gorgon gas development

gorgon and jansz feed gas pipeline and wells operations (commonwealth waters) environment plan

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1 environment plan summary

This *Gorgon and Jansz Feed Gas Pipeline and Wells Operations (Commonwealth Waters) Environment Plan Summary* (Table 1-1) has been prepared from material provided in this Environment Plan, and as required by Regulation 11(4) of the Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009.

Table 1-1: Environment Plan summary

Regulation	EP summary material requirement	Relevant section of the EP
11(4)(a)(i)	the location of the activity	Section 2.2, Section 3.1.1
11(4)(a)(ii)	a description of the receiving environment	Section 4, Ref. 1^
11(4)(a)(iii)	a description of the activity	Section 3
11(4)(a)(iv)	details of environmental impacts and risks	Section 6
11(4)(a)(v)	a summary of the control measures for the activity	Section 6
11(4)(a)(vi)	a summary of the arrangements for ongoing monitoring of the titleholder's environmental performance	Section 7
11(4)(a)(vii)	a summary of the response arrangements in the oil pollution emergency plan	Section 6.15, Ref. 2*
11(4)(a)(viii)	details of consultation already undertaken, and plans for ongoing consultation	Section 2.6
11(4)(a)(ix)	details of the titleholder's nominated liaison person for the activity	Section 2.4

^ *Available at: appendix d*
* *Available publicly at: https://docs.nopsema.gov.au/A748691*

2 introduction

2.1 Overview

On behalf of the Gorgon Joint Venturers, Chevron Australia Pty Ltd (CAPL) is operating the Gorgon and Jansz–Io gas fields which includes offshore production wells and Feed Gas Pipeline infrastructure. The Feed Gas Pipeline infrastructure gathers and transports gas to the Gorgon Gas Treatment Plant (GTP) on Barrow Island.

This Environment Plan (EP) documents the assessment and management of potential environmental impacts and risks associated with operating the Gorgon and Jansz–Io production wells and Feed Gas Pipelines, including in-fill commissioning and start-up activities, in Commonwealth waters; this includes infrastructure and activities associated with both the Gorgon Foundation Project (GFP) and Gorgon Stage 2 (GS2).

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

2.2 Location

The Gorgon gas field is located within production licences WA-37-L and WA-38-L, ~130 km off the north-west coast of Western Australia (WA), and ~65 km north-west of Barrow Island (Figure 2-1).

The Jansz–Io gas fields are located within production licences WA-36-L, WA-39-L and WA-40-L ~200 km off the north-west coast of WA in water depths of ~1350 m (Figure 2-1).

Detailed information regarding the location and layout of subsea hydrocarbon infrastructure is included in Section 3.1.

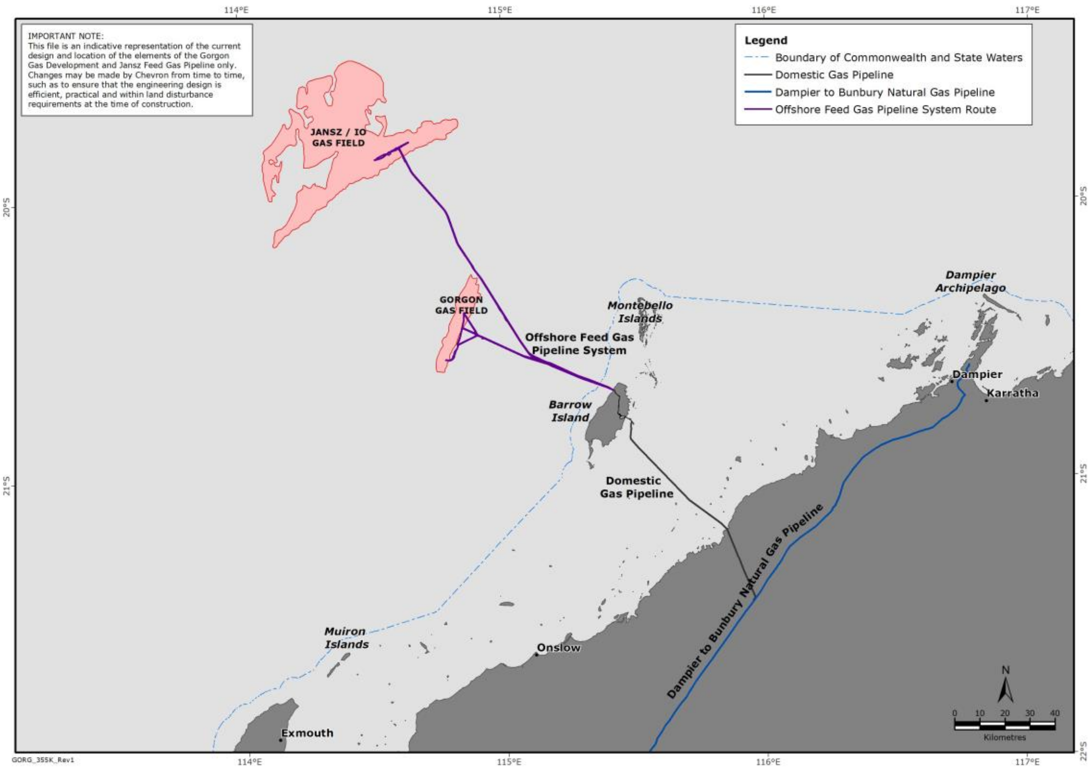


Figure 2-1: Location of Gorgon and Jansz–Io gas fields

2.3 Scope

2.3.1 In scope

This EP addresses activities in Commonwealth waters associated with the Gorgon and Jansz–Io production wells and the Feed Gas Pipeline (the 'petroleum activity'); this hydrocarbon system is further described in Section 3.2. Specifically, this EP addresses the following primary activities associated with the Gorgon and Jansz–Io hydrocarbon system:

- commissioning and start-up (Section 3.3)
- operations (Section 3.4)
- inspection, maintenance, and repairs (IMR) (Section 3.5)
- decommissioning (Section 3.6)
- field support (Section 3.7).

2.3.2 Out of scope

The following activities are excluded from the scope of this EP:

- installation and pre-commissioning activities (associated with the GFP) completed in accordance with the NOPSEMA-accepted *Offshore Feed Gas Pipeline System Installation Management Plan*[1] (Ref. 4)

[1] Activities under this EP have been completed and the notification of completion has been accepted by NOPSEMA as per the requirements of Regulation 25A of the OPGGS(E)R.

- installation and pre-commissioning activities (associated with GS2) which are covered under the NOPSEMA-accepted *Pipeline and Subsea Infrastructure Installation and Pre-commissioning Environment Plan* (Ref. 5)
- drilling, completion, and well maintenance activities (associated with both the GFP and GS2) which are covered under the NOPSEMA-accepted *Gorgon and Jansz-Io Drilling, Completions and Well Maintenance Program Environment Plan* (Ref. 6)
- commissioning, start-up and operation activities within State waters which are covered under the NOPSEMA-accepted *Gorgon and Jansz Feed Gas Pipeline Operations Environment Plan (State)* (Ref. 7)
- vessels (including emergency response vessels) transiting to or from the operational area (OA) (refer to Section 3.1.1 for definition of the OA); these vessels are deemed to be operating under the Commonwealth *Navigation Act 2012* and are not performing the petroleum activity
- end of facility life (EOFL) decommissioning and removal of infrastructure under Section 572(3) of the Commonwealth OPGGS Act; these activities are not scheduled to occur within the 5-year in-force period of this EP (refer to Section 3.6.1).

2.4 Titleholder details

CAPL is the nominated titleholder of the production and pipeline licences on behalf of the titleholder companies listed in Table 2-1. Regulation 286A of the OPGGS Act requires notification is provided to NOPSEMA and the National Offshore Petroleum Titles Administrator (NOPTA) if there is a change to one of the registered titleholders or contact details for the registered titleholders; this notification is to occur within 30 days of such a change.

The contact details for the nominated liaison person for this EP is listed in Table 2-2. Regulation 15(3) of the OPGGS(E)R requires that CAPL notifies NOPSEMA if the titleholder’s nominated liaison person or contact details for the nominated liaison person changes.

Table 2-1: Titleholder details

Titles	Details	Titleholders	Nominated Titleholder	Address
WA-36-L WA-37-L WA-38-L WA-39-L WA-40-L WA-19-PL WA-20-PL	Production Licence Production Licence Production Licence Production Licence Production Licence Pipeline Licence Pipeline Licence	Chevron Australia Pty Ltd Chevron (TAPL) Pty Ltd Mobil Australia Resources Company Pty Limited Shell Australia Pty Ltd Osaka Gas Gorgon Pty Ltd Tokyo Gas Gorgon Pty Ltd JERA Gorgon Pty Ltd	Chevron Australia Pty Ltd (ACN: 086 197 757)	250 St Georges Terrace, Perth WA 6000

Table 2-2: Titleholders' nominated liaison person

Name	
Company	Chevron Australia Pty Ltd
ACN	086 197 757
Position	Gorgon Operations Manager / PGPA Operations Manager
Business Address	250 St Georges Terrace, Perth WA 6000
Telephone Number	+61 8 9216 4000
Email Address	ABUEnvPlanInfo@chevron.com

2.5 Environmental management framework

CAPL's operations are managed in accordance with Chevron Corporation's Operational Excellence Management System (OEMS), which is described in Section 7.

2.5.1 Environmental policy

CAPL's commitment to environmental management in all aspects of operations is documented in Chevron Corporation's Operational Excellence (OE) Policy 530 (appendix a).

2.5.2 Legislative framework

In accordance with Regulation 13(4) of the OPGGS(E)R, the legislative framework relevant to the petroleum activity is described in Table 2-3 and Table 2-4.

Table 2-3: Commonwealth legislative requirements

Legislation	Description	Requirements relevant to the risks associated with the petroleum activity	Demonstration of how requirements are met
Australian Maritime Safety Authority Act 1990	Aims to promote maritime safety, protect the marine environment from pollution from ships or other environmental damage caused by shipping, and provide for a national search and rescue service	Requirements include the involvement of the Australian Maritime Safety Authority (AMSA) in response to relevant spill events	Roles and responsibilities are described in the Oil Pollution Emergency Plan (OPEP) (Ref. 2).
Biosecurity Act 2015 Biosecurity Regulations 2016	Provides biosecurity protection in Australian waters beyond territorial limits	Pre-arrival information must be reported through the Maritime Arrivals Reporting System (MARS) before arrival in Australian waters	Section 6.8
		Australian Ballast Water Management Requirements (Ref. 8)	
Environmental Protection Act 1986 (EP Act)	Provides for the prevention, control, and abatement of	The Gorgon Gas Development was approved under	Section 6.5 and Section 6.6

Legislation	Description	Requirements relevant to the risks associated with the petroleum activity	Demonstration of how requirements are met
	pollution and environmental harm, for the conservation, preservation, protection, enhancement, and management of the environment.	Part IV of the EP Act and is subject to approval conditions. The conditions are intended for the management of the Gorgon Gas Development as a whole, including activities which are beyond the scope of this EP.	
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) EPBC Regulations 2000	Provides for the protection and management of nationally and internationally important flora, fauna, ecological communities, and heritage places	The EP must describe matters protected under Part 3 of the EPBC Act and assess any impacts and risks to these protected matters	Section 4 and Section 6
		EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans	Section 6.2 and Section 6.7
		Injury or fatality caused to EPBC-listed fauna shall be reported	Section 7.4.2
		The Gorgon Gas Development was approved under EPBC Act and is subject to approval conditions. The conditions are intended for the management of the Gorgon Gas Development as a whole, including activities which are beyond the scope of this EP.	Section 6.6
Navigation Act 2012	Provides for vessel and seafarer safety, and marine pollution prevention	Notice to Mariners	Section 6.1 and Section 6.13
Navigation Act 2012 *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*	Gives effect to the requirements under the International Convention for the Prevention of Pollution from Ships	Marine order 30—Prevention of collisions	Section 6.13
		Marine order 91—Marine pollution prevention—oil	Section 6.9, Section 6.12 and Section 6.13

Legislation	Description	Requirements relevant to the risks associated with the petroleum activity	Demonstration of how requirements are met
Protection of the Sea (Harmful Anti-fouling Systems) Act 2006 Various marine orders	(MARPOL 73/78) in Australia	Marine order 95—Marine pollution prevention—garbage	Section 6.9 and Section 6.11
		Marine order 96—Marine pollution prevention—sewage	Section 6.9
		Marine order 97—Marine pollution prevention—air pollution	Section 6.4
		Marine order 98—Marine pollution prevention—anti-fouling systems	Section 6.8
National Greenhouse and Energy Reporting Act 2007 (NGER Act)	The NGER Act establishes the national scheme for the reporting of greenhouse gas emissions, energy production and energy consumption.	Greenhouse gas emissions, energy consumption and energy production from the facility will be reported under the NGER Act.	Section 6.5
Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGGS Act) OPGGS Environment Regulations 2009 (OPGGS(E)R)	The OPGGS(E)R under the OPGGS Act requires a titleholder to have an accepted EP in place prior to commencement of a petroleum activity The regulations ensure petroleum activities are undertaken in an ecologically sustainable manner in accordance with an EP	An EP for a petroleum activity must be accepted by NOPSEMA before activities commence	This EP, including the OPEP (Ref. 2) and Operational and Scientific Monitoring Plan (OSMP) (Ref. 3)
OPGGS (Resource Management and Administration) Regulations 2011	These regulations require a titleholder to have an accepted Well Operations Management Plan (WOMP) in place The purpose of a WOMP is to ensure systems are in place to manage well integrity and well activities	A WOMP for a petroleum well activity must be accepted by NOPSEMA before activities commence	WOMP (Ref. 9)
Underwater Cultural Heritage Act 2018	Provides protection for shipwrecks, sunken aircraft and other cultural heritage	Identification of the presence of protected cultural heritage sites and assessment of	Section 4 and Section 6

Legislation	Description	Requirements relevant to the risks associated with the petroleum activity	Demonstration of how requirements are met
	sites in Australian waters	any impacts and risks to these sites	

Table 2-4: Standards and guidelines

Standard / guideline	Description	Requirements relevant to the risks associated with the petroleum activity	Demonstration of how requirements are met
Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species (Ref. 10)	International Maritime Organization (IMO) guidelines for global management of biofouling	Requires a biofouling management plan and record book to be available and maintained	Section 6.8
National Light Pollution Guidelines for Wildlife, including Marine Turtles, Seabirds and Migratory Shorebirds (Ref. 11)	Outlines the process to be followed where there is the potential for artificial lighting to affect wildlife; applies to new projects, lighting upgrades and where there is evidence of wildlife being affected by existing artificial light	The EP must assess if artificial lighting is likely to affect wildlife and identify the management tools to minimise and mitigate impacts and risks	Section 6.5

2.6 Stakeholder consultation

2.6.1 Methodology

CAPL followed the following process to undertake consultation for this petroleum activity:

- identify relevant stakeholders
- provide sufficient information to enable stakeholders to understand how this activity may affect their functions, interests, or activities
- assess the merit of any objections or claims raised by the stakeholders
- provide a response to the objection or claim, and ensure this is captured in the EP.

This methodology is guidance sourced from:

- NOPSEMA's *Environment plan decision making* guideline (Ref. 12)
- NOPSEMA's *Consultation with Commonwealth agencies with responsibilities in the marine area* guideline (Ref. 13)
- NOPSEMA's *Considerations for five-year environment plan revisions* information paper (Ref. 14)
- Australian Petroleum Production and Exploration Association's (APPEA's) draft *Stakeholder Consultation and Engagement Principles and Methodology for Environment Plans* (Ref. 15).

A process for ongoing consultation is described in Section 2.6.5.

2.6.2 Identification of relevant stakeholders

Establishing relevance under the OPGGS(E)R depends on the nature and scale of the petroleum activity and its associated impacts and risks. In accordance with Regulation 11A of the OPGGS(E)R, a 'relevant person' is defined as:

- each department or agency of the Commonwealth to which the activities to be carried out under the EP, or the revision of the EP, may be relevant
- each department or agency of a State or the Northern Territory to which the activities to be carried out under the EP, or the revision of the EP, may be relevant
- the department of the responsible State Minister, or the responsible Northern Territory Minister
- a person or organisation whose functions, interests, or activities may be affected by the activities to be carried out under the EP, or the revision of the EP
- any other person or organisation that the titleholder considers relevant.

With regards to Commonwealth agencies, advice provided in the NOPSEMA guideline (Ref. 13) has been taken into consideration in identifying relevance with respect to the activities provided for in this EP.

To facilitate successful stakeholder interaction appropriate to the nature and scale of the activities under the EP, CAPL have adopted the approach that there must be a direct connection between the activities that the EP provides for and the potential effect to the functions, interests, or activities of a department, person, or organisation. Based on the impact and risk assessments undertaken in this EP, CAPL understands that the impacts of the planned activities are limited to the vicinity of the OA, thus persons or organisations directly connected with functions, interests, or activities within the OA have been taken to be relevant.

CAPL acknowledges that the EP also includes a risk assessment for two emergency events (unplanned releases from a vessel collision or major defect) that have the potential to effect areas extending beyond the OA. In the event of an emergency event occurring, additional stakeholder consultation would be undertaken in accordance with Section 2.6.5.1.

Since commencing the GFP, CAPL has developed and maintained a list of stakeholders who are considered relevant to the potential impacts and risks associated with the Gorgon Gas Development. CAPL engaged with stakeholders in 2014/2015 before starting the commissioning and start-up activities associated with the GFP and submission of the original version of this EP. As per NOPSEMA guidance (Ref. 14), this list has been reviewed to ensure that any new 'relevant person' is also included in the stakeholder consultation process as part of this current 5–year revision to the EP. For this 5–year EP revision, CAPL have also elected to use the Western Australian Fishing Industry Council's (WAFIC) oil and gas consultation service to help determine relevant commercial fisheries and fishers as well as review and distribute fishery-specific consultation material. The relevant stakeholders identified for consultation as part of this EP are listed in Table 2-5.

Table 2-5: Relevant stakeholders

Group	Stakeholder
Commonwealth departments or agencies	• Australian Fisheries Management Authority (AFMA) • Australian Hydrographic Office (AHO) • Australian Maritime Safety Authority (AMSA) • Department of Agriculture, Water and the Environment (DAWE) – Biosecurity – Fisheries • Department of Defence
State departments or agencies	• Department of Biodiversity, Conservation and Attractions (DBCA) • Department of Primary Industries and Regional Development (DPIRD) • Department of Transport (DoT) • Department of Mines, Industry Regulation and Safety (DMIRS)
Commonwealth fisheries (peak bodies)	• Australian Southern Bluefin Tuna Industry Association • Commonwealth Fisheries Association • Tuna Australia • Western Australian Fishing Industry Council (WAFIC) • Pearl Producers Association • Bilyara Holdings Mackerel Area 2 License Holder
Commercial fisheries	• West Coast Deep Sea Crustacean • Mackerel Managed Fishery (Area 2) • Onslow Prawn Managed Fishery • Pilbara Crab Managed Fishery • Pilbara Line Fishery • Pilbara Trap Managed Fishery • North West Slope Trawl Fishery • Western Tuna and Billfish Fishery
Recreational fisheries	• RecFishWest
Other petroleum operators	• Santos Ltd • Woodside Burrup Pty Ltd
Emergency response	• AECOM • Australian Marine Oil Spill Response Centre • Gorgon HSE/Emergency Management Specialists • DoT Oil Spill Response Coordination (OSRC) Unit • Oil Spill Response Limited (OSRL) • BMT • GHD • Cleanaway • Port Authorities

2.6.3 Provision of material

Under NOPSEMA's *Environment plan decision making* guideline (Ref. 12), stakeholders must be provided with sufficient information to enable them to understand how a petroleum activity may affect their functions, interests, or activities.

CAPL sent a detailed fact sheet to stakeholders on 01 April 2021.This fact sheet summarised the activity, aspects, and the proposed control measures to manage impacts and risks. WAFIC was also used to convey a factsheet, tailored for the commercial fishing sector (which also incorporated additional information as requested by WAFIC [as described in the stakeholder engagement log within the sensitive information report] prior to the release of the factsheet to fishery stakeholders), on 31 March 2021. Given WAFIC is the peak industry body representing commercial fisheries in WA, their review and advice on the factsheet is therefore considered by CAPL as assurance that the factsheet provided sufficient information to the fishery stakeholders. A copy of the consultation materials is included in appendix b.

The content of the factsheet focussed on the continued presence of the Gorgon and Jansz infrastructure (including that the new GS2 was part of the original field development plans) and the ongoing vessel operations to support IMR activities. Given that IMR schedules within this EP are determined using a risk-based approach, specific details on frequency and duration of vessel activity could not accurately be supplied as part of this initial material. However, Section 2.6.5 describes the process for ongoing consultation, including the triggers for when additional consultation in relation to specific IMR activities will occur. The same assessment and response process applies to any objections and claims received during ongoing consultation (Section 2.6.5) as it does for stakeholder consultation undertaken during the preparation of this EP.

All records and responses from relevant persons were included in a sensitive information report provided separately to NOPSEMA to preserve the privacy of those persons or organisations consulted. Specifically, these records and responses were considered to contain personal information (as defined by the Commonwealth *Privacy Act 1988*) or information that at the request of the relevant persons are not to be published as per Regulation 11(A) of the OPGGS(E)R.

2.6.4 Assessment and response

No objections or claims about adverse impacts relating directly to the petroleum activities covered in this EP were raised by relevant stakeholders during previous (2014/2015) or recent (2021) consultation.

A record of all consultation undertaken specifically for this activity is included in the stakeholder engagement log, which has been provided in the sensitive information report sent separately to NOPSEMA.

2.6.5 Ongoing consultation

The stakeholder notifications and ongoing consultation required for this petroleum activity is captured in Table 2-6.

Any objections or claims arising from ongoing consultation that have merit and have the potential to result in changes to the description of environment, impact or risk assessment, or control measures, will be subject to CAPL's Management of Change (MoC) process, in accordance with Section 7.3.2.2.

Table 2-6: Notifications and ongoing consultation

Stakeholder	Notification or ongoing consultation requirement	Timing	Frequency
Notifications			
AHO	Provide information to enable promulgation of Notice to Mariners Notify AHO via datacentre@hydro.gov.au	At least four working weeks before commencing activities, or as otherwise agreed with AHO	As required
AMSA	Provide information to enable promulgation of radionavigation warnings Notify AMSA's JRCC via rccaus@amsa.gov.au (phone: 1800 641 792 or +61 2 6230 6811)	At least 24 to 48 hours before commencing activities, or as otherwise agreed with AMSA	As required
Ongoing consultation			
WAFIC	To inform of changes to activities or impacts/risks occurring that may affect fisheries Notify WAFIC via oilandgas@wafic.org.au	Prior to new or significant changes to activities or impacts/risks occurring	As required
		Regular project updates provided that includes any upcoming scheduled IMR activities	Biannual
		Prior to any major repairs from an unplanned event	As required
Interested parties, potentially affected parties, government agencies including: • DNP • DMIRS	CAPL to advise of any new or significant changes to activities or impacts/risks within the scope of the EP, following an evaluation as per Section 7.3.2.2, that may potentially impact marine users	Prior to new or significant changes to activities or impacts/risks occurring	As required

2.6.5.1 Stakeholder consultation in the event of an emergency

In the event of an emergency spill event, CAPL will immediately conduct oil spill trajectory modelling using the actual inputs associated with the spill event to predict trajectory, as described in the OPEP (Ref. 2).

Once oil spill trajectory modelling is completed, CAPL will start engaging with potentially affected stakeholders (those considered relevant from Table 2-5 and any others identified from the oil spill trajectory modelling). The process for reaching out to these stakeholders includes direct contact (phone or email) or indirect contact via the CAPL website.

3 description of the petroleum activity

3.1 Overview

This section provides a description of the petroleum activity as required under Regulation 13(1) of the OPGGS(E)R. The description of the petroleum activity is presented in six sections:

- the hydrocarbon system—includes the infrastructure (including the wells, flowlines, and production pipelines) used for gathering and transporting hydrocarbon to the GTP on Barrow Island, and other supporting infrastructure (umbilicals, pipelines, etc.)(Section 3.2)
- commissioning and start-up—the verification and testing of infrastructure and the introduction of hydrocarbon to the system (Section 3.3)
- operations—the gathering and transport of hydrocarbon and other fluids from the subsea wells to the GTP (Section 3.4)
- IMR—undertaken to ensure the integrity of hydrocarbon system (Section 3.5)
- decommissioning—long-term planning for decommissioning of redundant infrastructure (Section 3.6)
- field support—includes IMR vessel operations, and helicopters for personnel transfers (Section 3.7).

3.1.1 Operational area

The location of the Gorgon and Jansz–Io gas fields and the Feed Gas Pipeline system is described in Section 2.2 and shown in Figure 2-1.

The OA for the petroleum activity is defined as the petroleum titles (WA-36-L, WA-37-L, WA-38-L, WA-39-L, WA-40-L) plus a 200 m wide corridor centred over the Gorgon and Jansz–Io pipeline within Commonwealth waters. It is within this OA that the petroleum activity defined within Section 3 of this EP will be undertaken.

3.1.2 Timing

CAPL is currently operating the hydrocarbon system associated with the GFP infrastructure.

Commissioning and start-up activities associated with GS2 infrastructure is expected to commence from Q2 2022 (pending the completion of installation and pre-commissioning activities as covered under Ref. 5). The duration of GS2 commissioning and start-up activities is expected to be approximately six months. This timing is indicative and subject to potential delays caused by weather events, vessel availability, and other unforeseen factors.

Operations for the Gorgon Gas Development are expected to continue for the nominal operational design life of 50 years. IMR activities may occur at any time during commissioning, start-up and operations.

Activities covered by this EP can occur 24 hours a day and 7 days a week.

3.2 Hydrocarbon system

3.2.1 Overview

The hydrocarbon system includes the infrastructure for gathering and transporting hydrocarbons from the production wells to the GTP on Barrow Island.

The initial field development comprised of wells and subsea infrastructure, including the Feed Gas Pipeline, associated with the GFP. This field development is being supplemented by GS2, which comprises additional wells and subsea infrastructure within the Gorgon and Jansz-Io gas fields. GS2 was part of the original field development plans for the Gorgon Gas Development.

3.2.1.1 Gorgon Foundation Project

The Gorgon production pipeline and umbilical route from the Gorgon field heads south-east toward Barrow Island. The pipeline and umbilical then crosses the Halyard Electrohydraulic Umbilical (EHU) at a water depth of ~95 m and continues south-east to Barrow Island. Flowlines and pipelines run from the Gorgon midline pipeline termination structure (PTS) to each of the three drill centres (Gorgon M1, Gorgon M2 and Gorgon M3).

The Jansz–Io production pipeline and umbilical route from the Jansz–Io gas field traverses the scarp between the Chrysaor Canyons and the Gorgon gas field, on to the continental shelf. The pipeline and umbilical then cross the Halyard EHU at a water depth of ~83 m and then converge with the Gorgon production pipeline and umbilical at ~70 m water depth. Flowlines and pipelines run from the Jansz–Io midline PTS to each of the two drill centres (Jansz DC-1 and Jansz DC-2).

A schematic diagram showing the layout of the GFP subsea infrastructure is presented in Figure 3-1.

3.2.1.2 Gorgon Stage 2

GS2 supplements the existing Gorgon and Jansz–Io gas field development with additional subsea infrastructure:

- three new tiebacks (from new infill wells) to the existing manifold at the Gorgon M1 drill centre
- four new tiebacks (from new production wells) to the new manifold (GOR-M4) at the new Gorgon M4 drill centre, which in turn is connected to the existing Gorgon gas gathering system via a new M4 PTS and associated flowlines and pipelines
- four new tiebacks (from new production wells) to a new Jansz DC-3 drill centre with a combined manifold/PTS, which in turn is connected to the existing Jansz–Io gas gathering system via associated flowlines and pipelines
- two infield control umbilicals for the new Gorgon M4 and Jansz DC-3 drill centres, and all interconnecting flying leads to allow control of the facility.

A schematic diagram showing the layout of the GS2 subsea infrastructure within the Gorgon and Jansz–Io fields is presented in Figure 3-2 and Figure 3-3 respectively.

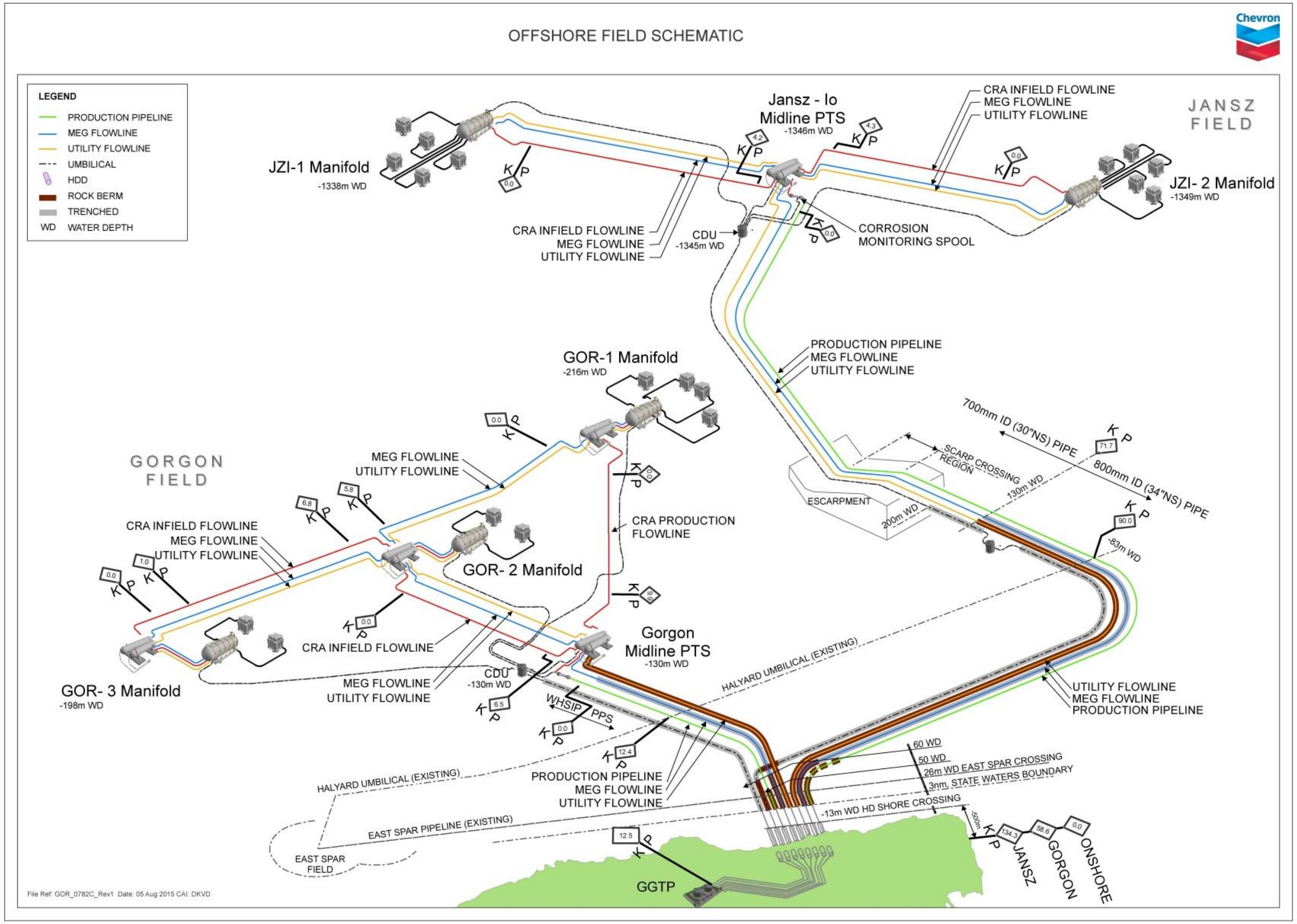


Figure 3-1: Schematic of the Gorgon and Jansz–Io subsea infrastructure associated with the Gorgon Foundation Project

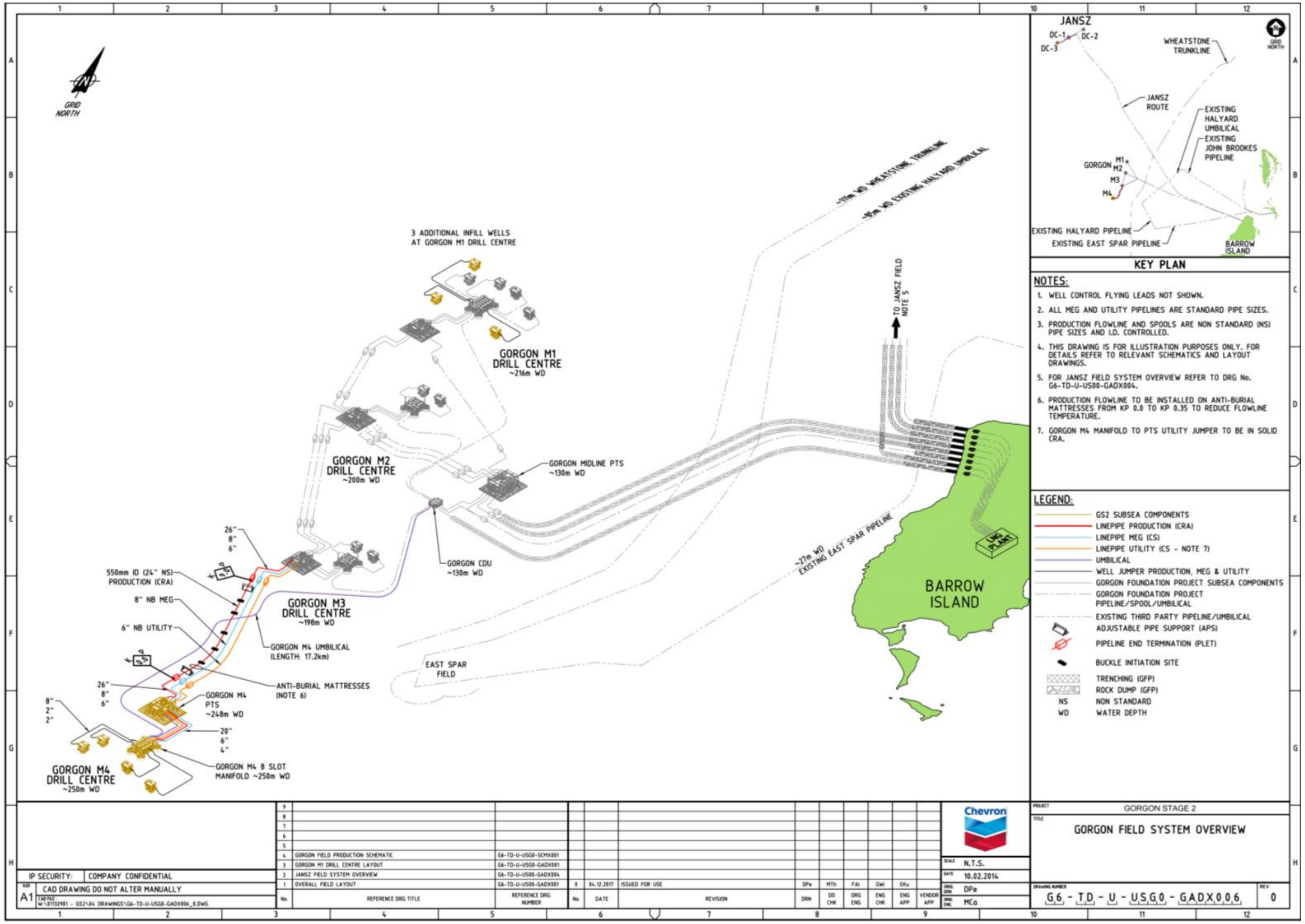


Figure 3-2: Schematic of the GS2 infrastructure within the Gorgon field

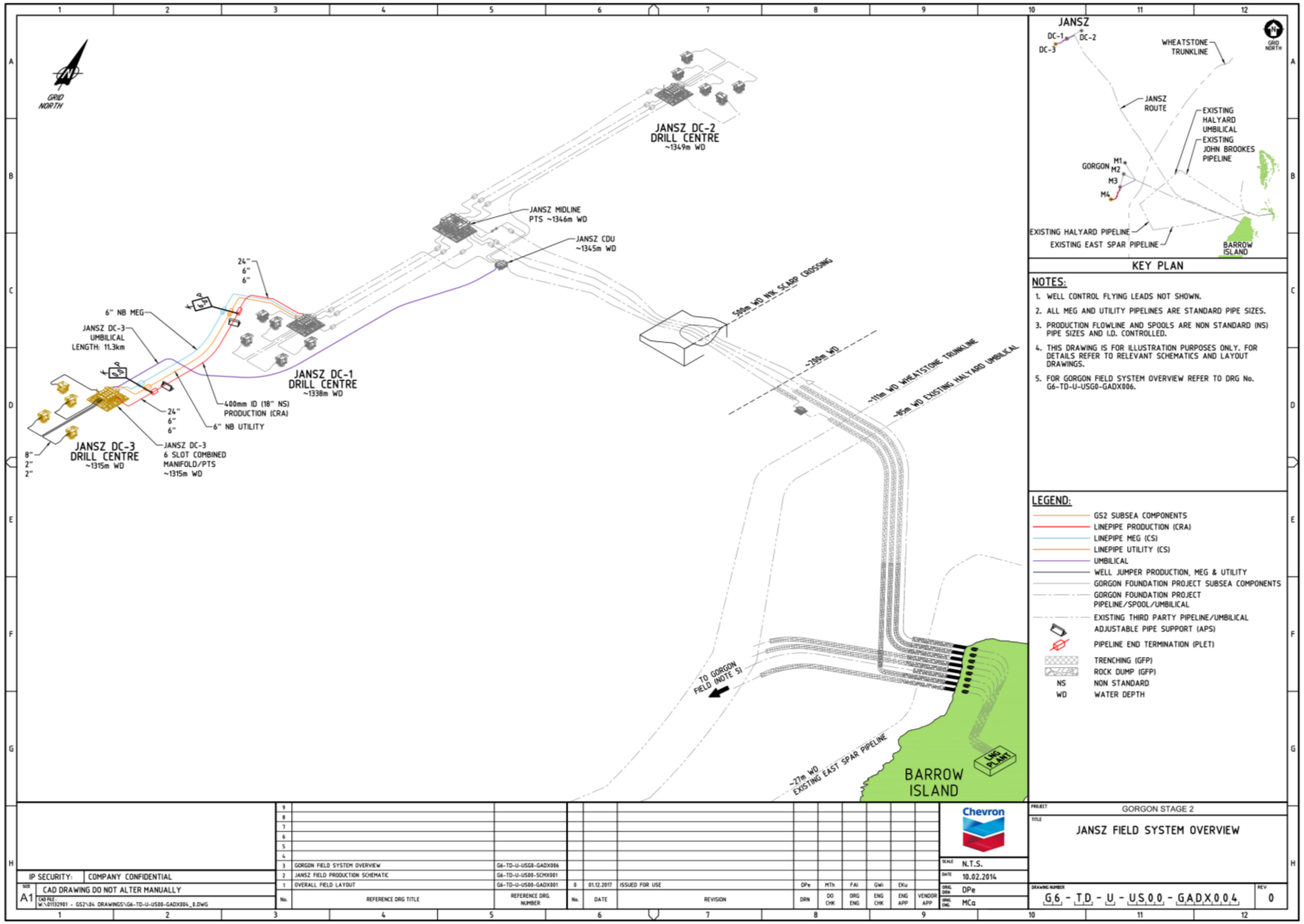


Figure 3-3: Schematic of the GS2 infrastructure within the Jansz–Io field

3.2.1.3 Reservoir characteristics

Table 3-1 summarises the compositional reservoir analyses undertaken by Shell Development Australia in 1999 (Ref. 16). More recent assays conducted during well flowbacks in 2014 (Ref. 17) and ongoing analysis indicate that the original compositional analysis is still accurate. The hydrocarbon from the additional GS2 wells is not expected to vary significantly from previous GFP assays and analyses.

Table 3-1: Hydrocarbon properties

Property	Gorgon	Jansz–Io
Classification	Group II, light persistent oil	Group I, non-persistent oil
Density	848 kg/m^3 at 15 °C	743.1 kg/m^3 at 15 °C
API gravity	35.3 °API	47.9 °API
Dynamic viscosity	2.4 cP at 20 °C	1.2 cP at 25 °C
Pour point	−9 °C	−30 °C
Gas to condensate ratio	5.9 bbl/MMscf	4.09 bbl/MMscf

3.2.1.4 Flow rates

All Gorgon wells have a steady-state design gas flow rate of 270 MMscfd, and all Jansz–Io wells have a steady-state design gas flow rate of 240 MMscfd.

3.2.2 Production wells

Under the current field development (GFP and GS2) there are a total of 15 production wells centred around four drill centres within the Gorgon gas field (Table 3-2). There is spare well slots at each of the subsea production manifolds available for future well tie-in.

Each well is fitted with a subsea christmas tree, which includes an arrangement of valves, controls, and instrumentation. Rigid well jumpers connect each christmas tree to the production manifolds at the drill centres.

Note: Although the production wells are described here, the construction of these wells and the installation of christmas trees and associated infrastructure are outside the scope of this EP (Section 2.3.2).

Table 3-2: Indicative locations and water depths for the production wells

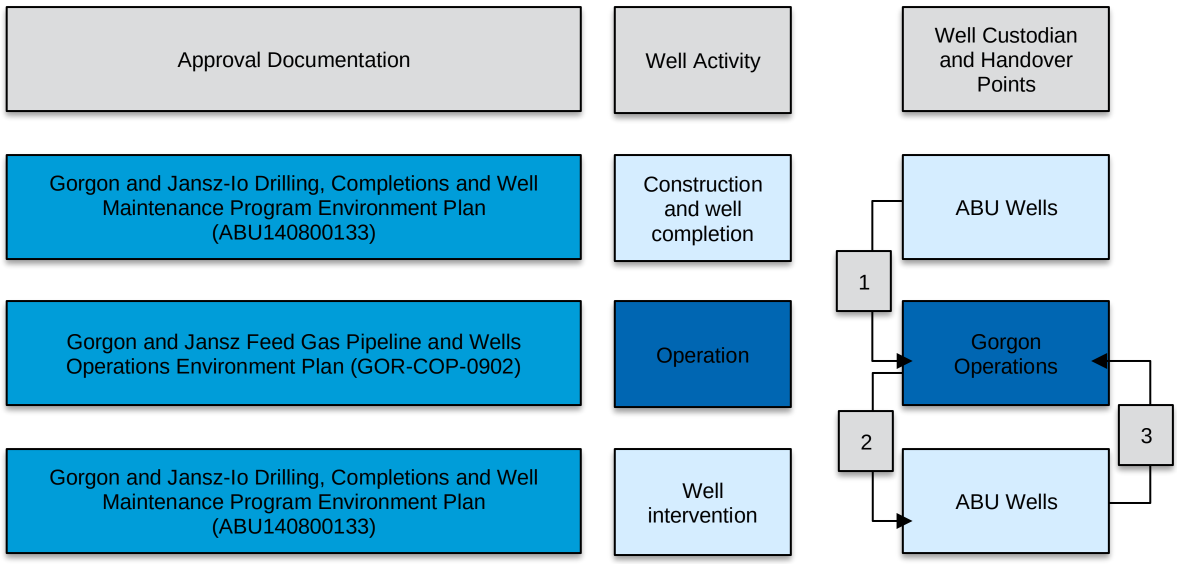
Field development	Well name	Associated drill centre	Latitude	Longitude	Approximate water depth
Gorgon field					
GS2	GOR-1A	Gorgon M1	20°24’29.13” S	114°50’56.00” E	216 m
GS2	GOR-1B		20°24’27.69” S	114°50’57.03” E	216 m
GFP	GOR-1C		20°24’28.37” S	114°50’56.84” E	215 m
GFP	GOR-1D		20°24’28.61” S	114°50’57.73” E	215 m
GFP	GOR-1E		20°24’29.17” S	114°50’58.31” E	215 m
GFP	GOR-1F		20°24’30.02” S	114°50’58.54” E	215 m
GS2	GOR-1G		20°24´29.87” S	114°50’59.26” E	216 m
GFP	GOR-2B	Gorgon M2	20°27´36.54” S	114°50’31.39” E	199 m

Field development	Well name	Associated drill centre	Latitude	Longitude	Approximate water depth
GFP	GOR-2C		20°27´37.10” S	114°50’31.96” E	199 m
GFP	GOR-3B	Gorgon M3	20°31’11.28” S	114°49’25.85” E	199 m
GFP	GOR-3C		20°31’11.84” S	114°49’26.42” E	199 m
GS2	GOR-4C	Gorgon M4	20°34’38.62” S	114°46’38.40” E	250 m
GS2	GOR-4D		20°34’38.34” S	114°46’37.54” E	250 m
GS2	GOR-4E		20°34’37.79” S	114°46’36.95” E	250 m
GS2	GOR-4F		20°34’36.94” S	114°46’36.39” E	250 m
Jansz–Io field					
GFP	JZI-1B	Jansz DC-1	19°49’36.51” S	114°34’13.94” E	1338 m
GFP	JZI-1C		19°49’36.40” S	114°34’12.96” E	1338 m
GFP	JZI-1D		19°49’35.44” S	114°34’12.47” E	1338 m
GFP	JZI-1E		19°49’34.62” S	114°34’12.95” E	1338 m
GFP	JZI-1F		19°49’33.97” S	114°34’12.93” E	1338 m
GFP	JZI-2B	Jansz DC-2	19°47’28.31” S	114°38’40.03” E	1349 m
GFP	JZI-2C		19°47’28.40” S	114°38’41.00” E	1349 m
GFP	JZI-2D		19°47’29.36” S	114°38’41.54” E	1349 m
GFP	JZI-2E		19°47’30.17” S	114°38’41.01” E	1349 m
GFP	JZI-2F		19°47’30.83” S	114°38’41.04” E	1349 m
GS2	JZI-3C	Jansz DC-3	19°51’11.42” S	114°30’54.64” E	1315 m
GS2	JZI-3D		19°51’10.40” S	114°30’54.33” E	1315 m
GS2	JZI-3E		19°51’09.69” S	114°30’54.97” E	1315 m
GS2	JZI-3F		19°51’09.04” S	114°30’55.05” E	1315 m

3.2.2.1 Environment Plan interface and well custody

When wells are under the custodianship of the Gorgon Operations work group, the wells will be operated and managed in accordance with this EP. However, in the event that a well integrity event occurs, the custodianship will be handed over to the ABU Wells work group and activities completed in accordance with the NOPSEMA-accepted *Gorgon and Jansz-Io Drilling, Completions and Well Maintenance Program Environment Plan* (Ref. 6). Figure 3-4 shows the handover points when internal custodianship of the Gorgon and Jansz–Io production wells are exchanged.

The well custodian is the work group that most recently took control of the well by signing the well handover certificate. The work group taking custody will be provided with a complete set of ‘as-built’ and ‘as-left’ well details as per the well handover document.



Handover Points

1. Post well construction
2. Pre-intervention
3. Post intervention

Figure 3-4: Well custody arrangements for Gorgon and Jansz–Io production wells

3.2.3 Subsea production manifolds

The production wells are connected to subsea production manifolds via rigid jumpers. This enables gas condensate from each wellhead to be commingled via the production manifolds before entering the corrosion-resistant alloy (CRA) infield production flowlines. These infield production flowlines then run from the production manifolds to the PTSs.

Double-valve isolation is provided on the subsea production manifolds. Individual header valves on the manifolds are actuated valves. Generally, these valves are remotely operated from the GTP; however, they can also be operated by remotely operated vehicle (ROV) if required.

Under the current field development (GFP and GS2) there are a total of four subsea production manifolds within the Gorgon gas field, and three subsea production manifolds within the Jansz–Io gas field (Table 3-3). The new Jansz drill centre (Jansz DC-3) has a combined manifold and PTS.

Table 3-3: Indicative locations and dimensions for the subsea production manifolds

Field development	Manifold	Approximate dimensions (length x width x height)	Latitude	Longitude
Gorgon field				
GFP	GOR-1	25 x 19 x 7 m	20°24'29.58" S	114°50'57.27" E
GFP	GOR-2	25 x 19 x 7 m	20°27'37.44" S	114°50'30.99" E
GFP	GOR-3	25 x 19 x 7 m	20°31'12.18" S	114°49'25.45" E
GS2	GOR-4	19 × 15 × 6 m	20°34’37.38″ S	114°46’37.97″ E
Jansz–Io field				
GFP	JZI-1	32 × 27 × 3 m	19°49'35.16" S	114°34'14.31" E

Field development	Manifold	Approximate dimensions (length x width x height)	Latitude	Longitude
GFP	JZI-2	32 × 27 × 3 m	19°47'29.65" S	114°38'39.66" E
GS2	JZI-3 (combined manifold/PTS)	19 × 23 × 7 m	19°51′10.44” S	114°30′56.19” E

3.2.4 Pipeline termination structure

The PTS connects the infield production flowlines (running from the subsea production manifolds) and the main production pipelines to the GTP. Gas condensate from the subsea production manifolds flows into the PTS where it is commingled before entering the main production pipelines.

The PTS includes several isolation valves, which are used for various purposes; these include:

- double-valve isolation at the pig launcher tie-in point to enable intelligent pigging operations to be undertaken
- isolation valves to enable subsea infrastructure to be isolated from the large pipeline inventory.

All valves on the PTS are operated by ROV and cannot be operated remotely from the GTP.

Under the current field development (GFP and GS2) there are two PTS within the Gorgon gas field, and two PTS within the Jansz–Io gas field (Table 3-4). The new Jansz drill centre (Jansz DC-3) has a combined manifold and PTS.

Table 3-4: Indicative locations and dimensions of PTSs

Field development	PTS	Approximate dimensions (length x width x height)	Latitude	Longitude
Gorgon field				
GFP	Gorgon Midline PTS	30 × 25 x 10 m	20°29’11.20” S	114º53’53.29” E
GS2	Gorgon M4 PTS	22 × 15 × 10 m	20°34′36.47” S	114°46′40.40” E
Jansz–Io field				
GFP	Jansz-Io Midline PTS	37 × 32 × 3 m	19°48’33.90” S	114º36’26.26” E
GS2	JZI-3 (combined manifold/PTS)	19 × 23 × 7 m	19°51′10.44” S	114°30′56.19” E

3.2.5 Infield flowlines and pipelines

The flowlines and pipelines[2] connecting the subsea production manifolds to the PTSs comprise infield production flowlines, monoethylene glycol (MEG) pipelines and utility pipelines (Table 3-5). There are also additional MEG and utility pipelines that run from the PTSs to the GTP (Table 3-5); these are located adjacent to the main Gorgon and Jansz–Io production pipelines (refer to Section 3.2.7).

[2] The production lines are classified as flowlines; the MEG and utility lines are classified as pipelines.

The CRA infield flowlines collect and transfer gas condensate from the production manifolds to the PTSs.

MEG pipelines provide continuous injection of MEG into the production system for hydrate management. In addition, MEG pipelines deliver production chemicals (for corrosion and scale management) to the field. MEG and production chemicals are then returned via the production pipelines to the GTP, where MEG will be regenerated for re-use.

Utility pipelines support a subsea maintenance depressurisation capability, annulus depressurisation, and double-sided depressurisation of the production system in the unlikely event of a hydrate blockage. The utility pipelines are filled with preservation fluid (e.g., MEG) when not in use to reduce susceptibility to corrosion and hydrate formation if gas bubbles are trapped in the pipeline.

All flowlines and pipelines are connected to the subsea production manifolds and PTSs by jumpers and spool pieces.

