM Plan and the RBI schedule.

9.7 Management of change

Changes to this EP will be managed in accordance with an INPEX Australia 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. 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, 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
- 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 is periodically checked against NOPSEMA guidance to ensure ongoing compliance. This is 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 Australian Marine Parks 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
- use of noticeboards, 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 specifies a requirement for consultation with relevant authorities of the Commonwealth, a state or territory, and other relevant interested persons or organisations. In addition to the Ichthys Project webpage (http://www.inpex.com.au) that provides project information, the mechanisms that provide ongoing opportunities for consultation in relation to the implementation of this EP are summarised in Table 9-8.

Table 9-8: Ongoing stakeholder consultation

Stakeholder	Information supply	Frequency
AMSA – Nautical Advice	Provide updates to both AHO and the JRCC on progress and any IMR activities.	As required
DAWE– Fisheries, AFMA and relevant fishing representatives	Provide updates on future developments relating to the project.	As required
WA DPIRD – Biosecurity Section	DPIRD will be consulted in relation to any change in IMS risk identified over time as described in the IMSMP (Section 9.6.2).	As required
NT DITT (NT Aquatic Biosecurity Unit)	NT DITT Aquatic Biosecurity Unit will be consulted in relation to any change in IMS risk identified over time as described in the IMSMP (Section 9.6.2).	As required
Department of Mines, Industry Regulation and Safety (DMIRS)	Provide updates on any changes to the intended operations.	As required

Table 9-9: 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 Project activities.	Ongoing stakeholder consultation with relevant stakeholders undertaken in accordance with Table 9-8.	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 works 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 learnt 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 8-9 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 performance 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 *Incident 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.

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
- a vessel collision resulting in a spill
- structural integrity failure (minor and major GEP loss of containment) resulting in a subsea gas/condensate release.

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, 8 or 9 of this EP and the *Browse Regional OPEP*.

For the purposes of regulatory reporting to DAWE, any significant impact to matters of national environmental significance (MNES), as classified using the INPEX Risk Matrix, will be reported to DAWE. The Director of National Parks 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
- the National Offshore Petroleum Titles Authority (Cwlth)
- the WA DMIRS or the 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:

- the National Offshore Petroleum Titles Authority (Cwlth)
- the 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.

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 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, INPEX will undertake a review of its compliance with the EPOs and EPSs set out in this EP and will provide a written report of its findings for the reporting period January 1 to December 31, to NOPSEMA on an annual basis, as agreed with NOPSEMA. The annual submission date for the environmental performance report will be April 1 of each year.

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
- INPEX HSE audit on Ichthys operations every two years to confirm alignment with and implementation of the HSE requirements of the INPEX BMS
- 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 Vessel inspections

Inspections are undertaken to ensure that the EPOs and EPSs documented in this EP are likely to be achieved. The inspections are conducted prior to mobilisation of vessels to the operational area. Findings during the inspections will be converted into actions that will be tracked within an action tracking database until closed.

Based on the intermittent and infrequent nature of the IMR activities described in this EP, the duration of a vessel's scope of work is unknown; however, is estimated to range from 5 to 60 days per year. Should an IMR vessel's scope of work extend beyond 60 days, an additional environmental inspection, to confirm compliance with this EP, will be conducted. Following the completion of an IMR vessel scope of work, a report on EP compliance will be prepared.

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 reporting 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 petroleum activity.

Management reviews of this EP shall assess whether:

- the environmental impacts and risks of the petroleum 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 petroleum 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 INPEX *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 management reviews have implications for this 5-year EP revision, the EP will be updated in accordance with the EP MoC process.

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APPENDIX A: EPBC ACT APPROVAL (2008/4208) MINISTERIAL CONDITIONS

APPENDIX B: EPBC ACT PROTECTED MATTERS REPORT AND SPECIES RISK EVALUATION

APPENDIX C: STAKEHOLDER CONSULTATION LOG

Appendix A-
EPBC Ministerial Conditions

On 27 May 2015, INPEX received revised conditions for Approval Decision EPBC 2008/4208 from DAWE, to reflect the outcomes of the Commonwealth Government's regulatory streamlining process. Condition 19 was added as a new condition and it requires INPEX to ensure elements of conditions which are no longer required to be implemented are included in Environment Plans submitted to NOPSEMA for assessment. This Appendix demonstrates how Condition 19 has been met.

Relevant EPBC 2008/4208 Ministerial Conditions	**Location in Environment Plan submission**
19. A plan, strategy or program (however described) required by conditions 1, 2, 5, 7, 8, 9 or 15 is automatically deemed to have been submitted to, and approved by, the Minister if the measures (as specified in the relevant condition) are included in an environment plan (or environment plans) relating to the taking of the action that:	This EP includes the elements of relevant conditions, as cross-referenced below.
a) was submitted to NOPSEMA after 27 February 2014; and	
b) either: i. is in force under the OPGGS Environment Regulations; or ii. has ended in accordance with Regulation 25A of the OPGGS Environment Regulations.	
19B. Where an environment plan which includes measures specified in the conditions referred to in conditions 19 and 19A above, is in force under the OPGGS Environment Regulations that relates to the taking of the action, the person taking the action must comply with those measures as specified in that environment plan.	This EP
1. Oil Spill Contingency Plan The person taking the action must develop and submit to the Minister for approval, an Oil Spill Contingency Plan that demonstrates the response preparedness of the person taking the action for any hydrocarbon spills, including the capacity to respond to a spill and mitigate the environmental impacts on the Commonwealth marine area and listed species habitat within offshore areas and Darwin Harbour. The Plan must include, but is not limited to:	This EP
a) Oil spill trajectory modelling for potential spills from the action. This should include consideration of a well blow out or uncontrolled release. The modelling should be specific to the characteristics of the hydrocarbons contained in the Ichthys gas field, the likely volumes released in a worst-case scenario spill, and the potential time over which the oil may be released in a worst-case scenario spill, including a scenario of a minimum eleven (11) week uncontained spill;	Section 8.1, Section 8.2 and Section 8.3 Table 8-4, Table 8-7

Relevant EPBC 2008/4208 Ministerial Conditions	**Location in Environment Plan submission**
b) A description of resources available for use in containing and minimising impacts in the event of a spill and arrangements for accessing them;	INPEX Browse Regional OPEP
c) A demonstrated capacity to respond to a spill at the site, including application of dispersants, if required and appropriate, and measures that can feasibly be applied within the first 12 hours of a spill occurring;	INPEX Browse Regional OPEP
d) Identification of sensitive areas that may be impacted by a potential spill, in particular, Browse Island, specific response measures for those areas and prioritisation of those areas during a response;	Section 4, Table 8-5, Table 8-8 of this EP and INPEX Browse Regional OPEP
e) Details of the insurance arrangements that have been made in respect of paying the costs associated with operational and scientific monitoring, as outlined in the Operational and Scientific Monitoring Program required under condition 2 and repairing any environmental damage arising from potential oil spills, as determined necessary from the results of the Operational and Scientific Monitoring Program;	Section 1.7 of this EP
f) Training of staff in spill response measures and identifying roles and responsibilities of personnel during a spill response; and	INPEX Browse Regional OPEP
g) Procedures for reporting oil spill incidents to the Department.	Section 9.11.3 and INPEX Browse Regional OPEP
The person taking the action must not commence drilling activities until the Oil Spill Contingency Plan is approved. The approved Oil Spill Contingency Plan must be implemented.	The accepted EP revision will be implemented as required under the OPGGS Act and OPGGS (E) Regulations.
2. Operational and Scientific Monitoring Program The person taking the action must develop and submit to the Minister for approval, an Operational and Scientific Monitoring Program that will be implemented in the event of an oil spill to determine the potential extent and ecosystem consequences of such a spill, including, but not limited to:	INPEX Browse Regional OPEP
a) Triggers for the initiation and termination of the Operational and Scientific Monitoring Program, including, but not limited to, spill volume, composition, extent, duration and detection of impacts;	INPEX Browse Regional OPEP

Relevant EPBC 2008/4208 Ministerial Conditions	**Location in Environment Plan submission**
b) A description of the studies that will be undertaken to determine the operational response, potential extent of impacts, ecosystem consequences and potential environmental reparations required as a result of the oil spill.	INPEX Browse Regional OPEP
c) Details of the insurance arrangements that have been made in respect of paying the costs associated with operational and scientific monitoring, as outlined in the Operational and Scientific Monitoring Program, and repairing any environmental damage arising from potential oil spills, as determined necessary from the results of the Operational and Scientific Monitoring Program;	Section 1.7 of this EP
d) Inclusion of sufficient baseline information on the biota and the environment that may be impacted by a potential hydrocarbon spill, to enable an assessment of the impacts of such a spill;	Section 4, Table 8-5, Table 8-8 and INPEX Browse Regional OPEP
e) A strategy to implement the Operational and Scientific Monitoring Program, including timelines for delivery of results and mechanisms for the timely peer review of studies;	INPEX Browse Regional OPEP
f) In the event of an oil spill the person taking the action must pay all costs associated with all operational and scientific monitoring undertaken in response to the spill, as outlined in the approved Operational and Scientific Monitoring Program and any environmental remediation determined necessary by the results of the approved Operational and Scientific Monitoring Program; and	Section 1.7 of this EP
g) Provision for periodic review of the program.	Section 9.13 of this EP and INPEX Browse Regional OPEP
The Operational and Scientific Monitoring Program must be submitted at least three months prior to the commencement of drilling activities. The person taking the action must not commence drilling activities until the Operational and Scientific Monitoring Program is approved. The approved Operational and Scientific Monitoring Program must be implemented.	The accepted EP revision will be implemented as required under the OPGGS Act and OPGGS (E) Regulations.
7. Offshore Waste Management Plan The person taking the action must submit for the Minister's approval an Offshore Waste Management Plan or plans to mitigate the environmental effects of any wastes generated from the proposal within the Commonwealth marine area. The Offshore Waste Management Plan(s) must address the following:	