Table 3-5: Indicative locations of flowlines and pipelines

Field development	Flowlines and pipelines between subsea production manifolds and PTSs	Pipelines between the PTSs to GTP
Gorgon field		
GFP	• 3 x 26” CRA infield production flowlines • 3 x 8” MEG pipelines • 3 x 6” utility pipelines	• 1 x 8” MEG pipeline • 1 x 6” utility pipeline
GS2	• 1 x 24” M4 CRA infield production flowline • 1 x 8” MEG pipeline • 1 x 6” utility pipeline	
Jansz–Io field		
GFP	• 2 x 24” CRA infield production flowlines • 2 x 6” MEG pipelines • 2 x 6” utility pipelines	• 1 x 6” MEG pipeline • 1 x 6” utility pipeline
GS2	• 1 x 18” DC-3 CRA infield production flowline • 1 x 6” MEG pipeline • 1 x 6” utility pipeline	

3.2.6 Umbilicals

The fibre-optic and electrohydraulic control umbilicals provide hydraulic power, electric power, and a fibre-optic control link from the GTP to the subsea infrastructure within the Gorgon and Jansz–Io gas fields. A Central Distribution Unit (CDU) is a termination point for the main control umbilical from the GTP into which the individual drill centre umbilicals connect. This is where the umbilical splits to provide links between the PTSs, christmas trees, production manifolds, and other components.

As part of GS2, new electrohydraulic umbilicals were installed between the existing Gorgon CDU and the new Gorgon M4 drill centre, and between the existing Jansz CDU and the umbilical termination assembly on the combined manifold/PTS at the new Jansz DC-3 drill centre.

3.2.7 Production pipeline

The Gorgon production pipeline runs for ~65 km between the Gorgon midline PTS to the shore crossing at North Whites Beach on Barrow Island (Figure 3-1). The Gorgon pipeline route crosses the Halyard EHU at a water depth of ~95 m and converges with the Jansz production pipeline at ~70 m water depth.

The Jansz–Io production pipeline runs for ~134 km between the Jansz–Io midline PTS to the shore crossing at North Whites Beach on Barrow Island (Figure 3-1). The pipeline transitions from 30” to 34” diameter at the top of the escarpment where it then crosses the Halyard EHU in ~83 m of water depth. The pipeline from the escarpment to the shore is a 34” pipeline.

3.2.8 Valves

The valves associated with the Gorgon electrohydraulic control system are located on christmas trees and production manifolds in waters deeper than 199 m. In addition to this, the Gorgon midline PTS contains several valves that cannot be actuated remotely, but are actuated manually via ROV.

The valves associated with the Jansz electrohydraulic control system are located on christmas trees and production manifolds in waters deeper than 1300 m. In addition to this, the Jansz–Io midline PTS contains several valves that are not a part of the Jansz electrohydraulic control system, and subsequently cannot be actuated remotely, but are actuated manually via ROV.

3.3 Commissioning and start-up

CAPL is currently operating the hydrocarbon system associated with the GFP infrastructure; and therefore, the commissioning and start-up activities described in this EP primarily relate to the additional infrastructure associated with GS2 (as described in Section 3.2). However, these commissioning and start-up activities are also relevant to all infrastructure (GFP and GS2) for any additional verification testing undertaken, or following any module/component change-outs, or field shut-ins.

The purpose of commissioning activities is to ensure that all components of the system are installed, tested, and function as per the project design documentation and specifications. Once commissioning is complete, start-up activities introduce hydrocarbons to the system. Commissioning and start-up activities therefore involve:

- verification and pre-start-up testing
- introduction of hydrocarbons.

3.3.1 Commissioning (verification and pre-start-up testing)

Verification and pre-start-up activities typically occur before initial start-up as well as after a field shut-in. Shut-ins, which are expected to occur infrequently, may be required to allow maintenance or repair activities to be undertaken.

The verification and pre-start-up testing activities include the testing of the subsea electrohydraulic control and monitoring systems. This involves testing subsea valves and the emergency shutdown of infrastructure such as the subsea trees and choke module. These tests are likely to result in small discharges of control fluids from individual valves. In total, up to ~5 m^3 of control fluid is expected to be discharged from each of the Gorgon and Jansz–Io systems during verification and testing activities.

Verification testing may also include leak testing of jumpers. While unlikely, this testing could result in the release of small volumes of MEG to the environment.

These activities will be supported by a vessel (refer to Section 3.7.1 for vessel operations) and ROVs equipped with video cameras.

3.3.2 Start-up (introduction of hydrocarbons)

Start-up activities commence with the controlled introduction of hydrocarbon into the infield production flowlines and production pipeline. The subsea infrastructure including the MEG and utility pipelines, and the umbilicals are then subject to function testing.

During the introduction of hydrocarbons, residual drilling fluids (within the wells) and other residual fluids (which may include MEG/water preservation media), within the CRA infield flowlines and production pipeline will be displaced. These fluids are expected to be displaced via production from the christmas tree back to the GTP.

3.4 Operations

The principal activity during operations will be the flow and transportation of hydrocarbon and other produced fluids from the wells to the GTP, via the infield production flowlines and the Gorgon and Jansz–Io production pipelines. The subsea infrastructure in Commonwealth waters is predominantly a closed system, however there are discharge points (valves) located at the subsea electrohydraulic control systems and at the Gorgon and Jansz–Io midline PTSs (as described in Section 3.2.8). Operation of this system will result in discharges of hydraulic control fluid to the marine environment from the valves, with each valve actuation estimated to result in a loss of a few litres to the marine environment. As an estimate, up to ~50 m^3/year of hydraulic control fluid is expected to be discharged from both the Gorgon and Jansz–Io subsea infrastructure during operations.

If an alternative pathway is required to supply production chemicals to the field, the chemical cores within the umbilicals may be used as a contingency measure. If these lines are required for this purpose, the hydraulic spacer fluid (~20 m^3) within the cores would normally be displaced via production back to the GTP (however may be displaced at the respective drill centre) and replaced with the required chemicals.

If field shut-in is required, system verification and pre-start-up testing will be required prior to start-up (refer to Section 3.3).

3.5 Inspection, maintenance, and repairs

Section 572(2) of the OPGGS Act requires a titleholder to maintain in good condition and repair all structures, equipment, and other property (hereafter collectively referred to as ‘property’) that is within the title area and is used in connection with the operations authorised by the title.

IMR of subsea infrastructure is undertaken to ensure that the integrity of the hydrocarbon system is maintained at or above acceptable standards. IMR activities may occur at any time during operations, including during commissioning and start-up.

The intent of Section 572(2) relates to ensuring that property is fit for purpose and is able to be removed when neither used, nor to be used, in connection with the operations (Ref. 18).

IMR typically requires the support of a vessel; these vessel operations are covered within Section 3.7.1.

3.5.1 Inspections

Inspections provide assurance that asset integrity is being maintained and operated according to design, as well as proactively identify maintenance or repair activities that may be required. Inspection generally involves the use of a vessel travelling along the route of the subsea hydrocarbon system with an autonomous underwater vehicle (AUV) or ROV (or in some cases, divers).

Inspections will be undertaken with a frequency determined using a risk-based approach. Inspections are typically conducted more frequently (e.g., one to three years) during early operations, with the frequency likely to decrease over time during steady-state operations, depending on previous inspection results. Typically, vessels will be on site for 40 to 100 days per year depending on the type and complexity of the inspection. Events such as cyclones or seismic activity that could affect the subsea infrastructure may also trigger inspections. Inspection techniques may include:

- visual inspections—may involve ROVs or AUVs deployed from a vessel; may also involve divers and a dive support vessel
- marine acoustic surveys—may include the use of side-scan sonar (SSS) and multibeam echo sounders (MBES), and are typically done from a vessel using towed acoustic instruments, ROVs, or AUVs
- non-destructive testing—may include ultrasonic testing and electrical resistance testing, which are typically undertaken using an ROV or AUV deployed from a vessel
- cathodic protection measurements—are completed using ROVs or AUVs and conductivity probes or by making visual assessments of anode wastage
- fatigue monitoring/inspection—where required, fatigue monitoring equipment will be installed, inspected, and/or retrieved by a ROV deployed from a vessel
- pigging—temporary pig launchers are deployed from a vessel and tied in to the midline PTS; they may use a combination of inhibiters, water, gel, MEG, and/or nitrogen slugs to complete pigging activities including internal inspection of the pipeline. Fluids used to drive the pig train are directed to the GTP, and pigs may be equipped with tracking transmitters.

3.5.2 Maintenance and repairs

Maintenance and repair activities, including equipment change-out, will be conducted during the operational life of the project to:

- prevent deterioration and/or failure of infrastructure
- maintain reliability and performance of infrastructure
- ensure infrastructure is adequately maintained to enable the potential for future removal.

The exact frequency of maintenance and repair activities will be dependent on the results of inspections. If minor maintenance and repair is required, a vessel may remain on site for between ~10–90 days at a time, depending on the type of maintenance or repair required. If major maintenance or repair is required, a vessel may be on site for between ~90–180 days at a time.

Maintenance and minor repairs (and any associated testing) may include, but are not limited to:

- module/component change-out (including back testing of seals)—may include, but is not limited to, the replacement of subsea pipeline equipment or control modules, such as choke modules, tree caps, or power and control distribution equipment
- installation of foundations and/or mudmats to support equipment and facilitate maintenance and repair activities
- stabilisation/span correction—may involve activities such as installation of grout bags or concrete mattresses
- subsea excavation—excavation alongside infrastructure may be required to gain access to, or enable minor repairs of, infrastructure
- maintenance of cathodic protection systems / additional anodes—cathodic protection equipment may be added to, or placed adjacent to, production pipelines using a vessel and ROV spread
- removal of marine biological growth and calcareous deposits—may be undertaken by water jetting from an ROV or by divers, generally with potable water or sea water, although items exhibiting calcareous deposit accumulation may require acid washing or soaking (typically using water-soluble sulfamic acid or similar)
  - this task generally precedes pigging or equipment change-out activities, where operation of or access to the equipment is hindered by marine growth or calcareous deposits and as such is estimated to have the same frequency as these activities.

3.5.2.1 Major repairs

This EP has allowed for scenarios where major repairs of the pipeline system (including flowlines, pipelines and umbilicals) may be required.

CAPL has prepared for a potential major repair event by implementing the Emergency Pipeline Repair System (EPRS). The EPRS delivers a set of repair procedures, common repair equipment, and specific equipment for the main production flowlines and production pipelines. The EPRS also includes methodologies for the repair of support infrastructure such as umbilicals and non-production pipelines.

The target repair duration is ~180 days, from mobilisation of equipment and vessels, in situ repair, to recommissioning. Several vessels are likely to be involved to conduct and support the repair works or provide temporary power and controls to maintain system operability and reliability.

As major repair of a pipeline is the most complex major repair activity, this has been described in greater detail below.

The EPRS includes a combination of equipment which, when used together, enables a section of production flowline or pipeline to be cut out and replaced. It is deployed off the back deck of a support vessel and supported with ROVs. The EPRS is stored in a warehouse in Perth until required. The EPRS equipment includes:

- hydraulic-actuated pipeline lifting and repair equipment deployment frames

- pipe preparation tools, including but not limited to, coating removal, weld seam removal, end preparation, and water blasting equipment
- pipeline specific repair clamps and flange adapters.

Depending on the seabed conditions at the repair location, additional seabed area immediately surrounding the pipeline system infrastructure may be disturbed if it is determined that the pipeline requires deburial or rock removal prior to repair, or if concrete mattresses or rock stabilisation measures are required post repair.

The EPRS equipment may be deployed for the production flowlines or pipelines where the pipeline (or section of pipeline) does not exceed the limitations of its design (i.e., not within water depths of <20 m).

3.5.2.1.1 Pipeline temporary decommissioning

Following a major defect or full-bore rupture, the field would be shut-in, and the pipeline allowed to naturally depressurise to subsea ambient pressure, resulting in free-flooding of the pipeline with sea water.

The pipeline would then be flooded with seawater inhibited with chemical additives (including biocide and oxygen scavenger) that will propel a flooding pig towards the defect location. Flooding may be undertaken from both ends of the pipeline, resulting in a release of sea water, gas, condensate, and rich MEG to the marine environment at the location of the defect.

3.5.2.1.2 Pipeline repair

The EPRS equipment is operated using ROVs, controlled from the support vessel. Two ROVs are expected to be required. The ROVs are electrically powered from the vessel and deliver hydraulic pressure to the operating parts of the repair system.

Pipeline repair includes the following stages:

- pre-deployment survey
- remove damaged section
- EPRS deployment
- installation of new replacement section
- pipeline stabilisation (if required).

Pre-deployment survey

Prior to deployment of the EPRS, a number of different surveys may be undertaken. These surveys may be undertaken up to 500 m away from the pipeline. The types of survey will depend on the location and event causing the pipeline defect, but may include:

- SSS or MBES or similar
- ROV
- piezocone penetration test (PCPT) or similar.

PCPT involves pushing a probe into the seabed to test soil characteristics and strengths. Up to three PCPTs may be required at each of the eight mudmat locations. The tests are expected to comprise a 100 mm diameter cone penetration test to a depth of 5 m.

Remove damaged section

If required, the damaged section will undergo pipeline deburial or have rock stabilisation material physically removed. The damaged section of the pipeline will then be cut using appropriate cutting tools.

Once cut, the damaged section of pipeline will be wet stored on the seabed whilst it is cut into smaller sections (~3 m lengths), then loaded into debris removal baskets and transferred back to the vessel.

EPRS deployment

Subsea transponders may be deployed to ensure accurate seabed positioning of the EPRS. The deployment of transponders may result in localised seabed disturbance of ~1–2 m^2 (per transponder). Once no longer needed these transponders are recovered back to the vessel using a ROV. The EPRS lifting frames and cradles for repositioning of the pipeline are then deployed and installed.

The length of pipeline over which a typical repair will take place is ~300 m. Over this length, the areas and depths of seabed expected to be disturbed during a repair include:

- at the four pipe lift frame locations, ~450 m^2 of surficial seabed will be disturbed by the pipe lift frame mudmats to an approximate maximum depth of ~4.5 m by the skirt foundations of these mudmats
- at the pipe end repair location, ~250 m^2 of surficial seabed will be disturbed by the repair pipeline flange adaptor (PFA) deployment frame mudmats skirts (up to ~0.3 m depth)
- in the vicinity of the repair location, ~100 m^2 of seabed will be required for temporary wet storage of materials and equipment during the repair operation.

Installation of new replacement section

Once the damaged section of pipeline is removed, the pipeline ends are prepared (coating and weld seams removed) to allow PFA installation. The PFA stud bolts are then tensioned with the flange bolting systems and subsequently back seal tested. The PFAs are then activated to complete the repair. The entire pipeline is then typically subjected to hydrostatic leak testing. If the leak testing fails, the repair will need to be rectified, and re-installed. The leak test may comprise flooding, gauging, and/or cleaning pigs, but is typically performed using a small water-winning/filtration and chemical injection spread, and high pressure pumping equipment, and will use an onshore spread that will differ depending on the pipeline.

Pipeline stabilisation

Depending on the seabed conditions at the repair location, additional seabed area may be disturbed by permanent concrete mattresses and post-repair rock stabilisation measures. However, this is location-specific and will be determined at the time of event.

3.5.2.1.3 Pipeline recommissioning

Following the successful hydrostatic leak test, the pipeline must be recommissioned via a dewatering and conditioning pig train. The conditioning pig train is expected to comprise slugs of compressed air, treated potable water, and MEG.

The pipeline contents will be discharged subsea via the appropriate Gorgon or Jansz PTS.

3.6 Decommissioning

Under Section 270(3)(c) of the OPGGS Act, before a title can be surrendered, all property brought into a title area must be removed or arrangements that are satisfactory to NOPSEMA must be made in relation to the property.
Section 572(3) of the OPGGS Act also requires a titleholder to remove all property that is within the title area and is neither used nor to be used in connection with the operations authorised by the title.

3.6.1 End of facility life

As described in Section 3.1.2 the operational design life for the Gorgon field development is expected to be 50 years. Therefore, no end of facility life (EOFL) decommissioning activities for the subsea infrastructure is scheduled to occur within the 5-year in-force period of this EP.

Prior to any EOFL decommissioning, CAPL will submit a Decommissioning EP to NOPSEMA that will demonstrate that the impacts and risks associated with field decommissioning activities are reduced to ALARP and acceptable levels. While the requirement for complete removal of property will be considered the base case within any Decommissioning EP (as per the requirements of Section 572(3) of the OPGGS Act), alternative arrangements that may be satisfactory are ones that deliver equal or better environmental, safety and well integrity outcomes compared to complete removal (Ref. 19). The Decommissioning EP will be developed to meet the requirements of the OPGGS Act and OPGGS(E)R, as well as any additional relevant legislation (e.g., *Environment Protection (Sea Dumping) Act 1981*) or guidelines (e.g., Ref. 18 and Ref. 19) in force at the time.

3.6.2 Subsea inventory

To assist with the long-term planning for decommissioning an internal inventory of subsea property is maintained by CAPL. The subsea inventory will include property that is “operational” by the Gorgon Gas Development, as well as “non-operated assets” that are not associated with any of its current operations[3]. A static summary of the inventory has been included in appendix c.

Subsea assets classified as abandoned (with relevant supporting regulator documentation) are not included within the subsea inventory.

3.6.3 Removal of property

In accordance with Section 572(3) of the OPGGS Act, removal of property will be undertaken throughout operations when property is neither used, nor to be used, in connection with the operations. However, NOPSEMA recognises that removal may not always be practical at the time when property is neither used, nor to be used (Ref. 18).

The process that CAPL will follow to determine where a deviation from the requirement to remove property at the point in time that it is neither used nor to be used is appropriate, includes consideration of several criteria. Deferral of removal may be considered by CAPL if:

[3] Note: at the time of submission of this EP, no non-operated assets are included within the subsea inventory provided in appendix c.

- redundant equipment is incorporated within or located close to live infrastructure which introduces additional complexities and risks that can be avoided during EOFL decommissioning
- while subsea property is in situ, the risks to other marine users associated with its physical presence are low
- the environmental risks when leaving redundant infrastructure in-situ under current operations is considered to be low
- the cost of standalone retrieval work scopes are considered disproportionate when considering the risks of retrieval during current operations versus risk of extending duration in-situ.

If after applying the above criteria, any redundant property is to remain in-situ within the title area for decommissioning as part of EOFL, it will be recorded in the subsea inventory as a “non-operated asset” (refer to Section 3.6.2), and will be subject to inspections to ensure that the property does not degrade to a state that would prevent future removal (refer to Section 3.5).

3.6.4 Non-operated assets

CAPL are currently undertaking an investigation to determine the presence of non-operated subsea assets within all their petroleum permits in Australia. This investigation also includes determining the status (e.g., abandoned) of the identified subsea asset. It is anticipated that this investigation will be completed by Q2 2022. Once this investigation is complete, if any subsea property that have not yet been abandoned are identified, CAPL will engage with NOPSEMA regarding the removal of property or deviation from this requirement via an EP. If it is determined that an EP (either new, or revision to an existing EP) is required, CAPL will consult with NOPSEMA within two months of completion of the investigation and submit the relevant EP/EPs relating to non-operated assets on Gorgon petroleum permits by no later than end of 2022 to address these requirements.

3.7 Field support

3.7.1 Vessel operations

Typically, a light construction or survey-type vessel (or similar) will be used for IMR. In exceptional circumstances, depending on the type of IMR activity, additional similar vessels may be used, and/or a larger vessel. Vessel operations may occur for periods of ~40–100 days for inspections (Section 3.5.1) and 10–180 days for maintenance and repairs (Section 3.5.2)

Vessels will typically use dynamic positioning (DP), however in certain circumstances, anchoring may be required. Vessels will not use Heavy Fuel Oil (HFO) but will utilise a lighter marine fuel such as marine diesel oil (MDO) or Marine Gas Oil (MGO). Vessels are expected to return to port to bunker, although may bunker at sea if required. Vessels routinely discharge a variety of wastewater streams to the marine environment including sewage, greywater, food waste, cooling water, brine, and oily bilge water; vessels may also incinerate solid wastes.

3.7.2 Helicopter operations

Where required, helicopters may be used for crew transfers to/from the IMR vessels. Helicopters will typically operate from Barrow Island.

4 description of the environment

4.1 Overview

This section provides a description of the environment as required under Regulation 13(2) of the OPGGS(E)R. For the purposes of this EP, CAPL have defined and described the following three areas:

- OA—as described in Section 3.1.1, this is the area in which the petroleum activities will be undertaken
- Environment that May Be Affected (EMBA)—defined as the area in which CAPL's activities may result in environmental impacts (thus for the purpose of this EP, defined as the area potentially impacted by hydrocarbons from a spill event above impact concentration thresholds [Table 6-9])
- Environmental Exposure Area (EEA)—defined as the outer area in which hydrocarbons from a spill event may be present in the environment (thus for the purpose of this EP, defined as the area potentially exposed to hydrocarbons from a spill event above exposure concentration thresholds [Table 6-8]).

These areas are shown in Figure 4-1.

CAPL's *Description of the Environment: CAPL Planning Area* (Ref. 1; appendix d) describes the environment within the total area in which all CAPL's activities may interact with the environment (i.e., includes activities and projects beyond the scope of this EP). The above three areas, the OA, EMBA and EEA, that are specifically relevant to activities within this EP, all occur within the spatial extent of Planning Area. Therefore, the descriptions as provided in the *Description of the Environment: CAPL Planning Area* (Ref. 1) are appropriate for providing supporting information for use in this EP. The identification of the specific values and sensitivities relevant to the areas for this EP are detailed in the following sections.

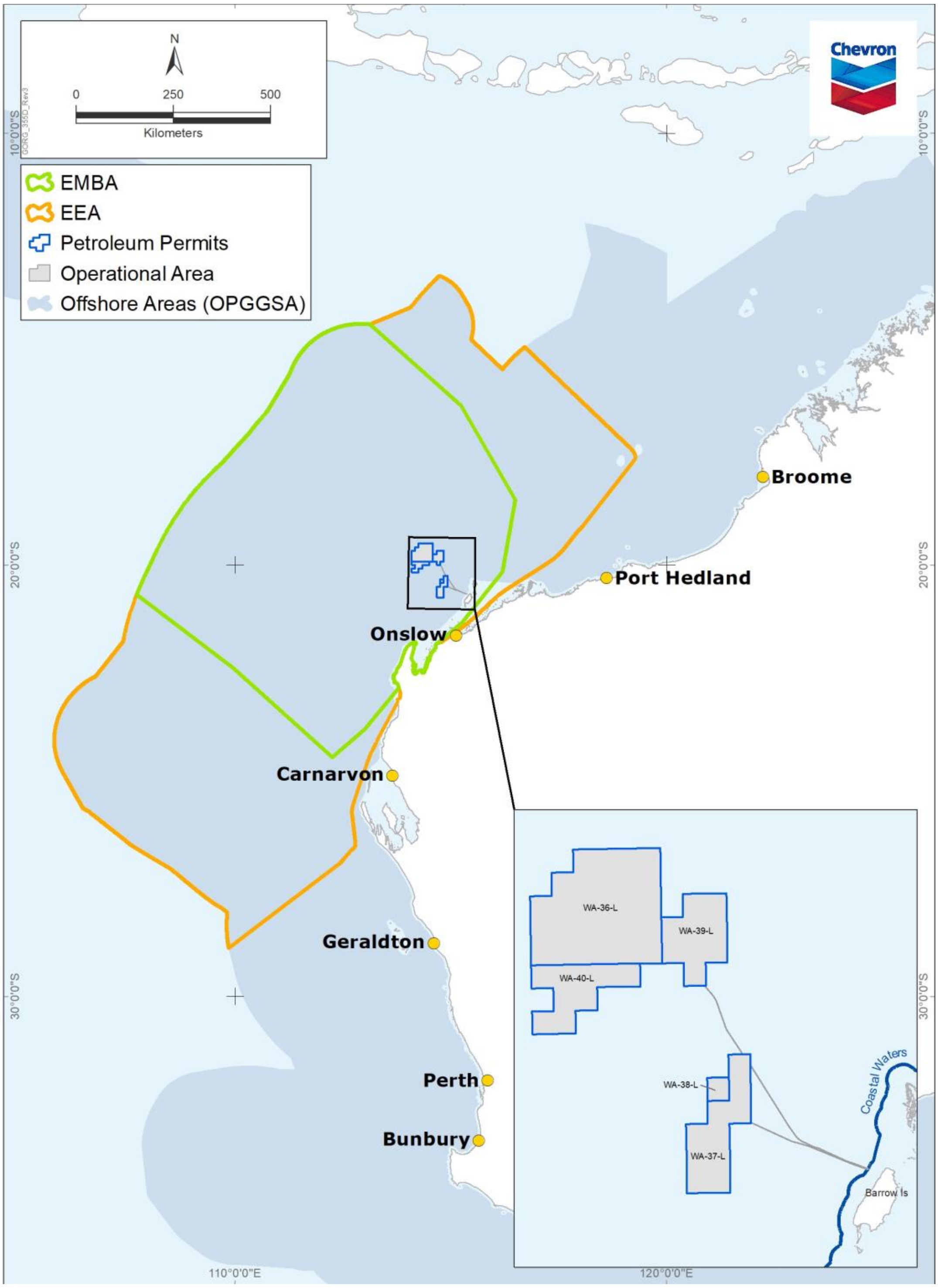


Figure 4-1: OA, EMBA and EEA for Gorgon operations in Commonwealth waters

4.2 Physical environment

CAPL's *Description of the Environment: CAPL Planning Area* (Ref. 1) identifies and summarises the physical environment within the Planning Area.

4.3 Biological environment

CAPL's *Description of the Environment: CAPL Planning Area* (Ref. 1) identifies and summarises the biological environment within the Planning Area. Key threats and relevant management actions from any Conservation Advices or Recovery Plans for threatened or migratory species have also been described (Ref. 1).

The specific presence of biological values and sensitivities within the OA, EMBA and EEA is detailed in the following subsections.

4.3.1 Marine mammals

Based on searches of the protected matters database (Ref. 20; appendix e), the threatened and/or migratory mammal species shown in Table 4-1 may be present within the OA, EMBA and EEA. Biologically important areas (BIAs) associated with marine mammal species are listed in Table 4-2.

Table 4-1: Presence of threatened and/or migratory marine mammals

Common name	OA	EMBA	EEA
Cetaceans (whales)			
Antarctic Minke Whale, Dark-shoulder Minke Whale	✓	✓	✓
Blue Whale	✓	✓	✓
Bryde's Whale	✓	✓	✓
Fin Whale	✓	✓	✓
Humpback Whale	✓	✓	✓
Sei Whale	✓	✓	✓
Southern Right Whale		✓	✓
Sperm Whale	✓	✓	✓
Cetaceans (dolphins)			
Indo-Pacific Humpback Dolphin	✓	✓	✓
Killer Whale, Orca	✓	✓	✓
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations)	✓	✓	✓
Sirenians			
Dugong	✓	✓	✓

Table 4-2: Presence of BIAs for marine mammals

Common name	BIA behaviour	Seasonal presence	OA	EMBA	EEA
Humpback Whale	Migration (north and south)	Northern migration, late July to September	✓	✓	✓
Pygmy Blue Whale	Distribution	(Not defined in database)	✓	✓	✓
	Foraging	(Not defined in database)		✓	✓
	Migration	Northern migration (enter Perth canyon January to May; pass Exmouth April to August; continue north to Indonesia); Southern migration (follow WA coastline from October to late December)	✓	✓	✓
Dugong	Breeding	Year round		✓	✓
	Calving	Year round		✓	✓

Common name	BIA behaviour	Seasonal presence	OA	EMBA	EEA
	Foraging (high density seagrass beds)	Year round		✓	✓
	Nursing	Year round		✓	✓

4.3.2 Reptiles

Based on searches of the protected matters database (Ref. 20; appendix e), the threatened and/or migratory reptile species shown in Table 4-3 may be present within the OA, EMBA and EEA. Habitat critical to survival and BIAs associated with marine reptile species are listed in Table 4-4 and Table 4-5 respectively.

Table 4-3: Presence of threatened and/or migratory reptiles

Common name	OA	EMBA	EEA
Turtles			
Flatback Turtle	✓	✓	✓
Green Turtle	✓	✓	✓
Hawksbill Turtle	✓	✓	✓
Leatherback Turtle	✓	✓	✓
Loggerhead Turtle	✓	✓	✓
Seasnakes			
Leaf-scaled Seasnake	✓	✓	✓
Short-nosed Seasnake	✓	✓	✓

Table 4-4: Critical habitat to the survival of marine turtles

Common name	Nesting location	Internesting buffer	Seasonal presence	OA	EMBA	EEA
Flatback Turtle	Barrow Island, Montebello Islands, coastal islands from Cape Preston to Locker Island	60 km	October to March	✓	✓	✓
	Dampier Archipelago, including Delambre Island and Hauy Island	60 km	October to March		✓	✓
Green Turtle	Barrow Island, Montebello Islands, Serrurier Island, and Thevenard Island	20 km	November to March	✓	✓	✓
	Exmouth Gulf and Ningaloo Coast	20 km	November to March		✓	✓
Hawksbill Turtle	Cape Preston to mouth of Exmouth Gulf including Montebello Islands and Lowendal Islands	20 km	October to February	✓	✓	✓
Loggerhead Turtle	Exmouth Gulf and Ningaloo Coast	20 km	November to May		✓	✓

Table 4-5: Presence of BIAs for reptiles

Common name	BIA behaviour	Seasonal presence	OA	EMBA	EEA
Flatback Turtle	Aggregation			✓	✓
	Foraging	Summer		✓	✓
	Internesting			✓	✓
	Internesting buffer	Summer	✓	✓	✓
	Mating	Summer		✓	✓
	Nesting	Summer		✓	✓
Green Turtle	Aggregation			✓	✓
	Basking	Summer		✓	✓
	Foraging	Summer, Year-round		✓	✓
	Internesting	Summer		✓	✓
	Internesting buffer	Summer	✓	✓	✓
	Mating	Summer		✓	✓
	Nesting	Summer		✓	✓
Hawksbill Turtle	Foraging	Year-round, spring, early-summer		✓	✓
	Internesting	Spring and early-summer		✓	✓
	Internesting buffer	Year-round, spring, early-summer	✓	✓	✓
	Mating	Year-round, spring, early-summer		✓	✓
	Nesting	Year-round, spring, early-summer		✓	✓
Loggerhead Turtle	Internesting buffer			✓	✓
	Nesting			✓	✓

4.3.3 Fishes, including sharks and rays

Based on searches of the protected matters database (Ref. 20; appendix e), the threatened and/or migratory fish species shown in Table 4-6 may be present within the OA, EMBA and EEA. BIAs associated with fish species are listed in Table 4-7.

Table 4-6: Presence of threatened and/or migratory fishes, including sharks and rays

Common name	OA	EMBA	EEA
Dwarf Sawfish, Queensland Sawfish	✓	✓	✓
Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray	✓	✓	✓
Green Sawfish, Dindagubba, Narrowsnout Sawfish	✓	✓	✓
Grey Nurse Shark (west coast population)	✓	✓	✓
Killer Whale, Orca			
Longfin Mako	✓	✓	✓

Common name	OA	EMBA	EEA
Narrow Sawfish, Knifetooth Sawfish	✓	✓	✓
Oceanic Whitetip Shark	✓	✓	✓
Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray	✓	✓	✓
Porbeagle, Mackerel Shark		✓	✓
Shortfin Mako, Mako Shark	✓	✓	✓
Whale Shark	✓	✓	✓
White Shark, Great White Shark	✓	✓	✓

Table 4-7: Presence of BIAs for fishes, including sharks and rays

Common name	BIA behaviour	Seasonal presence	OA	EMBA	EEA
Whale Shark	Foraging	Spring	✓	✓	✓
	Foraging (high density prey)	April–June, Autumn		✓	✓

4.3.4 Seabirds and shorebirds

Based on searches of the protected matters database (Ref. 20; appendix e), the threatened and/or migratory seabird and shorebird species shown in Table 4-8 may be present within the OA, EMBA and EEA. BIAs associated with fish species are listed in Table 4-9.

Table 4-8: Presence of threatened and/or migratory seabirds and shorebirds

Common name	OA	EMBA	EEA
Abbott's Booby		✓	✓
Amsterdam Albatross			✓
Australian Fairy Tern	✓	✓	✓
Australian Lesser Noddy			✓
Australian Painted Snipe		✓	✓
Bar-tailed Godwit		✓	✓
Black-browed Albatross		✓	✓
Bridled Tern		✓	✓
Campbell Albatross, Campbell Black-browed Albatross		✓	✓
Caspian Tern		✓	✓
Common Greenshank, Greenshank		✓	✓
Common Noddy	✓	✓	✓
Common Sandpiper	✓	✓	✓
Curlew Sandpiper	✓	✓	✓
Eastern Curlew, Far Eastern Curlew	✓	✓	✓
Flesh-footed Shearwater		✓	✓
Fork-tailed Swift	✓	✓	✓
Great Frigatebird, Greater Frigatebird		✓	✓

Common name	OA	EMBA	EEA
Greater Crested Tern		✓	✓
Indian Yellow-nosed Albatross			✓
Lesser Frigatebird, Least Frigatebird	✓	✓	✓
Little Tern			✓
Northern Giant Petrel			✓
Northern Siberian Bar-tailed Godwit, Russkoye Bartailed Godwit		✓	✓
Oriental Plover, Oriental Dotterel		✓	✓
Oriental Pratincole		✓	✓
Osprey	✓	✓	✓
Pectoral Sandpiper	✓	✓	✓
Red Knot	✓	✓	✓
Roseate Tern	✓	✓	✓
Sharp-tailed Sandpiper	✓	✓	✓
Shy Albatross		✓	✓
Soft-plumaged Petrel		✓	✓
Southern Giant Petrel	✓	✓	✓
Southern Royal Albatross			✓
Streaked Shearwater	✓	✓	✓
Wandering Albatross			✓
Wedge-tailed Shearwater		✓	✓
White-capped Albatross		✓	✓
White-tailed Tropicbird			✓
White-winged Fairy-wren (Barrow Island), Barrow Island Black-and-white Fairy-wren		✓	✓

Table 4-9: Presence of BIAs for seabirds and shorebirds

Common name	BIA Behaviour	Seasonal Presence	OA	EMBA	EEA
Bridled Tern	Foraging (in high numbers)	Late-September to early-May			✓
Fairy Tern	Breeding	July to late-September	✓	✓	✓
Lesser Crested Tern	Breeding	March to June	✓	✓	✓
Little Tern	Resting	June, July and October			✓
Roseate Tern	Breeding	Mid-March to July	✓	✓	✓
Sooty Tern	Foraging	Late-August to early-May			✓
Wedge-tailed Shearwater	Breeding	Mid-August to April (Pilbara) or mid-May (Shark Bay)	✓	✓	✓
	Foraging (in high numbers)	Mid-August to May			✓

Common name	BIA Behaviour	Seasonal Presence	OA	EMBA	EEA
White-tailed Tropicbird	Breeding	May and October			✓

4.3.5 Marine habitat

Marine habitats considered to provide a specific value for matters of national environmental significance (MNES), as described in CAPL's *Description of the Environment: CAPL Planning Area* (Ref. 1), that were identified within the OA, EMBA, and EEA are shown in Table 4-10.

Table 4-10: Marine habitat and key sensitivities

Matter of national environmental significance	Habitat type					Presence of key value or sensitivity		
	Seagrass	Mangroves	Coral	Saltmarsh	Macroalgae	OA	EMBA	EEA
Ningaloo Coast[1,2]		✓	✓				✓	✓
Ningaloo Marine Area – Commonwealth Waters[3]			✓				✓	

1. *World Heritage Property*
2. *National Heritage Place*
3. *Commonwealth Heritage Place*

In addition to the broad marine habitat description provided for the EMBA and EEA, CAPL conducted pre-construction seabed surveys within the OA.

Geophysical and geotechnical surveys, using techniques such as echo sounder, sub-bottom profilers, side-scan sonar, and ROV, were carried out along within the OA prior to pipeline construction. Surveys of benthic habitats targeting specific areas of interest along the route were then carried out based on the results of these surveys.

The substrate along the OA from the State Water boundary to water depth of ~50 m was found to be dominated by bare sand (Figure 4-2). Sand was the dominant substrate in most of the observations (~90%) along the operational area. Limestone pavement with a shallow sand veneer was the next most common substrate encountered, dominating the substrate in less than 10% of observations. Reef (low and high profile) was the dominant substrate in less than 5% of observations (Ref. 21).

Towed video surveys were also conducted at the inner reef area (~40 m water depth), the outer reef area (~50–55 m water depth), and the area between them. Most of the OA in this area is classified as unvegetated, in terms of the dominant ecological element observed (Ref. 21). The inner reef rises several metres above the surrounding seabed and is characterised by areas of exposed rocky platform reef and areas of upstanding reef. The platform reef supports scattered corals and sponges; however, this reef is too deep to support well-developed benthic primary producer assemblages. The reef appears to be part of a linear series of reefs that run north–south; side-scan sonar data revealed features of a similar profile ~5 km south of the OA (Ref. 22). The outer reef comprises limestone and supports encrusting sponges and scattered deep water coral (Ref. 22). Black coral, *Cirrhipathes* sp., was observed at nine locations along the outer reef. In locations where black coral was observed, it was present as a subdominant taxa in areas dominated by sponges and other benthic macroinvertebrates (Ref. 21).

Further offshore in the Gorgon gas field, at ~200 m water depth, the seabed comprises soft bioturbated sediments. The benthos in this area is well below the photic zone so there are no marine macrophytes (Ref. 22). Similarly, during an ROV survey in the gully region along the Jansz pipeline route in ~250 m water depth, the seabed was found to be dominated by silty mud with little evidence of life (Figure 4-3) (Ref. 23).

To determine the type of benthic habitat present in the deeper area, five transects, which ranged from 558 m to 714 m water depth, were filmed along the OA. An additional transect was also run along a narrow depth band between 643 m and 656 m water depth, following a hard outcropping area of the scarp (Figure 4-4). The substrate most found in this deeper water comprised soft sediments—sand, silt, and mud. However, these habitat types are widespread in the region and are not considered to be of regional significance due to their ubiquity and the sparseness of biota supported (Ref. 23). The steep scarp face was found to comprise mainly over-consolidated silt materials, mostly devoid of marine growth, with occasional sparse communities of benthic invertebrates including soft corals, bryozoans, and colonial ascidians (Figure 4-4). These over-consolidated silt sediments provide structural diversity to an otherwise flat benthos. They are of higher conservation significance than the soft sediment habitats found in the area as they are less widespread and support more abundant biota. However, based on the high-resolution bathymetry data from the area, these hard scarp features probably stretch at least 10 km to the north and 5 km to the south of the operational area (Ref. 23).

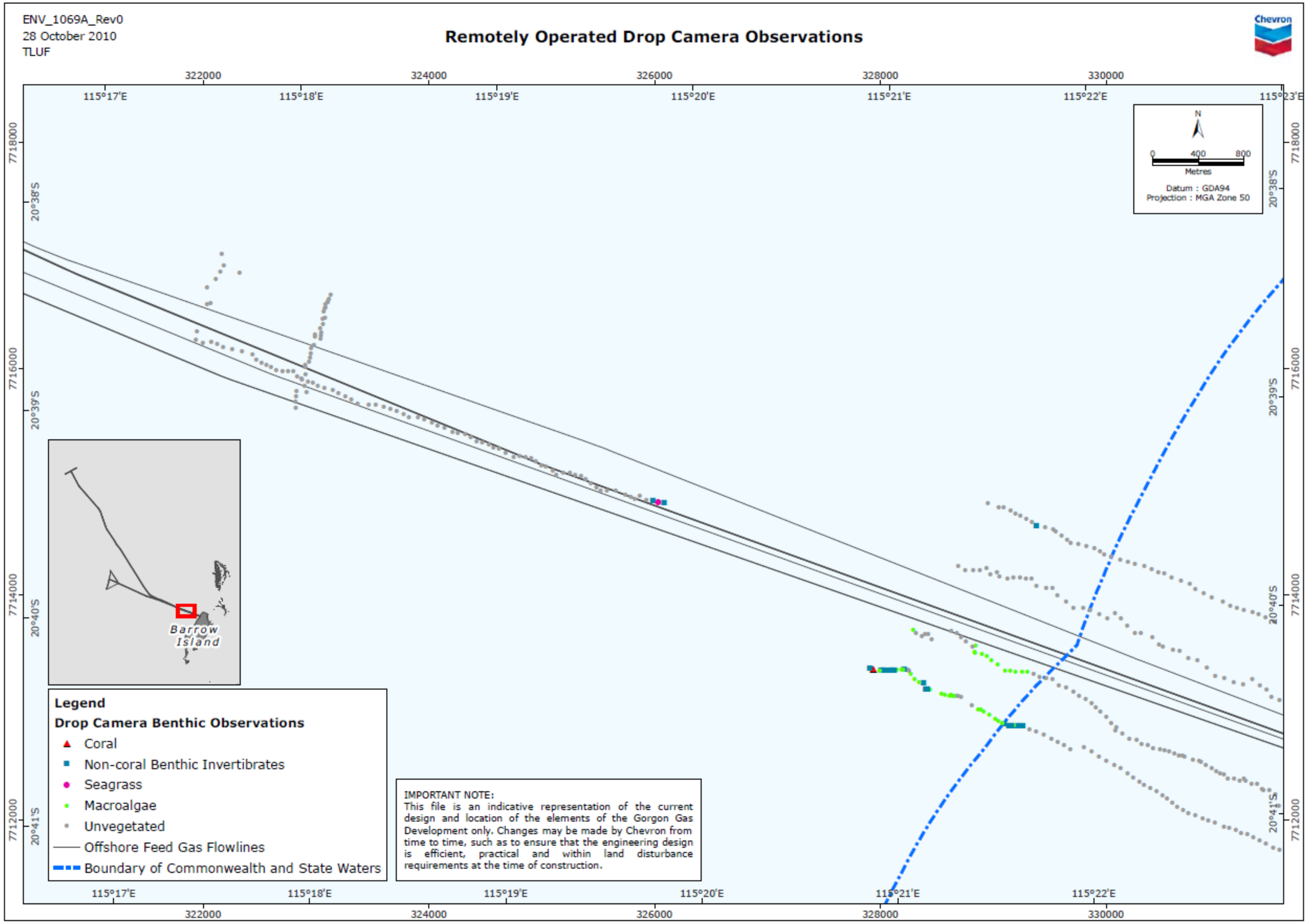
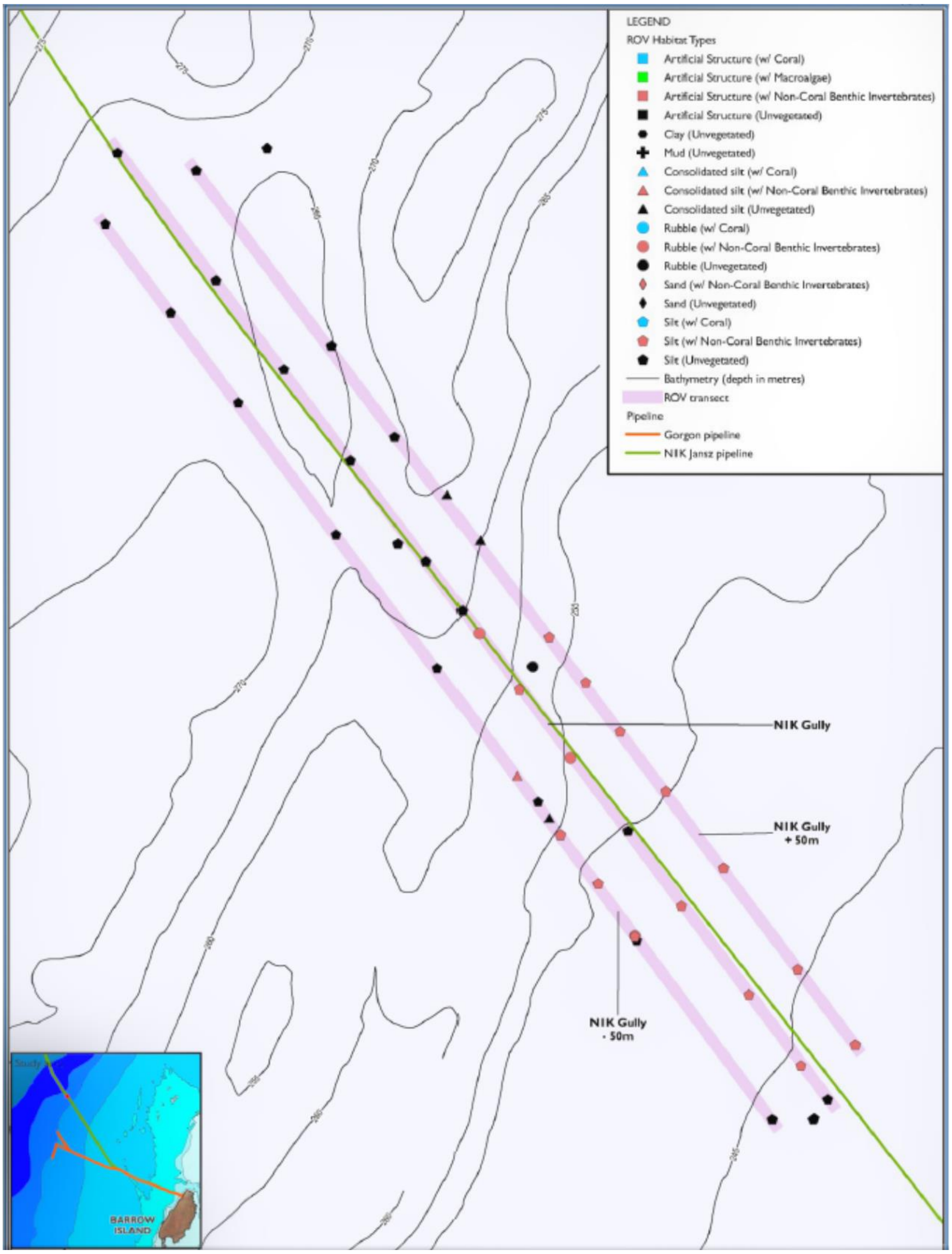
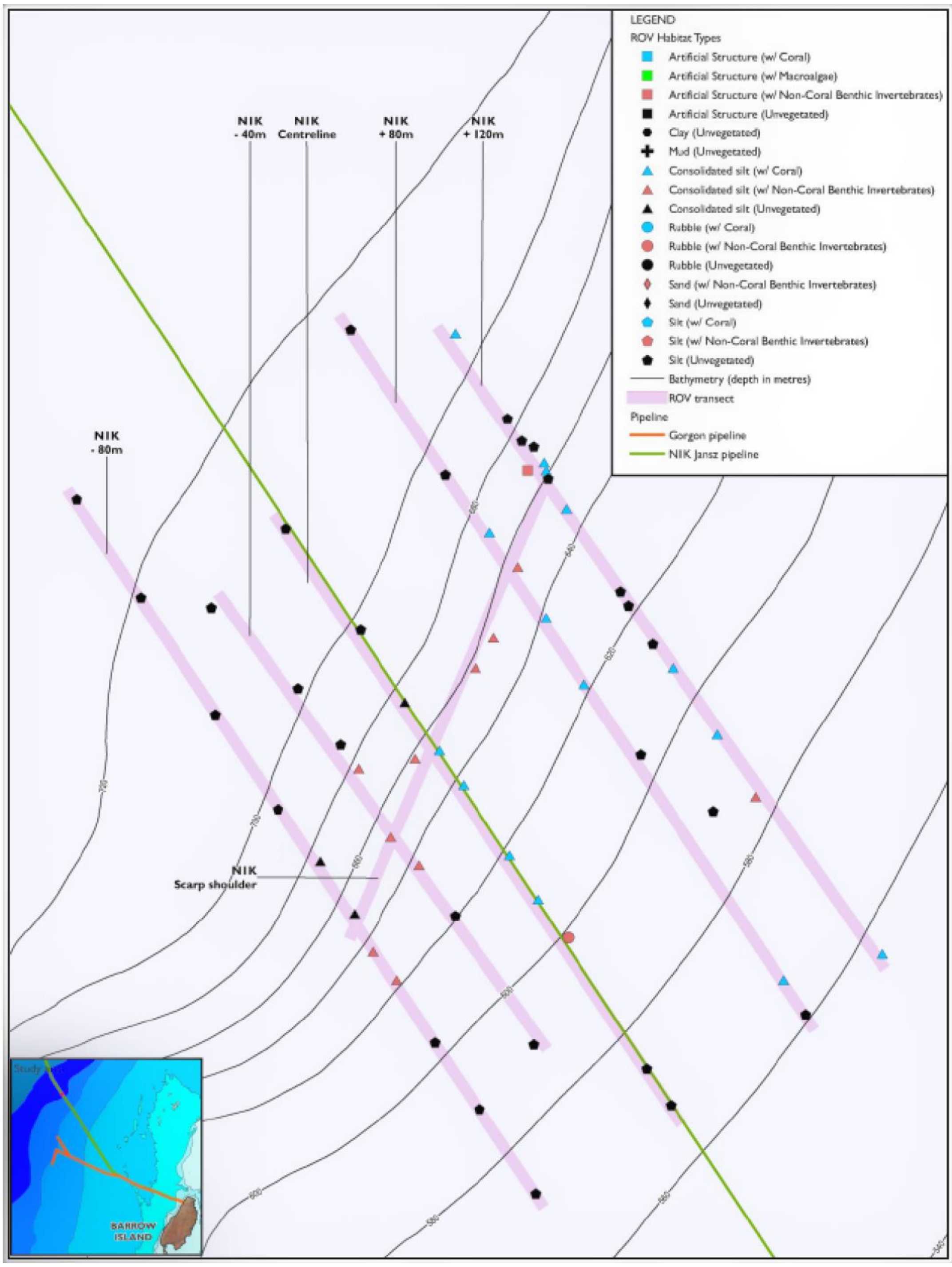


Figure 4-2: Dominant marine habitats within the OA



(Source: Ref. 23)

Figure 4-3: Benthic habitat at the gully region



(Source: Ref. 23)

Figure 4-4: Benthic habitat at the scarp region

4.4 Commercial interests

4.4.1 Commercial fisheries

Natural and physical resources are described as substances occurring in nature that can be exploited for economic gain. The specific resources considered in this EP include commercial fisheries. CAPL's *Description of the Environment: CAPL Planning Area* (Ref. 1) identifies and summarises the commercial fisheries that have management areas present within the Planning Area, and seasonal catch data for the entire fishery. The occurrence of recent fishing effort within the areas (OA, EMBA, and EEE) specific to this EP are identified below.

The State-managed commercial fisheries with fishing effort recorded over a 20-year period (1999–2019) (Ref. 24) within areas that overlap the OA, EMBA, and EEA are listed in Table 4-11. Three fisheries were identified with activity within the vicinity of the OA; these are shown in Figure 4-5, Figure 4-6, and Figure 4-7. The Mackerel Managed Fishery utilises near-surface trolling or jig fishing methods, with vessels primarily active during May to November (Ref. 25), and with the bulk of the catch typically taken north of the OA within Kimberley waters (Ref. 26). The Pilbara Line and Pilbara Trap fisheries are part of the Pilbara Demersal Scalefish Fishery. The Pilbara Line Fishery (line fishing methods) operates on an exemption basis which restricts vessels to operating within a nominated 5-month block period each year. The Pilbara Trap Fishery (trap methods) is managed through area closures and effort allocations (Ref. 26). For the 2019 fishing year, the bulk of the catch within the Pilbara Demersal Scalefish Fishery was landed by the trawl sector (which does not occur within the OA); with a smaller contributions from the trap (23%) and line (5%) sectors (Ref. 25).

The Commonwealth-managed commercial fisheries with fishing effort recorded over a five-year period (2014–2018) (Ref. 27) within areas that overlap the OA, EMBA, and EEA are listed in Table 4-12. The only fishery with fishing effort recorded within the OA was the North West Slope Trawl Fishery (Table 4-12, Figure 4-8). However, while the North West Slope Trawl Fishery was active within its management area and did record fishing effort during all (2014–2018) years, active fishing effort only occurred within the OA during 2015 (specifically within a 60 nm block intersecting the Jansz permit (Ref. 27). Relative fishing intensity data is not available for this fishery due to low vessel numbers and confidentiality. The North West Slope Trawl Fishery use bottom (or demersal) trawl methods to target deep-water prawn and scampi that live on or near the seafloor. The Southern Bluefin Tuna Fishery is active within waters in the Great Australian Bight and south-eastern Australia (i.e., not within the OA, EMBA, or EEA); however, the spawning grounds for Southern Bluefin Tuna are located in the north-east Indian Ocean (Ref. 27). This indicative spawning area extends into the OA, EMBA, and EEA.