Relevant EPBC 2008/4208 Ministerial Conditions	Location in Environment Plan submission
a) identify all sources of waste;	Table 3-5 and Section 7.3 of this EP
b) describe any impacts associated with disposal of these wastes;	Table 7-11 of this EP
c) clearly articulate the objectives of the plan and set measurable targets to demonstrate achievement of these;	Table 7-11 of this EP
d) outline measures to avoid impacts;	Table 7-11 of this EP
e) where impacts are unavoidable describe why they are unavoidable and measures to minimise impacts;	Section 7.3 of this EP
f) identify all regulatory requirements relating to the disposal of waste and how these will be met;	Table 2-1 and Table 7-11 of this EP
g) include a monitoring regime to determine achievement of objectives and success of measures used;	Table 7-11 and Section 9.12 of this EP
h) outline reporting and auditing arrangements; and	Section 9.11 and Section 9.12 of this EP
i) describe how the plan will apply the principles of adaptive management.	Section 9.13 of this EP
The plan(s) must be submitted prior to the commencement of the relevant activity to which they apply. The relevant activity may not commence until the plan is approved. The approved plan(s) must be implemented.	The accepted EP revision will be implemented as required under the OPGGS Act and OPGGS (E) Regulations.
8. Liquid Discharge Management Plan The person taking the action must submit for the Minister's approval a Liquid Discharge Management Plan or plans to mitigate the environmental effects of any liquid discharge from the proposal, including sewerage and surface water runoff. The Liquid Discharge Management Plan(s) must be for the protection of the Commonwealth marine area and habitat for listed species in Darwin Harbour and must:	This EP
a) identify all sources of liquid discharge;	Table 3-5 and Section 7.2 of this EP

Relevant EPBC 2008/4208 Ministerial Conditions	**Location in Environment Plan submission**
b) describe any impacts associated with the discharge of liquids, including the cumulative impacts associated with the discharge of sewerage;	Section 7.2 of this EP
c) clearly articulate the objectives of the plan and set measurable targets to demonstrate achievement of these;	Section 7.2 of this EP
d) outline measures to avoid impacts;	
e) where impacts are unavoidable describe why they are unavoidable and measures to minimise impacts;	
f) demonstrate how any discharges into Darwin Harbour are consistent with the guidelines for discharges, and the water quality objectives for Darwin Harbour, developed under the National Water Quality Management Strategy;	N/A
g) identify all regulatory requirements relating to the discharge of liquids and how these will be met;	Table 2-1 and Section 7.2 of this EP
h) include a monitoring regime to determine achievement of objectives and success of measures used;	Section 7.2 and Section 9.12 of this EP
i) outline reporting and auditing arrangements; and	Section 9.11 and Section 9.12 of this EP
j) describe how the plan will apply the principles of adaptive management.	Section 9.13 of this EP
The plan(s) must be submitted prior to the commencement of the relevant activity to which they apply. The relevant activity may not commence until the plan is approved. Separate Liquid Discharge Management plans can be submitted for the management of liquid discharges in the Commonwealth Marine Area and Darwin Harbour. The approved plan(s) must be implemented.	The accepted EP revision will be implemented as required under the OPGGS Act and OPGGS (E) Regulations.

Appendix B-
EPBC Act protected matters search reports and species risk evaluation

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.

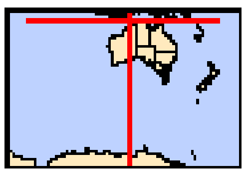
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 11/10/21 18:08:47

Coordinates

Buffer: 2.0Km



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:	21
Listed Migratory Species:	39

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:	75
Whales and Other Cetaceans:	24
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	1

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	None
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	4

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
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

Name	Status	Type of Presence
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation 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 clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat 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	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Listed Migratory Species [Resource Information]

* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat 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 known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat 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	Species or species habitat likely to occur within area
Dugong dugon Dugong [28]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Species or species habitat known to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat 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	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
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
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
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may 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

Name	Threatened	Type of Presence
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys 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
Festucalex cinctus Girdled Pipefish [66214]		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

Name	Threatened	Type of Presence
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
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammals		
Dugong dugon Dugong [28]		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

Name	Threatened	Type of Presence
		area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
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	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
Enhydrina schistosa Beaked Seasnake [1126]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis 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 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	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation 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 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]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Name	Label
Oceanic Shoals	Multiple Use Zone (IUCN VI)

Extra Information

Key Ecological Features (Marine) [Resource Information]

Key Ecological Features are the parts of the marine ecosystem that are considered to be important for the biodiversity or ecosystem functioning and integrity of the Commonwealth Marine Area.

Name	Region
Ancient coastline at 125 m depth contour	North-west
Carbonate bank and terrace system of the Sahul	North-west
Continental Slope Demersal Fish Communities	North-west
Pinnacles of the Bonaparte Basin	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

-13.934 123.297,-13.9199 123.299,-13.9152 123.3,-13.9102 123.303,-13.8997 123.311,-13.8983 123.312,-13.8963 123.315,-13.8941 123.319,-13.8906 123.326,-13.8885 123.33,-13.8873 123.333,-13.8864 123.338,-13.886 123.341,-13.8852 123.346,-13.8845 123.352,-13.8845 123.356,-13.8851 123.36,-13.8904 123.376,-13.8924 123.38,-13.9022 123.395,-13.9047 123.399,-13.9062 123.404,-13.9068 123.41,-13.9078 123.422,-13.9084 123.426,-13.9097 123.431,-13.9287 123.478,-13.971 123.583,-13.9741 123.593,-13.9764 123.606,-13.9791 123.617,-13.9835 123.627,-13.9926 123.647,-13.995 123.657,-13.9951 123.667,-13.992 123.68,-13.9852 123.692,-13.8485 123.821,-13.7901 123.876,-13.7747 123.892,-13.7614 123.903,-13.75 123.919,-13.6443 124.213,-13.6414 124.225,-13.6372 124.241,-13.6262 124.263,-13.5777 124.393,-13.5155 124.52,-13.465 124.64,-13.4223 124.717,-13.389 124.787,-13.3534 124.867,-12.8834 125.853,-12.8425 125.944,-12.8113 126.006,-12.7643 126.193,-12.7618 126.211,-12.7653 126.233,-12.7728 126.251,-12.7813 126.267,-12.7996 126.403,-12.6628 127.257,-12.6575 127.288,-12.6413 127.337,-12.6391 127.353,-12.6419 127.368,-12.6451 127.387,-12.6391 127.412,-12.6333 127.439,-12.5796 127.768,-12.5249 128.104,-12.5249 128.178,-12.5129 128.631,-12.5156 128.693,-12.5129 128.715,-12.5094 128.87,-12.5053 128.901,-12.5048 128.951,-12.5103 128.978,-12.5064 129.017,-12.5023 129.205,-12.5031 129.299,-12.4954 129.366,-12.4969 129.399,-12.5026 129.427,-12.5015 129.492,-12.4141 129.813,-12.318 130.163

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.

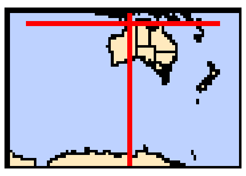
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

Information is available about Environment Assessments and the EPBC Act including significance guidelines, forms and application process details.

Report created: 04/10/21 14:54:42

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:	1
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	65
Listed Migratory Species:	85

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:	27
Commonwealth Heritage Places:	9
Listed Marine Species:	138
Whales and Other Cetaceans:	27
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	15

Extra Information

This part of the report provides information that may also be relevant to the area you have nominated.

State and Territory Reserves:	21
Regional Forest Agreements:	None
Invasive Species:	33
Nationally Important Wetlands:	6
Key Ecological Features (Marine)	10

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

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 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 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

Name	Status	Type of Presence
		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 likely 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
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
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 likely to 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
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

Name	Status	Type of Presence
		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
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding 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 likely to 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 likely 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

Name	Status	Type of Presence
Mitrella tiwiensis a vine [82029]	Vulnerable	Species or species habitat likely to occur within area
Stylidium ensatum a triggerplant [86366]	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 known 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 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
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
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		
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 known 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	Species or species habitat 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

Name	Status	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	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
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

Name	Threatened	Type of Presence
		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 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	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	Species or species habitat known to occur within area
Dugong dugon Dugong [28]		Breeding known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
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]	Vulnerable	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis 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	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		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
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

Name	Threatened	Type of Presence
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]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius dubius Little Ringed Plover [896]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting 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
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
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area

Name	Threatened	Type of Presence
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]		Roosting known to occur within area
Tringa incana Wandering Tattler [831]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
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 Customs Service
Commonwealth Land - Australian Government Solicitor
Commonwealth Land - Department of Administrative Services
Commonwealth Land - Department of Community Services & Health
Commonwealth Land - Department of Immigration Local Government & Ethnic Affairs
Commonwealth Land - Department of Transport & Regional Development
Commonwealth Land - Deputy Crown Solicitor
Commonwealth Land - Director of Property Services Defence Estate
Defence - AUSTRALIAN ARMY BAND - DARWIN
Defence - BERRIMAH ONE
Defence - DARWIN - AP10 RADAR SITE - LEE POINT
Defence - DARWIN - AP3 RECEIVING STATION - LEE POINT
Defence - DARWIN RELOCATIONS CENTRE
Defence - DEFENCE FORCE CAREERS REFERENCE CENTRE
Defence - Esanda Builidng
Defence - HMAS COONAWARRA (Berrimah)
Defence - LARRAKEYAH BARRACKS
Defence - LEANYER BOMBING RANGE
Defence - MT GOODWIN RADAR SITE
Defence - Patrol Boat Base (DARWIN NAVAL BASE)
Defence - QUAIL ISLAND BOMBING RANGE
Defence - RAAF BASE DARWIN
Defence - SHOAL BAY RECEIVING STATION
Defence - STOKES HILL OIL FUEL INSTALLATION
Defence - WINNELLIE ONE
Defence - WINNELLIE TWO

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Natural		
Ashmore Reef National Nature Reserve	EXT	Listed place
Scott Reef and Surrounds - Commonwealth Area	EXT	Listed place
Historic		
Larrakeyah Barracks Headquarters Building	NT	Listed place
Larrakeyah Barracks Precinct	NT	Listed place
Larrakeyah Barracks Sergeants Mess	NT	Listed place

Name	State	Status
RAAF Base Commanding Officers Residence	NT	Listed place
RAAF Base Precinct	NT	Listed place
RAAF Base Tropical Housing Type 2	NT	Listed place
RAAF Base Tropical Housing Type 3	NT	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
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]		Roosting 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

Name	Threatened	Type of Presence
Charadrius dubius Little Ringed Plover [896]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius 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]		Roosting 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]		Roosting known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area
Hirundo daurica Red-rumped Swallow [59480]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area
Larus novaehollandiae Silver Gull [810]		Breeding known to occur within area
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

Name	Threatened	Type of Presence
		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 rubricauda Red-tailed Tropicbird [994]		Breeding 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
Puffinus pacificus Wedge-tailed Shearwater [1027]		Breeding 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 likely 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
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]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known 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 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

Name	Threatened	Type of Presence
		area
[Doryrhamphus janssi](#) Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
[Festucalex cinctus](#) Girdled Pipefish [66214]		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 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
[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

Name	Threatened	Type of Presence
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammals		
Dugong dugon Dugong [28]		Breeding known to occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat 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 may 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
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

Name	Threatened	Type of Presence
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	Species or species habitat known to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
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 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
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

Name	Threatened	Type of Presence
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 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
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area
Lagenodelphis hosei Fraser's Dolphin, Sarawak Dolphin [41]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
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

Name	Status	Type of Presence
		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
Arafura	Multiple Use Zone (IUCN VI)
Argo-Rowley Terrace	Multiple Use Zone (IUCN VI)
Ashmore Reef	Recreational Use Zone (IUCN IV)
Ashmore Reef	Sanctuary Zone (IUCN Ia)
Cartier Island	Sanctuary Zone (IUCN Ia)
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)
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)

Extra Information

State and Territory Reserves	[Resource Information]
Name	State
Adele Island	WA
Bardi Jawi	WA
Browse Island	WA
Buffalo Creek	NT
Casuarina	NT
Channel Point	NT
Charles Darwin	NT
Dambimangari	WA
Djukbinj	NT
George Brown Darwin	NT
Holmes Jungle	NT
Low Rocks	WA
Marri-Jabin (Thamurrurr - Stage 1)	NT
Shoal Bay	NT
Tanner Island	WA
Tree Point Conservation Area	NT
Unnamed WA28968	WA
Unnamed WA41775	WA
Unnamed WA44669	WA
Unnamed WA44673	WA
Uunguu	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		
Acridotheres tristis Common Myna, Indian Myna [387]		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
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
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

Name	Status	Type of Presence
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
Plants		
Andropogon gayanus Gamba Grass [66895]		Species or species habitat likely to occur within area
Annona glabra Pond Apple, Pond-apple Tree, Alligator Apple, Bullock's Heart, Cherimoya, Monkey Apple, Bobwood, Corkwood [6311]		Species or species habitat may 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 may 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
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		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Sage, Wild Sage [10892]		
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
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
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
Adelaide River Floodplain System	NT
Ashmore Reef	EXT
Finniss Floodplain and Fog Bay Systems	NT
Port Darwin	NT
Shoal Bay - Micket Creek	NT
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
Carbonate bank and terrace system of the Sahul	North-west
Continental Slope Demersal Fish Communities	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

-17.4697 119.521,-16.8453 119.824,-16.2886 120.117,-15.5786 120.711,-14.8174 120.915,-14.3999 120.924,-13.9546 120.776,-13.4164 120.766,-12.8412 121.49,-12.47 121.518,-12.136 121.629,-11.8206 121.861,-11.57 122.251,-11.4587 122.529,-11.3474 122.993,-11.0983 123.774,-11.0746 124.564,-11.0178 125.057,-10.9261 125.55,-10.7064 125.924,-10.6827 126.612,-10.5524 126.985,-10.4986 127.39,-10.5376 127.705,-10.9473 128.14,-11.0983 128.394,-11.0327 128.747,-10.8489 129.017,-10.647 129.386,-10.4459 129.711,-10.2789 130.08,-10.2017 130.454,-10.1713 130.787,-10.1304 131.203,-10.0668 131.713,-9.97305 132.067,-9.89289 132.283,-9.88102 132.521,-9.92041 132.788,-10.0889 132.842,-10.2508 132.731,-10.6688 131.894,-11.1268 131.673,-11.375 131.703,-11.4798 131.855,-11.6959 131.947,-11.9367 131.81,-12.1854 131.29,-12.2583 131.133,-12.4986 130.813,-12.491 130.657,-12.5555 130.565,-12.6918 130.475,-12.9068 130.372,-13.0304 130.199,-13.2007 130.183,-13.4318 129.97,-13.698 129.843,-13.833 129.799,-13.9477 129.565,-14.1853 129.341,-14.5684 129.223,-14.5448 128.987,-14.4226 128.625,-14.3185 128.202,-13.8479 127.413,-13.6583 126.88,-13.7512 126.589,-13.8007 126.158,-13.9204 125.948,-14.2341 125.895,-14.3452 125.487,-14.5204 125.199,-14.7771 125.07,-14.8698 124.924,-14.8479 124.695,-15.2312 124.484,-15.7607 124.376,-16.2664 124.242,-16.226 123.885,-16.297 123.089,-16.0179 122.695,-15.7969 122.18,-16.0474 121.545,-16.07 121.046,-16.346 120.635,-16.7241 120.275,-17.1565 119.986,-17.5094 119.734,-17.4697 119.521

Acknowledgements

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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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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.	• 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 7.3 – Waste management • EP Section 7.4 - Noise and vibration • EP Section 7.5.1 - Introduction of invasive marine species • EP Section 7.5.2 - Interaction with marine fauna • EP Section 7.6 - Seabed disturbance • EP Section 7.2 - Emissions and discharges • 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
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. 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.	• Waste / marine debris • Noise and vibration • Introduced Marine Species • Vessel strike • Benthic habitat degradation / seabed disturbance • Emissions and discharges • Oil spill • Light emissions	• Manage artificial light from onshore and offshore sources to ensure biologically important behaviours of nesting adults and dispersing hatchlings can continue. • 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 7.2.3 - Light emissions • EP Section 7.3 – Waste management • EP Section 7.4 - Noise and vibration • EP Section 7.5.1 - Introduction of invasive marine species • EP Section 7.5.2 - Interaction with marine fauna • EP Section 7.6 - Seabed disturbance • EP Section 7.2 - Emissions and discharges • EP Section 8 - Emergency conditions (oil spills).
EPBC-listed seabirds and	Department of the Environment. 2015. EPBC Act Policy Statement 3.21 - Industry guidelines for	• Waste / marine debris • Noise and vibration	• Reduce risk of rodents gaining access to key vessels at key ports	• EP Section 7.2.2 - Emissions to air • EP Section 7.2.3 - Light emissions • EP Section 7.3 – Waste management

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
shorebirds	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. 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)	• Introduced Marine Species • Introduced Terrestrial Pests (rodents) • Benthic habitat degradation / seabed disturbance • Emissions and discharges • Oil spill • Light emissions	• 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 7.4 - Noise and vibration • EP Section 7.5.1 - Introduction of invasive marine species • EP Section 8 - Emergency conditions (oil spills) • EP Section 7.2 - Emissions and discharges.

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
	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. *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. 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. 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 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.			
EPBC-listed cetaceans	Department of the Environment. 2015. Conservation Management Plan for the Blue Whales - A Recovery Plan under the Environment Protection and Biodiversity	• Waste / marine debris • Noise and vibration • Introduced Marine Species	• Ensure all vessel strike incidents are reported in the National Ship Strike Database.	• EP Section 7.3 – Waste Management • EP Section 7.4 - Noise and Vibration • EP Section 7.5.1 - Introduction of invasive marine species

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**
	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. 2015. Approved Conservation 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 the Environment and Heritage, 2005. Australian National Guidelines for Whale and Dolphin Watching - Information Sheet. 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.	• Vessel strike • 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 7.5.2 - Interaction with marine fauna • EP Section 7.6 - Seabed disturbance • EP Section 7.2 - Emissions and discharges • EP Section 8 - Emergency conditions (oil spills).