Table 4-11: Presence of fishing effort recorded during 1999–2019 within State-managed commercial fisheries

Fishery	OA	EMBA	EEA
North Coast Bioregion			
Mackerel Managed Fishery	✓	✓	✓
Nickol Bay Prawn Managed Fishery		✓	✓
Onslow Prawn Managed Fishery		✓	✓
Pilbara Crab Managed Fishery		✓	✓
Pilbara Fish Trawl (Interim) Managed Fishery			✓
Pilbara Line Fishery	✓	✓	✓
Pilbara Trap Managed Fishery	✓	✓	✓
West Australian Sea Cucumber (Beche-De-Mer) Fishery		✓	✓

Fishery	OA	EMBA	EEA
Gascoyne Bioregion			
Exmouth Gulf Prawn Managed Fishery		✓	✓
Gascoyne Demersal Scalefish Fishery			✓
Shark Bay Crab Fishery			✓
Shark Bay Prawn Managed Fishery			✓
Shark Bay Scallop Managed Fishery			✓
West Coast Deep Sea Crustacean Fishery			✓
West Coast Bioregion			
West Coast Rock Lobster Fishery			✓
Statewide			
Marine Aquarium Fish Managed Fishery		✓	✓
Specimen Shell Managed Fishery		✓	✓

Table 4-12: Presence of recent (2014-2018) fishing effort recorded within Commonwealth-managed commercial fisheries

Fishery	OA	EMBA	EEA
North-West Slope Trawl Fishery	✓	✓	✓
Western Deepwater Trawl		✓	✓
Western Tuna and Billfish Fishery			✓

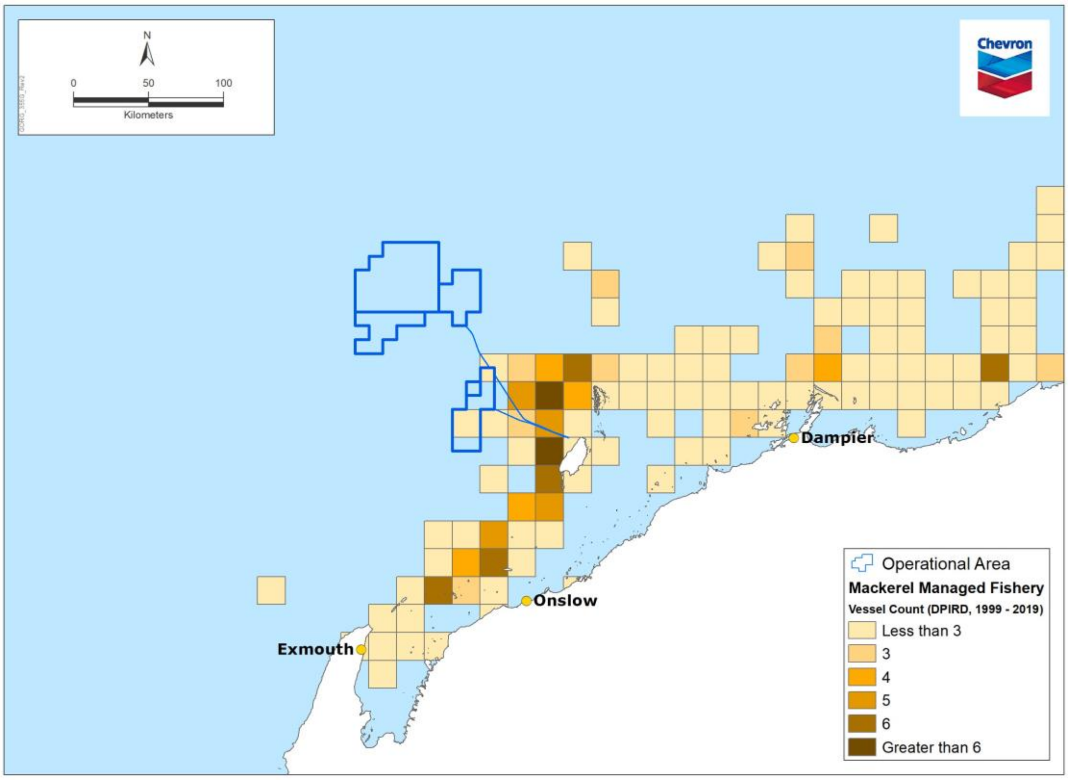


Figure 4-5: Recorded fishing effort (1999–2019) for the Mackerel Managed Fishery within the vicinity of the OA

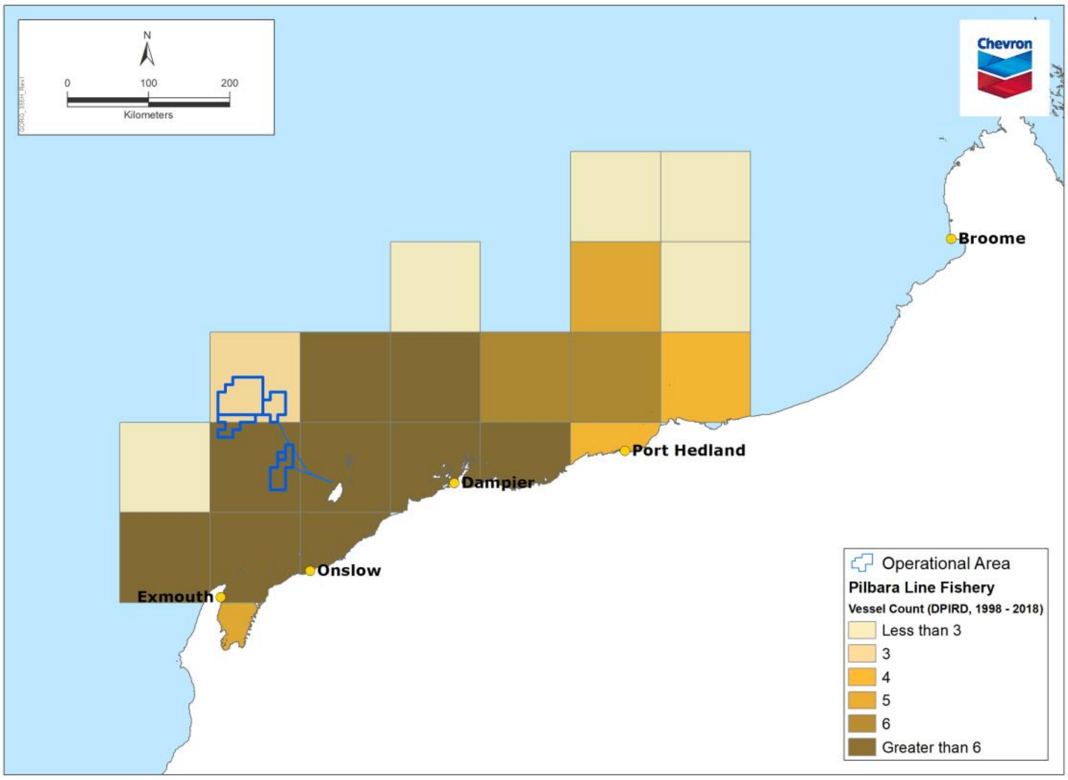


Figure 4-6: Recorded fishing effort (1999–2019) for the Pilbara Line Fishery within the vicinity of the OA

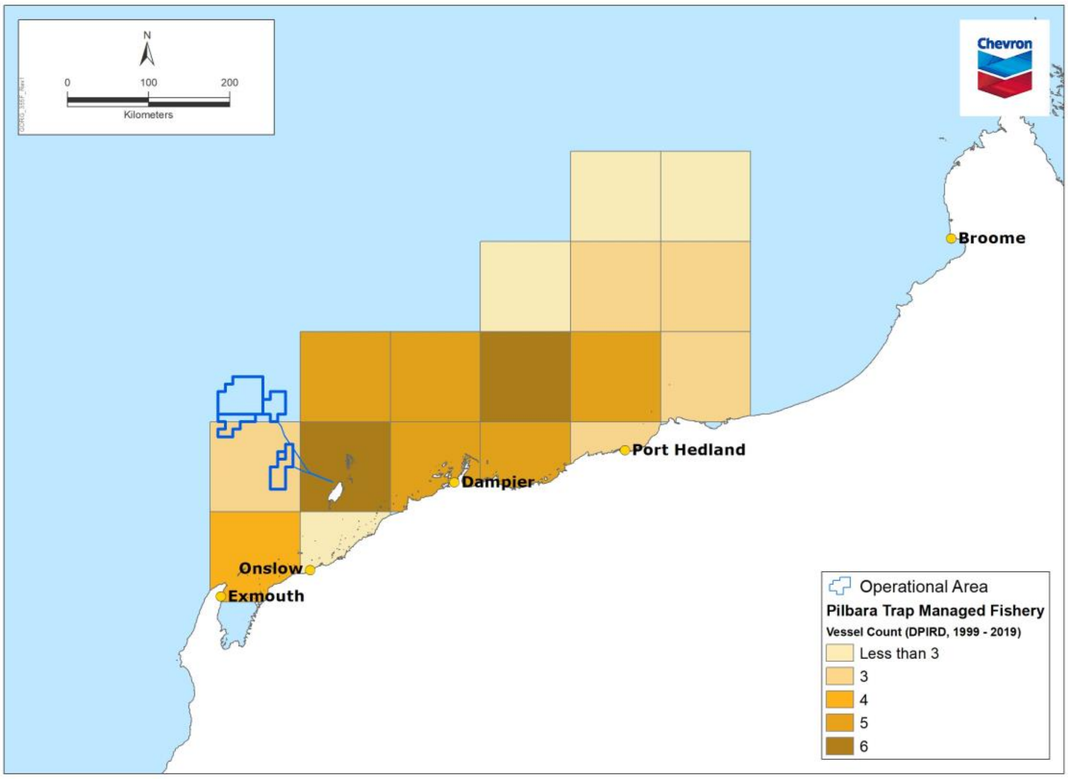
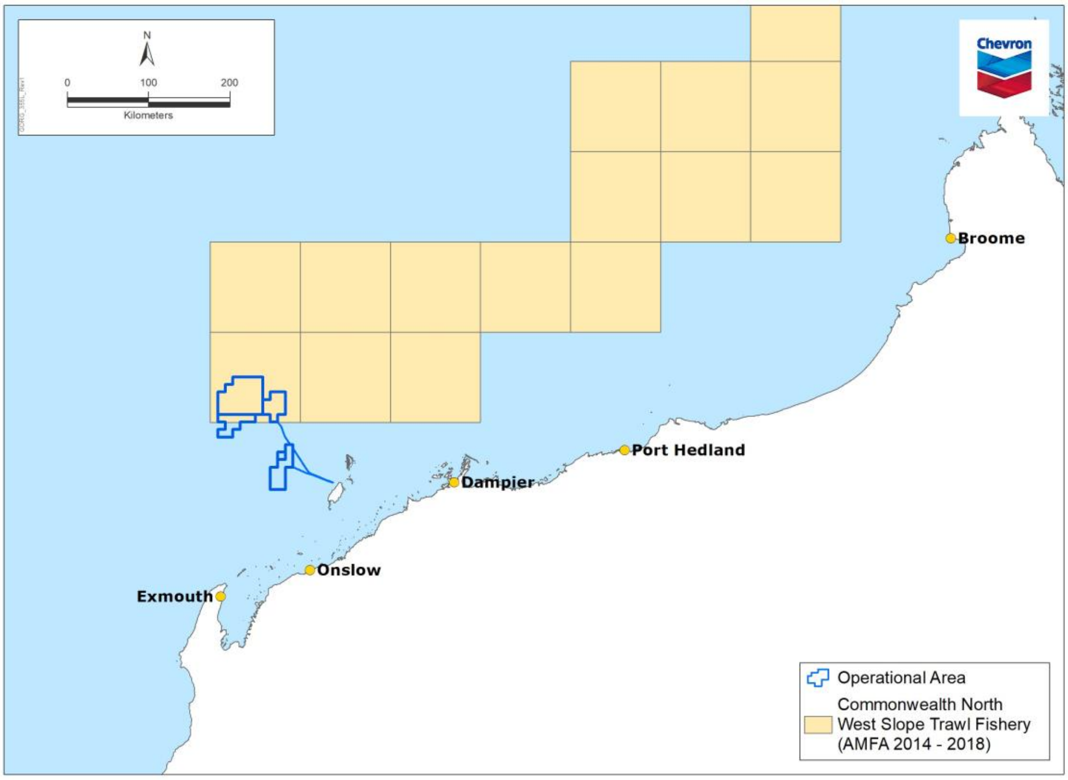


Figure 4-7: Recorded fishing effort (1999–2019) for the Pilbara Trap Managed Fishery within the vicinity of the OA



Source: Fisheries data were supplied by the Australian Bureau of Agricultural and Resource Economics and Sciences from data collected by the Australian Fisheries Management Authority. Where <5 vessels were operating data is available only in the form of a 'footprint' (i.e., total area of waters fished), and not as a relative fishing intensity.

Figure 4-8: Presence of fishing activity (2014-2018) for the North West Slope Trawl Fishery within the vicinity of the OA

4.4.2 Shipping

AMSA collects vessel traffic data from a variety of sources, including satellite shipborne automated identification system (AIS) data, across Australia's Search and Rescue region. This data has been used to develop Figure 4-9, which shows recent vessel traffic within the vicinity of the OA. The figure shows increased density around CAPL's existing infrastructure, but also shows that the OA is not located within any of the main shipping fairways on the North West Shelf (NWS).

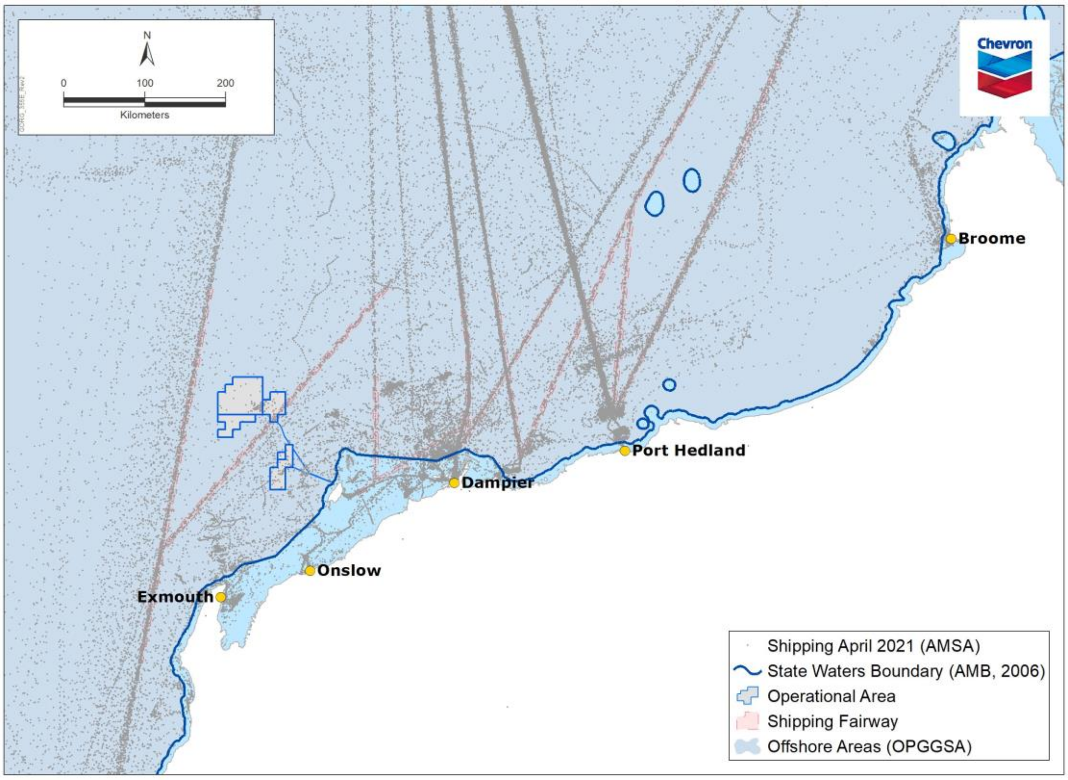


Figure 4-9: Vessel traffic within the vicinity of the OA

4.5 Qualities and characteristics of locations, places, and areas

CAPL's *Description of the Environment: CAPL Planning Area* (Ref. 1) identifies and describes the qualities and characteristics of the locations, places, and areas, present within the Planning Area, that CAPL considers to comprise these receptor groups:

- Ramsar wetlands
- Threatened ecological communities (TECs)
- Australian Marine Parks (AMPs)
- Key ecological features (KEFs).

Specific to activities within this EP, there were no Ramsar wetlands or TECs identified within the OA, EMBA, or EEA. The specific presence of AMPs and KEFs within the OA, EMBA, and EEA is detailed in Table 4-13 and Table 4-14 respectively.

Table 4-13: Presence of AMPs

Australian Marine Park	OA	EMBA	EEA
Abrolhos			✓
Argo-Rowley Terrace			✓
Carnarvon Canyon		✓	✓
Gascoyne		✓	✓
Montebello	✓	✓	✓

Australian Marine Park	OA	EMBA	EEA
Ningaloo		✓	✓
Shark Bay			✓

Table 4-14: Presence of KEFs

Key ecological feature	OA	EMBA	EEA
Ancient coastline at 125 m depth contour	✓	✓	✓
Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula		✓	✓
Commonwealth waters adjacent to Ningaloo Reef		✓	✓
Continental slope demersal fish communities	✓	✓	✓
Exmouth Plateau	✓	✓	✓
Glomar Shoals			✓
Mermaid Reef and Commonwealth waters surrounding Rowley Shoals			✓
Meso-scale eddies			✓
Wallaby Saddle			✓
Western demersal slope and associated fish communities			✓

4.6 Heritage value of places

CAPL's *Description of the Environment: CAPL Planning Area* (Ref. 1) identifies and describes heritage values present within the Planning Area.

The World Heritage properties, National Heritage places, and Commonwealth Heritage places within the OA, EMBA and EEA are listed in Table 4-15, Table 4-16, and Table 4-17 respectively.

Historic shipwrecks and sunken aircrafts (>75 years old) and other underwater heritage artefacts and sites are protected under the Commonwealth *Underwater Cultural Heritage Act 2018*. The Australasian Underwater Cultural Heritage Database (Ref. 28) identified that no historic shipwrecks are present within the OA, but some do occur within the spatial extent of the EMBA and EEA; and no historic sunken aircrafts were identified within the OA, EMBA, or EEA.

Table 4-15: World Heritage properties

World Heritage Properties	OA	EMBA	EEA
The Ningaloo Coast		✓	✓

Table 4-16: National Heritage places

National Heritage Properties	OA	EMBA	EEA
HMAS Sydney II and *HSK Kormoran* shipwreck sites			✓
The Ningaloo Coast		✓	✓

Table 4-17: Commonwealth Heritage places

Commonwealth Heritage Properties	OA	EMBA	EEA
HMAS Sydney II and *HSK Kormoran* shipwreck sites			✓
Learmonth Air Weapons Range Facility			✓
Ningaloo Marine Area – Commonwealth Waters		✓	✓

5 environmental impact and risk assessment methodology

This section provides a description of the methods used to identify and evaluate the environmental impacts and risks associated with the petroleum activities (as described in Section 3) and any potential emergency conditions associated with these activities. These methods support the environmental impact and risk assessment as required under Regulation 13(5) of the OPGGS(E)R.

The impact and risk assessment for this EP was undertaken in accordance with the CAPL's *ABU OE Risk Management Process* (Ref. 29) and using Chevron Corporation's Integrated Risk Prioritization Matrix (Table 5-1). This approach generally aligns with the processes outlined in ISO 31000:2018 *Risk management – Principles and guidelines* (Ref. 30) and the HB 203:2012 *Managing environment-related risk* (Ref. 31).

The impact and risk assessment process and evaluation involved consulting with environmental, health, safety, commissioning, start-up, operations, maintenance, engineering, and emergency response personnel. The impacts and risks considered and covered in this EP were identified and informed by:

- experience gained during the GFP
- expertise and experience of CAPL personnel involved in operations
- stakeholder engagement (Section 2.6).

5.1 Identification and description of the petroleum activity

All components of the petroleum activity and potential emergency conditions relevant to the scope of this EP are described and evaluated during the impact and risk assessment. The petroleum activity is described in detail in Section 3.

5.2 Identification of particular values and sensitivities

The presence of environmental values and sensitivities within the OA, EMBA, and wider EEA is documented in Section 4, with these values and sensitivities further described in CAPL's *Description of the Environment: CAPL Planning Area* (Ref. 1; appendix d). In accordance with Regulation 13(3) of the OPGGS(E)R, the particular values and sensitivities were identified as:

- 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
  - Commonwealth land within the meaning of the EPBC Act.

Because many protected, rare, or endangered fauna have the potential to transit through the OA, EMBA, and wider EEA, the habitat and/or temporal area that supports protected and endangered fauna (including areas defined as BIAs for these species) is considered the particular value or sensitivity.

5.3 Identification of relevant aspects

CAPL defines an aspect as an element of CAPL's activities, products, or services related to an operation that has the potential to interact with the environment at present or later (e.g., wastewater discharge, greenhouse gas emission, legacy environmental obligations).

After describing the petroleum activity, an assessment was carried out to identify potential interactions between the petroleum activity and the receiving environment. The outcomes of stakeholder consultation also contributed to this scoping process.

Note: Potential interactions with safety, health, and assets is outside the scope of this EP.

Environmental aspects categorised for use in the impact and risk assessment of this petroleum activity include:

- physical presence
- seabed disturbance
- air emissions
- greenhouse gas emissions
- light emissions
- underwater sound
- invasive marine pests
- planned discharges
- unplanned releases.

5.4 Identification of relevant environmental impacts and risks

Potential impacts and risks arising from the aspects were then identified during a scoping exercise and then evaluated in detail.

5.5 Evaluation of impacts and risks

5.5.1 Consequence

After identifying the aspects, and associated potential impacts and risks, the potential consequences were evaluated using the Integrated Risk Prioritization Matrix (Table 5-1). The consequence level is determined by considering:

- the spatial scale or extent of potential interactions within the receiving environment
- the nature of the receiving environment (within the spatial extent), including proximity to sensitive receptors, relative importance, and sensitivity or resilience to change

- the impact mechanisms (cause and effect) of the aspect within the receiving environment (e.g., persistence, toxicity, mobility, bioaccumulation potential)
- the duration and frequency of potential effects and time for recovery
- the potential degree of change relative to the existing environment or to acceptability criteria.

For aspects that have the potential to cause both impacts and risks, the highest level consequence was carried through the remainder of the assessment to ensure the most conservative analysis is presented.

Table 5-1: Chevron Corporation’s Integrated Risk Prioritization Matrix

Likelihood Descriptions	Expected to occur	Likely	1	6	5	4	3	2	1
	Conditions may allow to occur	Occasional	2	7	6	5	4	3	2
	Exceptional conditions may allow to occur	Seldom	3	8	7	6	5	4	3
	Reasonable to expect will not occur	Unlikely	4	9	8	7	6	5	4
	Has occurred once or twice in the industry	Remote	5	10	9	8	7	6	5
	Rare or unheard of	Rare	6	10	10	9	8	7	6
Consequence Descriptions				6	5	4	3	2	1
				Incidental	Minor	Moderate	Major	Severe	Catastrophic
				Limited environmental impact	Localised, short-term environmental impact	Localised, long-term environmental impact	Short-term, widespread environmental impact	Long-term widespread environmental impact	Persistent landscape-scale environmental impact

5.5.2 Control measures and ALARP

The process for identifying control measures depends on the 'as low as reasonably practicable' (ALARP) decision context set for that particular aspect. Regardless of the process, control measures are assigned in accordance with the defined environmental performance outcomes, with the objective to eliminate, prevent, reduce, or mitigate consequences associated with each identified environmental impact and risk.

5.5.2.1 ALARP decision context

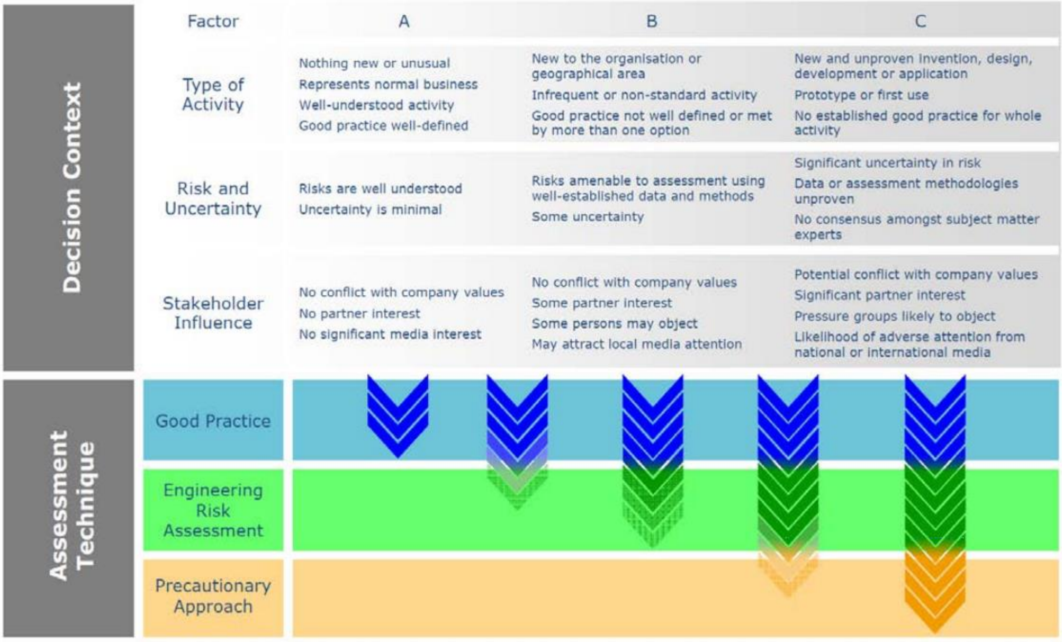
In alignment with NOPSEMA's ALARP guidance note (Ref. 32), CAPL has adapted the approach developed by Oil and Gas UK (OGUK) (Ref. 33) for use in an environmental context to determine the assessment technique required to demonstrate that impacts and risks are ALARP. Specifically, the framework considers the magnitude of impacts and risks along with these guiding factors:

- activity type
- risk and uncertainty
- stakeholder influence.

A Type A decision (Figure 5-1) is made for lower-order impacts and risks (Table 5-3) where they are relatively well understood, activities are well-practised, and there is no significant stakeholder interest. However, if good practice is not sufficiently well defined, additional assessment may be required. In addition, where an aspect associated with the activity is listed as either a key threat to a protected matter under a document made or implemented under the EPBC Act (such as recovery plans, conservation management plans, or a conservation advice), or identified as an aspect of concern to a listed conservation value under an EPBC Act marine bioregional plan, and can result in a credible impact or risk to these sensitivities, additional control consideration will be undertaken.

A Type B decision (Figure 5-1) is made for higher-order impacts and risks (Table 5-3) if there is greater uncertainty or complexity around the activity, and there are relevant concerns from stakeholders. In this instance, established good practice is not considered sufficient and further assessment is required to support the decision and ensure the risk is ALARP.

A Type C decision (Figure 5-1) typically involves sufficient complexity, higher-order impact and risks (Table 5-3), uncertainty, or stakeholder interest to require a precautionary approach. In this case, relevant good practice still has to be met, additional assessment is required, and the precautionary approach must be considered for those controls that only have a marginal cost benefit.



(Source: Ref. 32)

Figure 5-1: ALARP decision support framework

In accordance with the regulatory requirement to demonstrate that environmental impacts and risks are ALARP, CAPL has considered the above decision context in determining the level of assessment required. This is applied to each aspect described in Sections 6. The assessment techniques considered include:

- good practice
- engineering risk assessment
- precautionary approach.

5.5.2.2 Good practice

OGUK (Ref. 33) defines 'good practice' as:

> *The recognised risk management practices and measures that are used by competent organisations to manage well-understood hazards arising from their activities.*

Good practice can also be used as the generic term for those measures that are recognised as satisfying the law. For this EP, sources of good practice include:

- requirements from Australian legislation and regulations
- relevant Commonwealth government policies
- relevant Commonwealth government guidance
- relevant industry standards
- relevant international conventions.

If the ALARP technique is determined to be good practice, further assessment (an engineering risk assessment) is not required to identify additional controls. However, additional controls that provide a suitable environmental benefit for an insignificant cost have been identified.

5.5.2.3 Engineering risk assessment

All impacts and risks that require further assessment are subject to an engineering risk assessment. Based on the various approaches recommended by OGUK (Ref. 33), CAPL believes the methodology most suited to this activity is a comparative assessment of risks, costs, and environmental benefit. A cost–benefit analysis should show the balance between the risk benefit (or environmental benefit) and the cost of implementing the identified measure, with differentiation required such that the benefit of the risk-reduction measure can be seen and the reason for the benefit understood.

5.5.2.4 Precautionary approach

After considering all available engineering and scientific evidence, OGUK (Ref. 33) state that if the assessment is insufficient, inconclusive, or uncertain, then a precautionary approach to hazard management is needed. A precautionary approach will mean that uncertain analysis is replaced by conservative assumptions that will result in control measures being more likely to be implemented.

That is, environmental considerations are expected to take precedence over economic considerations, meaning that a control measure that may reduce environmental impact is more likely to be implemented. In this decision context, the decision could have significant economic consequences to an organisation.

5.5.3 Likelihood

For environmental impacts (where there is a planned emission or discharge resulting in a known change to the environment) likelihood is not considered.

For risks where the aspect or event may lead to environmental impacts under certain circumstances, the likelihood (probability) of the defined consequence occurring is determined. The likelihood is considered on the assumption that all control measures are in place. The likelihood of a consequence occurring was identified using one of the six likelihood categories shown in Table 5-1.

5.5.4 Quantification of the level of risk

The Integrated Risk Prioritization Matrix (Table 5-1) was applied during an environmental risk assessment workshop. This matrix uses consequence and likelihood rankings of 1 to 6, which when combined, result in a risk level between 1 (highest risk) and 10 (lowest risk). Risk assessment outcomes are based solely on assessment of risk to the environment (as defined under the OPGGS(E)R).

5.6 Impact and risk acceptance criteria

NOPSEMA provides guidance on demonstrating that impacts and risks will be of an ‘acceptable level’ (Ref. 12). This guidance indicates that an acceptable level is the level of impact or risk to the environment that may be considered broadly acceptable with regard to all relevant considerations, including:

- principles of ecologically sustainable development (ESD)
- legislative and other requirements (including laws, policies, standards, conventions)
- matters protected under Part 3 of the EPBC Act, consistent with relevant policies, guidelines, threatened species recovery plans, management plans, management principles etc.

- internal context (titleholder policy, culture, processes, standards and systems)
- external context (existing environment, stakeholder expectations).

5.6.1 Principles of ESD and precautionary principle

The principles of ESD are considered in Table 5-2 in relation to acceptability evaluations.

Under the EPBC Act, the Minister must also take into account the precautionary principle in determining whether or not to approve the taking of an action. The precautionary principle (Section 391(2) of the EPBC Act) is that lack of full scientific certainty should not be used as a reason for postponing a measure to prevent degradation of the environment where there may be threats of serious or irreversible environmental damage.

Table 5-2: Principles of ESD in relation to petroleum activity acceptability evaluations

Principles of ESD	How they have been applied
(a) decision-making processes should effectively integrate both long-term and short-term economic, environmental, social, and equitable considerations	CAPL's impact and risk assessment process integrates long-term and short-term economic, environmental, social, and equitable considerations. This is demonstrated through the Integrated Risk Prioritization Matrix (Table 5-1), which includes provision for understanding the long-term and short-term impacts associated with its activities, and the ALARP process, which balances the economic cost against environmental benefit. As this principle is inherently met by applying the EP assessment process, it is not considered separately for each evaluation.
(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	Consider if there is serious or irreversible environmental damage (i.e., consequence level between Major [3] and Catastrophic [1]). If so, assess whether there is significant uncertainty associated with the aspect.
(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 risk assessment methodology ensures that impacts and risks are reduced to levels that are considered ALARP. If the impacts and risk are determined to be serious or irreversible, the precautionary principle is implemented to ensure that risks are managed to ensure that the environment is maintained for the benefit of future generations.
(d) the conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making	Evaluate if there is the potential to affect biological diversity and ecological integrity.
(e) improved valuation, pricing, and incentive mechanisms should be promoted	Not considered relevant for petroleum activity acceptability demonstrations.

5.6.2 Defining an acceptable level of impact and risk

In alignment with NOPSEMA's ALARP guidance note (Ref. 32), CAPL has applied the approach that lower-order environmental impacts or risks (Table 5-3) assessed as Decision Context A are 'broadly acceptable', while higher-order environmental impacts or risks determined to be Decision Context B or C require further evaluation against a defined acceptable level because they are not inherently ‘broadly acceptable’. However, in alignment with NOPSEMA’s decision making guidance (Ref. 12) even where the impact or risk is evaluated as being a lower-order impact or risk, but the aspect associated with the activity is listed as a threat to a protected matter under a document made or implemented under the EPBC Act, or identified as an aspect of concern to a listed conservation value under an EPBC Act Marine Bioregional Plans, and can result in a credible impact or risk, CAPL will define an acceptable level of impact and risk in accordance with a document made or implemented under the EPBC Act.

Table 5-3: CAPL definition of lower-order and higher-order impacts and risks

Magnitude	Impacts	Risk	Decision context
Lower-order	Consequence Level: 4–6	Risk Level: 7–10	A
Higher-order	Consequence Level: 1–3	Risk Level: 1–6	B or C

CAPL will consider these types of documents when defining the acceptable level of impact or risk:

- bioregional plans
- AMP plans
- conservation advice
- recovery plans
- government guidelines.

The objectives of the documents are identified and, having regard for the described activity, CAPL will set an acceptable level of impact that aligns with these objectives. Where the impact arising from the activity is inconsistent with the defined level (or objectives of the relevant documents), it is unacceptable.

5.6.3 Summary of acceptance criteria

Table 5-4 outlines the criteria that CAPL used to demonstrate that impacts and risks from each identified aspect are acceptable.

Table 5-4: Acceptability criteria

Criteria	Test
Principles of ESD	Is there the potential to affect biological diversity and ecological integrity? Do activities have the potential to result in permanent/irreversible, medium-large scale, and/or moderate-high intensity environmental damage?
	If yes: Is there significant scientific uncertainty associated with the aspect?
	If yes: Are there additional measures to prevent degradation of the environment from this aspect?
Relevant environmental legislation and other requirements	Confirm that impact and risk management is consistent with relevant Australian environmental management laws and other regulatory / statutory requirements.

Criteria	Test
Internal context	Confirm that all good practice control measures were identified for this aspect through CAPL's management systems and that impact and risk management is consistent with company policy, culture, and standards.
External context	What objections and claims regarding this aspect were made, and how were they considered / addressed?
Defined acceptable level	Is the impact and risk broadly acceptable (i.e. Decision Context A)?
	If no: For higher-order environmental impacts and risks (Decision Context B or C), what is the defined level of impact, and does the activity meet this level?

5.7 Environmental performance outcomes, standards, and measurement criteria

Environmental performance outcomes, performance standards, and measurement criteria were defined to address the environmental impacts and risks identified during the risk assessment.

CAPL is committed to conducting activities associated with the petroleum activity in an environmentally responsible manner and aims to implement best practice environmental management as part of a program of continual improvement to reduce impacts and risks to ALARP. CAPL defines environmental performance outcomes, standards, and measurement criteria that relate to the management of the identified environmental risks as:

- **Environmental performance outcomes**—a measurable level of performance required for the management of environmental aspects of an activity to ensure that environmental impacts and risks will be of an acceptable level
- **Environmental performance standards**— a statement of the performance required of a control measure
  - These statements will consider the effectiveness of the control measures, and, in accordance with NOPSEMA's decision making guidance (Ref. 12), effectiveness will be considered with regards to the controls' functionality, availability, reliability, survivability, independence, and compatibility with other control measures
- **Measurement criteria**—compliance and assurance statement or records that detail how CAPL enacts the outlined performance standard; these are used to determine whether the environmental performance outcomes and standards were met and whether the implementation strategy was complied with. If no practicable quantitative target exists, a qualitative criterion is set.

6 environmental impact and risk assessment and management strategy

This section provides an evaluation of the impacts and risks associated with the petroleum activity appropriate to the nature and scale of each impact and risk, details the control measures that are used to reduce the risks to ALARP and to an acceptable level, and identifies the associated environmental performance outcomes, performance standards, and measurement criteria, as required under Regulations 13(5), 13(6) and 13(7) of the OPGGS(E)R.

Table 6-1 summarises the impacts and risks that were identified and evaluated for this activity.

Table 6-1: Summary of impact and risk evaluation

Section	Aspect	Impact	Risk			Decision context	ALARP	Acceptable
		C^	C^	L	R			
6.1	Physical presence—Other marine users	–	6	4	9	A	Yes	Yes
6.2	Physical presence—Marine fauna	–	6	3	8	A	Yes	Yes
6.3	Seabed disturbance	5	–	–	–	A	Yes	Yes
6.4	Air emissions	6	–	–	–	A	Yes	Yes
6.5	Greenhouse gas emissions	6	–	–	–	A	Yes	Yes
6.5	Light emissions	6	6	5	10	A	Yes	Yes
6.7	Underwater sound	5	5	3	7	A	Yes	Yes
6.8	Invasive marine pests	–	2	6	6	A	Yes	Yes
6.9	Planned discharges—Vessel operations	6	6	6	10	A	Yes	Yes
6.10	Planned discharges—Subsea operations	6	6	6	10	A	Yes	Yes
6.11	Unplanned release—Waste	–	6	5	10	A	Yes	Yes
6.12	Unplanned release—Loss of containment	–	5	5	9	A	Yes	Yes
6.13	Unplanned release—Vessel collision event	–	5	5	9	A	Yes	Yes
6.14	Unplanned release—Hydrocarbon system	–	5	5	9	A	Yes	Yes
6.15.4.1	Ground disturbance—shoreline spill response	–	5	5	9	A	Yes	Yes
6.15.4.2	Physical presence—oiled wildlife response	–	5	5	9	A	Yes	Yes

C = consequence, L = likelihood, R = risk

^ Where an aspect is identified as having both potential impacts and risks, the highest-level consequence was evaluated in detail to ensure that justification is provided to support the highest consequence level for that aspect.

6.1 Physical presence—Other marine users

Source			
Activities identified as having the potential to result in an interaction with other marine users are: • permanent presence of the subsea hydrocarbon system within the OA • temporary presence of vessels within the OA during IMR activities.			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
N/A	–	Unplanned interactions with other marine uses may result in: • disruption to commercial shipping and fishing vessels • entanglement of trawl fishing gear on subsea infrastructure.	6
Consequence evaluation			
The hydrocarbon system infrastructure associated with this activity is contained wholly within the OA. Support vessels undertaking IMR activities will also be present within the OA but only have a temporary presence (e.g., estimates of 40–100 days for inspections, 10–90 days for minor maintenance/repairs, or 90–180 days for major maintenance/repairs). The OA consists of an area of ~1550 km^2. The potential for unplanned interactions between other marine users with the subsea hydrocarbon system is limited to where these users interact with the seafloor. Marine users that have the potential to interact with the subsea infrastructure are limited to commercial fisheries that utilise trawling fishing methods. The potential risks to trawling vessels from subsea infrastructure includes disruption to fishing efforts caused by the need for vessels to avoid the infrastructure and physical damage to trawling gear that contacts the hydrocarbon system. As identified in Section 4.4.1, one Commonwealth managed commercial trawl fishery (North West Slope Trawl Fishery) has a management area that overlaps with the OA. The extent to which the hydrocarbon system infrastructure overlaps this trawl fishery management area is <1%. Fishing activity within the Commonwealth trawl fisheries is restricted to waters >200 m water depth. The entire fishery has a small number of active permits and vessels (e.g., seven permits with four vessels were active during the 2018-2019 season [Ref. 1]), and does not regularly record fishing effort within the OA (e.g., one year [2015] out of the 2014-2018 period; Section 4.4.1). Subsea infrastructure has been in place within the OA since 2012, and to date, no incidences of commercial fishing activities interacting with the infrastructure has been communicated to CAPL. Consequently, the continued presence of the hydrocarbon system infrastructure is not expected to result in a significant impact to commercial trawl fishing operations (via loss of catches or damage to fishing equipment). Any deviation required by trawling vessels around the subsea infrastructure is not expected to impact on the functions, interests, or activities of other marine users (as confirmed by stakeholder consultation records). The use of support vessels during IMR activities has the potential to result in a disruption to other marine users, including commercial shipping or fishing vessels. As identified in Section 4.4.1, there are four commercial fisheries that have recent fishing effort that overlaps with the OA. Fishing effort records obtained from DPIRD (Ref. 24) for State managed commercial fisheries indicate that fishing effort within the OA varies each year, but that there may be up to >6 vessels operating some years(Ref. 24). However, as noted above, fishing activity within the OA associated with Commonwealth managed fisheries is limited (Section 4.4.1). The OA is predominantly located outside major shipping fairways and commercial vessel traffic density within and around most of the OA is low (Figure 4-9). Therefore, the temporary presence of IMR vessels within the OA are not expected to affect commercial shipping operators. Any deviation required by these vessels is not expected to impact on the functions, interests, or activities of other marine users (as confirmed by stakeholder consultation records). In summary, the physical presence of the hydrocarbon system or support vessels is not expected to cause significant impacts to other marine users, and the risks are considered limited with potential consequences. Therefore, CAPL has ranked the potential consequence to other marine users from physical presence as Incidental (6).			

Source		
ALARP decision context justification		
The operation of subsea infrastructure and vessels are commonplace and well-practised nationally and internationally. The control measures to manage the risks associated with unplanned interactions with other marine users are well defined and understood by the industry. During stakeholder consultation, no objections or claims were raised regarding disturbance/disruption to other marine users arising from the petroleum activity. The risks arising from the physical presence of subsea infrastructure and support vessels to other marine users are considered lower-order risks in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.		
Good practice control measures and source		
Control measure	**Source**	
Stakeholder engagement	Relevant stakeholders will be advised of the commencement of key phases of activities and any relevant exclusion zone information. Communicating the activity details, location, and presence of vessels to other marine users ensures they are informed and aware, thereby reducing the risk of unplanned interactions. For planned IMR activities this notification will occur via the regular project updates provided by CAPL to WAFIC for dissemination to commercial fisheries (Table 2-6). For a major repair resulting from an unplanned event, a specific notification will be released detailing the location and duration of any works required (Table 2-6).	
Maritime safety information	Maritime safety information, such as AUSCOAST navigational warnings, are issued by the Joint Rescue Coordination Centre (JRCC) Australia, part of AMSA. Under the *Navigation Act 2012*, the AHO is also responsible for maintaining and disseminating navigational charts and publications, including providing safety-critical information to mariners (including any change to prohibited/restricted areas, obstructions to surface navigation, etc.) via the Notice to Mariners system. Notice to Mariners can be permanent or temporary notifications. Where required for an IMR activities, AUSCOAST and/or Notice to Mariners will be issued; thus enabling other marine users to also safely plan their activities.	
Marine Safety Reliability and Efficiency (MSRE) process	CAPL's *ABU MSRE Corporate OE Process* (Ref. 36) ensures that various legislative requirements are met. These include: • crew meet the minimum standards for safely operating a vessel, including watchkeeping requirements • navigation, radar equipment, and lighting meets industry standards. These requirements will ensure that direct vessel radio contact is available to other marine users operating in this area to enable ease of communication in highlighting risks and nearby exclusion zones.	
Managing Safe Work (MSW) process	CAPL's *Managing Safe Work OE Process* (Ref. 35) ensures that workplace safety and health hazards are assessed and managed. The permit to work (PTW) system is part of this process and includes simultaneous operations (SIMOPS) and hazard analysis. Where required under the MSW process, a SIMOPS Plan will be developed to identify and manage hazards arising from IMR activities and other marine users activities when occurring within the same area.	
Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A
Likelihood and risk level summary		

Source		
Likelihood	Due to the nature and scale of vessel activities within the scope of this EP, the slow-moving nature of vessels within the OA, and the limited area of operation, the likelihood of interaction with other marine users is considered low. Interaction with subsea infrastructure is expected to be limited based upon operating experience over the past five years. As such, CAPL consider that the likelihood of the consequence occurring is Unlikely (4).	
Risk level	Very low (9)	
Determination of acceptability		
Principles of ESD	The risks associated with this aspect are associated with unplanned interactions causing incidental disruption to other marine users, which is not considered as having the potential to affect biological diversity and ecological integrity. The consequence associated with this aspect is Incidental (6). Therefore, no further evaluation against the Principles of ESD is required.	
Relevant environmental legislation and other requirements	Legislation and other requirements considered relevant for this aspect include: • Commonwealth *Navigation Act 2012.*	
Internal context	These CAPL environmental performance standards or procedures were deemed relevant for this aspect: • MSRE process (Ref. 36).	
External context	During stakeholder consultation, no objections or claims were raised regarding interaction with other marine users arising from the activity.	
Defined acceptable level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.	
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
No impacts to other marine users outside of the OA from petroleum activities	**Stakeholder engagement** Relevant stakeholders will be advised of the commencement of key phases of activities and any relevant exclusion zone information via biannual project updates for planned activities, or specific notification regarding major repair works	Stakeholder consultation records
	Maritime safety information Where required, Notice to Mariners and/or AUSCOAST warnings are issued prior to commencing offshore IMR work	Record of lodgement of notification to relevant agency
	MSRE process Vessels will meet the crew competency, navigation equipment, and radar requirements of the MSRE process	Records indicate that vessels meet the crew competency, navigation equipment, and radar requirements of the MSRE process
	MSW process	Records indicate that MSW process has been applied, and

Source		
	Where required, CAPL will develop and implement SIMOPS Plan(s) to manage IMR activities	where identified as relevant, a SIMOPS Plan has been developed and implemented

6.2 Physical presence—Marine fauna

Source			
Activities identified as having the potential to result in an interaction with marine fauna are: • temporary presence of vessels within the OA during IMR activities.			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
N/A	–	Unplanned interactions with marine fauna may result in: • injury or death of marine fauna.	6
Consequence evaluation			
Surface-dwelling fauna are the species most at risk from this aspect and thus are the focus of this evaluation. As identified in Section 4.3, several marine species listed as threatened and/or migratory under the EPBC Act have the potential to occur within the OA. Several BIAs also overlap with the OA, including: • Humpback Whale (migration) • Pygmy Blue Whale (migration and distribution) • Flatback Turtle, Green Turtle, Hawksbill Turtle (internesting buffer) • Whale Shark (foraging). The *Recovery Plan for Marine Turtles in Australia* (Ref. 56) identify vessel disturbance as a key threat; however, it also notes that this is particularly an issue in shallow coastal foraging habitats. The OA within this EP occurs in Commonwealth waters only and does not include shallow coastal habitats. Therefore, vessel disturbance to turtles is not evaluated further, and the focus of this evaluation is on cetaceans and sharks, as they provide a representative case to enable an indicative consequence evaluation to be undertaken. A review of the documents made or implemented under the EPBC Act for all shark and cetacean species likely to be present within the OA (i.e., Whale Sharks [Ref. 58], Fin Whale [Ref. 59], Humpback Whale [Ref. 60], Sei Whale [Ref. 61] and Blue Whale [Ref. 62]) indicates that either vessel disturbance or interaction (such as collisions) as a key threat to the recovery of the species. For all cetacean species likely to be present within the OA, these documents indicate that management actions are limited to reporting of incidents via the national database (refer to the identified control measures) and ensuring that the risk of vessel strike is assessed (see the following text below). Cetaceans are naturally inquisitive marine mammals that are often attracted to offshore vessels and facilities. The reaction of whales to the approach of a vessel is quite variable. Some species remain motionless when near a vessel, while others are curious and often approach vessels that have stopped or are slow moving, although they generally do not approach, and sometimes avoid, faster-moving vessels (Ref. 63). Both the *Conservation Management Plan for the Blue Whale 2015–2025* (Ref. 62) and *Conservation Advice Megaptera novaeangliae Humpback Whale* (Ref. 60) indicate that although all forms of vessels can collide with whales, severe or lethal injuries are more likely to occur by larger or faster vessels. Laist et al. (Ref. 64) found that larger vessels with reduced maneuverability moving >10 knots may cause fatal or severe injuries to cetaceans, with the most severe injuries caused by vessels travelling >14 knots. Given that vessels will be stationary or slow moving whilst undertaking the activities within the scope of this EP, any interaction with marine fauna would not be expected to cause severe injuries. There have been recorded instances of cetacean deaths in Australian waters (e.g., a Bryde's Whale in Bass Strait in 1992) (Ref. 65), although the data indicates deaths are more likely to be associated with container ships and fast ferries. Mackay et al. (Ref. 66) report that four fatal and three non-fatal collisions with Southern Right Whales were recorded in Australian waters between 1950 and 2006, with one fatal and one non-fatal collision reported between 2007 and 2014. A review of the documents made or implemented under the EPBC Act for Whale Sharks indicate that management actions should consider minimising offshore developments and transit time of large vessels in areas close to marine features likely to correlate with whale shark aggregations (Ningaloo Reef, Christmas Island and the Coral Sea). On the basis that vessels activities are minimised to the smallest practicable extent (as also driven by economic considerations), the			

Source		
high-density foraging BIA is not located within the OA and given that the nature and scale of vessel operations over the course of this EP are limited the activity is considered to be consistent with all relevant management actions. Whale Sharks are known to spend considerable time close to the surface increasing their vulnerability to vessel strike. Whale sharks tagged off Western Australia (Ref. 67, Ref. 68) spent ~25% of their time <2 m from the surface and >40% of their time in the upper 15 m of the water column. Spending such considerable time within 15 m of the surface leaves them vulnerable to collision with smaller vessels as well as larger commercial vessels that have drafts greater than 20 m below the surface. A search of the National Database did not identify any previous incidences of vessel strikes with Whale Sharks, indicating that although the risk is possible, previous events are limited in frequency. Although the OA overlaps the Whale Shark foraging BIA, vessels will be stationary or slow-moving whilst implementing the activities within the scope of this EP. Consequently, incidences of fauna strike are not expected considering the slow vessel speed, the low number of vessels within the OA at any one time and the very low (cetaceans) and no (whale sharks) reports of fauna strikes. If a fauna strike occurred and resulted in death, it is not expected to have a detrimental effect on the overall population; this event would result in a limited environmental impact (individual impacts); thus, fauna strike is evaluated as having the potential to result in an Incidental (6) consequence.		
ALARP decision context justification		
Offshore commercial vessel operations are commonplace and well-practised nationally and internationally. The control measures to manage the risk associated with fauna strike are well defined via legislative requirements that are considered standard industry practice. These are well understood and implemented by the petroleum industry and CAPL. During stakeholder consultation, no objections or claims were raised regarding interaction with marine fauna arising from the activity. The risks arising from the physical presence of vessels are considered lower-order risks in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.		
Good practice control measures and source		
Control measure	**Source**	
EPBC Regulations 2000 – Part 8 Division 8.1 – Interacting with cetaceans	The requirements to manage interactions between vessels and cetaceans are detailed in the EPBC Regulations 2000 – Part 8 Division 8.1 – Interacting with cetaceans. These regulations describe strategies to ensure cetaceans are not harmed during offshore interactions with people.	
Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A
Likelihood and risk level summary		
Likelihood	Due to the nature and scale of vessel activities within the scope of this EP, the slow-moving nature of vessels within the OA, and the limited area of operation, the likelihood of a vessel collision with marine fauna is considered low. Based upon previous experience in the OA, CAPL consider that the likelihood of the consequence occurring is Seldom (3).	
Risk level	Low (8)	
Determination of acceptability		
Principles of ESD	The risks associated with this aspect are associated with unplanned interactions causing incidental disruption to other marine users, which is not considered as having the potential to affect biological diversity and ecological integrity. The consequence associated with this aspect is Incidental (6). Therefore, no further evaluation against the Principles of ESD is required.	

Source		
Relevant environmental legislation and other requirements	Legislation and other requirements considered relevant for this aspect include: • EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans • *Conservation Management Plan for the Blue Whale 2015–2025* (Ref. 62) • *Conservation Advice Megaptera novaeangliae Humpback Whale* (Ref. 60) • *Conservation Advice Balaenoptera borealis Sei Whale* (Ref. 61) • *Conservation Advice Balaenoptera physalus Fin Whale* (Ref. 59) • *Conservation Advice Rhincodon typus Whale Shark* (Ref. 58) • *Recovery Plan for Marine Turtles in Australia* (Ref. 56) • *Approved Conservation Advice for Dermochelys coriacea (Leatherback Turtle)* (Ref. 57).	
Internal context	No CAPL environmental performance standards or procedures were deemed relevant for this aspect.	
External context	During stakeholder consultation, no objections or claims were raised regarding interaction with marine fauna arising from the activity.	
Defined acceptable level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan. However, given that vessel strike is listed as a threat to protected matters under documents made or implemented under the EPBC Act, CAPL has defined an acceptable level of impact such that it is not inconsistent with these documents. The Conservation Advices for Blue Whales, Humpback Whales, Sei Whales, and Fin Whales (Ref. 62; Ref. 60; Ref. 61; Ref. 59) all specify the following action: • ensure all vessel strike incidents are reported in the National Ship Strike Database. This action is incorporated into reporting requirements under this EP (Section 7.4).	
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
No injury or mortality to marine fauna within the OA from petroleum activities	**EPBC Regulations 2000 – Part 8 Division 8.1 – Interacting with cetaceans** Vessels will implement caution and no approach zones, where practicable: • caution zone (300 m either side of whales; 150 m either side of dolphins)–vessels must operate at ≤6 knots within in this zone, maximum of three vessels within zone, and vessels should not enter if a calf is present • no approach zone (300 m to the front and rear of whales and 100 m either side; 300 m for whale calves; 150 m to the front and rear of dolphins and 50 m either side)–vessels should not enter this zone, and should not wait in front of the direction of travel of an animal or pod. or follow directly behind.	Induction materials include relevant marine fauna caution and no approach zone requirements Training records confirm offshore personnel involved in IMR activities have completed the induction Vessel records show if marine fauna interaction occurred within caution or approach zones, and what mitigation (e.g., divert or slow vessel)

Source		
		measure was implemented

6.3 Seabed disturbance

Source

Activities identified as having the potential to result in seabed disturbance are:

- subsea IMR
- vessel anchoring.

Potential impacts and risks

Impacts	C	Risks	C
Seabed disturbance may result in: • alternation of marine habitats.	5	N/A	–

Consequence evaluation

Subsea IMR activities are expected to result in disturbance to the seabed within close proximity of subsea infrastructure. This type of activity is targeted to the specific area above or adjacent to the infrastructure within the OA, typically resulting in only a small area being affected. The typical area of seabed disturbance predicted to occur from IMR activities is associated with a major pipeline repair, which could result in ~800 m^2 of seabed disturbance (Section 3.5.2.1). This indicative seabed disturbance area represents <1% of the OA.

Although anchoring is not a planned activity, it has been carried through as a contingent activity in the event a different vessel is required onsite to conduct IMR activities, or anchoring is required within the OA due to a significant weather event. As detailed by NERA (Ref. 69), a vessel anchored within water depths greater than 70 m with a single anchor could result in a total disturbance area of up to 1300 m^2. This indicative seabed disturbance area represents <1% of the OA.

The particular values and sensitivities within the OA with the potential to be impacted by seabed disturbance include the following KEFs:

- ancient coastline at 125 m depth contour
- continental slope demersal fish communities
- Exmouth Plateau.

Although these KEFs have been identified as having the potential to be impacted from IMR activities, any planned disturbance would be in close proximity of existing infrastructure. As such, exposure of Exmouth Plateau is not considered likely given its location at the northwestern extent of the Jansz-Io permits and away from existing infrastructure. The areas with the existing infrastructure have been historically disturbed, and any additional disturbance is expected to be minimal. Benthic habitats within the OA mostly comprise unvegetated, soft, and unconsolidated sediments with a low but varying degree of benthic invertebrate habitation (Section 4.3.5).

Given the nature of the receiving environment within the OA, performing IMR activities is not expected to affect ecosystem function or connectivity of communities. As such, CAPL has ranked the consequence as Minor (5).

ALARP decision context justification

Seabed disturbance from IMR activities is commonplace; the activities causing this aspect are practised nationally and internationally. The control measures to manage the impacts associated with seabed disturbance are well understood and implemented by the industry.

During stakeholder consultation, no objections or claims were raised regarding seabed disturbance arising from the activity.

The impacts associated with seabed disturbance are considered lower-order impacts in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.

Good practice control measures and source

Control measure	Source
Inspection, monitoring and maintenance (IMM) acceptance criteria	IMR activities are undertaken only when necessary, in accordance with pre-determined IMM acceptance criteria. Acceptability of identified anomalies in subsea infrastructure is guided by predetermined acceptance criteria which define allowable identifiable defects, degradation or limits, thereby ensuring that IMR activities are undertaken as required to maintain system integrity.

Source		
IMR work procedures	Activity specific work procedures are developed and address Hazard Identification and Risk Assessment (HIRA) findings, including any additional controls identified for implementation.	
Activity-specific HIRA	The HIRA will include HSE Specialist participation to identify and assess potential environmental impacts and risks associated with the specific maintenance or repair campaign proposed. The HIRA will consider relevant information, which may include: • proximity to potentially sensitive environmental receptors • other known activities and/or impacts that have occurred at that location • material minimisation • alternative materials • alternative execution methodologies • learnings from previous comparable IMR activities/campaigns. Where the HIRA identifies that risks and impacts are potentially greater than those assessed in this EP, the management of change process will be triggered (Section 7.3.2.2).	
MSRE process	CAPL's *ABU MSRE Corporate OE Process* (Ref. 36) ensures that various legislative requirements are met including that vessels will meet the crew competency, navigation equipment, and radar requirements.	
Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A
Likelihood and risk level summary		
Likelihood	N/A	
Risk level	N/A	
Determination of acceptability		
Principles of ESD	The potential impact associated with this aspect is limited to localised short-term effects that are not expected to affect biological diversity and ecological integrity. The consequence associated with this aspect is Minor (5). Therefore, no further evaluation against the Principles of ESD is required.	
Relevant environmental legislation and other requirements	Legislation and other requirements considered for this aspect include: • *Marine Bioregional Plan for the North-West Marine Region* (Ref. 70).	
Internal context	These CAPL environmental performance standards or procedures were deemed relevant for this aspect: • MSRE process (Ref. 36).	
External context	During stakeholder consultation, no objections or claims were raised regarding seabed disturbance arising from the activity.	
Defined acceptable level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.	

Source		
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
Reduce the risk of impacts to sensitive environmental receptors^ within the OA from petroleum activities	**IMM acceptance criteria** IMR activities undertaken only when necessary (in accordance with pre-determined IMM acceptance criteria)	Records show that IMR activities undertaken only when necessary (in accordance with pre-determined IMM Acceptance Criteria)
	IMR work procedures IMR activity specific work procedures developed and implemented	Records show that activity specific work procedures are developed for each IMR activity and address HIRA findings, including any additional controls identified for implementation
	Activity-specific HIRA Activity-specific HIRA undertaken prior to maintenance or repair activity commencing	Records show that activity-specific HIRA undertaken prior to maintenance or repair activity commencing
	MSRE process Vessels will meet the crew competency, navigation equipment, and radar requirements of the MSRE process	Records indicate that vessels meet the crew competency, navigation equipment, and radar requirements of the MSRE process

^ *"Sensitive environmental receptors" as identified within the activity-specific HIRA*

6.4 Air emissions

Source			
Activities identified as having the potential to result in air emissions are: • combustion of marine fuel from vessels within the OA during IMR activities.			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
Air emissions may result in: • localised and temporary reduction in air quality.	6	N/A	–
Consequence evaluation			
Modelling was undertaken for nitrogen dioxide (NO_2) emissions from MODU power generation for another offshore project (Ref. 71). NO_2 is the focus of the modelling because it is considered the main (non-greenhouse) atmospheric pollutant of concern, with larger predicted emission volumes compared to other pollutants, and has potential to impact on human health (as a proxy for environmental receptors). Results of this modelling indicate that on an hourly average, there is the potential for an increase in ambient NO_2 concentrations of 0.0005 ppm within 10 km of the emission source and an increase of <0.1 µg/m^3 (0.00005 ppm) in ambient NO_2 concentrations >40 km away. The *National Environmental Protection (Ambient Air Quality) Measure* (NEPM) recommends that hourly exposure to NO_2 is <0.12 ppm with annual average exposure <0.03 ppm. Given that referencing this modelling is considered overly conservative as the volume of fuel required for power generation is expected to be significantly less for support vessels when compared to MODU operations, and as the highest hourly averages (0.00039 ppm or 0.74 µg/m^3) were restricted to a distance of ~5 km from the MODU (Ref. 71), exposures from vessel activities covered under this EP would be well below NEPM standards and thus any impacts were considered to be Incidental (6).			
ALARP decision context justification			
Offshore commercial vessel operations and subsequent atmospheric emissions arising from these activities are commonplace in offshore environments, both nationally and internationally. The control measures to manage the risk associated with atmospheric emissions are well defined via legislative requirements that are considered standard industry practice. These are well understood and implemented by the petroleum industry and CAPL. During stakeholder consultation, no objections or claims were raised regarding air emissions arising from the activity. The impacts arising from atmospheric emissions constitute lower-order impacts (Table 5-3). As such, CAPL applied ALARP Decision Context A for this aspect.			

Good practice control measures and source	
Control measure	**Source**
Reduced sulfur content fuel	Sulfur content of diesel/fuel oil complies with Marine Order 97 and Regulation 14 of MARPOL 73/78 Annex VI. Only low-sulfur (0.50 mass % concentration [m/m]) fuel oil will be used to minimise sulfur oxides (SO_x) emissions when available
Marine Order 97: Marine Pollution Prevention – Air Pollution	Prior to commencement of IMR activities, the MSRE process (Ref. 36) is used to verify that all vessels comply with Marine Order 97: Marine Pollution Prevention – Air Pollution (appropriate to vessel class) for emissions from combusting fuel, including: • Vessels will hold a valid International Air Pollution Prevention (IAPP) certificate and a current international energy efficiency (IEE) certificate • All vessels (as appropriate to vessel class) will have a Ship Energy Efficiency Management Plan (SEEMP) as per MARPOL 73/78 Annex VI Vessel engine nitrous oxides (NO_x) emission levels will comply with Regulation 13 of MARPOL 73/78 Annex VI.

Source		
Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A

Likelihood and risk level summary	
Likelihood	N/A
Risk level	N/A

Determination of acceptability	
Principles of ESD	The potential impact associated with this aspect is limited to a direct reduction in air quality for a localised area for a short time, which is not considered to have the potential to affect biological diversity and ecological integrity. The consequence associated with this aspect is Incidental (6). Therefore, no further evaluation against the Principles of ESD is required.
Relevant environmental legislation and other requirements	Legislation and other requirements considered relevant to this aspect include: • Marine Order 97 • MARPOL 73/78
Internal context	These CAPL environmental performance standards or procedures were deemed relevant for this aspect: • MSRE process (Ref. 36).
External context	During stakeholder consultation, no objections or claims were raised regarding atmospheric emissions arising from the activity.
Defined acceptable level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.

Environmental performance outcome	Performance standard / Control measure	Measurement criteria
No impacts to air quality outside of the OA from petroleum activities	**Reduced sulfur content fuel** Only low-sulfur (0.50 mass % concentration [m/m]) fuel oil will be used to minimise SO_x emissions when available	Bunker receipts verify the use of low-sulfur fuel oil
	Marine Order 97: Marine Pollution Prevention – Air Pollution Prior to commencement of IMR activities, the following will be verified, as per the MSRE process: • vessels will hold a valid International Air Pollution Prevention (IAPP) certificate and a current international energy efficiency (IEE) certificate • all vessels (as appropriate to vessel class) will have a Ship Energy Efficiency Management Plan (SEEMP) as per MARPOL 73/78 Annex VI • Vessel engine nitrous oxides (NOx) emission levels will comply with Regulation 13 of MARPOL 73/78 Annex VI.	OVIS report / ABU Marine OE Inspection Checklist confirms vessels hold IAPP and IEE certificates, and a SEEMP is in place (as appropriate to class), and NO_x emission levels comply with regulations

6.5 Greenhouse gas emissions

The Commonwealth government supports the implementation of mature technologies, including LNG, to support Australia's low emissions transformation (Ref. 169). The current Commonwealth government views gas as part of the Commonwealth government's plan to reduce emissions without imposing new costs on households, while at the same time creating jobs, growing businesses and the economy (Ref. 170). The Commonwealth's *Australia's Long-Term Emissions Reduction Plan* does not require shut down of the gas export industry (Ref. 171). Under the plan, this industry will continue through to 2050 and beyond, supporting jobs and regional communities, and production will be higher in 2030 than it is today (Ref. 171). The Commonwealth predicts that there will be a significant proportion of gas in the electricity grid in 2050 (Ref. 171).

Australia is a signatory to the Paris Agreement and is currently committed to reducing greenhouse gas (GHG) emissions by 26–28% below 2005 levels by 2030. Emissions in the year to March 2021 were 20.8% below emissions in the year to June 2005 (the baseline year for Australia's 2030 target under the Paris Agreement) (Ref. 172). Recent emissions trends (based on emissions for the year to March 2021) show a ~5.3% decrease compared to the previous year, which were identified as primarily being due to a combination of reduced emissions from:

- electricity
- fugitive emissions (due in part to both a reduction in coal production, and an increase in carbon capture and storage from the Gorgon Gas Development on Barrow Island)
- transport (associated with travel restrictions due to COVID) (Ref. 172).

Since their peak in the year to June 2007, Australia's GHG emissions have declined 23.4%, and are currently (to March 2021) at their lowest levels recorded in the National Inventory (Ref. 172). Australia is currently (based on 2018 data) estimated at contributing ~1.3% of direct global GHG emissions (Ref. 173).

The Commonwealth government has also recently (October 2021) announced an aspirational target of net zero emissions by 2050 (Ref. 174); however, this target has not been legislated and no management measures for industry have yet been defined or mandated.

6.5.1 Emissions boundaries

One of the main principles of GHG accounting and reporting is relevance, of which an integral aspect is defining an appropriate GHG emissions inventory boundary (Ref. 175).

The primary environmental approvals under both the Commonwealth EPBC Act and the WA EP Act were assessments based on project-level emissions. Under a secondary approval, such as this EP, the emissions boundary for a GHG assessment is inherently different from and more limited in scope than that of the primary approvals, as the EP covers only a subset of activities (as described in Section 3) associated with the Gorgon Gas Development. Consequently, the appropriate emissions boundary for this EP is also bound by this subset of activities.

It is also noted that when assessing at this activity-level, what may be characterised as an indirect emission under this EP, may become a direct emission associated with a different secondary approval (activity-level) or primary approval (project-level) boundary. Therefore, the GHG emissions inventory in this

EP is presented with respect to direct and indirect emissions only and does not correspond to the internationally recognised scopes. The GHG emissions inventory in this EP will also not directly equate to values presented within primary environmental approvals, or to those reported under other (e.g., NGER Act) legislation due to the differing boundaries and facility definitions. The direct and indirect emission sources that form the inventory for this EP are identified within Section 6.5.2 and Section 6.5.3.

While emission assessment boundaries and inventories may vary, the control measures adopted to manage GHG emissions to an ALARP and acceptable level are predominantly the same across primary and secondary approvals, as management typically occurs at the project level, and not at individual activity level.

6.5.2 Direct emissions

As described above, CAPL has defined the emissions boundary for the assessment of GHG emissions in relation to the planned petroleum activities[4] within the OA as described in Section 3 of this EP. Any unplanned activities, including repairs, or emergency events, are considered out of scope of the emissions inventory.

The following activities have been identified as direct emission sources for planned activities under this EP:

- fuel combustion by vessels during planned IMR activities within the OA
- fugitive emissions.

Any equipment (e.g., AUV, ROV) used to support IMR activities are powered by the support vessel itself, and as such these don’t represent an additional emission source to that already accounted for by the vessel. In addition, while helicopter operations are described within Section 3.7.2, these are not a routine planned activity and are only associated with longer IMR scopes (e.g., repairs), and therefore have not been accounted for within this emissions inventory.

While CAPL acknowledge that fugitive emissions may occur from the subsea hydrocarbon system in Commonwealth waters, these are considered to represent a minor proportion of fugitive emissions for the entire project. Fugitive emissions for the Gorgon Gas Development are estimated based on product throughput (as per accepted NGERS methodology), and therefore, any offshore component cannot easily be separated. As such, fugitive emissions estimates have been fully incorporated into the indirect GHG emissions inventory (Section 6.5.3).

Based on the boundary and inventory described above, an estimate of annual direct GHG emissions for the activities under this EP is ~0.002 Mtpa CO_2-e[5]. Planned activities under this EP are not expected to significantly vary, such that it would result in a significant change to the above estimated annual direct emissions over the next five-year in-force period of this EP. The Gorgon Gas Development has approval to operate until 2070 (Section 6.5.4).

As described within the *Gorgon Gas Development Fourth Train Expansion Proposal Public Environmental Review / Draft Environmental Impact Statement* (Ref. 176) GHG emissions within the Commonwealth Marine Area[6] will be

[4] Where ‘petroleum activity’ is as defined within Regulation 4 of the OPGGS(E)R.

[5] Emissions calculation is based on 100 days of vessel activity (upper limit of planned inspection days as per Section 3.5.1) using NGER energy content and emissions factors (Ref. 197).

[6] Commonwealth marine areas are considered a MNES under the EPBC Act.

relatively low during the operations phase. The above annual estimate of GHG emissions for activities under this EP is consistent with this previous assessment.

6.5.3 Indirect emissions

To determine the relevance of indirect emissions to the activities under this EP, CAPL undertook an assessment against the factors for determining what is an indirect consequence, in accordance with the *'Indirect consequences' of an action: Section 527E of the EPBC Act* Policy Statement. As an outcome of this assessment, the following activities have been identified as indirect emission sources for planned activities under this EP:

- gas processing at the GTP on Barrow Island[7]
- transport and third party end-use of LNG, condensate and domestic gas products.

As the Gorgon Gas Development supplies both the Australian domestic market and the international market, these third-party indirect emissions may occur across multiple global regions. A large percentage of LNG produced by the Gorgon Gas Development is supplied internationally under long-term contracts. This long-term export market is primarily Japan, with some exports to other countries including South Korea. These indirect emissions would be direct emissions for the end consumers and would also have to operate under other regulatory regimes, Australian, Japanese, and South Korean, to manage their emissions and any associated impacts.

Japan is a signatory to, and has ratified, the Paris Agreement. Japan initially submitted an Intended Nationally Determined Contribution to reduce its greenhouse gas emissions by 26% in fiscal year 2030 from its fiscal year 2013, however Prime Minister Suga recently declared that Japan would aim to reduce its GHG emissions by 46% in fiscal year 2030 from its fiscal year 2013 levels (Ref. 177; Ref. 178). Japan's implementation plan includes driving the shift to gas utilisation (such as high efficiency LNG thermal power plants), whilst in the longer term, decarbonising with moderate social costs using existing LNG infrastructure (Ref. 179), and promoting use of LNG fuel vessels of a lower environmental impact by establishing bunkering bases in Japanese ports (Ref. 179).

South Korea is a signatory to, and has ratified, the Paris Agreement. In December 2020, South Korea submitted an updated Nationally Determined Contribution to reduce its GHG emissions by 24.4% from 2017 GHG emissions levels by 2030 (Ref. 180). South Korea's implementation plan includes a "significant reduction of coal power generation" and "conversion to eco-friendly fuels such as LNG", and "expanding eco-friendly ships fuelled by LNG" (Ref. 180).

Based on the boundary and inventory described above, an estimate of annual indirect GHG emissions related to activities under this EP are shown in Table 6-2. Planned activities under this EP are not expected to significantly vary, such that it would result in a significant change to the above estimated annual indirect emissions over the next five-year in-force period of this EP. The Gorgon Gas Development has approval to operate until 2070 (Section 6.5.4).

[7] The "gas processing at the GTP on Barrow Island" incorporates several emission sources, including gas turbine drivers, gas turbine generators, heating, flaring, venting, diesel consumption, and fugitive emissions. The gas turbine generators are also used to provide electricity to the offshore infrastructure within scope of this EP (Section 3.2).

Table 6-2: Estimated indirect emissions associated with activities under this EP

Source	Annual estimated emissions (Mt CO_2e)
Gas processing at the GTP on Barrow Island [1]	9.5
Transport and third-party end use of products [2,3]	52.3

1. Source Fourth Train EIS ERMP (Ref. 176), GHGAP (Ref. 181) total unabated emissions footprint

2. Transport emissions estimated from shipping fuel consumption scaled for a representative year of production. Emissions factors sourced from IMO Resolution MEPC.245(66) (Ref. 182) and IPCC AR5 100-year global warming potentials (Ref. 183).

3. Emissions from third-party use of products calculated in alignment with methods in Category 11 of IPIECA's Estimating Petroleum Industry Value Chain (Scope 3) Greenhouse Gas Emissions *(Ref. 184), including product quantity and fuel specific higher heating values, and the CO_2, CH_4 and N_2O combustion emissions factors for each fuel type. Evaluation based upon production data from a representative year, applying API compendium methodologies (Ref. 185) and factors, and IPCC AR5 100-year GWP (Ref. 183).*

6.5.4 Primary approvals

The two-train Gorgon Gas Development was referred, pursuant to the EPBC Act, on 23 November 2003. The Minister's delegate set the assessment approach as assessment by environmental impact statement. Chapter 13 of the *Draft Environmental Impact Statement / Environmental Review and Management Programme for the Proposed Gorgon Development* (Ref. 186) and the *Final Environmental Impact Statement / Response to Submissions on the Environmental Review and Management Programme for the Proposed Gorgon Development* (Ref. 187) set out the environmental impact assessment of GHG emissions. In that assessment it was estimated that the Gorgon Gas Development would emit ~4.0 Mtpa CO_2-e of direct GHG emissions. The Gorgon Gas Development was approved with conditions (EPBC 2003/1294) by the Minister on 3 October 2007. The approval has effect until 1 January 2070.

The three-train Revised Gorgon Gas Development was subsequently referred, pursuant to the EPBC Act, on 14 April 2008. The Minister's delegate set the assessment approach as assessment by public environmental review. Chapter 12 of the *Gorgon Gas Development Revised and Expanded Proposal Public Environmental Review* (Ref. 188) set out the environmental impact assessment of GHG emissions. In that assessment it was estimated that the Gorgon Gas Development would emit ~5.45 Mtpa CO_2-e of direct GHG emissions. The Revised Gorgon Gas Development was approved with conditions (EPBC 2008/4178) by the Minister on 26 August 2009. The approval has effect until 26 August 2070.

The Gorgon Gas Development Fourth Train Expansion Proposal was subsequently referred, pursuant to the EPBC Act, on 27 April 2011. The Minister's delegate set the assessment approach as assessment by environmental impact statement. Chapter 11 of the *Gorgon Gas Development Fourth Train Expansion Proposal Public Environmental Review / Draft Environmental Impact Statement* (Ref. 176) set out the environmental impact assessment of GHG emissions. In that assessment it was estimated that the Gorgon Gas Development would emit ~7.6 Mtpa CO_2-e of direct GHG emissions for four-trains. The Gorgon Gas Development Fourth Train Expansion was approved with conditions (EPBC 2011/5942) by the Minister on 12 May 2016. The approval has effect until 1 January 2070. Emissions estimated for the three-train proposal were revised to a total emissions footprint of ~9.5 Mtpa CO_2-e with no abatement in place, and ~6.1 Mtpa CO_2-e incorporating CO_2 reinjection estimates within the *Gorgon Gas Development and Jansz Feed Gas Pipeline: Greenhouse Gas Abatement Program* (Ref. 181), which was approved by the Ministers delegate of the WA Environmental Protection Authority in May 2015.

The Gorgon Gas Development is currently operating with three trains. As such, the Gorgon Gas Development currently has environmental approvals based on an total emissions footprint of ~9.5 Mtpa CO_2-e with no abatement in place, and ~6.1 Mtpa CO_2-e incorporating CO_2 reinjection estimates.

6.5.5 Risk assessment

Source			
Activities identified as having the potential to result in GHG emissions are: • direct emissions from planned activities within scope of this EP • indirect emissions from activities associated with processing of gas on Barrow Island • indirect emissions from the transport and third party end-use of LNG, condensate and domestic gas produced by the Gorgon Gas Development.			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
GHG emissions may result in: • contribution to the reduction of the global atmospheric carbon budget (by the amount of the direct and indirect GHG associated with activities under this EP)	6	A decrease in the global atmospheric carbon budget may result in: • contribution to the anthropogenic influence on the global climate system.	—
Consequence evaluation			
Contribution to the reduction of the atmospheric carbon budget Direct GHG emissions from activities within this EP are estimated to be ~0.002 Mtpa CO_2-e, and indirect GHG emissions from the processing of gas on Barrow Island are estimated to be ~9.5 Mtpa CO_2-e[8]. Combined these emissions represent ~1.9% of national Australian emissions (when compared to 2021 inventory) (Ref. 172). The total direct (from the activities within this EP) and indirect (from gas processing at the GTP on Barrow Island) GHG emissions are within levels previously assessed and approved for the Gorgon Gas Development pursuant to the EP Act and EPBC Act. The indirect GHG emissions from the transport and third party end-use of LNG, condensate and domestic gas are estimated to be ~52.3 Mtpa CO_2-e[9,10]. According to the IPCC, Assessment Sixth Report for Working Group 1, “the total anthropogenic effective radiative forcing (ERF) in 2019, relative to 1750, was 2.72 [1.96 to 3.48] Wm^{-2} (*medium confidence*) and has likely been growing at an increasing rate since the 1970s, [and] . . . Over 1750–2019, CO_2 increased by 131.6 ± 2.9 ppm (47.3%).”[11] The IPCC defines the term “carbon budget” as “refer[ing] to the maximum amount of cumulative net global anthropogenic CO_2 emissions that would result in limiting global warming to a given level with a given probability, taking into account the effect of other anthropogenic climate forcers. This is referred to as the total carbon budget when expressed starting from the pre-industrial period, and as the remaining carbon budget when expressed from a recent specified date. Historical cumulative CO_2 emissions determine to a large degree warming to date, while future emissions cause future additional warming. The remaining carbon budget indicates how much CO_2 could still be emitted while keeping warming below a specific temperature level.”[12]			

[8] Source Fourth Train EIS ERMP (Ref. 176), GHGAP (Ref. 181) total unabated emissions footprint.

[9] Transport emissions estimated from shipping fuel consumption scaled for a representative year of production. Emissions factors sourced from IMO Resolution MEPC.245(66) (Ref. 182) and IPCC AR5 100-year global warming potentials (Ref. 183).

[10] Emissions from third-party use of products calculated in alignment with methods in Category 11 of IPIECA’s *Estimating Petroleum Industry Value Chain (Scope 3) Greenhouse Gas Emissions* (Ref. 184), including product quantity and fuel specific higher heating values, and the CO_2, CH_4 and N_2O combustion emissions factors for each fuel type. Evaluation based upon production data from a representative year, applying API compendium methodologies (Ref. 185) and factors, and IPCC AR5 100-year GWP (Ref. 183).

11 IPCC, AR6, WG1, at TS-35.

12 IPCC, AR6, WG1, at SPM-48 footnote 43

Source
The remaining carbon budget for a 50% likelihood to limit global warming to 1.5°C, 1.7°C, and 2°C is respectively, 500 Gt CO_2, 850 Gt CO_2, and 1350 Gt CO_2.[13] If the total direct and indirect GHG emissions from activities associated with this EP are ~61.8 Mtpa CO_2-e, then the activities under this EP may contribute ~0.2–0.6% to the reduction in the total remaining global carbon budget, which is a *de minimis* decrease. It is noted that this estimated contribution to the total global carbon budget is based the current emissions estimates (as shown in this EP), operations continuing at maximum capacity through to 2070 (i.e., current end of approval life), and with no allowance for future mitigation (including net zero aspirations, future technology or operational efficiencies, or future Australian regulatory or international policy requirements). According to the IEA (Ref. 189), an estimated 1.2 Gt of CO_2 could be abated in the short term by switching from coal to existing gas-fired plants, if relative prices and regulation are supportive. Although the IEA states that switching between unabated consumption of fossil fuels, on its own, does not provide a long-term solution, there is significant CO_2 and air quality benefits, from using less emission-intensive fuels such as natural gas (Ref. 189). As such, the use of gas produced from the Gorgon Gas Development supports Australia in providing short-term CO_2 emission reduction through the displacement of more emission intensive fuels. It is noted that the Gorgon Gas Development itself does not create this transition to lower emission intensive fuels, but can contribute to meeting the transition. It was also acknowledged by IEA (Ref. 189) that a limiting factor in the scale of switching from coal to gas, particularly in developing countries is the cost of importing gas. Therefore, realising the full global potential for switching would require an extra 450 billion cubic metres of gas to be produced each year (~12% of today's global gas production) to reduce the price of gas to a level which would disincentivise coal use in the developing world i.e., an increase in global gas production and reduction in its price may reduce use of coal and in turn reduce carbon emissions (Ref. 189). When used as a primary energy source, LNG has a number of benefits over other fossil fuels, including lower emissions of sulphur dioxide, particulate matter, and greenhouse gases (Ref. 186). A benchmarking assessment for the LNG processing emissions was undertaken during the *Gorgon Gas Development Fourth Train Expansion Proposal Public Environmental Review / Draft Environmental Impact Statement* (Ref. 176). This benchmarking assessment showed that the Gorgon Foundation Project is within the range of emissions intensities compared to other Australian projects benchmarked, e.g., it has a lower emissions intensity compared to Ichthys LNG and Prelude FLNG, but a higher emissions intensity compared to Curtis Island LNG (Ref. 176). The nominal project life of the Gorgon Gas Development (Section 3.1.2) is also considered to be consistent with the Commonwealth's *Australia's Long-Term Emissions Reduction Plan* and that the use of gas is expected to continue through the coming decades through to 2050 and beyond (Ref. 171). Therefore, the continued use of natural gas from the Gorgon Gas Development is expected to contribute to the displacement of the use of higher carbon intensive fossil fuel energy sources, which will have a corresponding reduction in potential global fossil fuel emissions. Indirect emissions associated with the transport and third party end-use of LNG, condensate and domestic gas products is the largest category of emissions associated with Chevron's activities (Ref. 190). These types of indirect emissions are driven by global demand, which is in turn driven by economics, policy, regulation, and consumer behaviour on a global scale (Ref. 190). In summary, due to the relatively lower emissions intensity of natural gas compared to other fossil fuel alternatives, that natural gas is part of Australia's long-term emissions reduction plan, as well as the emissions reduction plans of the foreign jurisdictions to which the Gorgon facility exports its products, and that it can be considered as supporting the global transition to lower carbon intensive fuels, and the overall *de minimis* contribution to the reduction of the global carbon budget from the Gorgon Gas Development, the impact of contribution to the global carbon budget has been evaluated as having the potential to result in an Incidental (6) consequence.
Contribution to anthropogenic influence on the global climate system *Changes to climate systems* As the Working Group I contribution to the newly released Sixth Assessment Report (WGI AR6) of the Intergovernmental Panel on Climate Change (IPCC) acknowledges, "[c]limate change is a global phenomenon, but manifests differently in different regions" (Ref. 191). Moreover, the *Summary for Policymakers* to the same report states that "[h]istorical cumulative CO_2 emissions

[13] IPCC, AR6, WG1, at SPM-29 Table SPM.2.

Source
determine to a large degree warming to date, while future emissions cause future additional warming" (Ref. 192). Future emissions are relevant to remaining carbon budgets, which vary based on emissions scenarios, and "indicate[] how much CO_2 could still be emitted while keeping warming below a specific temperature level" (Ref. 192). The physical risks of climate change are varied and widespread, and CAPL acknowledge that disruption from natural or human causes beyond its control, include physical risks from hurricanes, severe storms, floods, heat waves, other forms of severe weather, wildfires, ambient temperature increases, and sea level rise (Ref. 190). According to the IPCC, among other things, global changes to the climate system can include the following: increase in global surface temperatures, changes to frequency and intensity of precipitation, sea level rise, retreat of glaciers and artic sea ice, changes to the intensity and frequency of certain extreme weather events and droughts (Ref. 193). Specifically, the IPCC projections for the Australia include: • **Droughts:** Additional regional changes in Australasia [. . .] include a significant decrease in April to October rainfall in southwest Western Australia, observed from 1910 to 2019 and attributable to human influence (*high confidence*[14]), which is *very likely* to continue in future. Agricultural and ecological and hydrological droughts have increased over southern Australia (*medium confidence*), and meteorological droughts have decreased over northern and central Australia (*medium confidence*). (. . .) Agricultural and ecological droughts are projected to increase in southern and eastern Australia (*medium confidence*) for a 2°C GWL."[15] • **Fire Weather Conditions**: "The number of evident attribution studies on compound events is limited. There is *medium confidence* that weather conditions that promote wildfires have become more probable in southern Europe, northern Eurasia, the USA, and Australia over the last century. In Australia a number of event attribution studies show that there is *medium confidence* of increase in fire weather conditions due to human influence.".[16] (. . .) Fire weather is projected to increase throughout Australia (high confidence) . . . .[17] • **Precipitation:** "In the future, heavy precipitation and pluvial flooding are *very likely* to increase over northern Australia and central Australia, and they are *likely* to increase elsewhere in Australasia for global warming levels (GWLs) exceeding 2°C and with *medium confidence* for a 2°C GWL."[18] • **Relative Sea Level Rise: "**Relative sea level has increased over the period 1993–2018 at a rate higher than GMSL around Australasia (*high confidence*). Sandy shorelines have retreated around the region, except in southern Australia, where a shoreline progradation rate of 0.1 myr^{-1} has been observed."[19] . . . "Relative sea-level rise is virtually certain to continue in the oceans around Australasia, contributing to increased coastal flooding in low-lying areas (*high confidence*) and shoreline retreat along most sandy coasts (*high confidence*)."[20] • **Snowfall:** "Snowfall is expected to decrease throughout the region at high altitudes in [] Australia (*high confidence*)."[21] (. . .) "Observations in Australia show that the snow season length has decreased by 5% in the last five decades. Furthermore, the date of peak snowfall in Australia has advanced by 11 days over the last 5 decades."[22]

[14] "The following terms have been used to indicate the assessed likelihood of an outcome or a result: virtually certain 99–100% probability, very likely 90–100%, likely 66–100%, about as likely as not 33–66%, unlikely 0–33%, very unlikely 0–10%, exceptionally unlikely 0–1%. Additional terms (extremely likely 95–100%, more likely than not >50–100%, and extremely unlikely 0–5%) may also be used when appropriate." IPCC AR6, SPM-4.

[15] IPCC AR6, WG1, TS-93.

[16] IPCC AR6, WG1, TS-74.

[17] IPCC AR6, WG1, TS-93.

[18] IPCC AR6, WG1, TS-93.

[19] IPCC AR6, WG1, TS-93.

[20] IPCC AR6, WG1, 12-57.

[21] IPCC AR6, WG1, TS-93.

[22] IPCC AR6, WG1, TS-93-94.

Source
• **Tropical Cyclones:** "In Australia, the number of [topical cyclones] has generally declined since 1982, and the frequency of intense TCs that make landfall in north eastern Australia has declined significantly since the 19th century (*medium confidence*). There is *high confidence* that cyclones making landfall along north eastern and north Australian coastlines will decrease in number and *low confidence* of an increase I their intensities for a 2°C global warming level as well as for the mid-century period with scenarios RCP4.5 and above, with the amplitude of changes increasing from RCP4.5 to RCP8.5. Decreases in frequency are projected for 'east coast lows.'"[23] *Values and sensitivities vulnerable to climate change* The Working Group II contributions to the IPCC's Fifth Assessment Report (WGII AR5) provides a summary of the observed impacts, vulnerability and exposure, and adaptive responses observed to date (Ref. 194). The Assessment Sixth Report for Working Group II is expected to be released in late February/March 2022. Observed impacts attributed to climate change reported within the Australasian region include: • **Snow and ice, rivers and lakes, floods and drought**: – "Significant decline in late-season snow depth at 3 of 4 alpine sites in Australia (1957–2002) (*medium confidence, major contribution from climate change*[24]) – Substantial reduction in ice and glacier ice volume in New Zealand (*medium confidence*, major contribution from climate change) – Intensification of hydrological drought due to regional warming in southeast Australia (*low confidence, minor contribution from climate change*) – Reduced inflow in river systems in southwestern Australia (since the mid-1970s) (*high confidence, major contribution from climate change*)" • **Terrestrial ecosystems:** – "Changes in genetics, growth, distribution, and phenology of many species, in particular birds, butterflies, and plants in Australia, beyond fluctuations due to variable local climates, land use, pollution, and invasive species (*high confidence, major contribution from climate change*) – Expansion of some wetlands and contraction of adjacent woodlands in southeast Australia (*low confidence, major contribution from climate change*) – Expansion of monsoon rainforest at expense of savannah and grasslands in northern Australia (*medium confidence, major contribution from climate change*) – Migration of glass eels advanced by several weeks in Waikato River, New Zealand (*low confidence, major contribution from climate change*)" • **Coastal erosion and marine ecosystems:** – "Southward shifts in the distribution of marine species near Australia, beyond changes due to short-term environmental fluctuations, fishing, and pollution (*medium confidence, major contribution from climate change*) – Change in timing of migration of seabirds in Australia (*low confidence, major contribution from climate change*) – Increased coral bleaching in Great Barrier Reef and western Australian reefs, beyond effects from pollution and physical disturbance (*high confidence, major contribution from climate change*) – Changed coral disease patterns at Great Barrier Reef, beyond effects from pollution (*medium confidence, major contribution from climate change*)" • **Food production and livelihoods:** – "Advanced timing of wine-grape maturation in recent decades, beyond advance due to improved management (*medium confidence, major contribution from climate change*) – Shift in winter vs. summer human mortality in Australia, beyond changes due to exposure and health care (*low confidence, major contribution from climate change*)

[23] IPCC AR6, WG1, 12-54, 55.

[24] These impacts have been attributed to climate change with very low, low, medium, or high confidence, with the relative contribution of climate change to the observed change indicated (major or minor), for natural and human systems over the past several decades (Ref. 194)

Source
– Relocation or diversification of agricultural activities in Australia, beyond changes due to policy, markets, and short-term climate variability (*low confidence, minor contribution from climate change*)." A report by Australia's Biodiversity and Climate Change Advisory Group (Ref. 195) indicates that "[b]iodiversity is one of the most vulnerable sectors to climate change". The report also notes that "Australia's biodiversity is not distributed evenly over the continent but is clustered in a small number of hotspots with exceptionally rich biodiversity", and that these "include the Great Barrier Reef, south-west Western Australia, the Australian Alps, the Queensland Wet Tropics and the Kakadu wetlands" (Ref. 195). The report identifies "a few examples of recently observed changes in Australia's biota that are consistent with the emerging climate change 'signal' ", as genetic constitution, geographic ranges, life cycles, populations, ecotonal boundaries, ecosystems, and disturbance regimes (Table 1 within Ref. 195). Further, it is noted that "many of the most important impacts of climate change on biodiversity will be the indirect ones at the community and ecosystem levels, together with the interactive effects with existing stressors (Ref. 195). DAWE have identified climate change as a key threat, specifically that "[a] changing climate is impacting our threatened animals, plants and environments. It is reducing the number of animals and plants, and reducing the places where they occur" (Ref. 196). DAWE also note that "[t]he changing climate is driving changes in species distribution and the composition and functioning of ecological communities, exacerbating the impacts of other pressures such as habitat fragmentation and invasive species" (Ref. 196). Climate change is identified as a threat to some protected species, including marine turtles and whales. The *Recovery Plan for Marine Turtles in Australia* states that "[c]limate change is of particular concern to marine turtles because it is likely to have impacts across their entire range and at all life stages. Climate change is expected to cause changes in dispersal patterns, food webs, species range, primary sex ratios, habitat availability, reproductive success and survivorship" (Ref. 56). The *Conservation Management Plan for the Blue Whale* states: [c]limate change is expected to cause changes in migratory timing and destinations, population range, breeding schedule, reproductive success and survival of baleen whales, including blue whale species and subspecies" (Ref. 62). The Conservation Advice for Humpback Whale states that [c]limate change may lead to changes in species abundance, migration timing and range, species distribution, changes to prey/predator relationships, prey availability and reproductive timing and success, which could impact on the health and survival of species" (Ref. 60). The *North-west Marine Parks Network Management Plan 2018* identifies climate change as a pressure that may impact marine park values (Ref. 157). The management plan states that "[t]he impacts of climate change on the marine environment are complex and may include changes in sea temperature, sea level, ocean acidification, sea currents, increased storm frequency and intensity, species range extensions or local extinctions, all of which have the potential to impact on marine park values" (Ref. 157). *Anthropogenic influence on the climate system* Anthropogenic changes to the global climate system cannot be directly attributed to any one development or emission source or product, as they are the result of the net accumulation of global GHGs (emissions minus sinks) in the atmosphere since the industrial revolution. Growing populations, rising incomes, and urbanisation are the principal forces behind energy-demand growth, as they typically lead to greater use of transportation, heating, cooling, lighting, and refrigeration (Ref. 190). The changing regulatory and international initiatives on climate change (e.g., which may result in changing reduction targets and timeframes) will also influence the total global GHG emissions into the future – making a future prediction of changes to climate systems, inaccurate. *Summary* As a contribution to the anthropogenic influence on the global climate system cannot be directly attributed to any one development, no further assessment has been completed.
ALARP decision context justification
Offshore subsea operations and associated field support are common both nationally and internationally. The control measures to manage the impact associated with GHG emissions are well understood and implemented by industry and CAPL. Currently, under international climate agreements, Australia has the following target to reduce GHG emissions: 26-28% below 2005 levels by 2030 (under the Paris Agreement). Recently, the Commonwealth government also announced an aspirational target of net zero emissions by 2050

Source	
(Ref. 174); however, this target has not been legislated and no management measures for industry have yet been defined or mandated. CAPL's existing *Greenhouse Gas Abatement Program* (Ref. 181) (and as approved under the EP Act) is required to demonstrate that currently applied best practice in terms of GHG emissions have been adopted in the design and operation of the GTP, and periodic review and adoption of advances in technology and operational processes aimed at reducing greenhouse gas emissions per tonne of LNG. Similarly, the Carbon Dioxide Injection System is required to inject underground at least 80% of reservoir CO_2 (calculated on a 5-year rolling average) removed during gas processing operations on Barrow Island that would be otherwise vented to the atmosphere. These arrangements are documented under the primary approvals and associated conditions for the Gorgon Gas Development and detailed in control measures below. There are also other, non-petroleum related legislation that are related to GHG emissions reporting and management, such as the Commonwealth NGER Act and Safeguard Mechanism, to which the Gorgon Gas Development is required to comply. Therefore, given there is sufficient legal mechanisms under the EPBC Act, EP Act, and NGER Act to monitor and report on the emissions associated with the Gorgon Gas Development (to which the activities within scope of this EP are just a component of), there is no uncertainty regarding the emissions associated with the activity, nor the appropriateness of their reporting and management. CAPL is committed to conducting activities in an environmentally responsible manner and aims to implement best practice environmental management as part of a program of continuous improvement. This commitment to continuous improvement means that CAPL reviews the Greenhouse Gas Abatement Program periodically and considers advances in technology and/or operational processes and considers adoption of those technologies that offer a practicable way of reducing GHG emissions per tonne of LNG. Reviews also address matters such as the overall design and effectiveness of the Program, progress in environmental performance, changes in business conditions, and any relevant emerging environmental issues Given the GHG emissions associated with the activities detailed in this EP result in a *de minimis* contribution to the reduction of the global carbon budget, CAPL considers this aspect to comprise a lower-order impact (Table 5-3). As such, CAPL applied ALARP Decision Context A for this aspect. However, given feedback by NOPSEMA, CAPL have considered additional mitigation measures that could potentially lower the contribution to the reduction of the global carbon budget associated with the direct and indirect emissions arising from the activities covered in this EP.	
Good practice control measures and source	
Control measure	**Source**
EP Act approval	The Gorgon Gas Development was approved with conditions under the WA EP Act by the EPA. Ministerial Statement 800 included conditions relating to the management of GHG emissions for the Gorgon Gas Development, specifically the requirement to design and construct a Carbon Dioxide Injection System (Condition 26) and prepare and implement a *Greenhouse Gas Abatement Program* (Condition 27). The Carbon Dioxide Injection System was required to be designed and constructed so that it was capable of injecting 100% of reservoir carbon dioxide removed during gas processing operations. CAPL must implement all practicable means to inject all reservoir carbon dioxide removed during gas processing operations. The Carbon Dioxide Injection System is required to inject underground at least 80% of reservoir CO_2 (calculated on a 5-year rolling average) removed during gas processing operations on Barrow Island that would be otherwise vented to the atmosphere. The *Greenhouse Gas Abatement Program* (Ref. 181) is required to demonstrate that currently applied best practice in terms of GHG emissions have been adopted in the design and operation of the GTP, and periodic review and adoption of advances in technology and operational processes aimed at reducing greenhouse gas emissions per tonne of LNG.
EPBC Act approval	The Gorgon Gas Development was approved with conditions under the EPBC Act by the Minister. Both EPBC References 2003/1294 and 2008/4178 included conditions relating to the management of the carbon dioxide injection system for the Gorgon Gas Development, specifically the

Source	
	requirement to prepare and implement a monitoring program (Condition 19).
National Greenhouse and Energy Reporting scheme	The Gorgon Gas Development (i.e., the facility as a whole) is required to report GHG emissions under *the National Greenhouse and Energy Reporting Act 2007* (NGER Act). From July 2016 emissions have been subject to a baseline in accordance with the National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015. A revised Safeguard Mechanism baseline for Gorgon Operations is currently undergoing audit by the Clean Energy Regulator delegate. Once approved, this baseline will apply throughout the next 5-year in-force period of this EP. Consequently, CAPL will continue to monitor and report GHG emissions, and maintain a baseline, under this legislation.
Corporate governance	Chevron Corporation has set an aspirational target of net zero upstream Scope 1 and Scope 2 emissions by 2050, as well as reduction targets for two metrics: portfolio carbon intesnsity (PCI) and upstream carbon intensity (UCI) (Ref. 190) The PCI metric developed by Chevron Corporate represents “the carbon intensity across the full value chain associated with bringing products to market, including Scope 3 emissions"[25] (Ref. 190). It uses a representative value chain that includes emissions associated with bringing products to market, and emissions from their use. The Chevron PCI reduction target for 2028 (i.e., >5% reduction from 2016) are corporate level targets incorporating emissions from all Chevron operated assets and non-operated joint ventures. The timing of the Chevron reduction targets is aligned with the Global Stocktake process under the Paris Agreement (with the second Global Stocktake will occur in 2028). Within CAPL operational control, Scope 1 and Scope 2 emissions, and Gorgon gas and liquids production data (used to calculate estimated Scope 3 emissions) are compiled, assured, and reported by CAPL to Chevron Corporate annually for inclusion in the PCI metric on an equity basis. Management strategies, projects or improvements that serve to reduce Gorgon emissions per unit production will contribute to the overall PCI metric. The UCI metric developed by Chevron Corporate are equity-based “emission intensity metrics for oil production, gas production, flaring, and methane” (Ref. 190). The Chevron UCI reduction targets for 2028 (e.g., 26% reduction from 2016 for gas production) are corporate level targets incorporating emissions from all Chevron operated assets and non-operated joint ventures. Australia has been identified as one of six corporate assets that will account for two-thirds of the financial commitment over the next four years to reduce UCI (Ref. 190). UCI includes Scope 1 and Scope 2 emissions. Within CAPL operational control, Gorgon gas and liquids production, and Scope 1 and Scope 2 emissions data, are compiled, assured, and reported by CAPL to Chevron Corporate annually for inclusion in the UCI metric, which is depicted on an equity basis. Management strategies, projects, or improvements that serve to reduce Gorgon emissions per unit production will contribute to the overall UCI metric.
Emissions reduction review	As a global company, Chevron operates in many jurisdictions that have enacted lower-carbon policies. CAPL regularly evaluates carbon emission reduction projects for opportunities to avoid, eliminate, or reduce emissions. Continual improvement processes, including but not limited to marginal abatement cost curve (MACC) evaluations, allow CAPL to rank emission reduction opportunities by their relative cost and abatement potentials. Given the sheer scale of the global challenge to address the global carbon budget, allocation of limited resources as efficiently and effectively as possible is critical to creating the greatest opportunity for success. Prioritizing efforts that curtail emissions at the lowest cost per

[25] Quote CCR (October 2021), at pg 38.

Source	
	tonne, irrespective of where or in which sectors those abatements occur, is the most economically efficient approach. The enterprise approach to drive emissions reductions in Chevron's portfolio is the marginal abatement cost curve (MACC) process. Like supply stacks, MACCs can enable a visualization of abatement opportunities, showing their relative cost and abatement potential on a similar basis. The relevant stages in the MACC process are: • opportunity identification by CAPL cross-functional team (with input from all Gorgon Joint Venture participants) • opportunity development and submission by CAPL • enterprise-wide portfolio optimisation / selection for funding • implementation and reporting by CAPL • project tracking and knowledge sharing to ensure constant learning and continuous improvement. The process is ongoing with MACC project selection for funding occurring annually. The scope of the MACC process is activities within CAPL operational control (e.g., with respect to Gorgon Operations, this includes the offshore hydrocarbon system and the GTP on Barrow Island). CAPL provide input on appropriate assumptions for decision analysis, upon which the US-based Carbon Reduction team apply both deterministic and probabilistic analysis to assess emissions reduction opportunities, consistent with Chevron Decision Analysis practices. The US-based Carbon Reduction team use portfolio theory and efficient frontier analysis to identify a portfolio of opportunities to progress across the technology spectrum, segments, business units, and geographies.
Marine Order 97: Marine Pollution Prevention – Air Pollution	Prior to commencement of IMR activities, the MSRE process (Ref. 36) is used to verify that all vessels comply with Marine Order 97: Marine Pollution Prevention – Air Pollution (appropriate to vessel class) for emissions from combusting fuel, including: • Vessels will hold a valid International Air Pollution Prevention (IAPP) certificate and a current international energy efficiency (IEE) certificate • All vessels (as appropriate to vessel class) will have a Ship Energy Efficiency Management Plan (SEEMP) as per MARPOL 73/78 Annex VI • Vessel engine nitrous oxides (NOx) emission levels will comply with Regulation 13 of MARPOL 73/78 Annex VI.
IMR vessel supply contract	While IMR vessels are not on permanent hire by CAPL, there is currently a contract in place with a vessel supplier. A new component within the 'request for tender' documentation for vessel supply is being developed by CAPL; this additional information will allow CAPL to incorporate an evaluation of CO_2 emissions within the tender evaluation process. It is expected that this new additional scope within the evaluation process will be in place for when the next IMR vessel supply contract is released for tender.
Legislative and other requirements review	CAPL is committed to continual improvement and adaptive management processes, and regularly monitors for revised or contemporary Australian regulatory and/or relevant international guidelines or standards in relation to GHG and carbon management. With specific reference to international shipping, CAPL is aware that the IMO is continually updating their mandatory measures to reduce emissions from international shipping. The commercial arrangements governing all export shipping engaged in loading cargoes from the Gorgon Marine Terminal, requires CAPL and their partners to procure ships that comply with international and Australian standards, so to the extent that a ship's Flag State, or AMSA as Port State, adopts IMO resolutions for measures to reduce emissions, these will apply to those third-party vessels (as well as Chevron Shipping vessels).

<table>
<tr><th colspan="2">Source</th></tr>
<tr><td>Address uncertainty</td><td>CAPL acknowledges the residual uncertainty associated with evaluation of environmental impacts and risks from the generation of GHG emissions. Uncertainty arises from advancements in climate science, revised forecasts in global energy energy mix, and subsequent changes in regulatory and policy requirements. These areas will evolve and new information will become available over the in-force period of this EP. As such, CAPL is committed to implementing an adaptive management process to ensure that impacts and risks associated with this aspect are continually reduced to ALARP and managed to acceptable levels.