Appendix C-
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 and Darwin Offices (Cwth)	8/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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)	8/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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 Fisheries Management Authority (AFMA) (Cwth)	8/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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

STAKEHOLDER	Date of Correspondence	Type of Correspondence	Summary of Correspondence / Objection / Claim / Query	Attachments	Assessment of Merit
Authorities					
Australian Hydrographic Office (AHO)- Department of Defence	8/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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 Maritime Safety Authority (AMSA) - Nautical Advice (Cwth)	8/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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
	11/03/2021	Email / letter from stakeholder	Response received from officer at AMSA Connect confirming receipt. Confirmed AMSA has no concerns with the proposed activity. Requested that INPEX ensure timely and relevant Maritime Safety Information, including: (1) Contact AHO no less than four working weeks before operations for promulgation of the appropriate Notice to Mariners. (2) Notify AMSA's Join Rescue Coordination Centre (JRCC) by email or phone for promulgation of radio-navigation warnings at least 24-48 hours before operations commence. (3) INPEX should plan to provide updates to both AHO and the JRCC on progress and any changes to the intended operations. Reminded INPEX to exhibit appropriate lights and shapes to reflect the nature of operations in accordance with COLREGS requirements.	Yes - activity fact sheet	Relevant matter – stakeholder has provided information relevant to the petroleum activity and/or the stakeholder's functions, interests or activities. INPEX will make the required notifications and updates to JRCC and AHO with regard to IMR activities to be undertaken. This information has been incorporated into Section 9.8.3 of the EP. Vessel light navigation lighting is managed in accordance with the Navigation Act and associated Marine Orders, which align with COLREGS requirements. This information has been incorporated into Table 7-6, Table 7-16, Table 8-5 and Section 9.8.3 of the EP. The stakeholder raised no concerns or objections regarding the activity.
	11/03/2021	Email / letter to stakeholder from INPEX	INPEX thanked stakeholder for feedback and ensured the relevant notifications will be made at the appropriate times to conduct work safely in the area.	Yes - activity fact sheet	N/A - consultation sent by INPEX
Australian Maritime Safety Authority (AMSA) - Marine Environment Pollution Response (Cwth)	11/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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

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Authorities					
Department of Agriculture, Water and Environment (DAWE) – Biosecurity (Marine Pests) (Vessels, aircraft and personnel) (Cwth)	8/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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 Agriculture, Water and Environment (DAWE) – Ichthys Project officer	8/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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 Agriculture, Water and Environment (DAWE) Fisheries	8/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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
	31/03/2021	Email / letter from stakeholder	The Department of Agriculture, Water and the Environment's Petroleum & Fisheries noted consultation required by the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009. The Department requested to be informed of future developments relating to this project. The Department requested that future developments be communicated with the Australian Fisheries Management Authority at petroleum@afma.gov.au and the relevant fishing industry representation organisations in that region.	No	Relevant matter - stakeholder has requested to remain informed of other project activities. The stakeholder raised no concerns or objections regarding the activity.
	31/03/2021	Email / letter to stakeholder from INPEX	INPEX confirmed that a similar communication was sent to Petroleum@afma.gov.au, and engaged with WAFIC for support with required consultation of the relevant fishery industry representation.	No	N/A - consultation sent by INPEX

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Department of Biodiversity Conservation and Attractions (DBCA) - Environmental Management Branch (WA)	8/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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
	23/03/2021	Email / letter from stakeholder	Thanked INPEX for providing the Department of Biodiversity, Conservation and Attractions (DBCA) with the attached information in relation to INPEX's upcoming activities in WA-50-L within Commonwealth waters. Advised that DBCA has undertaken a review of the documentation provided and other readily available information, and provides the following comments in relation to its responsibilities under the Conservation and Land Management Act 1984 and Biodiversity Conservation Act 2016. Advised that there are a number of ecologically important areas including marine parks and island/coastal conservation reserves located in the vicinity of the proposed operations, including the Browse Island Nature Reserve and the Scott Reef Nature Reserve. Based on the information provided it appears that there is potential for these areas 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 importance of areas potentially affected by a hydrocarbon release from the proposed activities, it is considered important that the baseline values and state of the potentially affected environment are appropriately understood and documented prior to any operations commencing that pose a significant risk of impacting these areas. DBCA advised it would like to have confidence that INPEX maintains appropriate baseline survey data on the important ecological values of these areas and any current contamination if present within the area of potential impact of spills (as identified through INPEX's modelling). Following a desktop review and risk assessment, INPEX should also collect appropriate baseline abundance and distribution data for any threatened and specially protected marine fauna species in the area of potential impact, including information on the key habitats these species use for activities like foraging, breeding and aggregating. If baseline information is not available, 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 monitored and remediated. DBCA advised it undertakes monitoring in marine 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 marine park management and is not necessarily suitable to provide all baseline information required for oil spill risk assessment and management planning. DBCA encouraged INPEX to ensure it attains all information required to implement a Before-After, Control-Impact (BACI) framework in planning its management response. This may include independently monitoring and collecting data where required or identifying other data sources. In reviewing its Environmental Plan/s, 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 (https://www.environment.gov.au/biodiversity/publications/national-light-pollution-guidelines-wildlife). INCIDENTS AND EMERGENCY RESPONSE In the event of a hydrocarbon release, DBCA requested that INPEX notify DBCA's Kimberley regional office as soon as practicable on (08) 9195 5500. DBCA noted that it 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. Advised that INPEX should also commit to the monitoring and clean-up of any DBCA interests affected by an oil spill in consultation with DBCA. Noting the above, DBCA confirmed understanding that INPEX maintains Oil Pollution Emergency Plans developed in consultation with the Department of Transport and reviewed by NOPSEMA. Requested that INPEX continue to provide all future notifications to EMBAdmin@dbca.wa.gov.au.	No	Relevant matter – stakeholder has provided information relevant to the petroleum activity and/or the stakeholder's functions, interests or activities. This information has been incorporated into Section 4 (Existing environment), Table 7-6 (light emissions) of the EP; and the BROPEP (Notifications, Section 4.5.2 - OWR and Section 4.7 - BROPEP). The stakeholder raised no concerns or objections regarding the activity.
	1/04/2021	Email / letter to stakeholder from INPEX	INPEX requested to meet with stakeholder to provide detail in relation to INPEX's Environmental management capabilities	No	N/A - consultation sent by INPEX

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	15/04/2021	Email / letter to stakeholder from INPEX	INPEX provided the following summary of INPEX capabilities in relation to stakeholder feedback: **Topic 1 – baseline data** The INPEX facility (comprising the FPSO, CPF and subsea gathering system) have been connected in the Ichthys Field, Browse Basin since 2017 and in operations since July 2018. In 2014, prior to the arrival of the facility, 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 is included in the existing environment section of the revised Offshore Facility (Operations) Environment Plan. As part of the Offshore Facility (Operations) Environment Plan revision, INPEX will also undertake a literature review for new information that can be included in the existing environment section and potential sources of baseline data. 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 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 are detailed in the Offshore Facility (Operations) Oil Pollution Emergency Plan (OPEP). The OPEP also contains 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 revision 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 revised OPEP In all of 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.	No	N/A - consultation sent by INPEX
	27/04/2021	Email / letter from stakeholder	Stakeholder thanked INPEX for providing required information and confirmed that they will contact environment team, or refer to EP, if further information is required.	No	Not a relevant matter - general correspondence only.
Department of Defence – Northern Command (DoD)	10/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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

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Department of Foreign Affairs and Trade (DFAT)	10/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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)	8/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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)	8/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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
	26/03/2021	Email / letter from stakeholder	Advised that DMIRS has reviewed the information provided relating to operations in the Ichthys field over the next five years and acknowledged that the matters will be regulated by NOPSEMA under the provisions of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009. Advised no further information is required at this stage but requested DMIRS is informed of any relevant updates.	No	Relevant matter – stakeholder has provided information relevant to the petroleum activity and/or the stakeholder's functions, interests or activities. This information has been incorporated into Section 9.8.3 of the EP. The stakeholder raised no concerns or objections regarding the activity.

STAKEHOLDER	Date of Correspondence	Type of Correspondence	Summary of Correspondence / Objection / Claim / Query	Attachments	Assessment of Merit
Authorities					
Department of Primary Industries and Regional Development (DPIRD) - Aquatic Environment section (WA)	8/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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
	8/03/2021	Email / letter from stakeholder	Automatic email response advising stakeholder is not currently in Perth (returning soon); provided alternative contact number.	No	Not a relevant matter - general correspondence only.
Department of Primary Industries and Regional Development (DPIRD) - Biosecurity section formerly Department of Fisheries	8/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Inquired whether DPIRD would be interested in having a discussion to confirm that the text INPEX includes in the EP revision remains ALARP and acceptable to DPIRD. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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
	8/03/2021	Email / letter from stakeholder	DPIRD responded to confirm interest in discussing above mentioned biosecurity matters.	No	Not a relevant matter - general correspondence only. Note refer to ongoing specific activity/aspect engagement undertaken for the domestic biofouling risk assessment.
Department of Transport (WA DoT) – Marine Safety	11/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility:	Yes - activity fact sheet	N/A - consultation sent by INPEX
	11/03/2021	Email / letter from stakeholder	Stakeholder thanked INPEX for the notification.	No	Not a relevant matter - general correspondence only.
	12/03/2021	Email / letter from stakeholder	Stakeholder thanked INPEX for the notification in regards to the proposed Ichthys LNG field development activities. Stakeholder requested that if there are any changes to the corresponding Oil Pollution Emergency Plans or changes to the spill risk that may impact on State waters, for INPEX to please ensure that the Department of Transport is consulted in accordance with the requirements outlined in the Department of Transport Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (July 2020).	No	Relevant matter - stakeholder has requested to be notified of activity commencement or other project activities. The stakeholder raised no concerns or objections regarding the activity.
	12/03/2021	Email / letter to stakeholder from INPEX	INPEX informed stakeholder that there are no changes to spill risks from our activities, or associated changes associated with risks to WA State Waters. INPEX advised it will be in touch as the OPEPs are updated for its Offshore Facility EP/OPEP and GEP EP/OPEP 5 year revision submissions to NOPSEMA later this year.	No	N/A - consultation sent by INPEX. Note refer to ongoing specific activity/aspect engagement undertaken for the BROPEP development.
	18/03/2021	Email / letter from stakeholder	Stakeholder thanked INPEX for response.	No	Not a relevant matter - general correspondence only.

STAKEHOLDER	Date of Correspondence	Type of Correspondence	Summary of Correspondence / Objection / Claim / Query	Attachments	Assessment of Merit
Authorities					
Department of Water and Environmental Regulation (DWER) Hazard Management Branch Contaminated Sites Branch	11/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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
Indigenous Land and Sea Corporation (ILSC)	10/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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
Indonesian Ministry for Marine Affairs and Fisheries (MMAF)	10/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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

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Authorities					
Kimberley Land Council (KLC)	10/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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
	10/03/2021	Email / letter from stakeholder	KLC confirmed internal lead for the activity/future correspondence.	No	Not a relevant matter - general correspondence only.
	11/03/2021	Email / letter to stakeholder from INPEX	INPEX confirmed receipt.	No	Not a relevant matter - general correspondence only.
NT Department of Industry, Tourism and Trade (DITT) - Fisheries	8/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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 Environment, Parks and Water Security (EPaWS) - NT EPA	8/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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
	8/03/2021	Email / letter from stakeholder	Automatic email confirming receipt.	N/A	Not a relevant matter - general correspondence only.

STAKEHOLDER	Date of Correspondence	Type of Correspondence	Summary of Correspondence / Objection / Claim / Query	Attachments	Assessment of Merit
Authorities					
NT Department of Industry, Tourism and Trade (DITT) - Mining and Energy	8/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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)	11/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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
National Native Title Tribunal (NNTT) (Cwth)	10/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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

STAKEHOLDER	Date of Correspondence	Type of Correspondence	Summary of Correspondence / Objection / Claim / Query	Attachments	Assessment of Merit
Authorities					
National Offshore Petroleum Titles Administrator (NOPTA)	8/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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
	8/03/2021	Email / letter to stakeholder from INPEX	NOPTA responded confirming receipt of email and advised INPEX that NOPTA would discuss internally and follow up with any queries or other feedback.	No	Not a relevant matter - general correspondence only.
Northern Land Council (NLC)	10/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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
Office of the Director of National Parks (Cwth)	8/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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

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Authorities					
	12/03/2021	Email / letter from stakeholder	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. Noted 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 stakeholder's functions, interests or activities. This information has been incorporated into Section 4 (Existing environment), Section 7 (Risk and impact evaluation) and Section 8 (Emergency conditions) of the EP, and oil/gas pollution notifications have been included in the BROPEP. The stakeholder raised no concerns or objections regarding the activity.
Business					
Australian Marine Oil Spill Centre (AMOSC)	11/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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
	11/03/2021	Email / letter from stakeholder	Confirmed receipt. AMOSC noted the drilling of 15 planned wells from Q3 2020 through to 2023, and confirmed this will be noted by our Duty Officers. Requested INPEX inform AMOSC each time a new well is drilled, then AMOSC can focus the Duty Officers information for the timings that the well enters and then seals the reservoir(s).	No	Relevant matter - stakeholder has requested to be notified of activity commencement or other project activities. This notification will be made under the Offshore Facility (Operation) EP and is not duplicated in this EP. The stakeholder raised no concerns or objections regarding the activity.
	15/07/2021	Email / letter to stakeholder from INPEX	INPEX requested that AMOSC is just provided with our overall drilling program timeframes, instead of individual status of depths and risks for well. Awaiting response.	No	N/A - consultation sent by INPEX
	27/07/2021	Email / letter from stakeholder	AMOSC agreed that the simplest notification to AMOSC should be on the overall drilling program.	No	Relevant matter - stakeholder has requested to be notified of activity commencement or other project activities. See above, notification to stakeholder made under the Offshore Facility (Operation) EP and is not duplicated in this EP.
	28/07/2021	Email / letter to stakeholder from INPEX	INPEX thanked AMOSC and noted it would provide updates on drilling program schedules. INPEX noted that production drilling was continuing for the next two years through to 2023 at this stage.	No	N/A - consultation sent by INPEX

STAKEHOLDER	Date of Correspondence	Type of Correspondence	Summary of Correspondence / Objection / Claim / Query	Attachments	Assessment of Merit
Authorities					
Darwin Port Operations Pty Ltd (a Landbridge company)	8/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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
DNV GL Australia Pty Ltd.	25/05/2021	Email / letter from stakeholder	Following email exchange with DAWE - Biosecurity (Marine Pests), stakeholders shared with INPEX DNV checklists including fuel change over procedure and fuel change over record, stating that checklists are generic and may not be application to one or both of the facilities.	No	Not a relevant matter - general correspondence only.
	28/05/2021	Email / letter to stakeholder from INPEX	INPEX representative responded with complete feedback for both facilities (CFP and FPSO), and requested a call to discuss merging ideas into the equivalence 288 application and taking stakeholder through INPEX existing records.	No	N/A - consultation sent by INPEX
	2/06/2021	Email / letter to stakeholder from INPEX	INPEX representative followed up on meeting request.	No	N/A - consultation sent by INPEX
	3/06/2021	Email / letter from stakeholder	Stakeholder suggested time for meeting.	No	Not a relevant matter - general correspondence only.
	3/06/2021	Email / letter to stakeholder from INPEX	INPEX representative confirmed meeting date and time.	No	N/A - consultation sent by INPEX
	3/06/2021	Email / letter from stakeholder	Stakeholder added comments in preparation to scheduled meeting.	No	Not a relevant matter - general correspondence only.
	4/06/2021	Email / letter to stakeholder from INPEX	INPEX thanked stakeholder for their time at the meeting and recapped action item by providing Form 228 for review.	No	N/A - consultation sent by INPEX
	14/06/2021	Email / letter from stakeholder	Stakeholder provided recommendation and changes to reflect on From 288.	No	Not a relevant matter - general correspondence only.
	29/06/2021	Email / letter to stakeholder from INPEX	INPEX representative responded with Form 288 reflecting advised changes and confirming that INPEX reviewed documents.	Yes - 288 exemption FPSO (& CPF) Equivalence	N/A - consultation sent by INPEX
RPS Asia-Pacific Applied Science Associates (APASA)	11/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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

STAKEHOLDER	Date of Correspondence	Type of Correspondence	Summary of Correspondence / Objection / Claim / Query	Attachments	Assessment of Merit
Authorities					
Oil Spill Response Limited (OSRL)	11/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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
Northern Territory Seafood Council (NTSC), represents: • Aquarium Fishery • Coastal Line Fishery • Demersal Fishery • Mollusc Fishery • Mud Crab Fishery • Offshore Net and Line Fishery • Spanish Mackerel Fishery • Trepang Fishery • Pearl Oyster Fishery • Squid Jigging Fishery • Northern Prawn Fishery (Cwth)	30/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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
Pearl Producers Association of WA (PPAWA)	9/03/2021	Email / letter to stakeholder from WAFIC	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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 WAFIC on behalf on INPEX

STAKEHOLDER	Date of Correspondence	Type of Correspondence	Summary of Correspondence / Objection / Claim / Query	Attachments	Assessment of Merit
Authorities					
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 Cwth fisheries • North West Slope Trawl Fishery • Western Tuna and Billfish Fisheries	8/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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
WA Fisheries					
North West Slope Trawl Fishery	9/03/2021	Email / letter to stakeholders from WAFIC	Correspondence sent to 4 licence holders by WAFIC on behalf of INPEX.	Yes - activity fact sheet	N/A - consultation sent by WAFIC on behalf on INPEX
Northern Demersal Scalefish Managed Fishery	9/03/2021	Email / letter to stakeholders from WAFIC	Correspondence sent to 11 licence holders by WAFIC on behalf of INPEX.	Yes - activity fact sheet	N/A - consultation sent by WAFIC on behalf on INPEX
Pearl Oyster Managed Fishery	9/03/2021	Email / letter to stakeholders from WAFIC	Correspondence sent to 4 licence holders by WAFIC on behalf of INPEX.	Yes - activity fact sheet	N/A - consultation sent by WAFIC on behalf on INPEX
West Coast Deep Sea Crustacean	9/03/2021	Email / letter to stakeholders from WAFIC	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility and GEP (Operation) Environment Plans. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with environment plans accepted by NOPSEMA in 2016 and 2017, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility and GEP (Operation) EPs to NOPSEMA in Q4 2021. 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 WAFIC on behalf on INPEX
Joint Authority Fisheries					
Joint Authority Northern Shark Fishery (Cwth/WA) and North Coast Shark Fishery (WA)	9/03/2021	Email / letter to stakeholder from WAFIC	Correspondence sent to one licence holder by WAFIC on behalf of INPEX	Yes - activity fact sheet	N/A - consultation sent by WAFIC on behalf on INPEX
Joint Authority Northern Shark Fishery (Cwth/WA) and North Coast Shark Fishery (WA)	9/03/2021	Email / letter to WAFIC	Licence holder requested WAFIC fix the problem that they cant fish first.	No	Not a relevant matter - general correspondence only / not relevant to the activity.