To address the residualuncertainty associated with impacts and risks from the generation of GHG emissions, the following adaptive management process will be implemented:

• Monitor:
– contemporary climate science in relation to Corporate climate risk management (as sourced from the periodic release of Chevron’s Climate Change Resilience report; Section 7.5)
– historical and forecast global energy mix and associated emissions, including the role of Gorgon product types
– revised or contemporary Australian regulatory and/or relevant international guidelines or standards (as per ‘legislative and other requirements review’ control measure)
• Evaluate:
– review the accuracy of, and validate, the estimated downstream indirect GHG emissions associated with the Gorgon Gas Development
– review and validate the environmental impact and risk assessment for GHG emissions to ensure that GHG emissions are being reduced to ALARP and managed to an acceptable level
• Adjust and implement:
– identify improvements (e.g., to emission estimates, consequence evaluation, control measures, determination of acceptability, etc.) and implement changes as required.

CAPL will implement this adaptive management process annually during the in-force period of this EP. The results of the annual monitoring and evaluation will be documented internally by CAPL. Where this annual review identifies improvements, any changes to the EP will be managed as per the MoC (Section 7.3.2.2) and Environment Plan review (Section 7.5) processes.</td></tr>
<tr><td>Emissions management opportunities</td><td>Chevron supports the Paris Agreement and is committed to addressing climate change while continuing to deliver energy that supports society (Ref. 190). Chevron’s approach to climate policy is to achieve emissions reductions as efficiently and effectively as possible (Ref. 190). This approach is actioned through global engagement, research and innovation, balanced and measured policy, and transparency.

CAPL monitors new and evolving opportunities to work with business partners downstream of our operational control to seek to advance its ambition of managing emissions, including through industry partnerships, research agreements, and commercial opportunities for business diversification into lower carbon energy solutions and/or complimentary technologies for improved efficiency. This is an ongoing process, with opportunities identified, assessed, and implemented on an ad-hoc basis. With any significant technology development, these opportunities may develop over a medium to long term timeframe (i.e., greater than the 5-year in-force periods of EPs).</td></tr>
</table>

Source		
Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
(Avoid) Use non-hydrocarbon powered vessels	If non-hydrocarbon (e.g., hydrogen) powered vessels were used for the program, CAPL could avoid emissions associated with fuel combustion from IMR support vessels. However, for activities under this EP, this avoidance of emissions is minimal (fuel combustion from IMR vessels was estimated at 0.002 Mtpa CO_2-e; Section 6.5.2) on both a project and global scale. Consequently, the benefit would be negligible.	No commercially viable vessels are currently available to implement the activities discussed in this EP. Consequently, the practicability of using vessels with alternative fuel sources to avoid direct emissions is not considered practicable.
(Reduce) Always use lower carbon intensive vessels	If vessels utilising a lower carbon intensive power source (e.g., dual-fuel, LNG, hybrid, battery-supported, etc.) were always used for the program, CAPL could reduce emissions associated with typical marine fuel combustion from IMR support vessels. However, for activities under this EP, this reduction of emissions is minimal (fuel combustion from IMR vessels was estimated at 0.002 Mtpa CO_2-e; Section 6.5.2) on both a project and global scale. Consequently, the benefit would be negligible.	IMR vessels are supplied under an ongoing contract with CAPL. IMR vessels are considered vessels of opportunity from within the suppliers' fleet, with the selection based on the location, type, and availability of suitable vessels, for the individual IMR scope/s. Most IMR vessels are sourced from southeast Asia (e.g., Singapore) or within Australian waters; and have previously included diesel electric vessels (i.e., vessels with lower marine fuel consumption). Any delay to IMR schedules and operational activities due to waiting on the availability of a specific power-sourced vessel introduces the potential of production delays and safety costs that are disproportionate to the environmental benefit of reducing GHG emissions. In addition, sourcing vessels from other regions introduces greater transit emissions to relatively short-term IMR scopes. Consequently, it is not currently considered practicable to always use vessels with alternative power sources to reduce direct GHG emissions.
(Avoid) Use renewable electricity to power the hydrocarbon system and GTP	If a renewable energy source (e.g., solar) was available then the associated emissions from power generation from the gas turbines would be avoided. However, there is a limited Development Envelope allowed for use on Barrow Island, and the construction of any renewable energy source and supply would require an increase to the land disturbance allowed under existing environmental approvals and bring in new environmental impacts.	The cost of implementing this control is grossly disproportionate to the level of risk reduction achieved. Consequently, the practicability of using renewable energy sources to avoided emissions for the activities covered in this EP is not considered practicable.

Source		
(Avoid) Eliminate flaring	The design basis for the GTP specifies no routine flaring during normal operations other than flare pilots and purged gas. Three flare systems have been incorporated into the GTP design. The wet and dry flare systems safely and reliably collect and dispose of hydrocarbon vapour and liquids during commissioning, start-up, and operations, process upsets, or emergencies. The BOG flare system is an independent flare system that collects and disposes of emergency operational releases from the low-pressure LNG Storage and Loading System. The flare systems are considered a safety critical element and cannot be eliminated. Eliminating flaring would introduce safety and production risks and therefore is not a reasonably practicable alternative.	The potential production and safety costs are disproportionate to the environmental benefit of avoiding flaring emissions, and is therefore not a reasonably practicable alternative
Likelihood and risk level summary		
Likelihood	N/A	
Risk level	N/A	
Determination of acceptability		
Principles of ESD	The impact associated with this aspect is a *de minimis* contribution to the reduction of the global carbon budget. The consequence associated with this aspect was evaluated as Incidental (6). One of the UN 2030 Agenda sustainable development goals (SDGs) is “ensure access to affordable, reliable, sustainable and modern energy for all”. Chevron is “inspired” by the UN SDGs and “seek[s] to achieve a more sustainable future” through its business operations (Ref. 202). The principle of inter-generational equity is considered to be met for the Gorgon Gas Development. Energy is fundamental to society, and access to reliable and affordable energy sources is interlinked with their ability to sustainably develop and maintain health, diversity, and productivity for future generations (Ref. 203). Natural gas provides both a reliable and affordable energy source and is one of the lower emission fossil fuels. The continued use of natural gas is in line with Australia’s *Long-Term Emissions Reduction Plan* (Ref. 171), the natural gas from the Gorgon Gas Development is produced with a lower emissions intensity than other gas supplies on the North West Shelf, and the use of natural gas is considered to support the global transition to lower carbon intensive fuels. In addition, as described in Section 6.5.3, the current sales markets for the Gorgon Gas Development are countries that have also ratified the Paris Agreement and established their own NDCs for managing emissions. The Parties to the Paris Agreement acknowledge that climate change is a common concern of humankind and the Parties should consider their respective obligations, including intergenerational equity. By not materially or substantially contributing to Australia’s GHG emissions, the Gorgon Gas Development will support Australia’s global efforts to reach net zero by 2050. If Australia achieves its efforts to meet net zero by 2050, then it will contribute to global efforts to keep warming to the Paris Agreement target of below 2°C above pre-industrial levels and reduce the risks and impacts of climate change. Consequently, the principle of intergenerational equity is considered to be met because the Gorgon Gas Development is consistent with Australia’s carbon budget and therefore Australia’s efforts to keep	

Source	
	warming to the Paris Agreement target of below 2°C above pre-industrial levels and reduce the risks and impacts of climate change, thereby ensuring that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations. The control measures identified and described above are considered to reduce this impact to ALARP. In particular, that GHG emissions from the Gorgon Gas Development will be managed to within an emissions footprint of 9.5 Mtpa CO_2-e (Section 6.5.4) and also adaptively managed via the GHGAP (Ref. 181) and EP review process (Section 7.5), demonstrates CAPL's commitment to GHG management. Therefore, no further evaluation against the Principles of ESD is required.
Relevant environmental legislation and other requirements	Legislation and other requirements considered relevant to this aspect include: • *Environment Protection and Biodiversity Conservation Act 1999* (Cth) • *Environmental Protection Act 1986* (WA) • *National Greenhouse and Energy Reporting Act 2007* (Cth) • National Greenhouse and Energy Reporting (Safeguard Mechanism) Rule 2015 (Cth) • *Conservation Management Plan for the Blue Whale 2015–2025* (Ref. 62) • *Conservation Advice Megaptera novaeangliae Humpback Whale* (Ref. 60) • *Conservation Advice Balaenoptera borealis Sei Whale* (Ref. 61) • *Conservation Advice Balaenoptera physalus Fin Whale* (Ref. 59) • Conservation Management Plan for the Southern Right Whale (Ref. 199) • *Conservation Advice Rhincodon typus Whale Shark* (Ref. 58) • Recovery Plan for the White Shark (Carcharodon carcharias) (Ref. 198) • *Recovery Plan for Marine Turtles in Australia* (Ref. 56) • *Approved Conservation Advice for Dermochelys coriacea (Leatherback Turtle)* (Ref. 57) • Draft *Wildlife Conservation Plan for Seabirds* (Ref. 200) • *Wildlife Conservation Plan for Migratory Shorebirds* (Ref. 80).
Internal context	These CAPL environmental performance standards or procedures were deemed relevant for this aspect: • Climate Change Resilience (Ref. 190).
External context	During stakeholder consultation, no objections or claims were raised regarding greenhouse gas emissions arising from the activity.
Defined acceptable level	Climate change is listed as a threat to protected matters under documents made or implemented under the EPBC Act. As a reduction in the global carbon budget may result in changes to global climate systems, CAPL has defined an acceptable level of impact such that it is not inconsistent with these documents. Specifically, the following action is defined within the *Conservation Management Plan for the Blue Whale 2015–2025* (Ref. 62) and the *Recovery Plan for Marine Turtles in Australia* (Ref. 56): • continue to meet Australia's international commitments to reduce GHG emissions As both of these species have the potential to be directly impacted by other environmental aspects arising from the activities detailed within this EP, CAPL has defined an acceptable level of impact as not materially or substantially contributing to Australia's GHG emissions, and as such,

<table>
<tr><th colspan="3">Source</th></tr>
<tr><td></td><td colspan="2">subsequently not preventing Australia meeting international GHG emission commitments.

Australia is a signatory to the Paris Agreement and is currently committed to reducing greenhouse gas (GHG) emissions by 26–28% below 2005 levels by 2030. The objective of the Paris Agreement includes to “hold[] the increase in the global average temperature to well below 2°C above pre-industrial levels and pursuing efforts to limit the temperature increase to 1.5°C above pre-industrial levels, recognizing that this would significantly reduce the risks and impacts of climate change” (Article 2). The Commonwealth government acknowledges that “[a]chieving the Paris Agreement’s global goals, including limiting warming to well below 2°C and reaching global net zero, will require practical action from all countries. Australia will play its part in the global effort to reach net zero emissions by 2050” (Ref. 171). Australia’s plan and the global context is that “Australia recognises we must reduce emissions while accommodating countries’ economic development goals, especially in the Asia- Pacific and Indo-Pacific regions. As well as reducing our own emissions, our plan focuses on how Australia can play a global leadership role through low emissions energy exports and contributions to innovation” (Ref. 171). Moreover, Australia has already reduced emissions by 20% since 2005 (Ref. 171). By providing low emission energy exports (LNG) and by not materially or substantially contributing to Australia’s GHG emissions, the Gorgon Gas Development will support Australia’s global efforts to reach net zero by 2050. If Australia achieves its efforts to meet net zero by 2050, then it will contribute to global efforts to keep warming to the Paris Agreement target of well below 2°C above pre-industrial levels and significantly reduce the risks and impacts of climate change.

As discussed within the above consequence evaluation, based on the predicted emissions, the Gorgon Gas Development has a de minimis contribution to the reduction of the global carbon budget. Given that anthropogenic changes to the global climate system cannot be directly attributed to any one development or emission source or product, CAPL considers that the Gorgon Gas Development will meet the defined “acceptable level of impact as not materially or substantially contributing to Australia’s GHG emissions, and as such, subsequently not preventing Australia meeting international GHG emission commitments” by managing their emissions to within an emissions footprint of 9.5 Mtpa CO2-e (Section 6.5.4). Additionally, there are other regulatory management plans (i.e., the GHGAP), and other regulatory reporting mechanisms (i.e., the National Greenhouse and Energy Reporting scheme) in place to ensure that GHG emissions from the Gorgon Gas Development are adaptively managed in line with best practice and contemporary legislative and other requirements.</td></tr>
<tr><th>Environmental performance outcome</th><th>Performance standard / Control measure</th><th>Measurement criteria</th></tr>
<tr><td rowspan="3">Do not materially or substantially contribute to Australia not meeting its international GHG emissions commitments by managing direct and indirect GHG emissions associated with Gorgon Gas Development in</td><td colspan="2">EP Act approval
Because implementation of the EP Act Approval is a regulatory requirement, no EPS has been developed for this requirement.</td></tr>
<tr><td colspan="2">EPBC Act approval
Because implementation of the EPBC Act Approval is a regulatory requirement, no EPS has been developed for this requirement.</td></tr>
<tr><td colspan="2">National Greenhouse and Energy Reporting scheme
Because NGER reporting is a regulatory requirement, no EPS has been developed for this requirement. The Safeguard Mechanism baseline is a requirement that needs to be met. The Safeguard Mechanism sets a GHG baseline. Any exceedance is required to be offset through multi-year averaging or the purchase of ACCUs.</td></tr>
</table>

Source		
Australia* to within an emissions footprint of 9.5 Mtpa CO_2-e	**Emissions reduction review** CAPL will implement its emissions reduction review to identify emissions reduction opportunities (within its operational control) for the Gorgon Gas Development to be included in an enterprise-wide selection process	Records show that annual review of emissions reduction opportunities was performed
	Emissions reduction review CAPL will measure and investigate >5% annual increases to absolute Scope 1 and Scope 2 emissions or intensity	Records show that Gorgon asset total emissions (t CO_2-e) and upstream intensity (t CO_2-e/t LNG) are measured, root cause of annual increases >5% are investigated, and where practicable, improvement opportunities are evaluated through the MACC process
	Corporate governance CAPL will support Chevron's corporate aspiration of managing global upstream emissions by implementing management strategies, projects, or improvements for the Gorgon Gas Development selected during an enterprise-wide selection process	Records show that when upstream emissions management strategies, projects, or improvements have been selected for the Gorgon Gas Development, these are implemented as soon as reasonably practicable (with consideration given to the scope, planned turnaround schedule, and scale of the activity)
	Corporate governance CAPL will report Scope 1 and Scope 2 emissions data from the Gorgon Gas Development to Chevron Corporation annually for inclusion in the calculation of its UCI metric	Records show that annual emissions data from the Gorgon Gas Development was provided to Chevron Corporation
	Corporate governance CAPL will support Chevron's corporate aspiration of managing global portfolio emissions by implementing management strategies, projects, or improvements for the Gorgon Gas Development selected during an enterprise-wide selection process	Records show that when portfolio emissions management strategies, projects, or improvements have been selected for the Gorgon Gas Development, these are implemented as soon as reasonably practicable (with consideration given to the scope, planned turnaround schedule, and scale of the activity)
	Corporate governance CAPL will report Scope 1 and Scope 2 emissions data from the Gorgon Gas Development to Chevron Corporation annually for inclusion in the calculation of its PCI metric	Records show that annual emissions data from the Gorgon Gas Development was provided to Chevron Corporation
	Marine Order 97: Marine Pollution Prevention – Air Pollution Prior to commencement of IMR activities, the following will be verified, as per the MSRE process: • vessels will hold a valid International Air Pollution Prevention (IAPP) certificate and a current international	OVIS report / ABU Marine OE Inspection Checklist confirms vessels hold IAPP and IEE certificates, and a SEEMP is in place (as appropriate to class), and NOx emission levels comply with regulations

Source		
	energy efficiency (IEE) certificate • all vessels (as appropriate to vessel class) will have a Ship Energy Efficiency Management Plan (SEEMP) as per MARPOL 73/78 Annex VI • Vessel engine nitrous oxides (NOx) emission levels will comply with Regulation 13 of MARPOL 73/78 Annex VI.	
	IMR vessel supply contract The tender evaluation for the IMR vessel supply contract will include an evaluation of CO_2 emissions	Records indicate that tender evaluation for the IMR vessel supply contract included a consideration of vessel CO_2 emissions
Manage downstream indirect GHG emissions^ associated with Gorgon Gas Development	**Legislative and other requirements reviews** CAPL will undertake annual monitoring of revised or contemporary Australian regulatory requirements, and applicable international guidelines or standards, in relation to carbon management of downstream indirect GHG emissions	Records show that annual monitoring of revised or contemporary Australian regulatory requirements, and applicable international guidelines or standards, in relation to carbon management of downstream indirect GHG emissions was undertaken
	Address uncertainty CAPL will undertake an annual adaptive management process to address the residual uncertainty associated with impacts and risks from the generation of GHG emissions, specifically including: • monitoring the historical and forecast global energy mix and associated emissions, including the role of Gorgon product types • review of the accuracy of estimated downstream indirect GHG emissions associated with the Gorgon Gas Development to validate the estimates used as the basis for the impact and risk assessment • review of the environmental impact and risk assessment for GHG emissions to ensure that GHG emissions are being reduced to ALARP and managed to an acceptable level.	Records show that an annual adaptive management process addressing downstream indirect GHG estimates was undertaken
	Address uncertainty If the above annual monitoring and evaluation identify improvement opportunities to manage downstream indirect GHG	As required, records show that the MoC and/or EP review process were undertaken in response to any improvement opportunities related to

Source		
	emissions, then CAPL will implement these changes within this EP in accordance with the MoC (Section 7.3.2.2) and EP Review (Section 7.5) processes	the management of downstream indirect GHG emissions
	Emissions management opportunities CAPL will evaluate opportunities to partner with organizations that promote and address GHG emissions reduction and carbon offsets in the LNG value chain, and advocate for LNG and natural gas as fuels of choice	Records show that opportunities to promote and address greenhouse gas emissions reduction and carbon offsets in the LNG value chain, and advocating for LNG and natural gas as fuels of choice have been evaluated annually
	Corporate governance CAPL will report production and emissions data from the Gorgon Gas Development to Chevron Corporation annually for inclusion in the calculation of its PCI metric	Records show that annual production and emissions data from the Gorgon Gas Development was provided to Chevron Corporation

** Where 'direct and indirect GHG emissions associated with Gorgon Gas Development in Australia' refers to the direct emissions associated with activities within this EP plus the indirect emissions from processing gas at the GTP on Barrow Island.*

^ Where 'downstream indirect GHG emissions' refers to the emissions associated with transport, and third party end-use of LNG, condensate and domestic gas products.

6.6 Light emissions

Source

Activities identified as having the potential to result in light emissions are:

- navigation and operational lighting from vessels within the OA during IMR activities.

Potential impacts and risks

Impacts	C	Risks	C
Light emissions may result in: • localised and temporary change in ambient light.	6	A change in ambient light may result in: • attractant for light-sensitive species and in turn affect predator-prey dynamics	6

Consequence evaluation

Localised and temporary change in ambient light

Monitoring undertaken by Woodside (Ref. 72) indicates that light density from navigational lighting on a MODU attenuated to below 1.0 lux and 0.03 lux at distances of ~300 m and ~1.4 km, respectively. Light densities of 1.0 lux and 0.03 lux are comparable to natural light densities experienced during deep twilight and during a quarter moon.

Based on Woodside (Ref. 72), CAPL expects that its vessel activities will result in temporary changes to ambient light emissions no larger than a radius of ~1.4 km from the support vessel. Navigational lighting is expected to be the less on support vessels in comparison to a MODU, therefore referencing this modelling is considered an overly conservative approach for this consequence evaluation.

Given the limited extent of the change arising from navigational lighting, the impacts associated with a direct change in ambient light levels was determined to be Incidental (6).

Acting as an attractant to light-sensitive species and in turn affecting predator–prey dynamics

There is no evidence to suggest that artificial light sources adversely affect the migratory, feeding, or breeding behaviours of cetaceans. Cetaceans predominantly use acoustic senses rather than visual sources to monitor their environment (Ref. 73), so light is not considered to be a significant factor in cetacean behaviour or survival.

Light-sensitive fauna (including reptiles, birds and fish) are the species most at risk from this aspect and thus are the focus of this evaluation. As identified in Section 4.3, several marine species listed as threatened and/or migratory under the EPBC Act have the potential to occur within the OA. Several BIAs also overlap with the OA, including:

- Flatback Turtle, Green Turtle, Hawksbill Turtle (internesting buffer)
- Whale Shark (foraging)
- Fairy Tern, Lesser Crested Tern, Roseate Tern, Wedge-tailed Shearwater (breeding).

The *National Light Pollution Guidelines* (Ref. 11) indicate that a 20 km buffer or exposure area can provide a general precautionary light impact limit based on observed effects of sky glow on marine turtle hatchlings demonstrated to occur at 15–18 km (Ref. 77; Ref. 78) and fledgling seabirds grounded in response to artificial light 15 km away (Ref. 79).

Studies conducted between 1992 and 2002 in the North Sea confirmed that artificial light was the reason that birds were attracted to and accumulated around illuminated offshore infrastructure (Ref. 74) and that lighting can attract birds from large catchment areas (Ref. 75). These studies indicate that migratory birds are attracted to lights from offshore platforms when travelling within a radius of 5 km from the light source, but their migratory paths are unaffected outside this zone (Ref. 76). At its closest, the OA is located ~6 km from the coast (Barrow Island). As light emissions from support vessels are expected to result in a change to ambient conditions up to a maximum of 1.4 km from the vessel, no coastal areas (and therefore fledgling seabirds) are expected to be exposed.

The *Recovery Plan for Marine Turtles in Australia* (Ref. 56) identifies light emissions as a key threat because it can disrupt critical behaviours, such as nesting, hatchling orientation, sea finding, and dispersal behaviour.

The *Recovery Plan for Marine Turtles in Australia* (Ref. 56) defines the critical habitat for nesting for each species at a stock level. The closest nesting critical habitats to the OA include Barrow, Montebello and Lowendal islands, which have been identified as nesting habitat for Flatbacks,

Source	
Greens, and/or Hawksbill turtles (Ref. 56). At its closest, the OA is located ~6 km from the coast (Barrow Island). As light emissions from support vessels are expected to result in a change to ambient conditions up to a maximum of 1.4 km from the vessel, no coastal areas (and therefore no adult nesting turtles, or turtle hatchlings) are expected to be exposed. The *Recovery Plan for Marine Turtles in Australia* (Ref. 56) defines the critical habitat for internesting as a distance seaward from nesting critical habitat of 60 km for Flatbacks and 20 km for other marine turtle species. However, recent studies (Ref. 92) have indicated that the internesting behaviour of Flatback Turtles on the North West Shelf appears more spatially restricted than that suggested by the Recovery Plan (Ref. 56). Whittock et. al. (Ref. 92) reported that Flatback Turtles preference habitats within proximity of the coast and at relatively shallow depths during the internesting periods. Specifically, during the study, a maximum distance from the nearest coast and maximum water depth of 27.8 km and <44 m respectively was recorded, with the mean maximum distance away from the nearest coast and mean water depth being less than 6.1 km and <10 m respectively (Ref. 92). This suggests that although the OA does overlap with some internesting critical habitat, due to the OA being located offshore (>6 km from Barrow Island) and with increasing water depths (up to ~1,350 m) it would be very unlikely that turtles would be aggregating within the OA during their internesting period. Consequently, only a small number of transient marine turtles are expected to be present, and any disruption to their behaviour is expected to be minimal given the spatially limited (up to 1.4 km) change in ambient light levels due to vessel presence. Anthropogenic disturbance and artificial lighting is identified as a threat within the *Wildlife Conservation Plan for Migratory Shorebirds* (Ref. 80). However, only a small number of threatened or migratory bird species would be expected to be present in this area. Light emissions that attract a small number of individual seabirds are not expected to result in any impact to the individual or to the greater population. Because light emissions have the potential to cause temporary impacts to a small number of protected species over the course of the activity, CAPL has ranked the consequence associated this impact as Incidental (6).	
ALARP decision context justification	
Offshore commercial vessel operations and subsequent light emissions arising from these activities are commonplace in offshore environments nationally and internationally. During stakeholder consultation, no objections or claims were raised regarding light emissions arising from the activity. The impacts and risks associated with light emissions are well understood, and considered lower-order impacts and risks in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.	
Good practice control measures and source	
Control measure	**Source**
MSRE process	CAPL's *ABU MSRE Corporate OE Process* (Ref. 36) ensures that various legislative requirements are met. This includes ensuring that lighting sufficient for navigational, safety and emergency requirements are met, as appropriate to vessel class.
IM Plan	The type of inspections of the subsea hydrocarbon system will be undertaken in accordance with the *Gorgon and Jansz Subsea and Pipelines Inspection and Monitoring Plan* (IM Plan) (Ref. 160). Inspections will be undertaken with a frequency determined using a risk-based approach; and the frequency of maintenance and repair activities will be dependent on the results of inspections (Section 3.5). Where practicable, planned IMR activities will be scheduled to avoid critical habitat within turtle nesting season (September to March). If scheduling of activities outside these spatial and temporal requirements is not practicable, an activity-specific HIRA assessment will be conducted.
Activity-specific HIRA	Where IMR activities are required to be undertaken at night within critical habitat and during turtle nesting season (September to March), an activity-specific HIRA will be conducted to identify and manage risks to marine turtles. If potential significant activity-related stressors to marine turtles are present, these management measures will be considered where practicable:

Source		
	• if marine turtles are sighted near the path of a vessel, vessels will divert to avoid them (if safe to do so), or slow down to idling speed • vessels working at night within critical habitat and during turtle season will be required to reduce lighting to the minimum required for safe operations.	
Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A
Likelihood and risk level summary		
Likelihood	Due to the nature and scale of this petroleum activity, vessel activities are likely to be focused within offshore waters away from the coast. As such the likelihood of exposing sensitive receptors resulting in the identified consequence was considered Remote (5).	
Risk level	Very low (10)	
Determination of acceptability		
Principles of ESD	The impact associated with this aspect is disruption to light-sensitive species behaviour, which given the location, is not considered as having the potential to affect biological diversity and ecological integrity. The impact associated with this aspect is Incidental (6). Therefore, no further evaluation against the Principles of ESD is required.	
Relevant environmental legislation and other requirements	Legislation and other requirements considered for this aspect include: • Commonwealth *Navigation Act 2012* • *National Light Pollution Guidelines* (Ref. 11) • *Recovery Plan for Marine Turtles in Australia* (Ref. 56) • *Wildlife Conservation Plan for Migratory Shorebirds* (Ref. 80).	
Internal context	CAPLs environmental performance standards / procedures considered relevant to this aspect include: • Gorgon Gas Development and Jansz Feed Gas Pipeline: Long-term Marine Turtle Management Plan (Ref. 168).	
External context	During stakeholder consultation, no objections or claims were raised regarding light emissions arising from the activity.	
Defined acceptable level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan. However, given that light pollution is listed as a threat to protected matters under documents made or implemented under the EPBC Act, CAPL has defined an acceptable level of impact such that it is not inconsistent with these documents. The *Recovery Plan for Marine Turtles in Australia* (Ref. 56) specifies the following relevant action: • 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. No other specific relevant actions were identified within other documents implemented under the EPBC Act. The OA does intersect with critical habitat as identified within the Recovery Plan for Flatback, Green, and Hawksbill Turtles around Barrow Island (Table 4-4). Therefore, CAPL has defined an acceptable level of impact as no displacement of marine fauna from critical habitat.	

Source		
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
Avoid displacement of marine fauna from critical habitat during nesting seasons from petroleum activities	**MSRE process** Vessels will meet the lighting requirements of the MSRE process	Records indicate that vessels meet lighting requirements of the MSRE process
	IM Plan Where practicable, planned IMR activities will be scheduled to avoid critical habitat within turtle nesting season (September to March)	Records show that planned IMR activities were scheduled to avoid critical habitat during nesting season, where practicable
	Activity-specific HIRA Where IMR activities are required to be undertaken at night within critical habitat and during turtle nesting season (September to March), an activity-specific HIRA will be undertaken prior to IMR activity commencing	Records show that activity-specific HIRA undertaken prior to IMR activity commencing
	Activity-specific HIRA Where required, these management measures will be considered where practicable: • if marine turtles are sighted near the path of a vessel, vessels will divert to avoid them (if safe to do so), or slow down to idling speed • vessels working at night within critical habitat and during turtle nesting season will be required to reduce lighting to the minimum required for safe operations.	Vessel records show if marine fauna interaction occurred within critical habitat area during nesting season and what mitigation (e.g., divert or slow vessel) measure was implemented
		Inspection records during night operations within critical habitat and during nesting season confirm only minimum lighting for safe operations is used

6.7 Underwater sound

Source

Activities identified as having the potential to result in underwater sound are:

- vessels or helicopter operations within the OA
- IMR marine acoustic surveys (SSS or MBES) within the OA.

These activities result in the emission of two types of sound:

Continuous sound (vessel operations)

Studies of underwater noise generated from propellers of offshore vessels when holding position indicate highest measured sound pressure level (SPL) up to 137 dB re 1 µPa and 120 dB re 1mPa at 405 m and ~3-4 km from the sound source (Ref. 83).

Continuous sound (helicopter operations)

Sound emitted from helicopter operations is typically below 500 Hz (Ref. 81). The peak-received level diminishes with increasing helicopter altitude, but the duration of audibility often increases with increasing altitude. Estimates of SPL for helicopters range 149–162 dB re 1 µPa (Ref. 63; Ref. 82). Richardson et al. (Ref. 63) report that helicopter sound was audible in air for four minutes before it passed over underwater hydrophones, but detectable under water for only 38 seconds at 3 m depth, and 11 seconds at 18 m depth.

Impulsive sound (IMR acoustic surveys)

Survey techniques are expected to emit various frequencies between 12 and 500 kHz; maximum at-source sound pressure levels are ~238 dB re 1 µPa (peak) (Ref. 84). Further to this, Lurton (Ref. 85) indicate medium to high-frequency MBES systems do not normally exceed source levels of 215–220 dB re 1 µPa @ 1 m and SSS has been previously measured with a peak source level of 210 dB re 1 µPa @ 1 m.

Potential impacts and risks

Impacts	C	Risks	C
Underwater sound emissions may result in: • localised and temporary change in ambient underwater sound.	5	A change in ambient underwater sound may result in: • behavioural disturbance • auditory impairment, temporary threshold shift (TTS), permanent threshold shift (PTS), recoverable or non-recoverable injury to marine fauna	5

Consequence evaluation

Exposure criteria

Mid-frequency (dolphins, toothed whales, beaked whales, bottlenose whales [e.g., Indo-Pacific Humpback and Spotted Bottlenose dolphins, Killer Whale, Sperm Whale]) and low-frequency (baleen whales [e.g., Blue, Brydes, Fin, Humpback, Sei, Antarctic Minke whales]) cetaceans have been identified as having the potential to be present within the OA. Exposure criteria for these species is included in Table 6-3.

Exposure criteria for marine turtles is provided in Table 6-4. Behavioural responses have been taken from McCauley et al. (Ref. 86) who reported that exposure to airgun shots caused Green and Loggerhead Turtles to display more erratic behaviours at 175 dB re 1 µPa , with turtles observed to increase their swimming activity at received sound levels of ~166 dB re 1 µPa .

Exposure criteria for fish is provided in Table 6-5.

Table 6-3: Noise exposure criteria for mid-frequency and low-frequency cetaceans

Cetacean hearing group	PTS onset thresholds (received level) (Ref. 87)		TTS onset thresholds (received level) (Ref. 87)		Behavioural response (Ref. 88)	
	Impulsive	Continuous	Impulsive	Continuous	Impulsive	Continuous
Low--frequency cetaceans	L_{pk}: 219 dB $L_{E,\ 24h}$: 183 dB	$L_{E,\ 24h}$: 199 dB	L_{pk}: 213 dB $L_{E,\ 24h}$: 168 dB	$L_{E,\ 24h}$: 179 dB	L_{pk}: 160 dB	L_{pk}: 120 dB

Source

Mid-frequency cetaceans	L_{pk}: 230 dB $L_{E,\ 24h}$: 185 dB	$L_{E,\ 24h}$: 198 dB	L_{pk}: 224 dB $L_{E,\ 24h}$: 170 dB	$L_{E,\ 24h}$: 178 dB	L_{pk}: 160 dB	L_{pk}: 120 dB

Peak sound pressure level (L_{pk}) has a reference value of 1 µPa, and weighted cumulative sound exposure level (L_E) has a reference value of 1 µPa^2 s. The subscript also describes the accumulation period (being 24 hours).

Table 6-4: Noise exposure criteria for marine turtles

PTS onset thresholds (received level) (Ref. 89)		TTS onset thresholds (received level) (Ref. 89)		Behavioural response (Ref. 86)
Impulsive	Continuous	Impulsive	Continuous	Impulsive
L_{pk}: 232 dB $L_{E,\ 24h}$: 204 dB	$L_{E,\ 24h}$: 220 dB	L_{pk}: 226 dB $L_{E,\ 24h}$: 189 dB	$L_{E,\ 24h}$: 200 dB	L_{pk}: 175 dB

Table 6-5: Noise exposure criteria for fish

Hearing group	Non-recoverable injury / potential mortal injury (Ref. 90)	Recoverable Injury (Ref. 90)		TTS onset thresholds (received level) (Ref. 90)	
	Impulsive	Impulsive	Continuous	Impulsive	Continuous
Fish without swim bladders	L_{pk}: 213 dB $L_{E,\ 24h}$: 219 dB	L_{pk}: 213 dB $L_{E,\ 24h}$: 216 dB		$L_{E,\ 24h}$: 186 dB	
Fish with swim bladders	L_{pk}: 207 dB $L_{E,\ 24h}$: 207 dB	L_{pk}: 207 dB $L_{E,\ 24h}$: 203 dB	$L_{E,\ 48h}$: 170 dB	$L_{E,\ 24h}$: 186 dB	$L_{E,\ 12h}$: 158 dB

Continuous sound (vessel and helicopter operations)

Acoustic modelling undertaken by Woodside for support vessels (Ref. 91) is considered suitable to inform potential sound exposures from this activity as the vessels are expected to be similar in size to those modelled thus source sound levels are expected to be similar, and the physical environment of the operational area is comparable.

The modelling also provides an indication of cumulative sound exposures by considering sound emissions from multiple sources at a single location. In reality, as multiple sound sources will occur at a distance from each other, the model exaggerates near field sound levels and is therefore considered highly conservative.

On the basis that multiple vessels have the potential to be within the OA during IMR activities activity, CAPL acknowledge the potential for cumulative sound emissions. However, modelling of sound exposure levels (SEL) and SEL exposure criteria assumes that transient species would be exposed over a 24 hour period. This is considered highly unlikely as species with the potential to be exposed are mobile and expected to transit through the area, thus cumulative impacts are not expected to arise from this activity.

The outcomes of this modelling are summarised throughout the subsequent risk and impact assessment.

In the absence of modelling, the maximum estimate of SPL from helicopter operations (162 dB re 1 µPa) has been used for the purposes of this consequence evaluation. With the exception of cetaceans, this maximum estimate is below peak SPL noise exposure criteria (and therefore not discussed further in the evaluation for marine reptiles or fish). Similarly, given the nature of helicopter operations (i.e., crew transfers) covered under this EP, exposure to sound from this source for an extended period (e.g., 12 or 24 hours) is not credible, and as such, comparison against the cumulative sound exposure level criterions is not relevant.

Marine Mammals

Behavioural disturbance

Acoustic modelling for support vessels indicate that the maximum radial distance in any direction from the source to 166 dB re 1 µPa was 0.046 km (Ref. 91). Noting that the United States National Marine Fisheries Service (NMFS) recommend applying a noise exposure criterion of

Source
120 dB re 1 µPa for behavioural disturbance (Table 6-3), cetaceans would need to be located close (~0.046 km) to the vessels in order to display some form of avoidance behaviour. As the OA overlaps a migration BIA for the Pygmy Blue and Humpback whales, there is the potential for a larger number of cetaceans to be present during migration periods. However, given the open-water environment, the close distance to the vessel before a behavioural response is likely to occur, and limited number of vessels in the field, it is not expected that the activity would result in a significant change to migration behaviours or displace species outside of the BIA. Estimates of SPL for helicopters range 149–162 dB re 1 µPa (Ref. 63; Ref. 82), which is above the NMFS criterion for behavioural disturbance. However, the spatial and temporal extent of the potential exposure to underwater sound from helicopters is limited (e.g., 38 seconds at 3 m depth, and 11 seconds at 18 m depth; Ref. 63). The helicopter operations covered under this EP (i.e., crew transfers for longer IMR campaigns) are also expected to be infrequent. Therefore, given the limited nature of the exposure, potential impacts from helicopters on cetacean behaviour are not evaluated further. Consequently, only localised short-term behavioural impacts to transient individuals have the potential to arise from these activities and have therefore been evaluated as Minor (5). *TTS and PTS* The NMFS recommend applying a noise exposure criterion of 179 dB re µPa^2.s and 178 dB re µPa^2.s for low and mid frequency cetaceans respectively (Table 6-3). Acoustic modelling for support vessels indicate that the maximum radial distance in any direction from the source to 170 dB re µPa^2.s was 0.010 km (Ref. 91). On this basis, neither TTS or PTS is likely to occur, as exceedance of the TTS and PTS threshold levels require marine mammals to remain within <10 m of the vessel over a 24-hour period, which is not credible. Consequently, TTS and PTS from continuous sound sources has not been considered further. **<u>Turtles</u>** *Behavioural disturbance* Although pulsed sounds are expected to result in different impacts to that of continuous sounds, in lieu of appropriate behavioral disturbance continuous noise exposure criteria for turtles, CAPL has applied noise exposure criteria associated with impulsive sound sources. Specifically, 175 dB re 1 µPa (Table 6-4) has been selected as a conservative threshold to inform the evaluation for this potential impact. Acoustic modelling for support vessels indicates that the maximum radial distance in any direction from the source to 166 dB re 1 µPa was 0.046 km. Therefore, turtles would need to be located close to the vessels in order to display some form of avoidance behaviour. Although the OA overlaps the BIAs for marine turtles (Table 4-5), Whittock et. al. (Ref. 92) reported that Flatback Turtles preference habitats within proximity of the coast and at relatively shallow depths during the internesting periods. Specifically, during the study, a maximum distance from the nearest coast and maximum water depth of 27.8 km and <44 m respectively was recorded, with the mean maximum distance away from the nearest coast and mean water depth being less than 6.1 km and <10 m respectively (Ref. 92). This suggests that although the OA overlaps some internesting areas, due to the distance offshore (>6 km) and increasing water depths it would be very unlikely that turtles would be aggregating within the OA. Consequently, only a small number of transient marine turtles are expected to be present. If individual marine turtles do come within close proximity (i.e. < 0.046 km) to a vessel, the behavioural responses are expected to be limited to increased swimming activity / avoidance (Ref. 91) thus impacts would be temporary in nature. Consequently, only short-term behavioural impacts to individuals have the potential to arise from these activities and have therefore been evaluated as Minor (5). *TTS and PTS* A noise exposure criterion of 200 dB re µPa^2.s and 220 dB re µPa^2.s for TTS and PTS respectively (Table 6-4). Acoustic modelling for support vessels indicate that the maximum radial distance in any direction from the source to 170 dB re µPa^2.s was less than 0.010 km (Ref. 91). Consequently, TTS and PTS is not expected to occur given that, exceedance of noise exposure criteria requires turtles to remain in vicinity (<10 m) of the vessel over a 24-hour period. Consequently, TTS and PTS from continuous sound sources has not been considered further. **<u>Fish including sharks and rays</u>** *Behavioural disturbance* Due to a lack of data on behavioural impacts to fish from continuous sound sources, CAPL has applied noise exposure criteria associated with TTS. Specifically, a noise exposure criterion of

Source
158 dB 1µPa^2.s (Table 6-5) has been selected as a conservative threshold to inform the evaluation for this potential impact. Acoustic modelling for support vessels indicate that sound levels would exceed the behavioural response noise exposure criteria of 156 dB 1µPa^2.s within 0.097 km of the source. Pelagic fish species are likely to be transient through the OA. If the fish are within the immediate vicinity of the sound source, behavioural responses are expected to be limited to an initial startle reaction before either returning to normal, or resulting in the fish moving away from the area (Ref. 93). Demersal fish species may reside around existing subsea infrastructure (i.e., if it is providing suitable artificial habitat) within the OA. However, given the water depths (~70–1350 m) of the OA, the sound levels at the seabed are expected to be below impact thresholds. Consequently, behavioural impacts to pelagic and demersal fish are expected to be limited to the duration of the activity and given the small extent of exposure, only short-term behavioural effects (specifically to pelagic species) are predicted. As such the consequence was evaluated as Minor (5). *TTS and Recoverable injury* Popper *et al.* (Ref. 90) propose noise levels criteria for fish with swim bladders involved in hearing at 170 dB re 1 µPa over 48 hours for a recoverable injury, and 158 dB re 1 µPa over 12 hours for TTS. Acoustic modelling indicates that the maximum radial distance in any direction from the source to 170 re 1µPa^2.s and 158 dB 1µPa^2.s was <0.010 km and 0.097 km respectively (Ref. 91). Pelagic fish species are likely to be transient through the OA. Given their transient nature, these fish are not expected to remain within close proximity (~10–100 m) of a sound source for extended periods (12–48 hours) such that an injury due to continued sound exposure would occur. Demersal fish species may reside around existing subsea infrastructure (i.e., if it is providing a suitable artificial habitat) within the OA. However, given the water depths (~70–1350 m) within the OA, the sound levels at the seabed are expected to be below impact thresholds and thus exposure to demersal species is not expected. On this basis, neither TTS nor recoverable injury to fish are considered credible, and have therefore not been considered further.
Impulsive sound (IMR acoustic surveys) **<u>Marine Mammals</u>** *Behavioural disturbance* Modelling undertaken by Zykov (Ref. 94) indicates that sound levels associated with the site survey would exceed the behavioural response noise exposure criteria of 160 dB re 1 µPa (Table 6-3) within 290 m of the vessel. Within the OA, both mid-frequency (Indo-Pacific Humpback and Spotted Bottlenose dolphins, Killer Whale, Sperm Whale) and low-frequency (Blue, Brydes, Fin, Humpback, Sei, Antarctic Minke whales]) cetaceans have been identified as having the potential to be present. If migrating cetaceans are present, CAPL does not expect that exposure to sound levels from IMR acoustic surveys would result in a significant change to migration behaviours or displace species outside of any relevant BIA given the limited exposure (within 290 m) above the behaviour impact thresholds and broad spatial area associated with intersecting BIAs. Furthermore, given the nature of acoustic surveys associated with this EP and as marine mammal species are expected to display transient (not sedentary) behaviours within the OA, the duration of exposure (even to levels above the impact threshold) would be very limited. As such, the only potential impacts expected would be short-term behavioural effects to individuals, which were evaluated as Minor (5). *TTS and PTS* Modelling undertaken by Zykov (Ref. 94) indicates that sound levels associated with the acoustic surveys would likely exceed the TTS and PTS noise exposure criteria of 168 dB re 1 µPa^2.s and 183 dB re 1 µPa^2.s respectively (Table 6-3) within 20 m of the source. Further to this, Zykov (Ref. 94) indicates that SPL levels of 208 dB re 1 µPa would only occur within 20 m of the source. On this basis, neither TTS nor PTS is expected to occur given that, to exceed the TTS and PTS threshold levels, marine mammals would need to remain within 20 m of the vessel over a 24-hour period. Further to this, the duration of the activity is limited and infrequent, consequently, TTS and PTS effects associated with the site survey has not been considered further.

Source
Turtles *Behavioural disturbance* Modelling undertaken by Zykov (Ref. 94) indicates that sound levels associated with a site survey over sandy substrate would likely exceed the behavioural response noise exposure criteria of 166 dB re 1 µPa (Table 6-4) within 290 m of the Vessel. On the basis that only transient individual turtles are expected to be encountered within the OA, any behavioural response would likely be limited to a small number of individuals. Consequently, given the potential for short-term effects to species, the consequence was ranked as Minor (5). *TTS and PTS* Modelling undertaken by Zykov (Ref. 94) indicates that sound levels associated with a site survey over sandy substrate would likely exceed the TTS and PTS exposure criteria of 189 dB re 1 µPa^2.s and 204 dB re 1 µPa^2.s respectively (Table 6-4) within 20 m of the source. Further to this, SPL is not expected to be above TTS or PTS onset threshold criteria (>226 dB re 1 µPa) given the source level (~215–220 dB re 1 µPa @ 1) is likely below which these impacts will occur. On this basis, neither TTS nor PTS is not expected to occur given that, to exceed the cumulative TTS and PTS threshold levels, turtles would need to remain within 20 m of the vessel over a 24-hour period. Further to this, the duration of the activity is limited and infrequent, consequently, TTS and PTS effects associated with the site survey has not been considered further. **Fish** *Behavioural disturbance* In lieu of specific behavioural noise exposure criteria for fish species, CAPL applied the most conservative noise exposure criteria for fish being 158 dB re 1 µPa (Table 6-5) to inform the evaluation for this potential impact. Modelling undertaken by Zykov (Ref. 94) indicates that sound levels associated with the site survey would exceed the behavioural response noise exposure criteria within ~290 m of the source. Behavioural impacts are expected to be limited to an initial startle reaction before behaviours return to normal or result in fish moving away from the area (Ref. 93). Although both pelagic and demersal fish species are likely to be present within the OA, demersal species that may reside around existing subsea infrastructure are likely to be most affected by this activity. However, as acoustic surveys covered under this EP are of limited duration and occur relatively infrequently, any species that move away from the area are likely to return once sound levels return to normal. As such, any potential impacts are expected to be limited, with short-term effects to species, and were ranked as Minor (5). *TTS, recoverable injuries and non-recoverable injuries* Modelling undertaken by Zykov (Ref. 94) indicates that any exceedance of the TSS, recoverable injury and non-recoverable injury exposure criteria of 186 dB re 1 µPa^2.s (for fish with and without swim bladders), 203 dB re 1 µPa^2.s and 207 dB re 1 µPa^2.s (both for fish with swim bladders) (Table 6-5) would be limited to within 20 m of the source. For TTS and more severe impacts to occur, fish species would need to be exposed to sound levels within close proximity (<20 m) of the source over a 24-hour period. Given common behavioural responses in fish such as c-startle reaction and avoidance, any exposure to SPL or SEL levels are not expected to occur as individuals would be expected to avoid the area prior to exceeding noise exposure criteria. Given the nature of the activity and as behavioural responses are likely to prevent exceedance of criteria, TTS and more severe impacts to fish are not considered further.
ALARP decision context justification
Offshore commercial vessel operations and IMR acoustic surveys are commonplace and well-practised nationally and internationally. The application of control measures to manage impacts and risks arising from this aspect are well defined, understood by the industry, and are considered standard industry practice. During stakeholder consultation, no objections or claims were raised regarding underwater sound emissions arising from the activity. Although some species that are known to be sensitive to underwater sound have the potential to be exposed to underwater noise above exposure criteria during these activities, the impacts and risks arising from underwater sound emissions are considered lower-order impacts and risks in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.

<table>
<tr><th colspan="3">Source</th></tr>
<tr><th colspan="3">Good practice control measures and source</th></tr>
<tr><th>Control measure</th><th colspan="2">Source</th></tr>
<tr><td>EPBC Regulations 2000 – Part 8 Division 8.1 – Interacting with cetaceans</td><td colspan="2">The requirements to manage interactions between vessels and cetaceans are detailed in the EPBC Regulations 2000 – Part 8 Division 8.1 – Interacting with cetaceans. These regulations describe strategies to ensure whales are not harmed during offshore interactions with people.
By implementing these control measures and managing interactions with cetaceans near the vessels or any site surveys, the potential impacts from underwater sound are limited.</td></tr>
<tr><th colspan="3">Additional control measures and cost benefit analysis</th></tr>
<tr><th>Control measure</th><th>Benefit</th><th>Cost</th></tr>
<tr><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><th colspan="3">Likelihood and risk level summary</th></tr>
<tr><td>Likelihood</td><td colspan="2">Baleen whales may exhibit behavioural avoidance when sound levels are at or above 160 dB re 1 µPa (Ref. 87). Baleen whales display a gradation of behavioural responses to pulsed sound, suggesting that acoustic discharges are audible to whales at considerable distances from the source, but that they are not disrupted from normal activities such as vessel operations (Ref. 95), particularly during migration.
As described above, other species such as turtles and fish are expected to initially practice avoidance behaviours in response to sound emissions, and thus the likelihood of underwater sound from these activities resulting in longer-term impact is very unlikely (Ref. 95; Ref. 96).
Although localised and temporary behaviour disturbance may occur, it is unlikely that this would result in any impact to a sensitive life stage of the fauna identified. Consequently, CAPL consider the likelihood of the consequence occurring as being Seldom (3).</td></tr>
<tr><td>Risk level</td><td colspan="2">Low (7)</td></tr>
<tr><th colspan="3">Determination of acceptability</th></tr>
<tr><td>Principles of ESD</td><td colspan="2">The impacts and risks associated with this aspect are limited to localised, short-term behavioural changes. On the assumption that this potential impact occurs during a sensitive life stage, CAPL would not expect these activities to affect migration, internesting, or foraging behaviours, nor impact on individuals or the wider population. As such, this aspect is not considered as having the potential to affect biological diversity and ecological integrity.
The consequence associated with this aspect is Minor (5).
Therefore, no further evaluation against the Principles of ESD is required.</td></tr>
<tr><td>Relevant environmental legislation and other requirements</td><td colspan="2">Legislation and other requirements considered relevant for this aspect include:
• EPBC Regulations 2000 – Part 8 Division 8.1 – Interacting with cetaceans
• Conservation Management Plan for the Blue Whale 2015–2025 (Ref. 62)
• Conservation Advice Megaptera novaeangliae Humpback Whale (Ref. 60)
• Conservation Advice Balaenoptera borealis Sei Whale (Ref. 61)
• Conservation Advice Balaenoptera physalus Fin Whale (Ref. 59)
• Conservation Advice Rhincodon typus Whale Shark (Ref. 58)
• Recovery Plan for Marine Turtles in Australia (Ref. 56).</td></tr>
<tr><td>Internal context</td><td colspan="2">These CAPL environmental performance standards or procedures were deemed relevant for this aspect:</td></tr>
</table>

Source		
	• MSRE process (Ref. 36).	
External context	During stakeholder consultation, no objections or claims were raised regarding underwater sound emissions arising from the activity.	
Defined acceptable level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan. However, given that underwater sound is listed as a threat to protected matters under documents made or implemented under the EPBC Act, CAPL has defined an acceptable level of impact such that it is not inconsistent with these documents. The *Conservation Management Plan for the Blue Whale 2015–2025* (Ref. 62) specifies the following relevant action: • anthropogenic noise in BIAs will be managed such that any Blue Whale continues to utilise the area without injury, and is not displaced from a foraging area. No other specific relevant actions were identified within other documents implemented under the EPBC Act. The OA does not intersect with a foraging BIA for the Pygmy Blue Whale (Table 4-2). The nearest foraging BIA occurs ~140 km southwest of the OA, offshore from North West Cape; and as such is not exposed to underwater sound emissions resulting from activities under this EP. Therefore, CAPL has defined an acceptable level of impact as no injury to marine fauna.	
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
No injury or mortality to marine fauna within the OA from petroleum activities	**EPBC Regulations 2000 – Part 8 Division 8.1 – Interacting with cetaceans** Vessels will implement caution and no approach zones, where practicable: • caution zone (300 m either side of whales; 150 m either side of dolphins)–vessels must operate at ≤6 knots within this zone, maximum of three vessels within zone, and vessels should not enter if a calf is present • no approach zone (300 m to the front and rear of whales and 100 m either side; 300 m for whale calves; 150 m to the front and rear of dolphins and 50 m either side)–vessels should not enter this zone, and should not wait in front of the direction of travel of an animal or pod, or follow directly behind.	Induction materials include relevant marine fauna caution and no approach zone requirements Training records confirm offshore personnel involved in IMR activities have completed the induction Vessel records show if marine fauna interaction occurred within caution or approach zones, and what mitigation (e.g., divert or slow vessel) measure was implemented

6.8 Invasive marine pests

Source			
Activities identified as having the potential to result in the introduction of an invasive marine pest (IMP) are: • planned discharged of ballast water or the presence of biofouling on vessels undertaking IMR activities within the OA.			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
N/A	–	An introduction of an IMP may result in: • displacement of, or compete with, native species.	2
Consequence evaluation			
IMPs are likely to have little or no natural competition or predators, thus potentially outcompeting native species for food or space, preying on native species, or changing the nature of the environment. It is estimated that Australia has >250 introduced marine pests, and that approximately one in six introduced marine species becomes a pest (Ref. 97). The particular values and sensitivities within the OA with the potential to be impacted by the introduction of a marine pest include the following KEFs: • ancient coastline at 125 m depth contour • continental slope demersal fish communities • Exmouth Plateau. Although these KEFs have been identified as having the potential to be impacted from IMR activities, any planned disturbance would be in close proximity of existing infrastructure. As such, exposure of Exmouth Plateau is not considered likely given its location at the northwestern extent of the Jansz-Io permits and away from existing infrastructure. Although KEFs have been identified as having the potential to be exposed, as described in Section 4.3.5, the benthic habitats within the OA mostly comprise unvegetated, soft, and unconsolidated sediments. The OA does not present a benthic habitat or community structure that is typically favourable to IMP survival. The OA is in water depths of ~70–1350 m, and rocky or hard outcrops are not known to occur; thus the typical requirements of hard substrate and light for IMP survival do not occur within the OA. Once established, some IMPs can be difficult to eradicate (Ref. 98) and therefore there is the potential for a long-term change in habitat structure. Highly disturbed shallow water and coastal marine environments (such as marinas) have been found to be more susceptible to colonisation than open-water environments, where the number of dilutions and the degree of dispersal is high (Ref. 99; Ref. 100; Ref. 101; Ref. 102). Although marine pests are identified as being of concern to marine reptile species under the *North-west Marine Bioregional Plan* (Ref. 70), the risk is associated with terrestrial based IMPs thus is not relevant to the activities covered under this EP. If an IMP was introduced, and if it did colonise an area, there is the potential for that colony to spread outside the OA resulting in a widespread long-term impact, therefore resulting in a Severe (2) consequence.			
ALARP decision context justification			
Offshore commercial vessel operations, and subsequent planned discharges, are commonplace and well-practiced locally, nationally, and internationally. The causes resulting in an introduction of an IMP from a planned release of ballast water or hull biofouling are well understood by the industry and CAPL. The control measures to manage the risk associated with the introduction of an IMP are well defined via legislative requirements that are considered standard industry practice. These control measures are well understood and implemented by the petroleum industry and CAPL. Specifically, CAPL has worked in the region for over 10 years, thus has a demonstrated understanding of industry requirements and their operational implementation in these areas. The risk of introducing an IMP is considered a lower-order risk in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.			
Good practice control measures and source			

Source	
Control measure	**Source**
Quarantine procedure	CAPL's *Quarantine Procedure Marine Vessels* (Ref. 42) provides information about quarantine compliance to CAPL, contractors, and others associated with marine vessels. The procedure also ensures that the requirements of various legislative or relevant guidelines are met, including: • undertaking biofouling risk assessments in line with the with the *National Biofouling Management Guidance for the Petroleum Production and Exploration Industry* (Ref. 103) and WA Vessel Check system • requirements for biofouling management plans and/or biofouling record books, in accordance with the *Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species (Biofouling Guidelines)* MPEC.207(62) 2011 (Ref. 10) The quarantine procedure requires that all relevant biofouling information is provided to enable suitable risk assessments to be completed.
Ballast water management	The *Australian Ballast Water Management Requirements* (Ref. 8) describes the management requirements for ballast water exchange, including: • non-discharge of 'high-risk' ballast water in Australian ports or waters • full ballast exchange outside Australian territorial seas • documentation of all ballast exchange activities.
Anti-fouling certificate	The Commonwealth *Protection of the Sea (Harmful Anti-fouling Systems) Act 2006* enacts Marine Order 98 (Marine pollution – anti-fouling systems). This marine order describes the conditions for when an antifouling certificate is required.
Maritime Arrivals Reporting System (MARS)	Under the Commonwealth *Biosecurity Act 2015*, pre-arrival information must be reported through MARS before a vessel arrives in Australian waters.

Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A

Likelihood and risk level summary	
Likelihood	As vessel activities are occurring in deeper Commonwealth waters (not within shallow coastal areas), and with the well-known and implemented IMP control measures in place, it is considered Rare (6) that an IMP would be introduced resulting in impacts to the ecological functions of the KEFs.
Risk level	Moderate (6)

Determination of acceptability	
Principles of ESD	The potential risks associated with this aspect is a widespread long-term impact to benthic communities, which are expected to comprise soft sediment communities. The introduction of an IMP to these communities has the potential to affect biological diversity and ecological integrity. The consequence associated with this aspect is Severe (2). Therefore, further evaluation against the remaining Principles of ESD is required. There is little uncertainty associated with this aspect as the activities and cause pathways are well known and the activities are well regulated and managed. The habitat within the OA is known from baseline studies, thus the understanding of benthic habitat at these locations is well understood. As such, there is limited scientific uncertainty associated with this aspect; consequently the precautionary principle has not been applied.

Source		
Relevant environmental legislation and other requirements	Legislation and other requirements considered relevant for this aspect include: • Commonwealth *Biosecurity Act 2015* • Commonwealth *Protection of the Sea (Harmful Anti-fouling Systems) Act 2006* (enacted by Marine Order 98 [Marine pollution – anti-fouling systems]) • *Australian Ballast Water Management Requirements* (Ref. 8) • *Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species (Biofouling Guidelines)* MPEC.207(62)) 2011 (Ref. 10) • *National Biofouling Management Guidance for the Petroleum Production and Exploration Industry* (Ref. 103).	
Internal context	This CAPL environmental performance standard / procedure was deemed relevant for this aspect: • *Quarantine Procedure Marine Vessels* (Ref. 42)	
External context	During stakeholder consultation, no objections or claims were raised regarding IMPs arising from the activity.	
Defined acceptable level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.	
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
No introduction and establishment of invasive marine pests within the OA due to petroleum activities	**Quarantine procedure** All marine vessels undertaking activities in the OA must meet the relevant requirements of the *Quarantine Procedure Marine Vessels*, including that where required*:* • biofouling risk assessments are completed • biofouling management plans and/or biofouling record books are available.	Records confirm that relevant vessels meet requirements of the *Quarantine Procedure Marine Vessels*
	Ballast water management International marine vessels will be required to comply with the key *Australian Ballast Water Management Requirements*, which are: • non-discharge of 'high-risk' ballast water in Australian ports or waters • full ballast exchange outside Australian territorial seas • documentation of all ballast exchange activities.	For international marine vessels, records show compliance with the Australian Ballast Water Management Requirements
	Anti-fouling certificate Marine vessels greater than 400 GT with an anti-foul coating are to maintain up-to-date international antifouling coating certification in accordance with *Protection of the Sea (Harmful Anti-fouling Systems) Act 2006* and/or the International	Inspection reports confirm that international antifouling coating certifications are up-to-date

Source		
	Convention on the Control of Harmful Anti-fouling Systems on Ships	
	Maritime arrivals reporting system Vessels entering into the Australian territorial sea from outside Australian territory will complete pre-arrival reporting (unless Excepted under Biosecurity Determination 2016), in accordance with the *Biosecurity Act 2015*	Records confirm that international vessels completed pre-arrival reporting (or can demonstrate meeting conditions for an exception)

6.9 Planned discharges—Vessel operations

Source			
Activities identified as having the potential to result in planned discharges are: • vessels operations (during IMR activities) within the OA. The types of planned vessel discharges include deck wash-water, fire-fighting foam, sewage, greywater, food wastes, cooling water, and oily bilge water.			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
Planned discharges from vessels may result in: • localised and temporary reduction in water quality.	6	A change in ambient water quality may result in: • changes to predator-prey dynamics.	6
Consequence evaluation			

Localised and temporary reduction to water quality

Open marine waters are typically influenced by regional wind and large-scale ocean current patterns resulting in the rapid mixing of surface and near-surface waters—where vessel discharges would occur (Ref. 104). Vessel discharges would occur in these surface and near-surface waters. Therefore, nutrients from sewage, or other similar, discharges will not accumulate or lead to eutrophication due to the highly dispersive environment (Ref. 104). This outcome was verified by sewage discharge monitoring for another offshore project (Ref. 72), which determined that a 10 m^3 sewage discharge reduced to ~1% of its original concentration within 50 m of the discharge location. In addition, monitoring at distances 50 m, 100 m, and 200 m downstream, and at five different water depths, confirmed that discharges were rapidly diluted and no elevations in water quality monitoring parameters (e.g. total nitrogen, total phosphorous, and selected metals) were recorded above background levels at any station. This modelling was based on volumes that far exceed volumes expected during support vessel operations. Therefore, the extent of impacts are expected to be localised to the discharge location.

Monitoring of desalination brine of continuous wastewater discharges (including cooling water) undertaken by Woodside for its Torosa South-1 drilling program in the Scott Reef complex found that discharge water temperature decreases quickly as it mixes with the receiving waters, with the discharge water temperature being <1 °C above ambient within 100 m (horizontally) of the discharge point, and 10 m vertically (Ref. 72).

A vessel's bilge system is designed to safely collect, contain and dispose of oily water so that discharge of hydrocarbons to the marine environment is minimised or avoided. Bilge water is processed via an oil-water separator before being discharged to sea. Discharge is intermittent and occurs at or near surface waters. As such, oily bilge discharges are expected to readily dilute and disperse under the action of waves and currents in surface waters. In addition, once exposed to air, any volatile components of the oil will readily evaporate.

Testing of fire-fighting deluge systems onboard vessels often leads to a release of fire-fighting foams offshore. 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 (Ref. 105; Ref. 106). These conditions are not consistent with the use under this EP where use of the systems may arise once or twice over the duration of this EP. In their diluted form (as applied in the event of a fire or test), fire-fighting foams are generally considered to have a relatively low toxicity to aquatic species (Ref. 107; Ref. 108) and further dilution of the foam mixtures in dispersive aquatic environments may then occur before there is any substantial demand for dissolved oxygen (Ref. 109).

Consequently, CAPL believes that the change in water quality from these standard discharges is limited to a localised area and returns to ambient following completion of the discharge; therefore, any impacts are Incidental (6).

Changes to predator / prey dynamics

The overboard discharge of sewage and macerated food waste creates a localised and temporary food source for scavenging marine fauna or seabirds, whose numbers may temporarily increase as a result, thus increasing the food source for predatory species.

However, the rapid consumption of this food waste by scavenging fauna, and physical and microbial breakdown, ensures that the impacts of food waste discharges are insignificant and temporary and that all receptors that may potentially be in the water column are not impacted.

Source		
The values and sensitivities within the OA with the potential to be affected by changes in predator–prey dynamics include: • Whale Shark (foraging) • Fish communities (associated with the various KEFs). Effects on environmental receptors along the food chain—fish, reptiles, birds, and cetaceans—are not expected beyond the immediate vicinity of the discharge in open waters (Ref. 104). Studies into the effects of nutrient enrichment from offshore sewage discharges indicate that the influence of nutrients in open marine areas is much less significant than that experienced in enclosed areas (Ref. 110) and suggest that zooplankton composition and distribution in areas associated with sewage dumping grounds are not affected. However, if any changes in phytoplankton or zooplankton abundance and composition occur, they are expected to be localised, typically returning to background conditions within tens to a few hundred metres of the discharge location (Ref. 111; Ref. 112; Ref. 113). As described above, plankton communities are not affected by sewage discharges, but if they are, such effects would be highly localised (expected to return to background conditions within tens to a few hundred metres of the discharge location). Consequently, subsequent indirect impacts to other marine fauna are not expected, and thus are not considered further. Although fish are likely to be attracted to these discharges, any attraction and consequent change to predator–prey dynamics is expected to be limited to close to the release and thus is expected to result in localised impacts to species. Any increased predation is not expected to result in more than a limited environmental impact; therefore, the consequence is Incidental (6).		
ALARP decision context justification		
Offshore commercial vessel operations, and subsequent planned discharges, are commonplace and well-practiced locally, nationally, and internationally. The control measures to manage the risk associated with these planned discharges are well defined via legislative requirements that are considered standard industry practice. These are well understood and implemented by the petroleum industry and CAPL. During stakeholder consultation, no objections or claims were raised regarding vessel discharges arising from the activity. The impacts associated with these discharges are lower-order impacts in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.		
Good practice control measures and source		
Control measure	**Source**	
MARPOL 73/78 sewage discharge	Marine Order 96 (Sewage) gives effect to MARPOL 73/78 Annex IV. MARPOL is the International Convention for the Prevention of Pollution from Ships is aimed at preventing both accidental pollution and pollution from routine operations.	
MARPOL 73/78 food waste discharge	Marine Order 95 (Marine pollution prevention – garbage) gives effect to MARPOL 73/78 Annex V, which details the conditions in which macerated and unmacerated food waste can be discharged to the environment.	
MARPOL 73/78 oily bilge discharge	Marine Order 91 (Marine pollution prevention – oil) gives effect to MARPOL 73/78 Annex I, which details the conditions by which oily bilge is authorized to be discharged to the environment.	
Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A
Likelihood and risk level summary		
Likelihood	Given the nature and scale of this activity with standard control measures in place, it is considered Rare (6) that these discharges would result in any impact to the ecological function of the particular values and sensitivities present within the OA.	
Risk level	Very low (10)	

Source	
Determination of acceptability	
Principles of ESD	The potential impacts and risks associated with this aspect is limited to a short-term direct reduction in water quality in a localised area, which is not considered as having the potential to affect biological diversity and ecological integrity. Accordingly, the consequence associated with this aspect is Incidental (6). Therefore, no further evaluation against the Principles of ESD is required.
Relevant environmental legislation and other requirements	Legislation and other requirements considered relevant to this aspect include: • Marine Order 91 • Marine Order 95 • Marine Order 96 • MARPOL 73/78 Annex I, IV and V
Internal context	These CAPL environmental performance standard / procedures were deemed relevant for this aspect: • *Hazardous Materials Management Procedure* (Ref. 37) • MSRE process (Ref. 36).
External context	During stakeholder consultation, no objections or claims were raised regarding planned discharges from vessel operations arising from the activity.
Defined acceptable level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.

Environmental performance outcome	Performance standard / Control measure	Measurement criteria
No impacts to marine habitats, or marine fauna outside of the OA from vessel discharges during petroleum activities	**MARPOL 73/78 sewage discharge** Offshore discharge of sewage from vessels will be in accordance with these MARPOL 73/78 Annex IV requirements: • An IMO approved comminution and disinfection system to discharge (greater than 3 nm from the nearest land); or • An IMO approved Sewage Treatment Plant at any location; or • Untreated sewage discharged ≥12 nm from the nearest land while the vessel is proceeding at no less than 4 knots.	Records show sewage is discharged in accordance with MARPOL 73/78 Annex IV, including current International Sewage Pollution Prevention (ISPP) Certificate (for marine vessels >400 T or certified to carry more than 15 persons)
	MARPOL 73/78 food waste discharge Offshore discharge of food waste from vessels will be in accordance with these MARPOL 73/78 Annex V requirements: • macerated to no greater than 25 mm and when the marine vessel is at least 3 nm from the nearest land; or • unmacerated when the marine vessel is at least 12 nm from the nearest land.	Records show food waste is discharged in accordance with MARPOL 73/78 Annex V
	MARPOL 73/78 oily bilge water discharge Oily bilge water will be discharged to marine environment only when the concentration is	Records show oily bilge water is discharged in accordance with MARPOL 73/78 Annex I, including

Source		
	<15 ppm in accordance with MARPOL 73/78, Annex I: • through an IMO approved on board oil-water separator; and • when the marine vessel is en route.	current International Oil Pollution Prevention (IOPP) Certificate

6.10 Planned discharges—Subsea operations

Source			
Activities identified as having the potential to result in planned subsea operational discharges are: • commissioning and start-up activities • operational activities • IMR operations within the OA. The types of planned subsea operational discharges include small volumes of control fluids, spacer fluids, hydrotest fluids, MEG, and chemically treated potable water.			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
Planned subsea operational discharges may result in: • localised and temporary reduction in water quality.	6	A change in ambient water quality may result in: • indirect impacts to fauna arising from chemical toxicity	6
Consequence evaluation			

Localised and temporary reduction in water quality

Subsea operational fluid discharges are intermittent, non-continuous, and of short duration, and as such frequency of exposure is limited. These fluids have positive buoyancy, upon release the plume will dilute and disperse (Ref. 114). The discharges occur at the wells or near the drill centres, which are located in water depths of ~200–250 m for Gorgon and ~1315–1350 m for Jansz

Previously completed fluid dispersion modelling for subsea releases of control fluids indicate that in similar water depths with a similar product the residence time or plume persistence was estimated to be in the order of 18 minutes (Ref. 71).

This suggests that the residence time associated with a release of control fluids from valve actuations is well below the release frequency. As the receiving environment is open and enables dispersion (i.e., water movement is not restricted), accumulation effects from this release are not expected.

Due to the small discharge volumes (e.g., up to ~50 m^3 of control fluid during operations [Section 3.4]), within open marine waters (which are typically influenced by large-scale ocean currents), rapid dispersion of fluids is expected to occur and the spatial extent of the discharges is expected to be limited to a small area in the water column around the source.

As subsea discharges are highly influenced by natural dispersion and dilution processes, the extent of exposure is most influenced by the volume of the release. Consequently, the planned discharges are expected to result in a limited environmental impact, and the consequence level was determined as Incidental (6).

Potential chemical toxicity

As described above, these discharges are expected to result in temporary reductions in water quality within the immediate surroundings of the release location. The extent of this water quality reduction is limited to around the subsea wells and drill centres.

The particular values and sensitivities identified as having the potential to be exposed to these discharges are:

- continental slope demersal fish communities (KEF)
- commercial fisheries.

Although these KEFs have been identified as having the potential to be exposed, as described in Section 4.3.5, the benthic habitats within the OA mostly comprise unvegetated, soft, and unconsolidated sediments. Given that biologically important habitats tend to be found in areas of rocky escarpment rather than soft sediments (Ref. 70), exposure to habitats comprising high levels of diversity are not expected. The *North-West Marine Bioregional Plan* (Ref. 70) does not identify toxicity or chemical pollution/contaminants as a key threat to the continental slope demersal fish communities KEF.

Given the rapid dilution and dispersion conditions, low bioaccumulation potential and the high biodegradability of the control fluids, and intermittent frequency of discharges, bioaccumulation in the receiving environment and sublethal impacts are expected to be limited. Consequently, the

Source		
release of subsea discharges are expected to result in a limited environmental impact, and the consequence level was determined as Incidental (6).		
ALARP decision context justification		
Subsurface operational discharges associated with the operation of subsea infrastructure are commonplace and well-practiced within the industry. The control measures to manage the risk associated with these planned discharges are considered standard industry practice. These are well understood and implemented by the petroleum industry and CAPL During stakeholder consultation, no objections or claims were raised regarding planned discharges from subsea operations arising from the activity. The impacts associated with these discharges are lower-order impacts in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.		
Good practice control measures and source		
Control measure	**Source**	
Hazardous materials selection process	As part of the hazardous materials selection process, hazardous materials that will be discharged to the environment will undergo a detailed environmental assessment, as per CAPL's *Hazardous Materials Management Procedure* (Ref. 37)	
IMR work procedures	Activity specific work procedures are developed and address HIRA findings, including any additional controls identified for implementation.	
Activity-specific HIRA	The HIRA will include HSE Specialist participation to identify and assess potential environmental impacts and risks associated with the specific maintenance or repair campaign proposed. The HIRA will consider relevant information, which may include: • proximity to potentially sensitive environmental receptors • other known activities and/or impacts that have occurred at that location • material minimisation • alternative materials • alternative execution methodologies • learnings from previous comparable IMR activities/campaigns. Where the HIRA identifies that risks and impacts are potentially greater than those assessed in this EP, the management of change process will be triggered (Section 7.3.2.2).	
Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A
Likelihood and risk level summary		
Likelihood	Given the nature and scale of this activity, and with standard control measures in place, it is considered Rare (6) that this discharge would result in any impact to the ecological function of the particular values and sensitivities present within the OA.	
Risk level	Very low (10)	
Determination of acceptability		
Principles of ESD	The potential impacts and risks associated with this aspect is limited to a short-term direct reduction in water quality in a localised area, which is not considered as having the potential to affect biological diversity and ecological integrity. Accordingly, the consequence associated with this aspect is Incidental (6). Therefore, no further evaluation against the Principles of ESD is required.	

Source		
Relevant environmental legislation and other requirements	No legislation or other requirements were considered relevant to this aspect.	
Internal context	This CAPL environmental performance standard / procedure was deemed relevant for this aspect: • *Hazardous Materials Management Procedure* (Ref. 37).	
External context	During stakeholder consultation, no objections or claims were raised regarding planned discharges from subsea operations arising from the activity.	
Defined acceptable level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.	
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
No impacts to marine habitats, or marine fauna outside of the OA from subsea discharges during petroleum activities	**Hazardous materials selection process** Subsea fluids planned for discharge are subject to the hazardous materials selection process as per the CAPL *Hazardous Materials Management Procedure*	Hazardous materials selection process assessment records (or similar)
	IMR work procedures IMR activity specific work procedures developed and implemented	Records show that activity specific work procedures are developed for each IMR activity and address HIRA findings, including any additional controls identified for implementation
	Activity-specific HIRA Activity-specific HIRA undertaken prior to maintenance or repair activity commencing	Records show that activity-specific HIRA undertaken prior to maintenance or repair activity commencing

6.11 Unplanned release—Waste

Source

Activities identified as having the potential to result in the unplanned release of waste are:

- vessel operations (during IMR activities) within the OA.

Because waste is generated on board vessels, inappropriate management and storage has the potential to result in a release to the environment.

Potential impacts and risks

Impacts	C	Risks	C
N/A	–	Unplanned release of waste to the environment may result in: • marine pollution resulting in entanglement or injury of marine fauna	6

Consequence evaluation

If hazardous or non-hazardous waste is lost overboard, the extent of exposure to the environment is limited.

Marine fauna most at risk from marine pollution include marine reptiles and seabirds, through ingestion or entanglement (Ref. 56; Ref. 115). Ingestion or entanglement has the potential to limit feeding or foraging behaviours and thus can result in marine fauna injury or death. Although marine debris is identified as being of concern to marine reptile species under the *North-west Marine Bioregional Plan* (Ref. 70), the risk is associated with ‘land-sourced plastic garbage, fishing gear from recreational and commercial fishing abandoned into the sea, and ship-sourced, solid non-biodegradable floating materials disposed of at sea’. This type of waste is not associated with the activities described under this EP and given the restricted exposures and the limited quantity of waste with the potential to cause marine pollution that is expected to be generated from petroleum activities, it is expected that any impacts from marine pollution would result in limited impacts to individuals. Thus, CAPL ranked this consequence as Incidental (6).

ALARP decision context justification

Offshore commercial vessel operations, and the subsequent management of waste, are commonplace and well-practiced activities within the industry.

The control measures to manage the risk associated with an accidental release of waste are well defined via legislative requirements that are considered standard industry practice. There is a good understanding of the release pathways, and the control measures required to manage these events are well understood and implemented by the petroleum industry and CAPL.

During stakeholder consultation, no objections or claims were raised regarding waste management arising from the activity.

An unplanned release of waste is a lower-order risk in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.

Good practice control measures and source

Control measure	Source
Marine Order 95 (Marine pollution prevention – garbage)	MARPOL 73/78 is the International Convention for the Prevention of Pollution from Ships and is aimed at preventing both accidental pollution, and pollution from routine operations. Specifically, MARPOL 73/78 Annex V requires that a garbage management plan and garbage record book is in place and implemented, and describes various requirements that are to be applied when managing waste offshore. Marine Order 95 (Marine pollution prevention – garbage) gives effect to MARPOL 73/78 Annex V.

Additional control measures and cost benefit analysis

Control measure	Benefit	Cost
N/A	N/A	N/A

Source		
Likelihood and risk level summary		
Likelihood	Marine pollution arising from mismanaged waste offshore has occurred previously in the industry but is not expected to occur during these activities, given the control measures in place. As such, the likelihood of incidental consequences to values and sensitivities from an unplanned release of waste is considered Remote (5).	
Risk level	Very low (10)	
Determination of acceptability		
Principles of ESD	The potential impact associated with this aspect is limited to individuals and consequently is not expected to affect biological diversity and ecological integrity. The consequence associated with this aspect is Incidental (6). Therefore, no additional evaluation against the Principles of ESD is required.	
Relevant environmental legislation and other requirements	Legislation and other requirements considered relevant to this aspect include: • Marine Order 95 • MARPOL 73/78 • *Recovery Plan for Marine Turtles in Australia* (Ref. 56) • *National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011–2016* (Ref. 115) • *Wildlife Conservation Plan for Migratory Shorebirds* (Ref. 80).	
Internal context	No CAPL environmental performance standards / procedures were deemed relevant for this aspect.	
External context	During stakeholder consultation, no objections or claims were raised regarding waste management arising from the activity.	
Defined acceptable level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.	
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
No uncontrolled release of waste to the environment during petroleum activities	**Marine Order 95 (Marine pollution prevention – garbage)** Marine vessels >100 T (or certified to carry >15 persons) will have a Garbage Management Plan on board, in accordance with MARPOL 73/78 Annex V	OVIS report / ABU Marine OE Inspection Checklist verifies that a Garbage Management Plan is on board marine vessels >100 T or certified to carry >15 persons
	Marine Order 95 (Marine pollution prevention – garbage) Marine vessels >400 T (or certified to carry >15 persons) will have a Garbage Record Book on board, in accordance with MARPOL 73/78 Annex V	Current and completed Garbage Record Book (for marine vessels >400 T or certified to carry >15 persons)
	Marine Order 95 (Marine pollution prevention – garbage) For waste that is incinerated on board a marine vessel, the	Current International Air Pollution Prevention (IAPP) Certificate (for marine vessels >400 T or certified to carry >15 persons)

Source		
	incinerator is to be IMO-approved and the waste incinerated is to be recorded in accordance with MARPOL 73/78 Annex V	Current and completed Garbage Record Book (for marine vessels >400 T or certified to carry >15 persons).

6.12 Unplanned release—Loss of containment

Source			
The operation of vessels includes handling, using, and transferring hazardous materials, and has the potential to result in a loss of containment (LOC) event. Based on the activities described in this EP, the following potential LOC scenarios were identified: • using, handling, and transferring hazardous materials and chemicals on board (<1 m^3)[1] • transferring hazardous materials between vessels (50 m^3)[2] • dropped objects (and interaction with the subsea infrastructure) resulting in a loss of various fluids including treated sea water, hydraulic fluids, or MEG[3]. *[1] A range of hydrocarbons and other hazardous chemicals / materials are likely to be present during IMR activities; however, the maximum credible volume associated with a single-point failure was estimated to be ~1 m^3 based on the loss of an entire intermediate bulk container due to rupture while handling.* *[2] AMSA (Ref. 116) suggests the maximum credible spill volume from a refuelling incident with continuous supervision is approximately the transfer rate × 15 minutes. Assuming failure of dry-break couplings and an assumed 200 m^3/h transfer rate (based on previous operations), this equates to an instantaneous spill volume of ~50 m^3.* *[3] Dropped objects may damage subsea infrastructure resulting in a release of hydrocarbons, treated sea water, hydraulic fluid, or MEG. CAPL defined the credible worst-case credible scenario during IMR activities as a ~50 m^3 release from one of the larger subsea valves (1" valve).* *CAPL engaged RPS APASA to run the OILMAP DEEP model to understand the near-field plume dynamics to determine whether visible oil and gas, at levels of concern, would reach the surface (from each release location) (Ref. 117). Both Jansz-Io and Gorgon condensate properties were considered on the basis that when under pressure, a volume of 50 m^3 of hydrocarbon has the potential to be released over a 24-hour period until the release is controlled. Modelling indicated that due to the depth of water at the Jansz DC-1 release site (1,338 m), no visible oil was predicted to reach the sea surface and that oil/gas plume execution depths ranged from 977 to 1,224 m below the sea surface (Ref. 117). Modelling indicated that due to the depth of water at the Gorgon M3 release site (200 m), no visible oil was predicted to reach the sea surface and that oil/gas plume execution depths ranged from 69 to 172 m below the sea surface (Ref. 117). These droplets of oil will be removed from the environment through biodegradation processes.*			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
N/A	–	Unplanned release of hazardous material to the environment may result in: • indirect impacts to fauna arising from chemical toxicity	5
Consequence evaluation			
Upon release, a loss of 50 m^3 of a hazardous product (such as light hydrocarbons [diesel] or chemicals) would be expected to change the water quality of both surface and pelagic waters. The environmental impacts associated with a surface release of 50 m^3 of marine diesel oil (MDO) or other hazardous materials are expected to be much less than those associated with a loss of hydrocarbons from a vessel collision (Section 6.13), and thus are not evaluated further here. Modelling was conducted for a 50 m^3 subsea release of condensate from the Gorgon field to understand the potential impacts associated with a release arising from a dropped object damaging previously installed subsea infrastructure. Modelling predicts that the extent of exposure to hydrocarbons (from the Gorgon field) was limited to within 22 m of the release location and that a subsea release from the Jansz–Io field was not expected to result in any surface exposures and limited in-water exposure due to rapid dilution and dispersion (Ref. 117). The values and sensitivities with the potential to be exposed to decreased water quality from an accidental subsea release include: • Humpback Whale (migration) • Pygmy Blue Whale (migration and distribution) • Flatback Turtle, Green Turtle, Hawksbill Turtle (internesting buffer) • Whale Shark (foraging). • continental slope demersal fish communities (KEF) • commercial fisheries.			

Source
Based on the nature of these unplanned releases, which are non-continuous and expected to occur in a location where no specific sedentary behaviours for values and sensitivities have been identified, the extent and severity of any potential impact is expected to be limited. Given the nature of unplanned releases covered under this EP and the transient nature of identified values and sensitivities, fauna would need to pass directly through the plume almost immediately upon release to be impacted. Any potential impact from such an event is expected to be short term and limited to a small number of individuals, thus the consequence level was determined as Minor (5).

ALARP decision context justification
Offshore operations including IMR and vessel operations are commonplace and well-practiced industry activities. The control measures to manage the risk associated with LOC scenarios from these activities are well defined via legislative requirements that are considered standard industry practice. There is a good understanding of potential spill sources, and the control measures required to managed these are well understood and implemented by the petroleum industry and CAPL. Modelling was undertaken for several scenarios associated with this aspect to support the environmental risk evaluation. Modelling has removed some of the uncertainty associated with this aspect, and supports the evaluation that due to the distance offshore and distance to sensitive receptors, these risks are lower-order risks in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.

Good practice control measures and source

Control measure	Source
MSRE process	The MSRE process (Ref. 36) ensures that various legislative requirements and CAPL standards are met. Specifically, pre-mobilisation inspections may include: • visual checks of accessible equipment and hydraulic hoses for defects • confirmation that dry-break couplings or similar automated stop devices are available for use on marine vessels that are refuelled at sea • secondary containment is available for hydrocarbons and chemicals stored on the deck of marine vessels • bunkering procedures are available.
Ship Oil Pollution Emergency Plan (SOPEP)/ Shipboard Marine Pollution Emergency Plan	MARPOL 73/78 Annex I and Marine Order 91 (Marine pollution prevention – oil) requires that each vessel has an approved SOPEP in place. To prepare for a spill event, the SOPEP details: • response equipment available to control a spill event • review cycle to ensure that the SOPEP is kept up to date • testing requirements, including the frequency and nature of these tests. In the event of a spill, the SOPEP details: • reporting requirements and a list of authorities to be contacted • activities to be undertaken to control the discharge of oil • procedures for coordinating with local officials.

Additional control measures and cost benefit analysis

Control measure	Benefit	Cost
N/A	N/A	N/A

Likelihood and risk level summary

Likelihood	The likelihood that a LOC event results in a Minor (5) consequence was determined to be Remote (5). With the control measures in place, it was considered very unlikely that a large LOC event associated with this activity would occur, and even more unlikely that such an event would

Source		
	impact any of the identified values and sensitivities, which are known to be transient and unlikely to be present at the exact location of the LOC.	
Risk level	Very low (9)	
Determination of acceptability		
Principles of ESD	The potential impact associated with this aspect would be short term, apply to some individuals, and consequently is not expected to affect biological diversity and ecological integrity. The consequence associated with this aspect is Minor (5). Therefore, no additional evaluation against the Principles of ESD is required.	
Relevant environmental legislation and other requirements	Legislation and other requirements considered relevant for this aspect include: • Marine Order 91, Marine pollution prevention – oil • MARPOL 73/78	
Internal context	These CAPL environmental performance standards or procedures were deemed relevant for this aspect: • MSRE process (Ref. 36).	
External context	During stakeholder consultation, no objections or claims were raised regarding LOC management arising from the activity.	
Defined acceptable level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.	
Environmental performance outcome	**Performance standard / Control measure**	**Measurement criteria**
No leak or spill of hydrocarbons / hazardous materials to the environment during petroleum activities	**MSRE process** Prior to commencement of IMR activities, the following will be undertaken during a pre-mobilisation vessel inspection, as per the MSRE process: • visual checks of accessible equipment and hydraulic hoses for defects • confirmation that dry-break couplings or similar automated stop devices are available for use on marine vessels that are refuelled at sea • confirmation that secondary containment is available for hydrocarbons and chemicals stored on the deck of marine vessels.	OVIS report / ABU Marine OE Inspection Checklist confirms that equipment and hydraulic hoses are visually free of defects, dry-break couplings or similar are available for use, and, and secondary containment is available on the deck of the marine vessel
	MSRE process Refuelling is undertaken in accordance with CAPL-approved refuelling / bunkering procedures, which include the appropriate weather / sea / visibility conditions, as determined by the Vessel Master.	Records confirm that refuelling is undertaken in accordance with CAPL-approved refuelling / bunkering procedure

Source		
Reduce the risk of impacts to the environment from the unplanned release of hydrocarbons / hazardous materials during petroleum activities	**SOPEP** Marine vessels >400 T will carry on board a Shipboard Oil Pollution Emergency Plan (SOPEP) in accordance with MARPOL 73/78 Annex I – Prevention of Oil Pollution	OVIS report / ABU Marine OE Inspection Checklist confirms an approved SOPEP is on board marine vessels >400 T
		Inspection records (or similar) show drills conducted in accordance with SOPEP
		Inspection records (or similar) show spill kits available in accordance with SOPEP
	SOPEP In the event of a vessel-based spill event, emergency response activities will be implemented in accordance with the vessel SOPEP (or equivalent)	Records confirm that emergency response activities were implemented in accordance with the vessel SOPEP in the event of a vessel-based spill.

6.13 Unplanned release—Vessel collision event

6.13.1 Credible scenario

A vessel collision event within the OA is considered a credible (but unlikely) unplanned event. A major marine spill because of vessel collision is only likely to occur under exceptional circumstances (e.g., loss of DP, navigational error, inclement weather conditions). Given the location, water depths, and lack of submerged features within the OA, grounding is not considered credible, and is not considered further.

Based upon the types of vessels typically used for IMR activities (with the exception of major repairs), size of largest fuel tanks and fuel type to be utilised for the activities in this EP, CAPL was able to identify the typical credible worst-case scenario (as per AMSA guidelines; Ref. 116) as being a surface release of ~325 m^3 of MDO resulting from a vessel collision event. However, in the event that major repairs are undertaken, larger vessels would be required. Typical fuel tank sizes associated with construction or heavy lift vessels are expected to be in the order of ~1,000 m^3. Therefore, as a conservative approach to risk assessment for activities covered under this EP, previous modelling of spills in the order of 1,500–1,750 m^3 have been used in the following analyses.

6.13.2 Spill modelling

CAPL commissioned RPS to conduct spill modelling to inform the risk assessment associated with a vessel collision event within the both the Gorgon (Ref. 118), and Jansz-Io (Ref. 119; Ref. 120) fields.

A three-dimensional oil spill model (SIMAP) was used to simulate the drift, spread, weathering and fate of the spilled oil (Ref. 118; Ref. 119; Ref. 120). Modelling was conducted using a stochastic approach, where multiple simulations (using the same spill parameters) were conducted, but under varying meteorological and oceanographic conditions.

Table 6-6 summarises the model settings; Table 6-7 summarises the hydrocarbon properties for MDO; and Table 6-8 and Table 6-9 describe the modelled environmental exposure and impact thresholds respectively.

Table 6-6: Vessel collision spill scenario model settings

Parameter	Details	
Release Location	Gorgon	Jansz-Io
Latitude	20°34'38.60" S	19°51'8.7" S
Longitude	114°46'38.39" E	114°30'57.8" E
Water Depth	~267 m	~1,350 m
Oil type	MDO	
Simulation spill type	Surface	
Simulation spill volume	1,500 m^3	1,750 m^3
Simulation spill duration	24 hours	
Total simulation duration	50 days	
Number of randomly selected spill simulation start times	100 per season (300 total)	
Seasons modelled	Summer (December to February)	

Parameter	Details
	Transitional (March, October and November) Winter (April to September)

Table 6-7: Physical properties and boiling point ranges for MDO

Characteristic	Value			
Density	829.1 kg/m3 (at 25 °C)			
Dynamic viscosity	4 cP			
Pour point	-14 °C			
API gravity	37.6 API			
Classification	Group II, light persistent oil			
Boiling point	Volatile <180 °C	Semi-volatile 180–265 °C	Low volatility 265–380 °C	Residual >380 °C
	6.0%	34.6%	54.4%	5.0%

Table 6-8: Hydrocarbon environmental exposure thresholds

Environmental exposure threshold^	Justification
Surface ≥1 g/m^2 (low)	In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 121), CAPL has set the surface exposure threshold at ≥1 g/m^2. This threshold is used to establish a planning area for scientific monitoring (Ref. 121).
In-water (dissolved) ≥10 ppb (low)	In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 121), CAPL has set the in-water (dissolved) exposure threshold at ≥10 ppb. This threshold is used to establish a planning area for scientific monitoring (specifically, for water quality) (Ref. 121).
In-water (entrained) ≥10 ppb (low)	In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 121), CAPL has set the in-water (entrained) exposure threshold at ≥10 ppb. This threshold is used to establish a planning area for scientific monitoring (specifically, for water quality) (Ref. 121).
Shoreline ≥10 g/m^2 (low)	CAPL has set the shoreline exposure threshold at ≥10 g/m^2. This threshold is consistent with the low exposure value for shoreline oil within NOPSEMA's oil spill modelling bulletin (Ref. 121).

^ *Environmental exposure thresholds have been used to define the EEA, and the presence of environmental values and sensitivities within this area have been identified in Section 4. These exposure thresholds and the spatial extent of the EEA is not used as part of the environmental impact and risk assessment presented below.*

Table 6-9 Hydrocarbon environmental impact thresholds

Environmental impact threshold	Justification
Surface ≥1 g/m^2 (low)	In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 121), CAPL has set the surface impact threshold for socio-economic effects at ≥1 g/m^2. This threshold is equivalent to ~1,000 L/km^2 or a layer thickness of ~1 µm. At this concentration, oil on the water surface is expected to be visible. The Bonn Agreement Oil Appearance Code (Ref. 122) describes a 0.3–5.0 µm thick oil layer as having a rainbow-coloured appearance. Due to this visibility, there is the potential to impact nature-based activities (such as tourism) via a reduction in aesthetics.
Surface ≥10 g/m^2 (moderate)	In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 121), CAPL has set the surface impact threshold for ecological effects at ≥10 g/m^2. This threshold is equivalent to ~10,000 L/km^2 or a layer

Environmental impact threshold	Justification
	thickness of ~10 µm. The Bonn Agreement Oil Appearance Code (Ref. 122) describes a 5–50 µm thick oil layer as having a metallic appearance. This threshold is considered by NOPSEMA to approximate the lower limit of harmful effects to birds and marine mammals (Ref. 121). This threshold is consistent with observations ranging from physical oiling to toxicity effects for marine fauna within literature, including French et al. (Ref. 123), French-McCay (Ref. 124), Engelhardt (Ref. 125), Clark (Ref. 126), Geraci and St. Aubin (Ref. 127) and Jenssen (Ref. 128).
In-water (dissolved) ≥50 ppb (moderate)	Laboratory studies have shown that dissolved oil exert most of the toxic effects of oil on aquatic biota (e.g., Carls et al. [Ref. 129], Nordtug et al. [Ref. 130], Redman [Ref. 131]). Being soluble, the dissolved oil can be taken up by organisms directly from the water column by absorption through external surfaces and gills, as well as through the digestive tract. In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 121), CAPL has set the in-water (dissolved) impact threshold for sublethal ecological effects at ≥50 ppb. This threshold is considered by NOPSEMA to approximate potential toxic effects, particularly sublethal effects to sensitive species (Ref. 121). This threshold is based on an instantaneous concentration, and therefore only requires the dissolved oil to be at this concentration for one-hour (based on minimum model time-step) to trigger this threshold.
In-water (dissolved) ≥4,800 ppb.hrs (moderate)	Toxicity is the relative ability of a substance to cause adverse effects; and this relative ability is dependent on factors including both dose and duration. As such, CAPL has set the in-water (dissolved) impact threshold for lethal ecological effects at ≥4,800 ppb.hrs. This threshold is based on the instantaneous concentration (50 ppb) recommended by NOPSEMA but also applies a duration component of 96 hours. Therefore, dissolved oil needs to be at this concentration consistently for 96 hours to trigger this threshold. French-McCay (Ref. 132) reviewed toxicity data for marine biota exposed to dissolved oil and found that 95% of species and life stages exhibited 50% population mortality (LC50) for total PAH concentrations between 6–400 ppb (with an average of 50 ppb) after 96 hours exposure.
In-water (entrained) ≥100 ppb (high)	Entrained oil are insoluble droplets suspended in the water column, and as such exposure pathways are direct contact with external tissue or direct oil consumption. In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 121), CAPL has set the in-water (entrained) impact threshold for sublethal ecological effects at ≥100 ppb. This threshold is considered by NOPSEMA as appropriate for informing risk evaluation (Ref. 121). This threshold is based on an instantaneous concentration, and therefore only requires the entrained oil to be at this concentration for one-hour (based on minimum model time-step) to trigger this threshold. French-McCay (Ref. 133) identified that if total hydrocarbons in entrained oil droplets was to be evaluated as a risk, 100 ppb would be an extremely conservative sublethal threshold.
In-water (entrained) ≥9,600 ppb.hrs (high)	CAPL has set the in-water (entrained) impact threshold for lethal ecological effects at ≥9,600 ppb.hrs. This threshold is based on the instantaneous concentration (100 ppb) recommended by NOPSEMA but also applies a duration component of 96 hours. Therefore, entrained oil needs to be at this concentration consistently for 96 hours to trigger this threshold. It is however noted that entrained oil, especially when in weathered state, is typically not considered toxic.

Environmental impact threshold	Justification
Shoreline ≥10 g/m^2 (low)	In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 121), CAPL has set the shoreline impact threshold for socio-economic effects at ≥10 g/m^2. This threshold is equivalent to ~10 mL/m^2 or ~2 teaspoons/m^2. At this concentration, oil on the shoreline is expected to be visible. Due to this visibility, there is the potential to impact nature-based activities (such as tourism or recreational use) via a reduction in aesthetics.
Shoreline ≥100 g/m^2 (moderate)	In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 121), CAPL has set the shoreline impact threshold for ecological effects at ≥100 g/m^2. This threshold is equivalent to ~100 mL/m^2 or 20 teaspoons/m^2. French et al. (Ref. 123) and French-McCay (Ref. 124) define shoreline oil accumulation at ≥100 g/m^2 as potentially harmful to wildlife (including invertebrates, birds, furbearing aquatic mammals and marine reptiles), based on studies for sub-lethal and lethal impacts. Impacts on vegetated habitats (such as saltmarsh and mangroves) have been observed at higher concentrations of shoreline oil. Observations by Lin and Mendelssohn (Ref. 134) demonstrated that loadings of >1,000 g/m^2 of oil during the growing season would be required to impact marsh plants significantly. Similar thresholds have been found in studies assessing oil impacts on mangroves (e.g., Grant et al. [Ref. 135], Suprayogi and Murray [Ref. 136]).

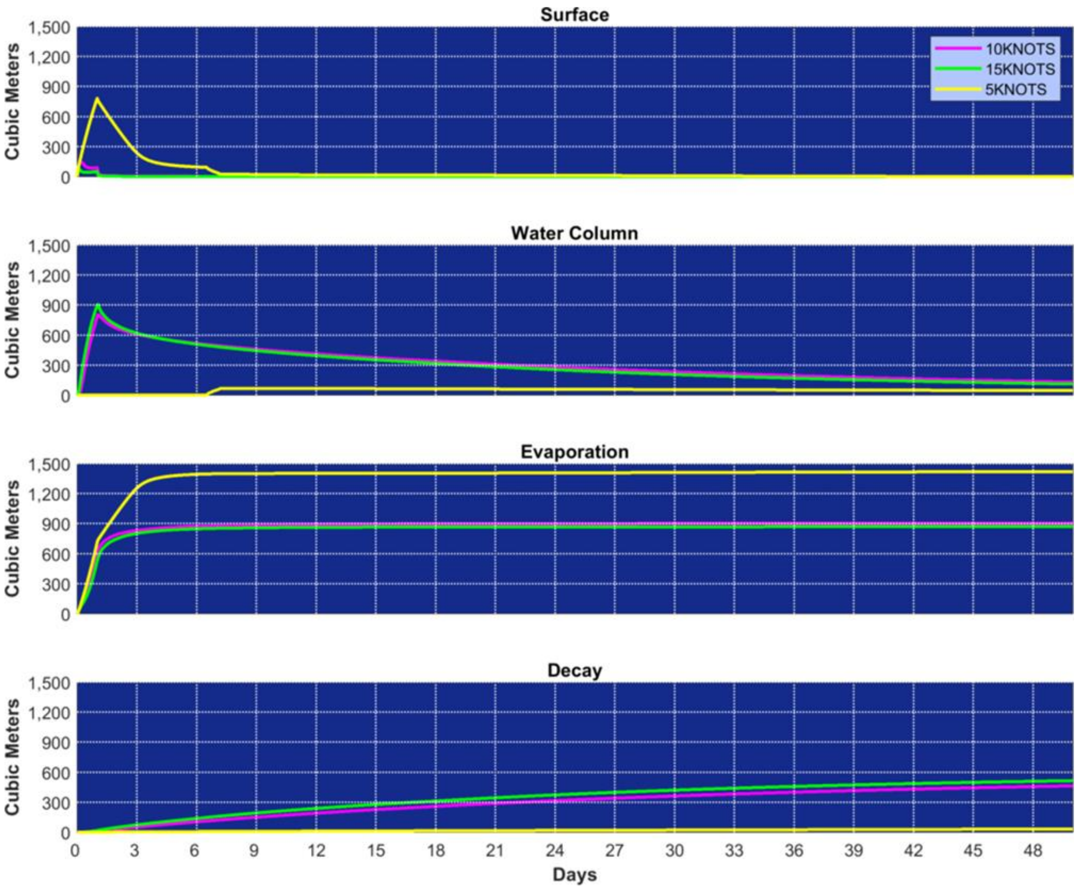
^ *Environmental impact thresholds have been used to define the EMBA, and the presence of environmental values and sensitivities within this area have been identified in Section 4. These impact thresholds and the spatial extent of the EMBA is used as part of the environmental impact and risk assessment presented below.*

6.13.2.1 Weathering and fate

MDO is a light-persistent fuel oil used in the maritime industry. It has a density of 829.1 kg/m^3, an API of 37.6, and a low pour point (−14 °C) (Table 6-7). The low viscosity (4 cP) indicates that this oil will spread quickly when released and will form a thin film on the sea surface, increasing the evaporation rate.

Generally, about 6.0% of the MDO mass should evaporate within the first 12 hours (boiling point <180 °C); a further 34.6% should evaporate within the first 24 hours (boiling point 180°C–265 °C); and an additional 54.4% should evaporate over several days (boiling point 265°C–380 °C). Approximately 5% (by mass) of MDO will not evaporate at atmospheric temperatures. These compounds will persist in the environment.

Figure 6-1 shows predicted weathering for a 1,500 m^3 release of MDO over 24 hours (tracked for 50 days) during three static wind conditions. Typically, <50% of the slick volume, and potentially far less, will remain on the water surface after ~3 days (Figure 6-1).



(Source: Ref. 118)

Figure 6-1: Predicted weathering

6.13.2.2 Modelling outputs

Stochastic modelling outputs from RPS (Ref. 118; Ref. 119; Ref. 120) are summarised in Table 6-10 and Table 6-11 having regard to the particular values and sensitivities within the EMBA, as identified in Section 4.

For the 1,500 m^3 MDO release within the Gorgon field:

- The maximum distance from the release location to the ≥1 g/m^2 and ≥10 g/m^2 surface impact thresholds was ~277 km southwest (transitional) and ~65 km south-southwest (transitional), respectively.
- The probability of contact to any shoreline at ≥10 g/m^2 was 3% in summer, with no contact predicted in transitional and winter months. The minimum time before shoreline contact was ~3 days and the maximum volume of oil ashore was 2.7 m^3. No shoreline contact at the ≥100 g/m^2 impact threshold was predicted to occur during any season.
- No dissolved oil at ≥50 ppb or ≥4,800 ppb.hrs impact thresholds was predicted to occur during any season.
- Entrained oil at ≥100 ppb or ≥9,600 ppb.hrs impact thresholds was predicted to occur. However, entrained oil was predicted to remain in the surface layers, with no exposure at depths >20 m below the surface predicted to occur during any season.

For the 1,750 m^3 MDO release within the Jansz-Io field:

- The maximum distance from the release location to the ≥1 g/m^2 and ≥10 g/m^2 surface impact thresholds was ~208 km east-northeast (transitional) and ~120 km northeast (transitional), respectively.
- No shoreline contact was predicted to occur during any season.
- Dissolved oil at ≥50 ppb impact thresholds was predicted to occur. However, dissolved oil was predicted to remain in the surface layers only (no predicted exposure at depths >10 m below the surface). No dissolved oil at ≥4,800 ppb.hrs impact thresholds was predicted to occur during any season.
- Entrained oil at ≥100 ppb and ≥9,600 ppb.hrs impact thresholds was predicted to occur. However, entrained oil was predicted to remain in the surface layers, with no exposure at depths >10 m below the surface predicted to occur during any season.

Table 6-10: Gorgon vessel collision spill modelling EMBA receptor exposure summary

Sensitivity	Name	Surface^		In-water (dissolved)^		In-water (entrained)^		Shoreline^	
		≥1 g/m²	≥10 g/m²	≥50 ppb	≥4,800 ppb.hrs	≥100 ppb	≥9,600 ppb.hrs	≥10 g/m²	≥100 g/m²
		(probability of exposure, minimum time to exposure)		(probability of exposure)		(probability of exposure)		(probability of exposure, minimum time to exposure, mean length of shoreline)	
AMP	Gascoyne	0–1%, 15–19 days	—	—	—	8–14%	1–2%	—	—
	Montebello	—	—	—	—	1–5%	0–1%	—	—
	Ningaloo	0–2%, 4 days	—	—	—	6–13%	0–3%	—	—
KEF	Ancient coastline at 125 m depth contour	4–16%, <1 day	2–4%, <1–1 day	—	—	11–26%	3–10	—	—
	Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	0–1%, 9 days	—	—	—	10–20%	0–1%	—	—
	Commonwealth waters adjacent to Ningaloo Reef	0–2%, 4 days	—	—	—	6–13%	0–3%	—	—
	Continental slope demersal fish communities	—	—	—	—	88–92%	78–85%	—	—
	Exmouth Plateau	0–1%, 19 days	—	—	—	6–7%	1%	—	—
World Heritage Properties / National Heritage Places	The Ningaloo Coast *(inferred from Cape Range IBRA, Exmouth shoreline)*	0–3%, 3 days	—	—	—	0–6%	0–3%	0–3%, 3 days, 8 km	—
Commonwealth Heritage Properties	Ningaloo Marine Area – Commonwealth Waters *(inferred from Ningaloo IMCRA)*	0–4%, 3 days	—	—	—	6–18%	0–4%	—	—

^ Ranges in values shown are due to the different results between seasons.