SPECIFIC ACTIVITY/ASPECT ENGAGEMENT - INPEX BROWSE REGION OIL POLLUTION EMERGENCY PLAN

STAKEHOLDER	Date of Correspondence	Type of Correspondence	Summary of Correspondence / Objection / Claim / Query	Attachments	Assessment of Merit
Ashmore Reef / Cartier Island Control Agency Clarifications					
Australian Maritime Safety Authority (AMSA) - Marine Environment Pollution Response (Cwth) & Department of Transport (WA DoT) – Marine Safety *Subject - Ashmore/Cartier Island oil spill response*	29/06/2021	Email / letter to stakeholder from INPEX	Stakeholder sent email as part of INPEX's formal consultation under the OPGGS E Regulations, in relation to the Browse Regional OPEP which is being prepared to cover petroleum activities in the Timor Sea. INPEX's query relates specifically to oil spill response at Ashmore Reef and Cartier Island. INPEX advised that both these locations have been identified as locations in which INPEX's activities (as well as many other TH's activities) present a spill risk, possibly requiring shoreline / wildlife response under a worst-credible case scenario. INPEX's understanding is that these locations are both "Commonwealth Lands", and not clearly under the jurisdiction of the WA or NT government Control Agency responsibility under the WA SHP MEE, or NT OSCP. Advised that the in force OPEPs are somewhat confusing, in some spots stating that INPEX would/could be the Control Agency for shoreline response activities (e.g. SCAT, shoreline clean-up, Oiled Wildlife Response etc), or it could be delegated to other agencies, or conducted in parallel with AMSA. Advised that previous stakeholder consultation INPEX conducted has resulted in a range of statements regarding Ashmore Reef / Cartier Island – and INPEX is now trying to clearly understand the spill response command/control arrangements for Ashmore Reef and Cartier Island. Advised stakeholder of the current arrangements in INPEX's most recently accepted OPEPs. INPEX identified items that were not clear and requested if these could be clarified and a clear command/control agency structure established. INPEX suggested three potential options: 1. INPEX is the Control Agency for Ashmore/Cartier, and conducts shoreline response 'in consultation' with AMSA and or WA DoT/DBCA/DWER 2. INPEX is not the Control Agency, and AMSA takes over Control Agency for all shoreline response at Ashmore/Cartier 3. INPEX is not the Control Agency, and AMSA delegates Control Agency, via the WA DEWR, to WA DoT (and OWR done by WA DBCA, under WA DoT). Or some other combination of the above.	No	N/A - consultation sent by INPEX
	23/07/2021	Email / letter from stakeholder	AMSA consulted DAWE and NOPSEMA. Outcome, advised by AMSA that the Department of Infrastructure, Transport, Regional Development and Communications is responsible for administration of the Indian Ocean Territories, including Ashmore Reef and Cartier Island. In addition, DAWE has responsibility over the marine parks. Titleholder, under the OPGGS Act 2006, is the Control Agency, including for spill response on Commonwealth lands. Therefore, TH must consult with the relevant Cwlth government agencies during spill response at these locations. WA Dot were copied in but did not provide specific response to this item.	No	Relevant matter- outcomes incorporated into the BROPEP documentation.
Regional OPEP Development					
Department of Biodiversity Conservation and Attractions (DBCA) - Environmental Management Branch (WA) and WA DoT *Subject - INPEX & APPEA OSWG Regional OPEP development and shoreline/oiled wildlife response arrangements within WA waters.*	14/04/2021	Email / letter to stakeholder from INPEX	Initial request sent to stakeholders to establish a time to discuss/workshop a regional OPEP.	No	N/A - consultation sent by INPEX
	23/04/2021	Email / letter from stakeholder	Stakeholder agreed with response received. Stakeholder requested INPEX liaise with relevant Planning Officer to identify a suitable date/time/venue for INPEX to brief other stakeholders.	No	Not a relevant matter - general correspondence only.
	23/04/2021	Email / letter from stakeholder	Stakeholder requested a date to meet as May is a busy month for department. Stakeholder advised they would look at feasibility when they get a response.	No	Not a relevant matter - general correspondence only.
	23/04/2021	Email / letter to stakeholder from INPEX	INPEX responded that June is fine. INPEX requested stakeholder to advise their availability.	No	N/A - consultation sent by INPEX
	17/05/2012	Email / letter to stakeholder from INPEX	INPEX followed up on the previous request to WA DoT to arrange a time to provide the Department with an update on INPEX's Browse Basin Regional OPEP which is under development, covering INPEX's offshore petroleum activities between Broome-Darwin. Reaffirmed that the Regional OPEP process is also being utilised by the APPEA Oil Spill Working Group (OSWG). Advised that the APPEA OSWG, in conjunction with AMOSC and Advisian (service provider), are looking to arrange a workshop in early July with the WA DoT, (and DBCA as relevant), to run through the shoreline contact scenarios for the Exmouth and Kimberley ROPEP scenarios. outlined the desired workshop outcomes: • Agree worst-case SCAT capability requirements and discuss those arrangements, with DoT • Agree worst-case shoreline clean-up capability requirements and discuss those arrangements, with DoT • Agree worst-case OWR capability requirements and discuss those arrangements, with DoT and DBCA, with the revised (or latest draft) DBCA OWR Plan.	No	N/A - consultation sent by INPEX

STAKEHOLDER	Date of Correspondence	Type of Correspondence	Summary of Correspondence / Objection / Claim / Query	Attachments	Assessment of Merit
	14/06/2021	Email / letter to stakeholder from INPEX	INPEX informed it is working with the APPEA Oil Spill Working Group to two 'Regional OPEPs', in an attempt to replace the 10s/100s of individual offshore oil and gas OPEPs currently accepted by NOPSEMA. Specifically, INPEX is preparing a Browse Regional OPEP, covering offshore Broome to offshore Darwin – all petroleum activities in Commonwealth waters in those regions. Advised that this will support INPEX's current operational activities, and will be submitted (first version) 31st August this year. This document will effectively be the 'test-case' for a Regional OPEP – to demonstrate how NOPSEMA and O&G companies can use regional planning, instead of individual plans. Advised that APPEA OSWG are also preparing an Exmouth regional OPEP – for a well blowout from the FPSOs offshore of the Ningaloo reef. This would be a future ROPEP, potentially replacing Woodside, BHP and Santos OPEPs in the future, if we can deliver the entire ROPEP project. Advised that INPEX, as the individual company, and APPEA OSWG working on the above two ROPEPs, are seeking to have meetings and workshops with the DBCA, to bridge the ROPEPs to the revised DBCA WA OWRP. Advised that the schedule is to have some workshops in Q3 of this year. Workshop objectives include: • Provide DoT/DBCA with the understanding of the worst credible shoreline impact scenarios for the regions • Discuss with DoT/DBCA, AMOSC and Industry, how we see the response being managed in terms of: • Command and control & IMT capabilities / expectations • Protection priorities, or ways in which DoT/DBCA wish for industry to discuss protection priorities within the upstream O&G OPEPs (as we are ultimately not the decision maker regarding protection priorities within 3nm during a spill event) • Field capabilities and arrangements - who is bringing what capability? What can industry expect/rely on from DoT/DBCA, and what does DoT/DBCA agree is the capability/arrangements industry should have in place, to support the DoT/DBCA as the Control Agency. Advised that the INPEX Browse ROPEP submission will need to go into NOPSEMA on 31st August, so if possible, INPEX would like to run through the Browse scenarios first. Advised that the Exmouth ROPEP doesn't have a specific submission schedule to NOPSEMA and does not have immediate urgency. Advised that INPEX meeting with DoT on 24th June for an initial Industry/DoT discussion around the ROPEPs, and following that session, it'd be great if Industry, AMOSC, DoT and DBCA can arrange a schedule for some workshops for the Browse shoreline contact scenarios.	No	N/A - consultation sent by INPEX
	17/06/2021	Email / letter from stakeholder	Stakeholder shared the above correspondence from INPEX with a colleague. Stakeholder requested to be informed when INPEX have a proposal for workshops, and expressed interest in continuing to work with INPEX on these processes. Stakeholder suggested input from regional management and those who know the OWR plans at the workshop.	No	Not a relevant matter - general correspondence only.
	18/06/2021	Email / letter to stakeholder from INPEX	Advised stakeholder that the 24th June session is for the APPEA OSWG and AMOSC to provide the DoT, a briefing on the whole Regional OPEP planning process which the upstream industry has developed. Advised stakeholder the session is also a background/overview session to then lead into workshops. Expressed intention for the Browse ROPEP workshop to be run first, mid/late July if possible. Requested stakeholder to reach out to the Kimberley regional DBCA team to identify potential windows of opportunity. Informed stakeholder that a more detailed proposal for the consultation workshops with AMOSC will be developed, and hopefully be available to share shortly.	No.	N/A - consultation sent by INPEX
	23/06/2021	Email / letter to stakeholder from INPEX	INPEX provided a presentation describing the abovementioned ROPEPs for consideration.	Yes - Region Oil Pollution Emergency Plans (ROPEPs) (file name: "BROPEP WA DoT June 2021")	N/A - consultation sent by INPEX
	24/06/2021	Workshop	Meeting held with WA DoT, AMOSC and APPEA oil spill working group members, including INPEX, BHP, Shell. High level presentation of Regional OPEP concepts. WA DoT agreed with processes and agreed to continue consultation with APPEA OSWG member companies regarding development of Regional OPEPs. INPEX committed to sending WA DoT additional information specific to the BROPEP, for their consideration ahead of another BROPEP specific workshop.	Yes - Regional OPEPs presentation - on behalf of INPEX and APPEA OSWG - presented to WA DoT on 24 June 2021.	Yes - workshop/briefing was to WA DoT, to request further engagement on Regional OPEP concept. WA DoT agreed to future engagement and collaboration on Regional OPEPs.
	6/07/2021	Email / letter to stakeholder from INPEX	INPEX provided workshop presentation materials (Shoreline Response and Oiled Wildlife Response) ahead of the scheduled workshop.	Yes - Browse Region Oil Pollution Emergency Plan (BROPEP) - Shoreline and OWR Workshop	N/A - consultation sent by INPEX
	7/07/2021	Email / letter from stakeholder	Stakeholder acknowledged receipt of presentation as pre reading material prior scheduled workshop on 27th of July 2021	No.	Not a relevant matter - general correspondence only.
	27/07/2021	Workshop	Workshop on 27 July 2021 with WA DoT and WA DBCA, and APPEA Oil Spill Working Group members (INPEX, BHP and Shell) discussed workshop presentation materials. Key discussion outcomes: - WA DoT SCAT - maximum capability statement - peak of 3 'roving' SCAT teams, and 3 SCAT teams incorporated as part of remote shoreline response units. - WA DoT - maximum capability statement - remote shoreline response - peak of 3 remote shoreline response units (total 44 personnel, including OWR). - WA DBCA - as part of each roving SCAT team, one OWR advisor. As part of each shoreline response unit, 8 OWR personnel including 1 vet. - WA DBCA - Wildlife welfare is the key priority. Based on the species at risk in the Kimberly and their likely ability to survive entire first-aid, OWR cleaning and rehabilitation processes, other wildlife welfare options would be credible. No requirement to plan for large-scale remote OWR capture, cleaning and rehabilitation.	No.	Relevant matter - agreed outcomes incorporated into the BROPEP documentation.
	27/07/2021	Email / letter from stakeholder to INPEX	Following the workshop, 2 emails, from Ray Bukholz (WA DoT) provided outcomes from WA DoT/Shell Browse Island spill response exercise from 2019. Attachments demonstrate the planning and maximum field capability requirements for remote shoreline response units, which are aligned with the outcomes of the 27 July workshop.	Yes.	Relevant matter- agreed outcomes incorporated into the BROPEP documentation.
Protection Priority Identification					
Subject - WA DoT protection priorities process	28/07/2021	Email / letter to stakeholder from INPEX	INPEX provided wording on to be included in the BROPEP regarding the process WA DoT use to define protection priorities and requested feedback.	No	N/A - consultation sent by INPEX
	28/07/2021	Email / letter from stakeholder	WA DoT advised that they will respond to the query by next week	No	Not a relevant matter - general correspondence only.
	5/08/2021	Email / letter from stakeholder	WA DoT advised INPEX to state "WA State waters, during an incident, it is expected that the protection area priorities will be determined by the Department of Transport as the Controlling Agency".	No	Not a relevant matter - general correspondence only.
	6/08/2021	Email / letter to stakeholder from INPEX	Following telephone discussion with WA DoT, INPEX provided written record of WA DoT process for protection priority identification, for incorporation into the BROPEP.	No	Not a relevant matter - general correspondence only.
	19/08/2021	Email / letter from stakeholder	WA DoT provided a text clarification to the proposed wording	No	Relevant matter - agreed outcomes incorporated into the BROPEP documentation.
NT OSCP					