Table 6-11: Jansz-Io vessel collision spill modelling EMBA receptor exposure summary

Sensitivity	Name	Surface^		In-water (dissolved)^		In-water (entrained)^		Shoreline^	
		≥1 g/m²	≥10 g/m²	≥50 ppb	≥4,800 ppb.hrs	≥100 ppb	≥9,600 ppb.hrs	≥10 g/m²	≥100 g/m²
		(probability of exposure, minimum time to exposure)		(probability of exposure)		(probability of exposure)		(probability of exposure, minimum time to exposure, mean length of shoreline)	
AMP	Gascoyne	—	—	—	—	7–10%	0–2%	—	—
	Montebello	—	—	—	—	0–1%	—	—	—
	Ningaloo	—	—	—	—		—	—	—
KEF	Ancient coastline at 125 m depth contour	—	—	—	—	0–1%	—	—	—
	Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	—	—	—	—	4–5%	—	—	—
	Commonwealth waters adjacent to Ningaloo Reef	—	—	—	—	—	—	—	—
	Continental slope demersal fish communities	0–1%, 50 days	—	—	—	3–12%	1–3%	—	—
	Exmouth Plateau	5–10%, 16–27 days	0–1%, 50 days	0–1%	—	12–14%	3–9%	—	—
World Heritage Properties / National Heritage Places	The Ningaloo Coast *(inferred from Cape Range IBRA, Exmouth shoreline)*	—	—	—	—	—	—	—	—
Commonwealth Heritage Properties	Ningaloo Marine Area – Commonwealth Waters *(inferred from Ningaloo IMCRA)*	—	—	—	—	—	—	—	—

^ Ranges in values shown are due to the different results between seasons.

6.13.3 Risk assessment

Source			
Activities identified as having the potential to result in a vessel collision event are: • vessels and IMR operations within the OA. A vessel collision event may occur as a result of a loss of DP, navigational error or floundering due to weather.			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
N/A	—	The potential environmental impacts associated with hydrocarbon exposures from a vessel collision event are:	
		• marine pollution resulting in sublethal or lethal effects to marine fauna	5
		• smothering of subtidal and intertidal habitats	5
		• indirect impacts to commercial fisheries	5
		• reduction in amenity resulting in impacts to tourism and recreation.	5

Consequence evaluation

Marine pollution resulting in sublethal or lethal effects to marine fauna

Marine mammals

Marine mammals may be exposed to hydrocarbons from an oil spill at the water surface or within the water column. Marine mammals can be exposed to oil externally (e.g., swimming through surface slick) or internally (e.g., swallowing the oil, consuming oil-affected prey, or inhaling of volatile oil related compounds) (Ref. 137; Ref. 138).

Direct contact with hydrocarbons may result in skin and eye irritation, burns to mucous membranes of eyes and mouth, and increased susceptibility to infection (Ref. 139). However, direct contact with surface oil is considered to have little deleterious effect on whales, possibly due to the skin’s effectiveness as a barrier. Furthermore, effect of oil on cetacean skin is probably minor and temporary (Ref. 139). French-McCay (Ref. 140) identifies that a ≥10 g/m^2 oil thickness threshold has the potential to impart a lethal dose to the species; however, also estimates a probability of 0.1% mortality to cetaceans if they encounter these thresholds based on the proportion of the time spent at surface.

The physical impacts from ingested hydrocarbons with subsequent lethal or sublethal impacts are applicable; however, the susceptibility of cetaceans varies with feeding habits. Baleen whales are not particularly susceptible to ingestion of oil in the water column as they feed by skimming the surface (i.e., they are more susceptible to surface slicks). Toothed whales and dolphins may be susceptible to ingestion of dissolved and entrained oil as they gulp feed at depth. As highly mobile species, in general it is very unlikely that these animals will be constantly exposed to concentrations of hydrocarbons in the water column for continuous durations (e.g., >48–96 hours) that would lead to chronic effects.

Studies have shown little impact on Bottlenose Dolphins after hydraulic and mineral oil immersion and ingestion, although there was evidence of temporary skin damage in dolphins and a Sperm Whale from contact with various oil products including crude oil (Ref. 139; Ref. 141).

Marine mammals are vulnerable if they inhale volatiles when they surface within a hydrocarbon slick. For the short period that they persist, vapours from the spill are a significant risk to mammal health, with the potential to damage mucous membranes of the airways and the eyes, which will reduce the health and potential survivability of an animal. Inhaled volatile hydrocarbons are transferred rapidly to the bloodstream and may also accumulate in tissues (Ref. 139).

Stochastic modelling was used to identify BIAs for marine mammals that may be exposed to hydrocarbon concentrations greater than impact thresholds. These were:

- Humpback and Pygmy Blue Whales (distribution, migration, foraging)

Source
• Dugong (breeding, calving, foraging, and nursing). As these species are considered most sensitive to surface exposures, deterministic analysis for the largest sea surface swept area was utilised to understand the potential extent and duration of exposure. The deterministic model indicates that surface hydrocarbons concentrations ≥10 g/m^2 are present for <2 days following the spill event, with a maximum area of coverage of ~15 km^2. This deterministic scenario is considered most relevant for offshore waters (where surface exposures were deemed to be larger) and subsequent impacts to offshore BIA's associated with whales. Using the Pygmy Blue Whale migration BIA as an example, modelling indicates that the extent of surface exposures was predicted to be limited to <1% of the entire BIA. Deterministic analysis for largest volume of oil ashore, predicts that surface hydrocarbons concentrations ≥10 g/m^2 are present for <2 days following the spill event, with a maximum area of coverage of ~1 km^2. This deterministic scenario is considered most relevant for nearshore waters and subsequent impacts to nearshore BIA's. Using the Dugong breeding BIA as an example, modelling indicates that the extent of surface exposures was predicted to be limited to <1% of the entire BIA. As the extent and duration of exposure to nearshore environments is expected to be limited the potential for environmental impacts would also be limited. However, as behaviours in nearshore waters are likely to result in increased sensitivity to hydrocarbon exposures as species are less likely to be transient, impacts to nearshore environments are expected to be larger than that associated with offshore exposures. Based on an assessment of the predicted magnitude and duration of surface oil, and both instantaneous and time-integrated entrained oil, it is expected that only a small proportion of any marine mammal population would be exposed above the defined impact exposure thresholds. Therefore, the potential impacts of oil to cause sublethal or lethal effects was ranked as Incidental (6) and Minor (5), respectively. *Reptiles* Marine reptiles may be exposed to hydrocarbons from an oil spill at the water surface or on the shoreline. Marine reptiles can be exposed to oil externally (e.g., swimming through surface slick) or internally (e.g., swallowing the oil, consuming oil-affected prey, or inhaling of volatile oil related compounds) (Ref. 142). Marine turtles are vulnerable to the effects of oil at all life stages: eggs, hatchlings, juveniles, and adults. Several aspects of turtle biology and behaviour place them at risk, including a lack of avoidance behaviour, indiscriminate feeding in convergence zones, and large pre-dive inhalations (Ref. 143). Oil effects on turtles can include impacts to the skin, blood, digestive, and immune systems, and increased mortality due to oiling. Shoreline hydrocarbons can impact turtles coming ashore at nesting beaches. Eggs may also be exposed during incubation, potentially resulting in increased egg mortality and detrimental effects on hatchlings. Hatchlings may be particularly vulnerable to toxicity and smothering as they emerge from the nests and make their way over the intertidal area to the water (Ref. 142). BIAs for the Flatback Turtle, Loggerhead Turtle, Green Turtle, and Hawksbill Turtle may be exposed to hydrocarbon concentrations greater than the impact thresholds. The behaviours associated with these BIAs include: aggregation, basking, foraging, internesting, mating, and nesting. Stochastic modelling predicted no shoreline accumulation above the ≥100 g/m^2 impact threshold; therefore, shoreline exposure to marine turtles is not discussed further. Deterministic analysis for largest volume of oil ashore, predicts that surface hydrocarbons concentrations ≥10 g/m^2 are present for <2 days following the spill event, with a maximum area of coverage of ~1 km^2. This deterministic scenario is considered most relevant for nearshore waters and subsequent impacts to nearshore BIA's. Using the Flatback Turtle internesting BIA around Barrow Island as an example, modelling indicates that the extent of surface exposures was predicted to be limited to <1% of the entire BIA. This information indicates that if a vessel spill event occurred during the nesting season, it is unlikely to impact entire local nesting populations. Based on an assessment of the predicted magnitude and duration of surface and shoreline oil, it is expected that only a small proportion of any marine reptile population would be exposed above the defined impact thresholds. Therefore, the potential impacts of oil to cause sublethal or lethal effects was ranked as Incidental (6) and Minor (5), respectively. *Fishes, including sharks and rays* Fish, including sharks and rays, may be exposed to hydrocarbons from an oil spill within the water column. Most fish do not break the sea surface, and therefore the risk from surface oil is not

Source
relevant; however, some shark species (including Whale Sharks) feed in surface waters, so there is also the potential for surface hydrocarbons to be ingested. Potential effects include damage to the liver and lining of the stomach and intestine, and toxic effects on embryos (Ref. 144). Fish are most vulnerable to oil during embryonic, larval and juvenile life stages. However, very few studies have demonstrated increased mortality of fish as a result of oil spills (Ref. 145; Ref. 146; Ref. 147). Demersal fish are not expected to be impacted given the presence of entrained oil is predicted in the surface layers (<20 m water depth) only. Pelagic free-swimming fish and sharks are unlikely to suffer long-term damage from oil spill exposure because dissolved/entrained hydrocarbons are typically insufficient to cause harm (Ref. 148). Pelagic species are also generally highly mobile and as such are not likely to suffer extended exposure (e.g., >48–96 hours) at concentrations that would lead to chronic effects due to their patterns of movement. Near the sea surface, fish can detect and avoid contact with surface slicks meaning fish mortalities rarely occur in the event of a hydrocarbon spill in open waters (Ref. 149). Fish that have been exposed to dissolved hydrocarbons can eliminate the toxicants once placed in clean water; hence, individuals exposed to a spill are likely to recover (Ref. 150). Marine fauna with gill-based respiratory systems, including Whale Sharks, are expected to have higher sensitivity to exposures of entrained oil. BIAs for fishes including sharks and rays that may be exposed to hydrocarbon concentrations greater than impact thresholds include: • Whale Shark (foraging). As these species are most sensitive to (surface) hydrocarbon exposures deterministic analysis for the largest sea surface swept area were analysed. The deterministic model indicates that surface hydrocarbons concentrations ≥10 g/m^2 are present for <2 days following the spill event, with a maximum area of coverage of ~15 km^2. This deterministic scenario is considered most relevant for offshore waters and subsequent impacts to offshore BIA's. Comparing this to the Whale Shark foraging BIA, modelling indicates that the extent of surface exposures was predicted to be limited to <1% of the entire BIA. Based on an assessment of the predicted magnitude and duration of surface oil, and both instantaneous and time-integrated entrained oil, it is expected that only a small proportion of any fish population would be exposed above the defined impact thresholds. Therefore, the potential impacts of oil to cause sublethal or lethal effects was ranked as Incidental (6) and Minor (5), respectively. *Seabirds and shorebirds* Birds may be exposed to hydrocarbons from an oil spill at the water surface (e.g., foraging, resting) or on the shoreline (e.g., roosting, nesting). Birds that rest at the water's surface (e.g., shearwaters) or surface-plunging birds (e.g., terns, boobies) are particularly vulnerable to surface hydrocarbons (Ref. 151; Ref. 143). Damage to external tissues, including skin and eyes, can occur, along with internal tissue irritation in lungs and stomachs (Ref. 152). Acute and chronic toxic effects may result where the product is ingested as the bird attempts to preen its feathers (Ref. 152). Breeding BIAs for the Fairy Tern, Lesser Crested Tern, Roseate Tern, and Wedge-tailed Shearwater may be exposed to hydrocarbon concentrations greater than impact thresholds. As these species are most sensitive to surface and shoreline hydrocarbon exposures, deterministic analysis for the largest volume of oil ashore to understand the potential extent and duration of nearshore hydrocarbon exposures. Deterministic analysis for largest volume of oil ashore, predicts that surface hydrocarbons concentrations ≥10 g/m^2 are present for <2 days following the spill event, with a maximum area of coverage of ~1 km^2. This deterministic scenario is considered most relevant for nearshore waters and subsequent impacts to nearshore BIA's. Using the Roseate Tern breeding BIA surrounding Lowendal Islands as an example, modelling indicates that the extent of surface exposures was predicted to be limited to <1% of the entire BIA. This information indicates that if a vessel spill event occurred during the breeding season, it is unlikely to impact entire local nesting populations. Stochastic modelling predicted no shoreline accumulation above the ≥100 g/m^2 impact threshold; therefore, direct shoreline exposure to seabirds is not discussed further. Based on an assessment of the predicted magnitude and duration of surface and shoreline oil, it is expected that only a small proportion of any seabird population would be exposed above the

Source
defined impact thresholds. Therefore, the potential impacts of oil to cause sublethal or lethal effects was ranked as Incidental (6) and Minor (5), respectively.
Smothering of subtidal and intertidal habitats *Coral* Direct contact of hydrocarbons to coral 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 (Ref. 153; Ref. 154). Stochastic modelling predicted coral reefs associated with the following key values or sensitivities within the EMBA have the potential to be exposed to hydrocarbon concentrations above impact thresholds: • Ningaloo Coast (World Heritage Property, National Heritage Place). No surface exposure at the ≥10 g/m^2 impact threshold was predicted for the Ningaloo Coast area (Table 6-10). Therefore, impacts from smothering within intertidal areas due to surface oil is not expected to occur. The probability of exposure to entrained oil (≥100 ppb) at the Ningaloo Coast area was low; 6–18% (Table 6-10); and stochastic modelling showed all entrained oil remained in the surface waters layers. As such, exposure to coral reefs in deeper waters at Ningaloo is not predicted to occur. For assessment of other coral habitats that occur around some of the Pilbara islands (including Barrow Island), the deterministic analysis for largest volume of oil ashore was used as an indicator. This deterministic scenario is considered most relevant for nearshore waters and subsequent impacts to nearshore corals. Deterministic analysis for largest volume of oil ashore, predicts that surface hydrocarbons concentrations ≥10 g/m^2 are present for <2 days following the spill event, with a maximum area of coverage of ~1 km^2. Therefore, as the extent and duration of exposure to nearshore environments is expected to be limited the potential for environmental impacts would also be limited. Based on an assessment of the predicted magnitude and duration of surface oil, and both instantaneous and time-integrated entrained oil, it is expected that only a small proportion of any coral habitat would be exposed above the defined impact thresholds. Therefore, the potential impacts of oil to cause smothering was ranked as Minor (5). *Mangroves and intertidal mudflats* Shoreline hydrocarbons can have smothering and toxic effects on mangroves and intertidal mudflats. Acute and chronic impacts to the health of mangrove communities can occur via pneumatophore smothering and exposure to the toxic volatile fraction of the hydrocarbons (Ref. 155). Intertidal mudflats, which are typically sheltered and have a large surface area for oil absorption, can trap oil, potentially causing toxicity impacts to infauna. Intertidal mudflats are very sensitive to oil pollution because the oil enters lower layers of the mudflats where a lack of oxygen prevents the oil from decomposing (Ref. 155). Stochastic modelling predicted no shoreline accumulation above the ≥100 g/m^2 impact threshold; therefore, shoreline exposure to mangroves and intertidal mudflats is not discussed further.
Indirect impacts to commercial fisheries As identified in Section 4.4.1, several commercial fisheries have management areas and recent fishing effort recorded within the EMBA. Direct impacts commercially targeted fish species are expected to occur from in-water exposures. Stochastic modelling showed that there no dissolved oil above impact thresholds (≥50 ppb; ≥4,800 ppb.hrs) was predicted to occur during any season. Entrained oil above impact thresholds (≥10 ppb; ≥9,600 ppb.hrs) was predicted to occur; however, was predicted to remain in the surface layers, with no exposure at depths >20 m below the surface predicted to occur during any season. Although exposures above impact thresholds have the potential to affect the recruitment of targeted commercial and recreational fish species, any acute impacts are expected to be limited, given this event is singular, non-continuous, and will result in a limited volume of hydrocarbon being released over a short time. On this basis recruitment of targeted species is not expected to be impacted significantly given the extent of exposure to concentrations above impact thresholds are expected to be limited due to rapid dilution and dispersion upon release. Spill events also have the potential to impact commercial fisheries through indirect impacts associated with tainting. Tainting is a change in the characteristic smell or flavour, and renders

<table>
<tr><th colspan="2">Source</th></tr>
<tr><td colspan="2">the catch unfit for human consumption or sale due to public perception. Tainting may not be a permanent condition but will persist if the organisms are continuously exposed; but when exposure is terminated, depuration will quickly occur (Ref. 156). Regardless of the small potential for tainting, customer perception that tainting has occurred may cause a larger impact then the direct impact itself. However, as this event is singular, non-continuous, and will result in a limited volume of hydrocarbon being released over a short time period, and the low persistence of the hydrocarbon in the environment, customer perceptions are not expected to be altered for a prolonged period.
Modelling predicts that inshore exposure would be limited, whilst offshore exposures are expected to dilute and disperse over a longer period of time. In both instances, it is expected that any impacts from this type of event would likely be short term in duration. Therefore, CAPL assesses the consequence to commercial fisheries as localised and short term and it is ranked as Minor (5).</td></tr>
<tr><td colspan="2">Reduction in amenity resulting in impacts to tourism and recreation
Modelling predicts shoreline exposure ≥10 g/m² (visible impact threshold) from a vessel spill event has the potential to occur along a small area of North West Cape coast during summer months, depending on the environmental conditions at the time of the event. No shoreline contact was predicted to occur during other (winter, transitional) seasons.
Deterministic analysis for largest volume of oil ashore, predicts the maximum length of shoreline oil above the visible impact threshold (≥10 g/m²) at any given time was ~15 km, and the maximum volume of oil ashore was ~2.7 m³. No shoreline contact was predicted above the ≥100 g/m² impact threshold.
Shoreline loading can impact the visual amenity of coastal areas and limit beach access for users, impacting tourism and recreation activities. However, given the short-term and localized disturbance to marine tourism and recreation activities, CAPL has ranked the consequence as Minor (5).</td></tr>
<tr><th colspan="2">ALARP decision context justification</th></tr>
<tr><td colspan="2">Support vessels commonly operate near each other during offshore surveys, and these activities are well-practised nationally and internationally.
The control measures to manage the risk associated with vessel collisions are well defined via legislative requirements that are considered standard industry practice. These are well understood and implemented by the petroleum industry and CAPL. Specifically, CAPL has worked in the region for over 10 years, and has a demonstrated understanding of industry requirements and their operational implementation in these areas.
During stakeholder consultation, no objections or claims were raised regarding vessel collision scenarios arising from the activity.
The risks associated with a vessel collision are considered lower-order risks in accordance with Table 5-3. As such, CAPL would apply ALARP Decision Context A for this aspect.</td></tr>
<tr><th colspan="2">Good practice control measures and source</th></tr>
<tr><th>Control measure</th><th>Source</th></tr>
<tr><td>Marine Safety Reliability and Efficiency (MSRE) process</td><td>CAPL's ABU MSRE Corporate OE Process (Ref. 36) ensures that various legislative requirements are met. These include:
crew meet the minimum standards for safely operating a vessel, including watchkeeping requirements
navigation, radar equipment, and lighting meets industry standards.
These requirements will ensure that direct vessel radio contact is available to other marine users operating in this area to enable ease of communication in highlighting risks and nearby exclusion zones.</td></tr>
<tr><td>Maritime safety information</td><td>Maritime safety information, such as AUSCOAST navigational warnings, are issued by the Joint Rescue Coordination Centre (JRCC) Australia, part of AMSA.
Under the Navigation Act 2012, the AHO is also responsible for maintaining and disseminating navigational charts and publications, including providing safety-critical information to mariners (including any change to prohibited/restricted areas, obstructions to surface navigation, etc.) via the</td></tr>
</table>

Source		
	Notice to Mariners system. Notice to Mariners can be permanent or temporary notifications. Where required for an IMR activities, AUSCOAST and/or Notice to Mariners will be issued; thus enabling other marine users to also safely plan their activities.	
SOPEP / Shipboard Marine Pollution Emergency Plan	MARPOL 73/78 Annex I and Marine Order 91 (Marine pollution prevention – oil) requires that each vessel has an approved SOPEP in place. To prepare for a spill event, the SOPEP details: • response equipment available to control a spill event • review cycle to ensure that the SOPEP is kept up to date • testing requirements, including the frequency and nature of these tests. In the event of a spill, the SOPEP details: • reporting requirements and a list of authorities to be contacted • activities to be undertaken to control the discharge of oil • procedures for coordinating with local officials.	
OPEP	Under the OPGG(E)R, NOPSEMA require that the petroleum activity have an accepted OPEP in place before commencing the activity. If a vessel collision occurs, the OPEP will be implemented. CAPL has developed an NOPSEMA-accepted OPEP (Ref. 2) to support all spill response activities across all its assets.	
OSMP	The OSMP details the arrangements and capability in place for operational and scientific monitoring. Operational monitoring collects information about the oil spill to aid planning and decision making for executing spill response or clean-up operations. Scientific monitoring focuses on the environmental impact attributable to the spill or the associated response activities and informs requirements for remediation (if required). CAPL has developed an NOPSEMA-accepted OSMP (Ref. 3) to support all spill monitoring activities across all its assets.	
Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A
Likelihood and risk level summary		
Likelihood	Based on industry data, vessel collisions are considered rare, with only 3% of all marine incidents that occurred in Australian waters between 2005 and 2012 associated with a vessel collision event. As most vessel collisions involve the LOC of a forward tank, which are generally double-lined and smaller than other tanks, the loss of the maximum credible volumes used in this scenario is unlikely. Considering the inherent low likelihood of a collision occurring, the safeguards in place, and enactment of the OPEP, the potential likelihood of causing the consequences described in this section is Remote (5)	
Risk level	Very low (9)	
Determination of acceptability		
Principles of ESD	The potential impact associated with this aspect would be short term, apply to some individuals, and consequently is not expected to affect biological diversity and ecological integrity. The consequence associated with this aspect is Minor (5). Therefore, no additional evaluation against the Principles of ESD is required.	

<table>
<tr><th colspan="3">Source</th></tr>
<tr><td>Relevant environmental legislation and other requirements</td><td colspan="2">Legislation and other requirements relevant for this aspect include:
• Commonwealth Navigation Act 2012
• Marine Order 91, Marine Pollution Prevention – oil
• Marine Order 30, Prevention of collisions
• Conservation Management Plan for the Blue Whale 2015–2025 (Ref. 62)
• Conservation Advice Balaenoptera borealis Sei Whale (Ref. 61)
• Conservation Advice Balaenoptera physalus Fin Whale (Ref. 59)
• Recovery Plan for Marine Turtles in Australia (Ref. 56)
• North-west Marine Parks Network Management Plan (Ref. 157).</td></tr>
<tr><td>Internal context</td><td colspan="2">These CAPL environmental performance standards or procedures were deemed relevant for this aspect:
• MSRE process (Ref. 36)
• OPEP (Ref. 2)
• OSMP (Ref. 3).</td></tr>
<tr><td>External context</td><td colspan="2">During stakeholder consultation, no objections or claims were raised regarding a vessel collision event arising from the activity.</td></tr>
<tr><td>Defined acceptable level</td><td colspan="2">These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.
However, given that chemical discharge and/or pollution (of which an oil spill is a component) is listed as a threat to protected matters under documents made or implemented under the EPBC Act, CAPL has defined an acceptable level of impact such that it is not inconsistent with these documents.
The Recovery Plan for Marine Turtles in Australia (Ref. 56) specifies the following relevant action areas and action:
• minimise chemical and terrestrial discharge
• ensure spill risk strategies and response programs adequately include management for marine turtles and their habitats, particularly in reference to ‘slow to recover habitats’, e.g. nesting habitat, seagrass meadows or coral reefs.
No other specific relevant actions were identified within other documents implemented under the EPBC Act.
CAPL addresses spill response and monitoring within their OPEP (Ref. 2) and OSMP (Ref. 3).
Therefore, CAPL has defined an acceptable level of impact as minimising the risk of impacts to the environment from spills from vessel operations.</td></tr>
<tr><th>Environmental performance outcome</th><th>Performance standard / Control measure</th><th>Measurement criteria</th></tr>
<tr><td rowspan="2">No leak or spill of hydrocarbons / hazardous materials to the environment during petroleum activities</td><td>MSRE process
Vessels will meet the crew competency, navigation equipment, and radar requirements of the MSRE process</td><td>Records indicate that vessels meet the crew competency, navigation equipment, and radar requirements of the MSRE process</td></tr>
<tr><td>Maritime safety information
Where required, Notice to Mariners and/or AUSCOAST warnings are issued prior to commencing offshore IMR work</td><td>Record of lodgement of notification to relevant agency</td></tr>
</table>

Source		
Reduce the risk of impacts to the environment from the unplanned release of hydrocarbons / hazardous materials during petroleum activities	**SOPEP** Marine vessels >400 T will carry on board a Shipboard Oil Pollution Emergency Plan (SOPEP) in accordance with MARPOL 73/78 Annex I – Prevention of Oil Pollution	OVIS report / ABU Marine OE Inspection Checklist confirms an approved SOPEP is on board marine vessels >400 T
		Records show drills conducted in accordance with SOPEP
	SOPEP In the event of a vessel-based spill event, emergency response activities will be implemented in accordance with the vessel SOPEP (or equivalent).	Records confirm that emergency response activities were implemented in accordance with the vessel SOPEP in the event of a vessel-based spill.
	OPEP In the event of a spill occurring, the OPEP will be implemented	Records confirm the OPEP has been implemented
	OSMP In the event of a spill occurring, the OSMP will be implemented	Records confirm the OSMP has been implemented

6.14 Unplanned release—Hydrocarbon system

Operation of the Gorgon and Jansz subsea hydrocarbon system introduces the potential for an unplanned release of gas and condensate. An evaluation of all spill scenarios associated with the hydrocarbon system was completed and the following scenarios identified:

- LOC event associated with damage to a valve or similar (Section 6.14.1.1)
- loss of well integrity event (Section 6.14.1.2)
- loss of effective well control event (Section 6.14.1.3)
- minor defect in flowline or production pipeline (Section 6.14.1.4)
- major defect in flowline or production pipeline (Section 6.14.1.5).

Based upon the scenario evaluation, a major defect in flowline or production pipeline was deemed to present the worst-case credible spill scenario under this EP and has been used as the basis for the risk assessment.

6.14.1 Scenario evaluation

6.14.1.1 LOC event associated with damage to a valve or similar

Dropped objects may damage subsea infrastructure resulting in a release of hydrocarbons, treated sea water, hydraulic fluid, or MEG. CAPL defined the worst-case credible scenario during IMR activities as a ~50 m^3 release from one of the larger subsea valves (1” valve).

This scenario was deemed feasible for the activities undertaken in this EP, given the potential for IMR activities to occur within the Gorgon and Jansz-Io fields and subsequent potential for dropped objects. The risk associated with this scenario is evaluated in Section 6.12.

6.14.1.2 Loss of well integrity

Section 13.2.2 of the NOPSEMA-accepted *Gorgon Project: Producing Phase Well Operations Management Plan* (Ref. 9) describes the different well control events and levels of emergency response associated with these situations. Under the WOMP, CAPL categorise well control into two categories:

- loss of well integrity—where integrity of the well has been compromised, but the well remains under control (which would prompt a Level 1 or Level 2 well control emergency response)
- loss of effective well control—where control of the well has been lost (which would require a Level 3 well control emergence response).

Section 4.2.1 of the WOMP (Ref. 9) identifies that a loss of well integrity during start-up and production operations has the potential to occur by:

- mechanical failure (leaks in annulus or production casing)
- overpressure (overpressure of annulus leading to burst casing or collapsed tubing)
- corrosion (corrosions leading to loss of tubing or casing integrity)
- erosion of barriers through excessive solids production

- operating error (incorrect operation of valves or controls, or SIMOPS clashes)
- dropped objects onto the well envelope (potential damage to subsea tree).

As detailed in the WOMP, primary and secondary barriers are in place to mitigate well integrity impacts during start-up and production operations. These barriers include:

- subsea tree (primary)
- production conduit pressure envelope (primary)
- "A" annulus pressure envelope (secondary).

In addition to this, an emergency (tertiary) barrier is in place being the SCSSV flapper valve.

Based upon the activities within scope of this EP, CAPL has calculated that a worst-case credible spill scenario associated with a loss of well integrity event is limited to the contents of the well above the SCSSV flapper valve. This equates to 8.7 m^3 for Gorgon wells and 18 m^3 for the Jansz-Io Wells. These volumes are based on the capacity of the production tubing conduit between the SCSSV flapper valve and the subsea tree located at the wellhead.

If a loss of well integrity event was to occur, following any closing of valves by the Operations work group (managed from the control room on Barrow Island), the shut-in well would be handed over to the ABU Wells work group as detailed in Section 3.2.2.1. Any subsequent works (e.g., well intervention) to address the well integrity issue would become planned activities implemented under the NOPSEMA-accepted *Gorgon and Jansz-Io Drilling, Completions and Well Maintenance Program Environment Plan* (Ref. 6). The risks, management measures, response and capability arrangements for well intervention activities are covered under the separate accepted EP (Ref. 6) and are not assessed here.

6.14.1.3 Loss of effective well control

As detailed in the WOMP, a loss of effective well control event is identified as a feasible risk during well interventions and drilling activities (Ref. 9). Well intervention and drilling activities are not within the scope of this EP (Section 2.3.2); they are covered within the NOPSEMA-accepted *Gorgon and Jansz-Io Drilling, Completions and Well Maintenance Program Environment Plan* (Ref. 6).

As well intervention and drilling activities are not included within the scope of this EP, CAPL does not consider a loss of effective well control to be a feasible risk associated with the activities within this EP. Consequently, this scenario is not assessed further here.

6.14.1.4 Minor defect in flowline or production pipeline

A 25 mm defect is considered indicative of the largest defect that can be fixed using pipe clamps; therefore, this defect provides an indication of the largest spill source that could be classed as a minor defect.

Modelling was undertaken by Intecsea (Ref. 158) to understand indicative release rates prior to isolation from 25 mm leaks from the Gorgon and Jansz pipelines. Results indicate that release rates of up to 41 m^3/day and 36 m3/day of condensate, under normal operating conditions, may occur for the Gorgon and Jansz pipelines respectively (Ref. 158).

While the exact duration of a leak (until isolation) is unknown, it has been estimated as up to two weeks based on: a small flow reduction trend (i.e., <5% reduction) may take the Flow Management Tool (FMT) up to a week to detect, plus an additional week for inspection activities to identify the leak source. Upon identification, the leak would be isolated, and therefore the release rate would significantly decline, prior to being repaired.

Therefore, based on a two-week un-isolated leak, a total of up to 574 m^3 of condensate may be release to the marine environment. However, due to the slow daily release rate (i.e., up to 41 m^3/day), the properties of the hydrocarbon fluid (including high volatile and evaporating once reaching the surface), and the high dispersion and dilution that would occur in an open ocean environment, the exposure due to a minor leak is considered to be limited in nature and scale.

6.14.1.5 Major defect in flowline or production pipeline

Upon evaluating the risks associated with activities covered under this EP, CAPL considers that a major defect in a flowline or production pipeline is the most credible (but unlikely) unplanned event. Specifically, a full-bore rupture was selected as the worst-case major defect event.

For the purpose of this risk assessment, identification of a location along the pipeline within the OA for a major rupture event was based on:

- the location with the greatest potential environmental consequence (closest to sensitive receptors)
- areas along the pipeline identified in engineering studies as most susceptible to potential materials fatigue or exposure to third-party interference.

Based on these considerations, three locations were identified and modelled to provide an indication of the EMBA from a major defect event. The locations were:

- Jansz-Io field (approximate location of Midline PTS)
- the base of the escarpment
- nearshore location (~15 km offshore from Barrow Island) in Commonwealth Waters.

Modelling was undertaken by Intecsea (Ref. 158) to understand potential volumes released during a major defect event. Model calculations were based upon:

- maximum allowable operating pressure (MAOP) of the pipeline
- water depth at the release location (and subsequent pressure differential)
- time to detect defect and enact emergency procedures
- time for pipeline to equalise with the ambient pressure at the release location.

Table 6-12 summarises the inputs and subsequent estimated volumes.

Table 6-12: Major defect volume calculations

Parameter	Release location			
	Jansz-Io field	Escarpment	Nearshore	Nearshore
Pipeline	Jansz	Jansz	Jansz	Gorgon
MAOP	260 bar	260 bar	260 bar	287 bar

Parameter	Release location			
	Jansz-Io field	Escarpment	Nearshore	Nearshore
Water depth	1,345 m	763 m	50 m	50 m
Time to detect defect and enact emergency procedures^	30 minutes	30 minutes	30 minutes	30 minutes
Time for pipeline to equalize with the ambient pressure at the release location	~7 hours	~6 hours	~12 hours	~5 hrs
Estimated volume	276 m³	388 m³	529 m³	494 m³

^ Duration is based on 15 minutes detection for alarms from the FMT, and 15 minutes for the operator to enact emergency procedures.

6.14.2 Spill modelling

CAPL commissioned RPS to conduct spill modelling to inform the risk assessment associated with a major defect event.

Two models were used as part of the spill modelling: OILMAP-DEEP was used to simulate the nearfield multiphase plume rise dynamics from the subsea release, and a three-dimensional oil spill model (SIMAP) was used to simulate the drift, spread, weathering and fate of the spilled oil (Ref. 159). Modelling was conducted using a stochastic approach, where multiple simulations (using the same spill parameters) were conducted, but under varying meteorological and oceanographic conditions.

Table 6-13 summarises the model settings; Table 6-14 and Table 6-15 summarises the hydrocarbon properties for Jansz and Gorgon condensates respectively; and Table 6-8 and Table 6-9 (in Section 6.13) describe the modelled environmental exposure and impact thresholds respectively.

Table 6-13: Major defect spill scenario model settings

Parameter	Details			
Release Location	Jansz-Io field	Escarpment	Nearshore	Nearshore
Latitude	19°48’34.09” S	20°12’55.273” S	20°38’19.099” S	20°38’25.549” S
Longitude	114°36’26.52” E	114°51’59.59” E	115°16’54.56” E	115°16’47.64” E
Water Depth	1,346 m	765 m	50 m	50 m
Oil type	Jansz condensate	Jansz condensate	Jansz condensate	Gorgon condensate
Simulation spill type	Subsea			
Simulation spill volume	276 m³	388 m³	529 m³	494 m³
Simulation spill duration	7.2 hours	5.8 hours	12.2 hours	4.7 hours
Total simulation duration	28 days			
Number of randomly selected spill simulation start times	100 per season (300 total)			
Seasons modelled	Summer (September to March)			

Parameter	Details
	Transitional (April and August) Winter (May to July)

Table 6-14: Physical properties and boiling point ranges for Jansz condensate

Characteristic	Value			
Density	772.8 kg/m³ (at 25 °C)			
Dynamic viscosity	1.2 cP (at 25 °C)			
Pour point	-81 °C			
API gravity	51.4 API			
Classification	Group I, non persistent oil			
Boiling point	Volatile <180 °C	Semi-volatile 180–265 °C	Low volatility 265–380 °C	Residual >380 °C
	72.5%	13.0%	14.0%	0.5%

Table 6-15: Physical properties and boiling point ranges for Gorgon condensate

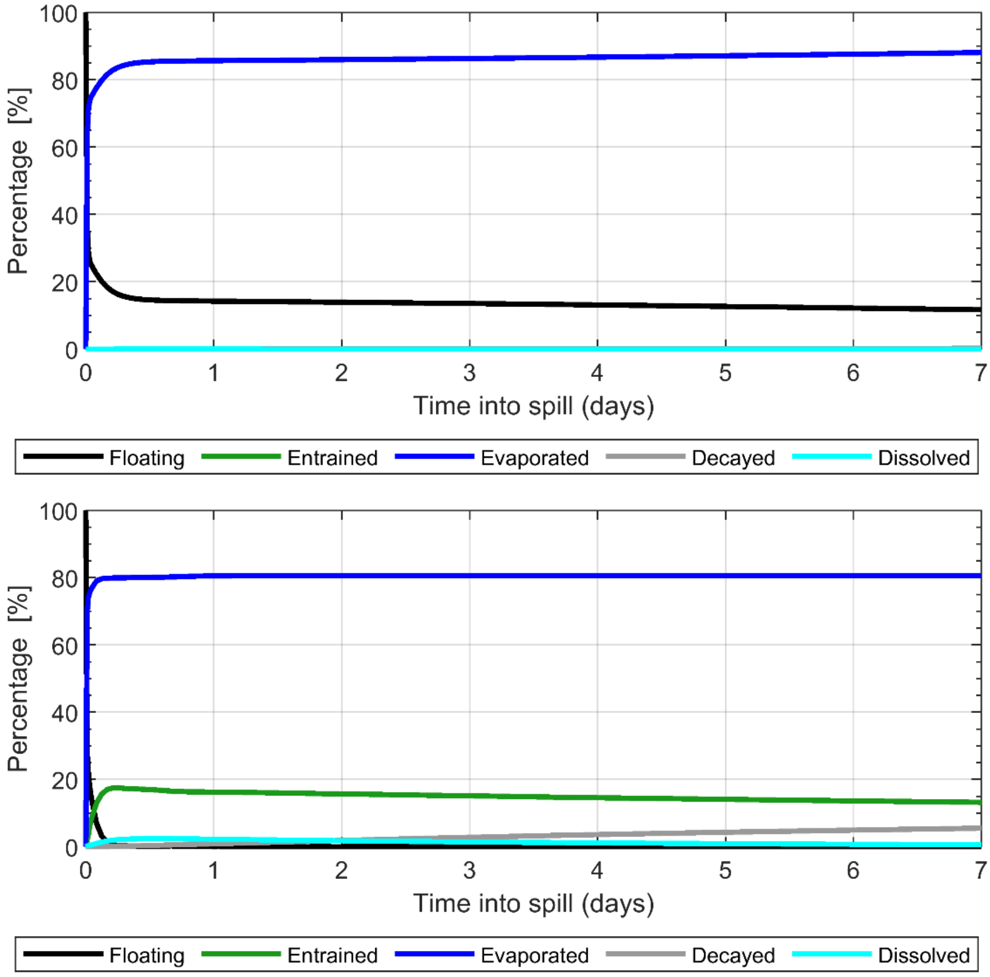
Characteristic	Value			
Density	847.8 kg/m³ (at 15 °C)			
Dynamic viscosity	2.4 cP (at 20 °C)			
Pour point	-9 °C			
API gravity	35.3 API			
Classification	Group II, light persistent oil			
Boiling point	Volatile <180 °C	Semi-volatile 180–265 °C	Low volatility 265–380 °C	Residual >380 °C
	33.3%	28.5%	32.3%	5.9%

6.14.2.1 Weathering and fate

Jansz condensate is non-persistent oil, with a density of 772.8 kg/m³, an API of 51.4, and a low pour point (−81 °C) (Table 6-14). The low viscosity (1.2 cP) indicates that this oil will spread quickly when released and will form a thin film on the sea surface, increasing the evaporation rate.

Generally, 72.5% of the Jansz condensate mass should evaporate within the first 12 hours (boiling point <180 °C); a further 13.0% should evaporate within the first 24 hours (boiling point 180°C–265 °C); and an additional 14% should evaporate over several days (boiling point 265°C–380 °C). Approximately 0.5% (by mass) of Jansz condensate will not evaporate at atmospheric temperatures. These compounds will persist in the environment.

Figure 6-2 shows predicted weathering for an instantaneous 50 m³ surface release of Jansz condensate (tracked for 7 days) under calm and variable wind conditions. Predictions show that under calm conditions, ~86% of the slick volume evaporated within the initial 24 hours; and under variable conditions ~80% has evaporated and ~16% has entrained within the initial 24 hours.



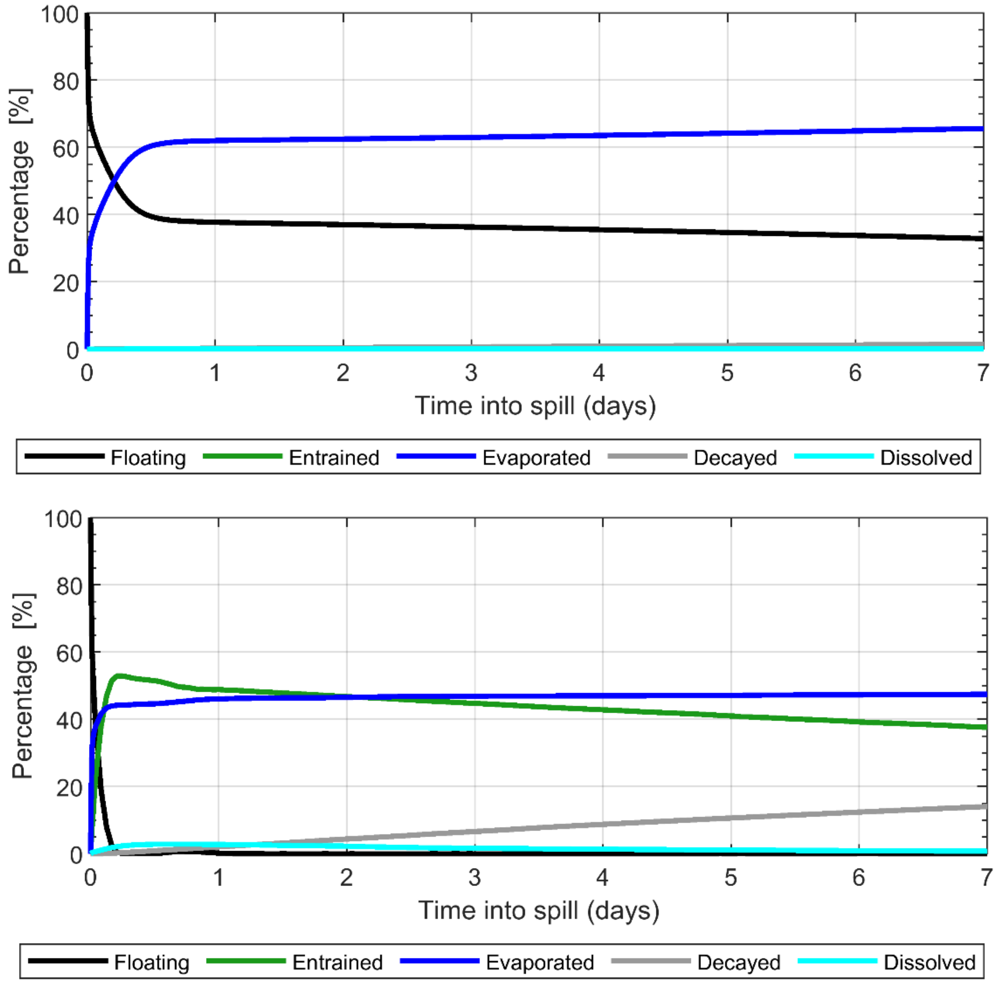
(Source: Ref. 159)

Figure 6-2: Predicted weather of an instantaneous surface release of 50 m^3 of Jansz condensate under calm (top image) and variable (bottom image) wind conditions

Gorgon condensate is light persistent oil, with a density of 847.8 kg/m^3, an API of 35.3, and a low pour point (−9 °C) (Table 6-14). The low viscosity (2.4 cP) indicates that this oil will spread quickly when released and will form a thin film on the sea surface, increasing the evaporation rate.

Generally, 33.3% of the Gorgon condensate mass should evaporate within the first 12 hours (boiling point <180 °C); a further 28.5% should evaporate within the first 24 hours (boiling point 180°C–265 °C); and an additional 32.3% should evaporate over several days (boiling point 265°C–380 °C). Approximately 5.9% (by mass) of Gorgon condensate will not evaporate at atmospheric temperatures. These compounds will persist in the environment.

Figure 6-3 shows predicted weathering for an instantaneous 50 m^3 surface release of Gorgon condensate (tracked for 7 days) under calm and variable wind conditions. Predictions show that under calm conditions, ~62% of the slick volume evaporated within the initial 24 hours; and under variable conditions ~46% has evaporated and ~49% has entrained within the initial 24 hours.



(Source: Ref. 159)

Figure 6-3: Predicted weathering of an instantaneous surface release of 50 m^3 of Gorgon condensate under calm (top image) and variable (bottom image) wind conditions

6.14.2.2 Modelling outputs

Stochastic modelling outputs from RPS (Ref. 159) are summarised in Table 6-16 having regard to the particular values and sensitivities within the EMBA as identified in Section 4.

For the 276 m^3 Jansz pipeline rupture within the Jansz-Io field:

- The maximum distance from the release location to the ≥1 g/m^2 visible impact threshold was ~28 km west-northwest (summer). No surface oil was predicted to occur at the ≥10 g/m^2 impact threshold
- No shoreline accumulation above impact thresholds was predicted to occur during any season
- No dissolved oil above impact thresholds was predicted to occur during any season
- No entrained oil above impact thresholds was predicted to occur during any season.

For the 388 m^3 Jansz pipeline rupture at the escarpment:

- The maximum distance from the release location to the ≥1 g/m^2 visible impact threshold was ~39 km south (summer), and ~2.5 km east (transitional) for the ≥10 g/m^2 impact threshold
- The probability of contact to any shoreline at ≥10 g/m^2 was 4% in summer, with no contact predicted in transitional and winter months. The minimum time before shoreline contact was ~5 days and the maximum volume of oil ashore was 1.8 m^3. No shoreline contact at the ≥100 g/m^2 impact threshold was predicted to occur during any season.
- Dissolved oil at ≥50 ppb and ≥4,800 ppb.hrs impact thresholds was predicted to occur; however remained in the surface layer (<10 m water depth) only. The maximum instantaneous dissolved oil concentration was 216 ppb.
- Entrained oil at ≥100 ppb or ≥9,600 ppb.hrs impact thresholds was predicted to occur; however remained in the surface layer (<10 m water depth) only. The maximum instantaneous dissolved oil concentration was 7,840 ppb.

For the 529 m^3 Jansz pipeline rupture nearshore:

- The maximum distance from the release location to the ≥1 g/m^2 visible impact threshold was ~21 km southwest (summer), and ~1.7 km west-southwest (transitional) for the ≥10 g/m^2 impact threshold
- The probability of contact to any shoreline at ≥10 g/m^2 was 8–21% (depending on the season). The minimum time before shoreline contact was ~1 day (transitional) and the maximum volume of oil ashore was 3 m^3 (summer). Shoreline contact at ≥100 g/m^2 was only predicted to occur during winter at Airlie Island, with a low probability of occurrence of 1%. The minimum time before shoreline contact was ~7 days and the maximum volume of oil ashore was 1.2 m^3.
- Dissolved oil at ≥50 ppb and ≥4,800 ppb.hrs impact thresholds was predicted to occur; however remained in the surface layer (<10 m water depth) only. The maximum instantaneous dissolved oil concentration was 285 ppb.
- Entrained oil at ≥100 ppb or ≥9,600 ppb.hrs impact thresholds was predicted to occur; however remained in the surface layer (<10 m water depth) only. The maximum instantaneous dissolved oil concentration was 5,821 ppb.

For the 494 m^3 Gorgon pipeline rupture nearshore:

- The maximum distance from the release location to the ≥1 g/m^2 visible impact threshold was ~47 km south-southwest (winter), and ~15 km southwest (transitional) for the ≥10 g/m^2 impact threshold.
- The probability of contact to any shoreline at ≥10 g/m^2 was 6–31% (depending on the season). The minimum time before shoreline contact was <1 day (summer) and the maximum volume of oil ashore was 15.8 m^3 (summer).
- Shoreline contact at ≥100 g/m^2 was only predicted to occur during summer at Barrow, Montebello and Serrurier islands, with low probability of occurrence of 2–4%. The minimum time before shoreline contact was ~1 day, the maximum volume of oil ashore was 15.8 m^3, and maximum length of shoreline accumulation was ~4.8 km.

- Dissolved oil at ≥50 ppb and ≥4,800 ppb.hrs impact thresholds was predicted to occur; however remained in the surface layer (<10 m water depth) only. The maximum instantaneous dissolved oil concentration was 9,015 ppb.
- Entrained oil at ≥100 ppb or ≥9,600 ppb.hrs impact thresholds was predicted to occur; however remained in the surface layer (<10 m water depth) only. The maximum instantaneous dissolved oil concentration was 13,916 ppb.

Table 6-16: Major defect spill modelling EMBA receptor exposure summary

Sensitivity	Name	Surface^		In-water (dissolved)^		In-water (entrained)^		Shoreline^	
		≥1 g/m²	≥10 g/m²	≥50 ppb	≥4,800 ppb.hrs	≥100 ppb	≥9,600 ppb.hrs	≥10 g/m²	≥100 g/m²
		(probability of exposure, minimum time to exposure)		(probability of exposure)		(probability of exposure)		(probability of exposure, minimum time to exposure, mean length of shoreline)	
AMP	Gascoyne	—	—	—	—	—	—	—	—
	Montebello	100%, <1 day	100%, <1 day	78%	43%	100%	100%	—	—
	Ningaloo	—	—	—	—	1%	—	—	—
KEF	Ancient coastline at 125 m depth contour	1%	—	2%	—	9%	—	—	—
	Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	—	—	1%	—	3%	—	—	—
	Commonwealth waters adjacent to Ningaloo Reef	—	—	—	—	1%	—	—	—
	Continental slope demersal fish communities	96%	62%	56%	0–31%	98%	—	—	—
	Exmouth Plateau	—	—	—	—	—	—	—	—
World Heritage Properties / National Heritage Places	The Ningaloo Coast *(inferred from Cape Range IBRA, Exmouth shoreline)*	—	—	1%	—	6%	—	2%, 6 days, 11.6 km	—
Commonwealth Heritage Properties	Ningaloo Marine Area – Commonwealth Waters *(inferred from Ningaloo IMCRA)*	—	—	—	—	1%	—	—	—

^ *Values shown represent the highest probability, shortest minimum time to exposure, and longest mean length of shoreline from all four scenarios modelled. Actual probabilities of exposure for listed sensitivities vary greatly between each individual scenario (e.g., from 0% to 100% probability of exposure of Montebello Marine Park, depending on the location of the spill).*

6.14.3 Risk assessment

Source			
The operation of the subsea hydrocarbon system has the potential for an unplanned release of gas and condensate to occur. Based on the activities described in this EP, the following potential scenarios were identified: • LOC event associated with damage to a valve or similiar[1] • Loss of well integrity[2] • Minor or major defect in flowline or production pipeline[3] *[1] Dropped objects may damage subsea infrastructure resulting in a release of hydrocarbons, treated sea water, hydraulic fluid, or MEG. CAPL defined the credible worst-case credible scenario during IMR activities as a ~50 m3 release from one of the larger subsea valves (1" valve). This scenario is risk assessed within Section 6.12.* *[2] As detailed in Section 6.14.1.2, a loss of well integrity scenario will result in a release limited to the volume of the production tubing conduit between the SCSSV flapper valve and the wellhead. This equates to 8.7 m^3 for Gorgon wells and 18 m^3 for the Jansz-Io wells.* *[3] As detailed in Section 6.14.1.5, modelling indicates that a subsea release of up to 529 m^3 could result from a major defect scenario.*			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
N/A	—	The potential environmental impacts associated with hydrocarbon exposures from a vessel collision event are:	
		• marine pollution resulting in acute and chronic impacts to marine fauna	5
		• smothering of subtidal and intertidal habitats	5
		• indirect impacts to commercial fisheries	5
		• reduction in amenity resulting in impacts to tourism and recreation.	5

Consequence evaluation

Marine pollution resulting in acute and chronic impacts to marine fauna

Marine mammals

Marine mammals may be exposed to hydrocarbons from an oil spill at the water surface or within the water column. Marine mammals can be exposed to oil externally (e.g., swimming through surface slick) or internally (e.g., swallowing the oil, consuming oil-affected prey, or inhaling of volatile oil related compounds) (Ref. 137; Ref. 138).