STAKEHOLDER	Date of Correspondence	Type of Correspondence	Summary of Correspondence / Objection / Claim / Query	Attachments	Assessment of Merit
NT Department of Environment, Parks and Water Security (EPaWS) - Marine Pollution *Subject - INPEX oil spill consultation with NT government*	17/05/2021	Email / letter to stakeholder from INPEX	Follow up email following conversation confirming understanding that DIPL has a final draft of the revised NT OSCP which is shortly going out for consultation via the APPEA OSWG. Confirmed INPEX representative is heading to Darwin in the last week of June and interested in a meeting to discuss INPEX's oil spill arrangements with relevant members of the NT government, and the way forward for bridging to the new NT OSCP revision. Specifically noted: • INPEX's new Browse Basin Regional OPEP (in draft), covering all of INPEX's offshore activities between Broome and Darwin (Commonwealth waters). • Cross Jurisdictional Arrangements in relation to INPEX Regional OPEP and the NT OSCP. • INPEX's revised IMT operating model with AMOSC. • Provide an update on some new information with demonstrates a revision/downgrading of the oil spill risk associated with the Ichthys Gas Export Pipeline • Bridging the INPEX Nearshore OPEP to the revised NT OSCP and Darwin Port OPEP.	No	N/A - consultation sent by INPEX
	Undated	Email / letter from stakeholder	Stakeholder informed other Department members that an INPEX representative is coming to Darwin to meet with anyone available to provide updates and discuss the following: INPEX's new Browse Basin Regional OPEP (in draft), covering all of INPEX's offshore activities between Broome and Darwin (Commonwealth waters) – this will be part of the formal consultation INPEX must undertake with relevant stakeholders, as part of INPEX's EP submissions/revisions process with NOPSEMA. Identified intention to discuss Cross Jurisdictional Arrangements, in relation to INPEX Regional OPEP and the NT OSCP; in addition to INPEX's revised IMT operating model with AMOSC. INPEX will provide an update on some new information with demonstrates a revision/downgrading of the oil spill risk associated with the Ichthys Gas Export Pipeline. INPEX will also provide information on bridging the INPEX Nearshore OPEP to the revised NT OSCP and Darwin Port OPEP.	No	Not a relevant matter - general correspondence only.
	21/06/2021	Email / letter to stakeholder from INPEX	INPEX provided technical comments on the Draft NT OSCP from the Ichthys LNG perspective and from the offshore / cross-jurisdiction perspective.	No	N/A - consultation sent by INPEX
	30/06/2021	Email / letter to stakeholder from INPEX	INPEX provided stakeholder with the key points from the meeting: Confirmation that the current Controlling Authority under the NT OSCP is the NT Dept Environment, Parks and Water Security (DEPAWS). The next meeting with the Territory Emergency Management Council (TEMC) is occurring in August 2021, which will hopefully lead to formalisation/sign-off of new Controlling Authority. Discussion held regarding NT's actual spill response capability. NT Govt identified that the intent for driving improvement/change in the NT spill response capability includes training for a multi-agency team of spill response trained personnel, and also potential for use of NT Rangers for spill response/observations. Stakeholder confirmed intent to include in the NT OSCP, a map of the boundaries of the Local Tactical Plans/ Local OSCPs (aligned with local govt jurisdictions), and confirmed the Local Tactical OSCPs will be bridged to the zones defined in the NT Oiled Wildlife Response Plan. Stakeholder confirmed intent is to include updated organisational charts of the various government/non-government organisations in the revised NT OSCP. Stakeholder confirmed they will clarify with DEPAWS the intent around use of dispersant in NT waters/Darwin Harbour – as this may open up additional first strike response capabilities/options. Discussion held regarding cross-jurisdiction response arrangements – the WA DoT model could be used by the NT Govt, for 'unified command' or alternative models. INPEX to share WA DoT industry guidance note. Discussion held regarding I-LNG first strike capability, and it's integration with the Darwin Port OSCP – It was noted that INPEX prepared the Nearshore OPEP for regulatory approval in 2016, and since then, although some joint work was done around INPEX first strike capability (zoom-boom storage/deployment location), there has been no formal consultation with the Darwin Port following the release of the Darwin Port OSCP in 2018, to confirm integration arrangements between the two documents. INPEX should undertake formal consultation to double-check the alignment / understanding of the INPEX and Darwin Port response capabilities and command/control arrangements and integration, in the respective INPEX NS OPEP & Darwin Port OSCP. Conduct of a joint exercise to confirm arrangements/integration would also be desirable. Ongoing consultation will occur in relation to: • INPEX Offshore OPEPs • INPEX and NT Govt agreed to maintain current 'cross-jurisdictional response arrangements' as per current Drilling / URF OPEPs, within the new INPEX Regional OPEP – for submission to NOPSEMA in August 2021. • INPEX to share the WA DoT cross-jurisdiction response arrangements/industry guidance note with NT Govt, for their consideration/use in the NT OSCP (see attached). INPEX to maintain ongoing consultation regarding cross-jurisdictional response (as per routine INPEX stakeholder consultation as per OPGGS E Reg requirements for EPs/OPEPs). Consultation to include: • DPAWS as the current hazard mgt authority • Territory Emergency Services / Territory Emergency Management Council • INPEX NS OPEP INPEX should conduct direct consultation with Darwin Port to re-confirm the I-LNG first strike capability, arrangements & integration, with Darwin Port OSCP. Regional Harbour Master – Anil Chadha - requested that he is provided the outcome of that consultation	Yes - Offshore Petroleum Industry Guidance Note - Marine Oil Pollution: Response and Consultation Arrangements.	N/A - consultation sent by INPEX
	19/08/2021	Phone call	Phone call between INPEX and Raechel Squired - confirmed no further updates regarding progress on the NT OSCP. Territory Emergency Management Council due to meet late August 2021.	No.	Not a relevant matter - general correspondence only.

SPECIFIC ACTIVITY/ASPECT ENGAGEMENT - DOMESTICALLY SOURCED VESSELS BIOSECURITY RISK ASSESSMENT

STAKEHOLDER	Date of Correspondence	Type of Correspondence	Summary of Correspondence / Objection / Claim / Query	Attachments	Assessment of Merit
Department of Agriculture, Water and Environment (DAWE) – Biosecurity (Marine Pests) (Vessels, aircraft and personnel) (Cwth)	5/07/2021	Email / letter to stakeholder from INPEX	Follow up email to advise stakeholder that INPEX is planning to amend some of the controls related to Invasive Marine species. Advised that INPEX does not believe the supply/support vessels are acting as a vector for spread of known pests between the facility and the Ports of Broome and Darwin. Requested feedback on INPEX's management of D. perlucidum and whether INPEX might be able to reduce the level of scrutiny applied to support vessels when they come on hire domestically.	Yes - IMS monitoring results.	N/A - consultation sent by INPEX
Department of Primary Industries and Regional Development (DPIRD) - Biosecurity section formerly Department of Fisheries	8/03/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility (Operation) Environment Plan. Inquired whether DPIRD would be interested in having a discussion to confirm that the text INPEX includes in the EP revision remains ALARP and acceptable to DPIRD. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder reminded that the Ichthys LNG offshore facilities operations are currently being undertaken in accordance with an environment plan accepted by NOPSEMA in 2016, and informed stakeholder that INPEX now plans to submit revisions of the Ichthys Offshore Facility (Operation) EP to NOPSEMA in Q4 2021. 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
	8/03/2021	Email / letter from stakeholder	DPIRD responded to confirm interest in discussing above mentioned biosecurity matters.	No	Not a relevant matter - general correspondence only.
	10/05/2021	Email / letter to stakeholder from INPEX	INPEX provided an update stating the annual review of opportunistic footage had been completed. INPEX informed stakeholder that an opportunity arose to conduct an IMS survey on the offtake support vessel on June 8-9th. INPEX informed that the vessel had been working alongside the FPSO and CPF for over three years and does supply runs to Broome, and this provided an opportunity to see any growth/IMS that may have developed when the vessel comes out of the water. INPEX requested to discuss findings mid-June.	No	N/A - consultation sent by INPEX
	17/06/2021	Email / letter to stakeholder from INPEX	Follow up email send to advise DPIRD that observations from the last 4 years show no signs of d.perlucidum on any of INPEX's support/supply vessels. Requested a meeting with the stakeholder to discuss implications for INPEX's domestic vessel risk assessment process and understand any new/recent data DBCA may have.	No	N/A - consultation sent by INPEX
	Undated	Email / letter to stakeholder from INPEX	INPEX sent a meeting invite to discuss the data INPEX has gathered over the last 4 years. INPEX informed stakeholder it believes the support vessels that are highly mobile are not a vector for the transport of pests domestically and would like to revise their controls in the EP to reflect this. INPEX advised a summary would be sent prior to the meeting.	No	N/A - consultation sent by INPEX
	28/06/2021	Meeting with stakeholder	Meeting cancelled.	No	Not a relevant matter - general correspondence only.
	29/06/2021	Email / letter to stakeholder from INPEX	INPEX provided stakeholder with a presentation detailing the current status of IMS in relation to project activities, a summary of new data collected and the proposed amendments to controls and frequency of monitoring.	Yes - Stakeholder consultation- IMS monitoring results	N/A - consultation sent by INPEX
NT Department of Industry, Tourism and Trade (DITT) - Fisheries, Biosecurity Section	5/07/2021	Email / letter to stakeholder from INPEX	Email and fact sheet sent to stakeholder with details on proposed INPEX-operated Ichthys LNG field offshore operations activities from 2021 to 2025, as part of the development of five-year revisions of Offshore Facility (Operation) Environment Plan. Informed stakeholder the key proposed operations activities associated with the offshore facility: - The Maersk Deliverer commenced a second phase of drilling in October 2020. This activity involves drilling 15 new wells and will continue through until 2023. - During the next five years the interlinked facilities will undertake shutdown periods to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. - A booster compression module will be placed on the west side of the CPF main deck to account for the future decline in pressure of reservoirs. - The CPF and FPSO are being supplied by support vessels that transfer goods and waste to and from Darwin and/or Broome approximately twice a week. - In addition to normal operations (i.e. production and processing of gas and offtake operations), during the course of the five years periodic shutdown periods will occur in order to conduct maintenance activities and to allow for the installation and commissioning of new equipment and infrastructure. Stakeholder was provided with specific information on INPEX's management of D. perlucidum.	Yes - activity fact sheet and IMS monitoring results.	N/A - consultation sent by INPEX
NT Department of Industry, Tourism and Trade (DITT) - Fisheries, Biosecurity Section & Department of Primary Industries and Regional Development (DPIRD) - Biosecurity section formerly Department of Fisheries	6/07/2021	Email / letter from stakeholder	NT DITT advised that marine pest ascidian D. perlucidum has spread around the coast of Australia and has been found in multiple locations along the WA, NT, Qld and NSW coast. It is considered not possible to control and to the best of the Department's knowledge all affected jurisdictions are not imposing any controls. Advised that this does not mean that INPEX should remove all biofouling risk management on domestic vessels and movements. A bio-fouled vessel travelling between Darwin, Broome and your gas site is still a potential risk. Advised that there is a national push towards vessels being pro-active and having operational biofouling management plans to help minimise biofouling issues. Advised that there are a range of vessel biofouling management assessment systems available that could be used to help in the assessment of vessel biofouling risks without the need to engage an IMS expert - as long as the vessel comes out with a low risk rating. Advised that there is a program called "Vessel Check" that was initially developed by WA fisheries that is now a commercial product that may be worth considering for this purpose.	No	Relevant matter- Request raised by stakeholder is relevant to the petroleum activity and/or the stakeholder's functions, interests or activities. However, stakeholder copied in WA DPIRD. Ongoing consultation occurred with WA DPIRD and NT DITT collaboratively. Biosecurity matters identified by the stakeholder have been addressed in Section 7.5.1 of the EP. INPEX responded on 06/07/2021 (see below).

STAKEHOLDER	Date of Correspondence	Type of Correspondence	Summary of Correspondence / Objection / Claim / Query	Attachments	Assessment of Merit
	6/07/2021	Email / letter to stakeholder from INPEX	INPEX thanked DITT for the response and provided the following clarifications on what INPEX was proposing: INPEX was hoping to remove the requirement for assessing short term mobile vessels with an IMS expert if they mobilise from within Australian waters, given that we have now done this for four out four of our supply vessels and none have shown any IMS of concern it seems an excessive control when the existing operating profile and antifoul coatings/management plans maintain the vessels' risk status. INPEX still plan to do the following for all our vessels: antifoul coatings, biofouling management plans (based on IMO guidance), and assessing visual observations from subsea footage for indication of IMS on our facilities. Confirmed that INPEX continues to strive toward best practice in relation to Biofouling management controls. INPEX offered to meet to discuss the revised EP and controls in detail, noting the offer has also been extended to DPIRD Biosecurity.	No	N/A - consultation sent by INPEX
	14/07/2021	Email / letter from stakeholder	Stakeholder agreed to remove if "the existing operating profile and antifoul coatings/management plans maintain the vessels' risk status". Stakeholder confirmed that using a program like "Vessel Check" can be considered as it assesses a range of factors including the vessels biofouling management and gives the vessel a risk rating.	No	Not a relevant matter - general correspondence only.
	14/07/2021	Email / letter to stakeholder from INPEX	INPEX contact confirmed that vessels are following 'best practice' set out by the International Maritime Organisation (IMO) guidelines, and suggested a video call to discuss vessel check prior year 5.	No	N/A - consultation sent by INPEX
	16/07/2021	Email / letter to stakeholder from INPEX	INPEX requested confirmation from DITT Fisheries and DPIRD that medium and low risk (as defined by Vessel check) are acceptable to operate within WA/NT waters.	No	N/A - consultation sent by INPEX
	22/07/2021	Email / letter from stakeholder	DITT Fisheries responded noting this was the case (i.e. low and medium risk vessels are acceptable. DITT further noted that the actual marine pest biofouling risk posed by the vessel probably does not change if the vessels are just travelling between Broome – Darwin – and production sites. DITT Fisheries have not detected any marine pest of concern at any of these locations so vessel movement between them is a low risk.	No	Relevant matter- DITT confirmed acceptability and risk of" medium" and "low" risk vessels in vessel check represent a LOW risk in relation to the movements occurring that support the Ichthys facilites. This acknowledgement is incorporated into the stakeholder feedback section regarding the proposed controls in Section 7.5.1
	23/07/2021	Email / letter to stakeholder from INPEX	INPEX contact thanked DITT Fisheries and noted that this would be considered in the EP revision.	No	N/A - consultation sent by INPEX
	28/07/221	Email / letter to stakeholder from INPEX	INPEX followed up with DPIRD to confirm alignment with advice received from DITT (22 July 2021).	No	N/A - consultation sent by INPEX
	28/07/2021	Email / letter from stakeholder	DPIRD confirmed they were aligned/agreed with the response provided by DITT.	No	Relevant matter- WA DPIRD confirmed acceptability and risk of" medium" and "low" risk vessels in vessel check represent a LOW risk in relation to the movements occurring that support the Ichthys facilites. This acknowledgement is incorporated into the stakeholder feedback section regarding the proposed controls in Section 7.5.1
	28/07/2021	Email / letter to stakeholder from INPEX	INPEX responded thanking DPIRD (with DITT in Copy) and provided the text included in the EP in relation to domestic vessel biosecurity risk assessment: *The annual reports and vessel inspection reports were provided to WA DPIRD, DAWR Aquatic Branch and DITT Fisheries, for information. A summary of proposed changes to the IMS monitoring program and domestic risk assessment process were provided for discussion. The stakeholders acknowledged (in the context of the controls applied by INPEX) that actual marine pest biofouling risk posed by support vessels operating vessel between Broome – Darwin – and offshore facilities is a low risk and that no IMS of concern have been identified to date from these activities.*	No	N/A - consultation sent by INPEX