Direct contact with hydrocarbons may result in skin and eye irritation, burns to mucous membranes of eyes and mouth, and increased susceptibility to infection (Ref. 139). However, direct contact with surface oil is considered to have little deleterious effect on whales, possibly due to the skin's effectiveness as a barrier. Furthermore, effect of oil on cetacean skin is probably minor and temporary (Ref. 139). French-McCay (Ref. 140) identifies that a ≥10 g/m^2 oil thickness threshold has the potential to impart a lethal dose to the species; however, also estimates a probability of 0.1% mortality to cetaceans if they encounter these thresholds based on the proportion of the time spent at surface.

The physical impacts from ingested hydrocarbons with subsequent lethal or sublethal impacts are applicable; however, the susceptibility of cetaceans varies with feeding habits. Baleen whales are not particularly susceptible to ingestion of oil in the water column as they feed by skimming the surface (i.e., they are more susceptible to surface slicks). Toothed whales and dolphins may be susceptible to ingestion of dissolved and entrained oil as they gulp feed at depth. As highly mobile

Source
species, in general it is very unlikely that these animals will be constantly exposed to concentrations of hydrocarbons in the water column for continuous durations (e.g., >48–96 hours) that would lead to chronic effects. Studies have shown little impact on Bottlenose Dolphins after hydraulic and mineral oil immersion and ingestion, although there was evidence of temporary skin damage in dolphins and a Sperm Whale from contact with various oil products including crude oil (Ref. 139; Ref. 141). Marine mammals are vulnerable if they inhale volatiles when they surface within a hydrocarbon slick. For the short period that they persist, vapours from the spill are a significant risk to mammal health, with the potential to damage mucous membranes of the airways and the eyes, which will reduce the health and potential survivability of an animal. Inhaled volatile hydrocarbons are transferred rapidly to the bloodstream and may also accumulate in tissues (Ref. 139). Stochastic modelling was used to identify BIAs for marine mammals that may be exposed to hydrocarbon concentrations greater than impact thresholds. These were: • Humpback and Pygmy Blue Whales (distribution, migration, foraging) • Dugong (breeding, calving, foraging, and nursing). As these species are considered most sensitive to surface exposures, deterministic analysis for the largest sea surface swept area was utilised to understand the potential extent and duration of exposure. Of the four scenarios modelled, deterministic analysis from the Gorgon condensate was selected for use as it is a slightly more persistent oil compared to Jansz condensate (Section 6.14.2.1). The deterministic model indicates that surface hydrocarbons concentrations ≥10 g/m^2 are present for <1 day following the spill event, with a maximum area of coverage of ~3 km^2. Using the Pygmy Blue Whale migration BIA as an example, modelling indicates that the extent of surface exposures was predicted to be limited to <1% of the entire BIA. Similarly, deterministic analysis for the largest area of entrained hydrocarbon indicates that entrained hydrocarbons concentrations ≥100 ppb are present for ~2 days following the spill event, with a maximum area of coverage of ~35 km^2. Using the Pygmy Blue Whale migration BIA as an example, modelling indicates that the extent of entrained exposures was predicted to be limited to <1% of the entire BIA. Based on an assessment of the predicted magnitude and duration of surface oil, and both instantaneous and time-integrated entrained oil, it is expected that only a small proportion of any marine mammal population would be exposed above the defined impact exposure thresholds. Therefore, the potential impacts of oil to cause sublethal or lethal effects was ranked as Incidental (6) and Minor (5), respectively. *Reptiles* Marine reptiles may be exposed to hydrocarbons from an oil spill at the water surface or on the shoreline. Marine reptiles can be exposed to oil externally (e.g., swimming through surface slick) or internally (e.g., swallowing the oil, consuming oil-affected prey, or inhaling of volatile oil related compounds) (Ref. 142). Marine turtles are vulnerable to the effects of oil at all life stages: eggs, hatchlings, juveniles, and adults. Several aspects of turtle biology and behaviour place them at risk, including a lack of avoidance behaviour, indiscriminate feeding in convergence zones, and large pre-dive inhalations (Ref. 143). Oil effects on turtles can include impacts to the skin, blood, digestive, and immune systems, and increased mortality due to oiling. Shoreline hydrocarbons can impact turtles coming ashore at nesting beaches. Eggs may also be exposed during incubation, potentially resulting in increased egg mortality and detrimental effects on hatchlings. Hatchlings may be particularly vulnerable to toxicity and smothering as they emerge from the nests and make their way over the intertidal area to the water (Ref. 142). BIAs for the Flatback Turtle, Loggerhead Turtle, Green Turtle, and Hawksbill Turtle may be exposed to hydrocarbon concentrations greater than the impact thresholds. The behaviours associated with these BIAs include aggregation, basking, foraging, internesting, mating, and nesting. The deterministic analysis for the largest volume of oil ashore (from the Gorgon condensate scenario) indicates that shoreline hydrocarbons concentrations ≥100 g/m^2 are present within ~2 days following the spill event, with a maximum volume ashore of ~12 m^3. Stochastic modelling also showed that the longest length of shoreline with exposure of ≥100 g/m^2 is ~4.8 km. Therefore, as the extent and duration of exposure to shorelines and associated nesting areas is expected to be limited, the potential for environmental impacts would also be limited.

Source
Deterministic analysis for largest sea surface swept area (from the Gorgon condensate scenario) indicates that surface hydrocarbons concentrations ≥10 g/m^2 are present for <1 day following the spill event, with a maximum area of coverage of ~3 km^2. Using the Flatback Turtle internesting BIA around Barrow Island as an example, modelling indicates that the extent of surface exposures was predicted to be limited to <1% of the entire BIA. This information indicates that if a vessel spill event occurred during the nesting season, it is unlikely to impact entire local nesting populations. Based on an assessment of the predicted magnitude and duration of surface and shoreline oil, it is expected that only a small proportion of any marine reptile population would be exposed above the defined impact thresholds. Therefore, the potential impacts of oil to cause sublethal or lethal effects was ranked as Incidental (6) and Minor (5), respectively. *<u>Fishes, including sharks and rays</u>* Fish, including sharks and rays, may be exposed to hydrocarbons from an oil spill within the water column. Most fish do not break the sea surface, and therefore the risk from surface oil is not relevant; however, some shark species (including Whale Sharks) feed in surface waters, so there is also the potential for surface hydrocarbons to be ingested. Potential effects include damage to the liver and lining of the stomach and intestine, and toxic effects on embryos (Ref. 144). Fish are most vulnerable to oil during embryonic, larval and juvenile life stages. However, very few studies have demonstrated increased mortality of fish as a result of oil spills (Ref. 145; Ref. 146; Ref. 147). Demersal fish are not expected to be impacted given the presence of dissolved and entrained oil is predicted in the surface layers (<10 m water depth) only. Pelagic free-swimming fish and sharks are unlikely to suffer long-term damage from oil spill exposure because dissolved/entrained hydrocarbons are typically insufficient to cause harm (Ref. 148). Pelagic species are also generally highly mobile and as such are not likely to suffer extended exposure (e.g., >48–96 hours) at concentrations that would lead to chronic effects due to their patterns of movement. Near the sea surface, fish can detect and avoid contact with surface slicks meaning fish mortalities rarely occur in the event of a hydrocarbon spill in open waters (Ref. 149). Fish that have been exposed to dissolved hydrocarbons can eliminate the toxicants once placed in clean water; hence, individuals exposed to a spill are likely to recover (Ref. 150). Marine fauna with gill-based respiratory systems, including Whale Sharks, are expected to have higher sensitivity to exposures of entrained oil. BIAs for fishes including sharks and rays that may be exposed to hydrocarbon concentrations greater than impact thresholds include: • Whale Shark (foraging). As fish species are sensitive to entrained hydrocarbon exposures, deterministic analysis for the largest area of entrained hydrocarbon were analysed. The deterministic model indicates that entrained hydrocarbons concentrations ≥100 ppb are present for ~2 days following the spill event, with a maximum area of coverage of ~35 km^2. Using the Whale Shark foraging BIA as an example, modelling indicates that the extent of entrained exposures was predicted to be limited to <1% of the entire BIA. As Whale Sharks are also sensitive to surface hydrocarbon exposures deterministic analysis for the largest sea surface swept area were analysed. The deterministic model indicates that surface hydrocarbons concentrations ≥10 g/m^2 are present for <1 day following the spill event, with a maximum area of coverage of ~3 km^2. Comparing this area to the Whale Shark foraging BIA, modelling indicates that the extent of surface exposures was predicted to be limited to <1% of the entire BIA. Based on an assessment of the predicted magnitude and duration of surface oil, and both instantaneous and time-integrated entrained oil, it is expected that only a small proportion of any fish population would be exposed above the defined impact thresholds. Therefore, the potential impacts of oil to cause sublethal or lethal effects was ranked as Incidental (6) and Minor (5), respectively. *<u>Seabirds and shorebirds</u>* Birds may be exposed to hydrocarbons from an oil spill at the water surface (e.g., foraging, resting) or on the shoreline (e.g., roosting, nesting). Birds that rest at the water's surface (e.g., shearwaters) or surface-plunging birds (e.g., terns, boobies) are particularly vulnerable to surface hydrocarbons (Ref. 151; Ref. 143). Damage to external tissues, including skin and eyes, can occur, along with internal tissue irritation in lungs

Source
and stomachs (Ref. 152). Acute and chronic toxic effects may result where the product is ingested as the bird attempts to preen its feathers (Ref. 152). Breeding BIAs for the Fairy Tern, Lesser Crested Tern, Roseate Tern, and Wedge-tailed Shearwater may be exposed to hydrocarbon concentrations greater than impact thresholds. The deterministic analysis for the largest volume of oil ashore (from the Gorgon condensate scenario) indicates that shoreline hydrocarbons concentrations ≥100 g/m^2 are present within ~2 days following the spill event, with a maximum volume ashore of ~12 m^3. Stochastic modelling also showed that the longest length of shoreline with exposure of ≥100 g/m^2 is ~4.8 km. Therefore, as the extent and duration of exposure to shorelines and associated breeding environments is expected to be limited, the potential for environmental impacts would also be limited. Deterministic analysis for largest sea surface swept area (from the Gorgon condensate scenario) indicates that surface hydrocarbons concentrations ≥10 g/m^2 are present for <1 day following the spill event, with a maximum area of coverage of ~3 km^2. Using the Roseate Tern breeding BIA surrounding Lowendal Islands as an example, modelling indicates that the extent of surface exposures was predicted to be limited to <1% of the entire BIA. This information indicates that if a spill event occurred during the nesting season, it is unlikely to impact entire local nesting populations. Based on an assessment of the predicted magnitude and duration of surface and shoreline oil, it is expected that only a small proportion of any seabird population would be exposed above the defined impact thresholds. Therefore, the potential impacts of oil to cause sublethal or lethal effects was ranked as Incidental (6) and Minor (5), respectively.
Smothering of subtidal and intertidal habitats *Coral* Direct contact of hydrocarbons to coral 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 (Ref. 153; Ref. 154). Stochastic modelling predicted coral reefs associated with the following key values or sensitivities within the EMBA have the potential to be exposed to hydrocarbon concentrations above impact thresholds: • Ningaloo Coast (World Heritage Property, National Heritage Place). No surface exposure at the ≥10 g/m^2 impact threshold was predicted for the Ningaloo Coast area (Table 6-16). Therefore, impacts from smothering within intertidal areas due to surface oil is not expected to occur. The probability of exposure to dissolved (≥50 ppb) or entrained oil (≥100 ppb) at the Ningaloo Coast area was low (less than 10%) (Table 6-16)); and stochastic modelling showed all dissolved and entrained oil remained in the surface waters layers. As such, exposure to coral reefs in deeper waters at Ningaloo is not predicted to occur. For assessment of other coral habitats that occur around some of the Pilbara islands (including Barrow Island), the deterministic analysis for the largest sea surface swept area (from the Gorgon condensate scenario) indicates that surface hydrocarbons concentrations ≥10 g/m^2 are present for <1 day following the spill event, with a maximum area of coverage of ~3 km^2. Similarly, the deterministic analysis for the largest area of entrained hydrocarbon indicates that entrained hydrocarbons concentrations ≥100 ppb are present for ~2 days following the spill event, with a maximum area of coverage of ~35 km^2. Therefore, as the extent and duration of exposure to nearshore environments is expected to be limited the potential for environmental impacts would also be limited. Based on an assessment of the predicted magnitude and duration of surface oil, and both instantaneous and time-integrated entrained oil, it is expected that only a small proportion of any coral habitat would be exposed above the defined impact thresholds. Therefore, the potential impacts of oil to cause smothering was ranked as Minor (5). *Mangroves and intertidal mudflats* Shoreline hydrocarbons can have smothering and toxic effects on mangroves and intertidal mudflats. Acute and chronic impacts to the health of mangrove communities can occur via pneumatophore smothering and exposure to the toxic volatile fraction of the hydrocarbons (Ref. 155). Intertidal mudflats, which are typically sheltered and have a large surface area for oil absorption, can trap oil, potentially causing toxicity impacts to infauna. Intertidal mudflats are very

Source
sensitive to oil pollution because the oil enters lower layers of the mudflats where a lack of oxygen prevents the oil from decomposing (Ref. 155). Mangroves and intertidal mudflats associated with key values and sensitivities (e.g., the Ningaloo Coast; Table 4-10) within the EMBA were not predicted to be exposed to shoreline hydrocarbons above impact thresholds. For assessment of other mangrove and intertidal habitats that occur around some of the Pilbara islands (including Barrow Island), the deterministic analysis for the largest volume of oil ashore (from the Gorgon condensate scenario) indicates that shoreline hydrocarbons concentrations ≥100 g/m^2 are present within ~2 days following the spill event, with a maximum volume ashore of ~12 m^3. Stochastic modelling also showed that the longest length of shoreline with exposure of ≥100 g/m^2 is ~4.8 km. Therefore, as the extent and duration of exposure to shorelines is expected to be limited the potential for environmental impacts would also be limited. Based on an assessment of the predicted magnitude and duration of shoreline oil, it is expected that only a small proportion of any mangrove and intertidal habitat would be exposed above the defined impact thresholds. Therefore, the potential impacts of oil to cause smothering was ranked as Minor (5).
Indirect impacts to commercial fisheries As identified in Section 4.4.1, several commercial fisheries have management areas and recent fishing effort recorded within the EMBA. Direct impacts commercially targeted fish species are expected to occur from in-water hydrocarbon exposures. Stochastic modelling showed that when dissolved and entrained oil was predicted to occur above the impact thresholds, it remained in the surface layers (<10 m water depth) only. Although exposures above impact thresholds have the potential to affect the recruitment of targeted commercial and recreational fish species, any acute impacts are expected to be limited, given this event is singular, non-continuous, and will result in a limited volume of hydrocarbon being released over a short time. On this basis recruitment of targeted species is not expected to be impacted significantly given the extent of exposure to concentrations above impact thresholds are expected to be limited due to rapid dilution and dispersion upon release. Spill events also have the potential to impact commercial fisheries through indirect impacts associated with tainting. Tainting is a change in the characteristic smell or flavour, and renders the catch unfit for human consumption or sale due to public perception. Tainting may not be a permanent condition but will persist if the organisms are continuously exposed; but when exposure is terminated, depuration will quickly occur (Ref. 156). Regardless of the small potential for tainting, customer perception that tainting has occurred may cause a larger impact then the direct impact itself. However, as this event is singular, non-continuous, and will result in a limited volume of hydrocarbon being released over a short time period, and the low persistence of the hydrocarbon in the environment, customer perceptions are not expected to be altered for a prolonged period. Modelling predicts that inshore exposure would be limited, whilst offshore exposures are expected to dilute and disperse over a longer period of time. In both instances, it is expected that any impacts from this type of event would likely be short term in duration. Therefore, CAPL assesses the consequence to commercial fisheries as localised and short term and it is ranked as Minor (5).
Reduction in amenity resulting in impacts to tourism and recreation Modelling predicts shoreline exposure ≥10 g/m^2 (visible impact threshold) has the potential to occur along parts of Barrow and Montebello islands, and several other Pilbara inshore islands. Deterministic analysis for the largest volume of oil ashore (from the Gorgon condensate scenario) indicates that shoreline hydrocarbons concentrations ≥10 g/m^2 are present within ~2 days following the spill event, with a maximum volume ashore of ~15.8 m^3. Stochastic modelling also showed that the longest length of shoreline with exposure of ≥10 g/m^2 is ~18 km. Therefore, as the extent and duration of exposure to shorelines is expected to be limited the potential for environmental impacts would also be limited. Shoreline loading can impact the visual amenity of coastal areas and limit beach access for users, impacting tourism and recreation activities. There is limited access to Barrow and Montebello islands; however, there is more likelihood of tourism or recreational activities occurring on some of the smaller islands closer to the mainland. However, given the short-term and localized disturbance to marine tourism and recreation activities, CAPL has ranked the consequence as Minor (5).

Source	
ALARP decision context justification	
The operation of subsea production systems offshore is a well-practised nationally and internationally activity. The control measures to manage the risk associated with a major defect event are well defined via legislative requirements that are considered standard industry practice. These are well understood and implemented by the petroleum industry and CAPL. Specifically, CAPL has worked in the region for over 10 years, and has a demonstrated understanding of industry requirements and their operational implementation in these areas. During stakeholder consultation, no objections or claims were raised regarding major defect events arising from the activity. The risks associated with a major defect event are considered lower-order risks in accordance with Table 5-3. As such, CAPL would apply ALARP Decision Context A for this aspect.	
Good practice control measures and source	
Control measure	**Source**
IM Plan	Inspections provide assurance that assets are in good condition and proactively identify maintenance or repair activities that may be required. The type and frequency of inspections of the subsea hydrocarbon system will be undertaken in accordance with the *Gorgon and Jansz Subsea and Pipelines Inspection and Monitoring Plan* (IM Plan) (Ref. 160). The IM Plan also requires that hydrocarbon system process monitoring (pressure, temperature and flow rates), fluid composition monitoring, and corrosion monitoring are undertaken. Inspection and monitoring results are assessed against acceptance criteria to allow early identification and management of potential anomalies through engineering assessment, maintenance, and repairs to ensure the integrity of the hydrocarbon system and prevent a loss of containment. Inspections are tracked via the Computerised Maintenance Management System (CMMS).
Source control	Source control is part of the first actions taken to stabilise the volume of hydrocarbon released and therefore reduce potential impacts and risks to the environment. CAPL has developed Emergence Operating Procedures (EOPs) (Ref. 161) that provides guidance to operations personnel to detect, isolate and stabilise non-routine events such as trunkline/flowline loss of containment scenarios.
Well handover	Should a loss of well integrity event occur, CAPL would implement the NOPSEMA-accepted WOMP. This would require a well handover between ABU Operations and ABU Wells work group in accordance with Section 3.2.2.1. Once the well is handed over to the ABU Wells work group, all well integrity remedial activities will be conducted in accordance with the NOSEPMA-accepted *Gorgon and Jansz-Io Drilling, Completions and Well Maintenance Program Environment Plan* (Ref. 6).
OPEP	Under the OPGGS(E)R, NOPSEMA require that the petroleum activity have an accepted OPEP in place before commencing the activity. If a vessel collision occurs, the OPEP will be implemented. CAPL has developed an NOPSEMA-accepted OPEP (Ref. 2) to support all spill response activities across all its assets.
OSMP	The OSMP details the arrangements and capability in place for operational and scientific monitoring. Operational monitoring collects information about the oil spill to aid planning and decision making for executing spill response or clean-up operations. Scientific monitoring focuses on the environmental impact

Source		
	attributable to the spill or the associated response activities and informs requirements for remediation (if required). CAPL has developed an NOPSEMA-accepted OSMP (Ref. 3) to support all spill monitoring activities across all its assets.	
Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A
Likelihood and risk level summary		
Likelihood	Analysis of the 2001 PARLOC database (Ref. 162) was used to evaluate the likelihood of a loss of containment from an individual offshore pipeline, which was determined to be equivalent to 0.189% per year (Ref. 163). This frequency was used as a guide to inform the likelihood of consequence. Given these statistics are based on incident history, largely for North Sea and European operations, their use is considered conservative given the geographically remote location of the Gorgon and Jansz Feed Gas Pipeline and the reduced risk of potential external interference. Because of the low probability of a major defect event, the likelihood of the event coinciding with the breeding or migration period of particular values and sensitivities, and the control measures in place, the likelihood of the worst-case environmental consequence occurring as described above was assessed as Remote (5).	
Risk level	Very low (9)	
Determination of acceptability		
Principles of ESD	The potential impact associated with this aspect would be short term, apply to some individuals, and consequently is not expected to affect biological diversity and ecological integrity. The consequence associated with this aspect is Minor (5). Therefore, no additional evaluation against the Principles of ESD is required.	
Relevant environmental legislation and other requirements	Legislation and other requirements relevant for this aspect include: • Marine Order 91, Marine Pollution Prevention – oil • *Conservation Management Plan for the Blue Whale 2015–2025* (Ref. 62) • *Conservation Advice Balaenoptera borealis Sei Whale* (Ref. 61) • *Conservation Advice Balaenoptera physalus Fin Whale* (Ref. 59) • *Recovery Plan for Marine Turtles in Australia* (Ref. 56) • North-west Marine Parks Network Management Plan (Ref. 157).	
Internal context	These CAPL environmental performance standards or procedures were deemed relevant for this aspect: • IM Plan (Ref. 160) • OPEP (Ref. 2) • OSMP (Ref. 3).	
External context	During stakeholder consultation, no objections or claims were raised regarding major defect events arising from the activity.	
Defined acceptable level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.	

<table>
<tr><th colspan="3">Source</th></tr>
<tr><td></td><td colspan="2">However, given that chemical discharge and/or pollution (of which an oil spill is a component) is listed as a threat to protected matters under documents made or implemented under the EPBC Act, CAPL has defined an acceptable level of impact such that it is not inconsistent with these documents.
The Recovery Plan for Marine Turtles in Australia (Ref. 56) specifies the following relevant action areas and action:
• minimise chemical and terrestrial discharge
• ensure spill risk strategies and response programs adequately include management for marine turtles and their habitats, particularly in reference to ‘slow to recover habitats’, e.g., nesting habitat, seagrass meadows or coral reefs.
CAPL addresses spill response and monitoring within their OPEP (Ref. 2) and OSMP (Ref. 3).
No other specific relevant actions were identified within other documents implemented under the EPBC Act.
Therefore, CAPL has defined an acceptable level of impact as minimising the risk of impacts to the environment from spills from major defect events.</td></tr>
<tr><th>Environmental performance outcome</th><th>Performance standard / Control measure</th><th>Measurement criteria</th></tr>
<tr><td rowspan="2">No leak or spill of hydrocarbons / hazardous materials to the environment during petroleum activities</td><td>IM Plan
Inspection and maintenance will include, but not be limited to, visual or acoustic survey of the subsea pipeline, in accordance with the IM Plan</td><td>CMMS records confirm a visual or acoustic survey of the subsea pipeline was undertaken in accordance with the IM Plan</td></tr>
<tr><td>IM Plan
Monitoring of hydrocarbon system pressure, temperature, flow rates and fluid composition against acceptable criteria and limits will be aligned with the IM Plan</td><td>Records confirm monitoring of hydrocarbon system pressure, temperature, flow rates and fluid composition against acceptable criteria and limits are aligned with the IM Plan</td></tr>
<tr><td rowspan="2">Reduce risk of impacts to the environment from the unplanned release of hydrocarbons / hazardous materials during petroleum activities</td><td>Source control
The isolation steps of the source control / isolation procedures implemented within 30 minutes if a spill is detected from the hydrocarbon system</td><td>Records demonstrate relevant isolation components of the source control procedures are implemented if a spill is detected from the hydrocarbon system</td></tr>
<tr><td>Well handover
In the event of a well integrity failure event, well custodianship is handed over from CAPL’s Gorgon Operations to the ABU Wells work group for</td><td>Completed well handover certification confirms that the well has transferred into the custodianship of the ABU Wells work group. This process is outlined in the NOPSEMA-accepted Gorgon Project: Producing Phase Well Operations Management Plan (Ref. 9)</td></tr>
</table>

Source		
	management and subsequent remediation	
	OPEP In the event of a spill occurring, the OPEP will be implemented	Records confirm the OPEP has been implemented
	OSMP In the event of a spill occurring, the OSMP will be implemented	Records confirm the OSMP has been implemented

6.15 Spill response

6.15.1 Response option selection

6.15.1.1 Strategic NEBA

CAPL has developed a series of strategic Net Environmental Benefit Analysis (NEBA) (Ref. 164) using generalised scenarios that reflect the spill risks associated with all CAPL offshore WA operations. Hydrocarbons associated with spill events from all CAPL operations were grouped into oil types as defined by the International Tanker Owners Pollution Federation Ltd (ITOPF) classification system:

- Group 1 – Including Iago, Wheatstone, and Jansz condensate; Wheatstone trunkline fluids; and Wheatstone flowline fluids
- Group 2 – Including MDO, Gorgon condensate, Barrow Island crude and Gorgon/Jansz mixed trunkline fluids
- Group 3 / 4 – Including HFO and intermediate fuel oil (IFO) (depending on blend).

These NEBAs were developed as a pre-spill planning tool for all CAPL EPs, to facilitate response option selection and support the development of the overall response strategies by identifying and comparing the potential effectiveness and impacts of oil spill response options (Ref. 165). After considering the benefits and drawbacks of each response option on the ecological, social, and economic receptors within the EMBA, the response options that were determined to minimise the impacts to the environment and people were pre-selected.

6.15.1.2 Protection prioritisation process

CAPL has developed a Protection Prioritisation Process (PPP) (Ref. 166) to support decision making in the event of a significant spill event. The information within the PPP document is used to identify priorities for protection within the activity specific spill scenario(s) EMBA, such as that described in Section 4. The identification of priorities for protection assists in the identification of resources to be assessed within the strategic and operational NEBAs, as described above. The NEBA considers the protection priority values, the EMBA, and the various control measures, including their feasibility, likely success, environmental benefits, level of effectiveness and performance of response tactics. The output of the NEBA and the protection priorities identified will then guide the strategic direction of the response through informing decisions made around tactical planning and response option selection.

The PPP (Ref. 166) ranks receptors (natural or anthropogenic value or resource that is potentially sensitivity to marine oil pollution) using a 5 level scale (from Very Low (1) to Very High (5)) based on a number of factors, including their sensitivity and vulnerability to oil, their conservation status and the biological and socioeconomic importance of the receptor. The CAPL PPP (Ref. 166) aligns with WA Department of Transport (DoT) PPP (Ref. 167) and utilises the same shoreline cells to illustrate broad scale identification of sensitive areas.

Areas with high value receptors and at greatest risk of contact with oil (as indicated by stochastic modelling) are assigned a high protection priority and designated as priority planning areas. The process for identifying these areas (described in the PPP document (Ref. 166)) considers all High (4) and Very High

(5) ranked shoreline cells where contact above the moderate exposure threshold (from stochastic modelling across all seasons) is predicted within 4 days (96 hours). As described in the PPP (Ref. 166), the 4 day contact timeframe is based on the expected time it would take CAPL to develop and implement a Tactical Response Guide (TRG) for an area predicted to be impacted. For contact outside this timeframe, it expected that CAPL will have reasonable time to develop and implement a TRG prior to oil contacting the resource.

High and Very High value areas (DoT shoreline cells) identified for contact within this timeframe have been identified in Table 6-17 below. These priority planning areas, and the specific receptors identified within them, are considered to ensure that tactical planning and response option selection are appropriate.

Table 6-17: Priority planning areas for major defect spill scenario

Potential area of impact	Distance from source of spill	Shoreline values	Planned response tactics
DoT Shoreline Cell # 320 and #321 (Barrow Island)	15 km	Turtles – BIAs including nesting Seabirds – BIAs including breeding Coral and reef communities Australian Marine Park	Monitor, Evaluation and Surveillance Shoreline Protection and Deflection Shoreline Clean-up Oiled Wildlife Response
Dot Shoreline Cell # 318 (Montebello Islands)	30 km	Turtles – BIAs including nesting Seabirds – BIAs including breeding Mangroves Coral and reef communities Australian Marine Park	Monitor, Evaluation and Surveillance Shoreline Clean-up Oiled Wildlife Response

* Note that the modelling for both Gorgon and Jansz-Io vessel collision event did not predict any impact to High and Very High ranked areas within 4 days.

6.15.2 Activity-specific response option selection

To select the appropriate response options for this EP, hydrocarbons applicable to the worst credible scenarios specific to this activity are:

- Group 1 – Jansz condensate
- Group 2 – Gorgon condensate, MDO.

The outcomes of the Strategic NEBA are outlined in Table 6-1 of the OPEP (Ref. 2). Taking into account the priority planning areas identified in Table 6-17 the outcomes of the Strategic NEBA determined that the recommended response options proposed to be used for the spill scenarios associated with this EP include:

- Monitoring, Evaluation, and Surveillance (MES)
- Shoreline Protection and Deflection (SPD)
- Shoreline Clean-up (SHC).

These response options are carried out alongside Oiled Wildlife and Waste Management response tactics. CAPL does not consider Oiled Wildlife and Waste Management as separate response options as they are implemented as support tactics for all spill events in a manner that is commensurate to the level of impact and risk of that event.

6.15.3 CAPL existing spill response capability assessment

Based on the spill response arrangements that CAPL has in place across the business, the capability of these arrangements was determined. This process involved:

- identifying CAPL's existing response arrangements and the equipment and personnel available to CAPL under these arrangements
- defining the response package for each response option, and identifying the critical components for each response package (i.e. equipment or personnel that are limited in number and cannot be purchased or accessed readily)
- determining the number of critical components available to CAPL under existing arrangements
- Identify the number of response packages available to CAPL under existing arrangements
- defining the volume of hydrocarbons that could be recovered or treated per response package.

The outcome of this evaluation is included as Appendix C of the OPEP (Ref. 2).

6.15.3.1 CAPL project-specific capability requirement assessment

To understand the spill response capability required for this activity, CAPL assessed the worst-case credible spill event and used modelling to understand the number of packages per response technique that may be required to respond to that event. The steps involved in this assessment were:

1. Review the Strategic NEBA (Ref. 164) and priority planning areas to understand the planned response to an event.
2. Predict the average surface hydrocarbon volume per day; and average volume of hydrocarbon accumulated onshore per shoreline per day (if relevant) to calculate the number of response packages required per response strategy.
3. Review the number of response packages available to determine if the capability exists.

6.15.3.2 CAPL planned response vessel collision

No shoreline contact was predicted for either the Gorgon or Jansz-Io scenarios, therefore there is no need to implement SPD and SHC responses. Offshore Containment and Recovery (CAR) would not be effective because of the hydrocarbon properties (Group 2). Consequently, in accordance with the Strategic NEBA (Ref. 164), the primary response CAPL proposes for these spill scenarios is MES.

Implement MES response

A MES response will commence for every spill to water as soon as the spill is identified. This may range from very simplistic visual observation only, through to more involved monitoring and evaluating tactics. Appendix C of the OPEP (Ref. 2) has documented the arrangements that CAPL have in place to implement all the required MES tactics; therefore, this technique is not discussed further.

6.15.3.3 CAPL planned response major defect

In accordance with the Strategic NEBA (Ref. 164), the response strategies proposed to be used for this spill scenario and response package calculations are described below. Offshore CAR would not be effective because of the hydrocarbon properties (Group 1 and 2).

Implement MES response

A MES response will commence for a subsea release as soon as the spill is identified. This may range from very simplistic visual observation only, through to more involved monitoring and evaluating tactics. Appendix C of the OPEP (Ref. 2) has documented the arrangements that CAPL have in place to implement all the required MES tactics; therefore, this technique is not discussed further.

Implement an SPD response

Deterministic analysis for the largest volume of oil ashore indicates that 15.8 m^3 may wash ashore within ~2 days after release. The volume of oil ashore was used to support the planned response requirements—the volume of hydrocarbons that would need to be treated by an SPD response is directly correlated to the volume of oil that may wash ashore.

Based on Appendix C of the OPEP (Ref. 2), each protection team is expected to recover 15.6 m^3 of hydrocarbon per day. On the assumption that 15.8 m^3 washes ashore on the second day, CAPL would need up to two SPD packages available on day two to implement the SPD response. Confirmation that CAPL has the arrangements in place to implement the required number of packages is provided in Table 6-18.

Modelling suggests there would only be a very short window to implement SPD on the west coast of Barrow Island (~1.7 days). This short timeframe, coupled with the remoteness, access constraints and the high energy environment of the western coastline would likely result in limited effectiveness, Regardless, a SPD response could be targeted at accessible areas of lower energy with known environmental sensitives, such as turtle nesting beaches.

A SPD response within the other Priority Planning area (Montebello Islands) would not be possible due to the predicted time to exposure (<1 day).

Implement an SHC response

For a spill event such as this (a non-continuous release), deterministic analysis indicates shoreline accumulation (if it occurs) occurs rapidly. CAPL will implement strategies to protect prioritised values and sensitivities; however, the focus would be on SHC operations.

Deterministic analysis for the largest volume of oil ashore indicates that 15.8 m^3 may wash ashore within ~2 days after release, and a maximum length of shoreline exposed to above actionable quantities was ~5 km. This scenario predicted exposure to the western coastlines of Barrow Islands.

The west-coast of Barrow Island comprises:

- High energy wave environment

- High / steep rocky cliffs
- Very limited vehicle access

From a tactical planning perspective, based upon these conditions, it is unlikely that a shoreline clean-up would be feasible along most of the west coast. Consequently, priority areas for clean-up would be those west coast bays / beaches accessible by vehicles or vessels and those that support Green Turtle nesting populations. Regardless, a conservative planning approach taken by CAPL is that it would attempt to clean up the entire volume of oil washed ashore.

Based on Appendix C of the OPEP (Ref. 2), each SHC team is expected to recover 1.6 m^3 of hydrocarbon per day. If two clean-up teams are mobilised on day 3 and used each day, all hydrocarbons can be recovered within 5 days. If required, these efforts could be ramped up as directed and informed by MES activities.

Table 6-18: Major defect response package deployment timeline

Response Technique	Days Following Event							Weeks Following Event				
	1	2	3	4	5	6	7	2	3	4	5	6
No. packages – planned MES	1	1	1	1	1	1	1	1	0	0	0	0
Does CAPL have the required capability?	Y	Y	Y	Y	Y	Y	Y	Y				
No. packages – planned SPD	0	2	2	0	0	0	0	0	0	0	0	0
Does CAPL have the required capability?		Y	Y									
No. packages – planned SHC	0	0	2	2	2	2	2	0	0	0	0	0
Does CAPL have the required capability?			Y	Y	Y	Y	Y					

6.15.4 Spill response environmental risk assessment

6.15.4.1 Ground disturbance—shoreline spill response

Conducting SPD or SHC involves moving personnel and equipment, which triggers the environmental aspect of ground disturbance.

SPD aims to decrease the overall effect of oil on shorelines before they are impacted and uses booms and sorbents placed adjacent to sensitive shoreline habitats to deflect or capture surface oil.

The objective of SHC is to apply techniques that are appropriate to the shoreline type to remove as much oil as possible. Various techniques may be used alone or in combination to clean oiled shorelines, including shoreline assessment, natural recovery, sorbents, sediment reworking, manual and mechanical removal, and washing, flooding, and flushing.

Source			
In the event of a worst-case spill event (major defect event at a nearshore location releasing Gorgon condensate), implementing SPD and SHC techniques involves people and equipment, which may disturb shoreline habitat.			
Potential Impacts and Risks			
Impacts	**C**	**Risks**	**C**
N/A	-	Conducting SPD and SHC, including moving personnel and equipment, has the potential to damage terrestrial habitats (including nests), with subsequent impacts to fauna such as turtles and birds.	5
Consequence Evaluation			
Potential impacts of SPD and SHC vary, depending on the method used and the shoreline habitat. General impacts include physical disturbance from using personnel, vehicles, and equipment. Particular values and sensitivities in the area that may be affected by the spill include sensitive shoreline habitats (such as mangroves) and nesting / foraging habitat for fauna species such as turtles and birds. The impacts associated with undertaking SHC may be more than if the hydrocarbon product was left in place and remediated through natural processes. Leaving the product in place is a common response option if continual human and vessel/vehicle traffic has the potential to generate greater impacts than the product itself. This technique has been implemented internationally, including for the Montara spill (where persistent components of the product were left to naturally break down in dense coastal mangroves) and the Macondo spill (where marshes and wetlands that had been impacted by weathered product were allowed to recover naturally). If a smaller extent of shoreline is impacted, the impacts from an SHC response activity may be lessened and more localised. Potential impacts associated with using vehicles, personnel, and equipment during SHC (and/or SPD) can include disturbing wildlife feeding or breeding (including damage to nests) and damaging dune structures, vegetation, or intertidal habitats. These shoreline activities have the potential to result in short-term and localised damage to or alteration of habitats and ecological communities and therefore the consequence is ranked as Minor (5).			
ALARP Decision Context Justification			
The risks associated with shoreline oil spill response techniques are well understood, with the techniques having been applied successfully for a number of large spill events. Although there is a good understanding of these response techniques, there is uncertainty regarding the specific location at which this may be undertaken, and the level of response that may be required in these areas. Spill modelling was used to inform the extent of such a spill, and thus provide a sound basis for response planning (including shoreline response) to such an incident. Control measures to manage the risks associated with shoreline spill response techniques are well defined with most being linked to detailed monitoring plans that feed into tactical planning requirements and NEBAs. During stakeholder consultation, no objections or claims were raised regarding spill response activities. The risks arising from implementing shoreline response techniques in the event of a spill are extremely low, and CAPL consider these to be lower-order risks in accordance with Table 5-3. As such, CAPL considers ALARP Decision Context A should be applied for this aspect.			

Control Measure	**Source of Good Practice Control Measure**
OSMP	The OSMP details the arrangements and capability in place for operational and scientific monitoring. Operational monitoring collects information about the oil spill to aid planning and decision making for executing spill response or clean-up operations. Scientific monitoring focuses on the environmental impact attributable to the spill or the associated response activities and informs requirements for remediation (if required).

	CAPL has developed an NOPSEMA-accepted OSMP (Ref. 3) to support all spill monitoring activities across all its assets. Specifically, Operational Study 6 – Rapid Seabird and Shorebird Assessment and Operational Study 7 – Rapid Marine Megafauna Assessment provide information on the presence of wildlife with regards to predicted trajectory to understand the level of oiled wildlife response (OWR) required.	
Likelihood and Risk Level Summary		
Likelihood	Depending on the clean-up technique and habitat, potential consequences of shoreline cleaning are remote (Note: Mechanical methods are generally expected to have greater consequences than manual cleaning). With the control measures in place, CAPL assessed the likelihood of the consequence described above as Remote (5).	
Risk Level	Very low (9)	
Acceptability Summary		
Principles of ESD	The potential impact associated with this aspect is considered to have the potential to result in minor, localised, incidental damage to, or alteration of, habitats and ecological communities; however, this is not expected to affect biological diversity and ecological integrity. The consequence associated with this aspect is Minor (5). Therefore, no additional evaluation against the Principles of ESD is required.	
Relevant Environmental legislation and Other Requirements	No legislation and other requirements relevant to this aspect were identified.	
Internal Context	This CAPL environmental performance standard / procedure was considered relevant for this aspect: • OSMP (Ref. 3).	
External Context	During stakeholder consultation, no objections or claims were raised regarding spill response activities.	
Defined Acceptable Level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.	
Environmental Performance Outcomes	**Performance Standards / Control Measures**	**Measurement Criteria**
Reduce the risk of impacts to the environment during event response	**OSMP** In the event of a spill occurring, the OSMP will be implemented	Records confirm the OSMP has been implemented

6.15.4.2 Physical presence—oiled wildlife response

Oiled wildlife response (OWR) activities are aimed at treating fauna that have encountered, or are likely to encounter, spilt hydrocarbons. OWR generates the environmental aspect of physical presence/interaction with fauna, through handling, treating, rehabilitating, and releasing fauna.

Source			
In the event of a worst-case spill event (major defect event at a nearshore location releasing Gorgon condensate), the handling and treating marine fauna (through an OWR) will result in personnel interacting with marine fauna.			
Potential Impacts and Risks			
Impacts	**C**	**Risks**	**C**
N/A	-	Conducting OWR has the potential to cause further harm to oiled fauna due to hazing, barriers, deterrents, and cleaning activities, and has the potential to cause injury/death.	5
Consequence Evaluation			
Particular environmental values that may be affected by OWR activities include marine fauna such as turtles and birds. Due to the intensive nature of OWR activities and the fragile nature of many shore and wading birds, OWR activities can have high bird mortality rates. Physical exclusion and hazing operations can result in entanglement and stress-related impacts to marine birds. Cleaning of oiled wildlife may result in skin irritations, impacts to the hydrophobic properties of bird plumage, and stress-induced physiological effects. Spill modelling indicates that areas along the coast frequented by fauna, such as the Ningaloo coast and Barrow and Montebello Islands, are areas where OWR is most likely to be undertaken. If a spill coincided with turtle nesting/hatchling or bird nesting periods, a large number of animals may be treated using OWR. Impacts from hazing and deterrents are anticipated to be localised to the area of potential spill impact and limited to the spill period. Even if OWR was undertaken during nesting periods, only a small proportion of the nesting population would be involved as the species potentially involved nest widely elsewhere. The potential consequences associated with an OWR are localised and short term and are ranked as Minor (5).			
ALARP Decision Context Justification			
The risks associated with OWR are well understood, with the technique having been applied successfully for a number of large spill events. Although there is a good understanding of the response technique, there is uncertainty regarding the specific location at which this may be undertaken, the number of animals that may be impacted, and thus the level of response that may be required. Spill modelling was used to inform the extent of such a spill, and thus provide a sound basis for response planning to such an incident. Control measures to manage the risks associated with OWR are well defined with most being linked to detailed monitoring plans that feed into tactical planning requirements and NEBAs. During stakeholder consultation, no objections or claims were raised regarding OWR activities. The risks arising from implementing OWR in the event of a spill are extremely low, and CAPL consider these to be lower-order risks in accordance with Table 5-3. As such, CAPL considers ALARP Decision Context A should be applied for this aspect.			

Control Measure	Source of Good Practice Control Measure
OSMP	The OSMP details the arrangements and capability in place for operational and scientific monitoring. Operational monitoring collects information about the oil spill to aid planning and decision making for executing spill response or clean-up operations. Scientific monitoring focuses on the environmental impact attributable to the spill or the associated response activities and informs requirements for remediation (if required). CAPL has developed an NOPSEMA-accepted OSMP (Ref. 3) to support all spill monitoring activities across all its assets. Specifically, Operational Study 6 – Rapid Seabird and Shorebird Assessment and Operational Study 7 – Rapid Marine Megafauna

	Assessment provide information on the presence of wildlife with regards to predicted trajectory to understand the level of OWR required.	
Likelihood and Risk Level Summary		
Likelihood	Where there is the possibility for surface oil to impact wildlife, the risks associated with OWR are lower than those associated with inaction. With the control measures in place, the likelihood of the described consequences occurring from OWR activities was determined to be Remote (5).	
Risk Level	Very low (9)	
Acceptability Summary		
Principles of ESD	The potential impact associated with this aspect is considered as having the potential to result in a localised incidental impact and thus is not expected to affect biological diversity and ecological integrity. The consequence associated with this aspect is Minor (5). Therefore, no additional evaluation against the Principles of ESD is required.	
Relevant Environmental Legislation and Other Requirements	No legislation and other requirements considered relevant to this aspect were identified.	
Internal Context	The CAPL environmental performance standard / procedure considered relevant for this aspect is: • OSMP (Ref. 3).	
External Context	During stakeholder consultation, no objections or claims were raised regarding spill response activities.	
Defined Acceptable Level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.	
Environmental Performance Outcomes	**Performance Standards / Control Measures**	**Measurement Criteria**
Reduce the risk of impacts to the environment during event response	**OSMP** In the event of a spill occurring, the OSMP will be implemented	Records confirm the OSMP has been implemented

7 implementation strategy

This section provides a description of the implementation strategy as required under Regulation 14 of the OPGGS(E)R. The implementation strategy identifies the systems, practices, and procedures used to ensure the environmental impacts and risks of the petroleum activities are continuously reduced to ALARP and the environmental performance outcomes and standards detailed in Section 6 are achieved.

7.1 Operational Excellence Management System

CAPL's operations are managed in accordance with Chevron Corporation's OEMS, which is a comprehensive management framework that supports the corporate commitment to protect the safety and health of people and the environment. The OEMS aligns with ISO 14001:2015 *Environmental management systems - Requirements with guidance for use* (Ref. 34) and meets the requirements of the OPGGS(E)R.

OE systematically manages workforce safety and health, process safety, reliability, and integrity, environment, efficiency, security, and stakeholders to meet the OE objectives and ensure safe operations of CAPL facilities and projects. The OEMS comprises the following key components (Figure 7-1):

- **leadership and OE culture**—through the OEMS, CAPL leaders engage employees and contractors to build and sustain the OE culture and deliver OE performance
- **management system cycle** (MSC)—by applying the MSC, CAPL leaders make risk-based and data-driven decisions, prioritise activities, and direct improvements
- **focus areas and OE expectations** (including common expectations)—focus areas are categories of OE risks and include workforce safety and health, process safety reliability and integrity, environment, efficiency, security, and stakeholder engagement; OE expectations guide the design, management, and assurance of the presence and effectiveness of safeguards.

The OEMS outlines the process for identifying, establishing, and maintaining safeguards and to provide assurance that they are in place, functioning as intended, and are in accordance with legal and OE requirements. The risk management process (Figure 7-1) assesses and identifies safeguards, which are the hardware and human actions designed to directly prevent or mitigate an incident or impact associated with the project, personnel, and the environment. The assurance process (Figure 7-1) provides the verification and validation that the safeguards are in place and functioning as intended.

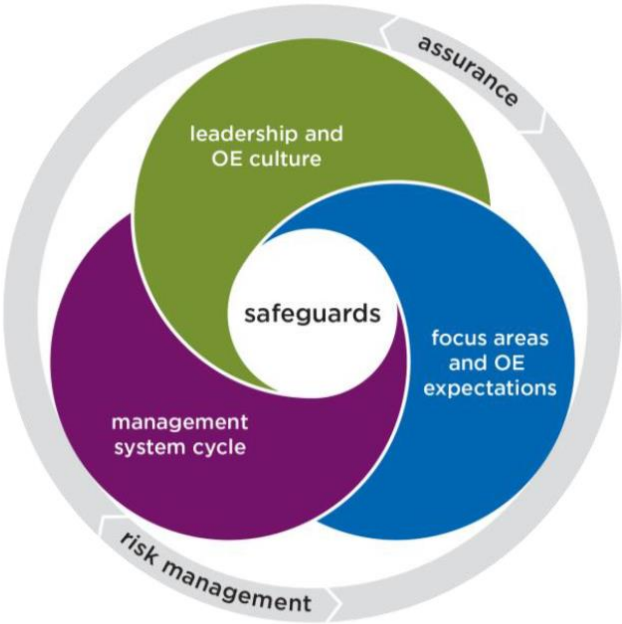


Figure 7-1: Overview of Chevron Corporation's OEMS

7.2 Leadership and OE culture

CAPL leaders demonstrate and are accountable for the consistent and rigorous application of the OEMS to drive performance and manage risks. The actions and visibility of leaders reinforce CAPL's commitment to place the highest priority on the safety and health of its workforce, and on the protection of communities, the environment, and its assets.

7.2.1 Roles and accountability

CAPL leaders have the overall accountability for the implementation of the OEMS.

7.2.1.1 Chain of command (petroleum activity)

As required under Regulation 14(4) of the OPGGS(E)R, a clear chain of command for implementing the petroleum activity is outlined in Figure 7-2.

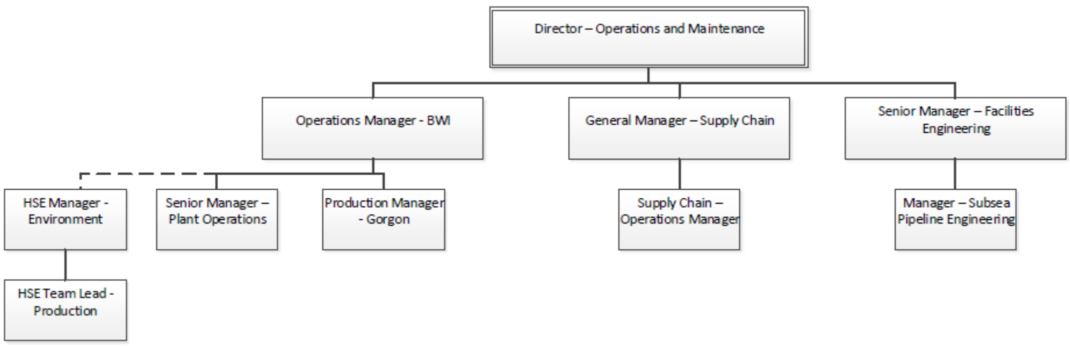


Figure 7-2: Chain of command—petroleum activities

7.2.1.2 Roles and responsibilities (petroleum activity)

The roles and responsibilities of key CAPL and contractor personnel for implementing task-specific control measures are detailed in Section 6, and are summarised in Table 7-1.

Table 7-1: Key roles and responsibilities—petroleum activities

Roles	Responsibilities
CAPL personnel	
Operations Manager - BWI	• Overall responsibility for implementing, managing, and reviewing this EP
Supply Chain – Operations Manager	• Ensure that all third-party vessels or contractors are aware of any requirements within this EP
Manager - Subsea Pipeline Engineering	• Ensure that inspection and monitoring of the hydrocarbon system is undertaken in accordance with the IM Plan (Ref. 160)
Production Manager - Gorgon	Ensure that: • hydrocarbon system is operated in accordance with NOPSEMA accepted *Gorgon Project: Producing Phase Well Operations Management Plan* (Ref. 9 • source control response is undertaken in accordance with the EOP – Loss of Containment (Hazardous or Environmental Release) Operating Procedure – Gorgon Operations (Ref. 161)
HSE Manager - Environment	Ensure that: • all personnel are made aware of their requirements under this EP • impacts and risks are continually reduced to ALARP by implementing this EP in accordance with Sections 6 and 7 • all changes to this EP are subject to a Management of Change assessment as described in Section 7.3.2.2 • compliance with this EP is verified in accordance with Section 7.3.6 • this EP is reviewed in accordance with Section 7.5
Contractor personnel	
Vessel Master	Ensure that: • impacts and risks are continually reduced to ALARP by implementing this EP in accordance with Sections 6 and 7 • all incidents are reported to CAPL • all emissions and discharges are monitored and recorded in accordance with Sections 6 and 7

7.2.1.3 Training and competency (petroleum activity)

In accordance with Regulation 14(5) of the OPGGS(E)R, each employee responsible for implementing task-specific control measures during operational activities must be aware of their specific responsibilities as detailed in this EP. People who hold responsibilities relating to implementing this EP are hired by CAPL on the basis of their particular qualifications, experience, and competency.

All external contractor personnel involved with activities within scope of this EP will hold qualifications or training certification relevant to their role, which will be confirmed through the contractor selection process, audits and review processes.

Personnel with specific responsibilities under this EP (refer to Section 7.2.1.2) were included during the internal review of this EP and are made aware of their role-specific responsibilities under this EP.

All personnel (including contractors) are required to attend inductions that are relevant to their role (Table 7-2).

Table 7-2: Inductions—petroleum activities

Induction	Required personnel	Scope
Induction	All relevant personnel	Before commencing operations, all personnel, including subcontractors, must attend an induction that includes an overview of the requirements of this EP. This induction fosters environmental stewardship amongst all personnel and ensures that they are aware of the control measures implemented to minimise the potential impact on the environment. The induction includes: • awareness of Chevron Corporation's Operational Excellence Policy 530 (appendix a) • an overview of environmental sensitivities, and key impacts and risks from the petroleum activity • cetacean interaction requirements under Part 8 of the EPBC Regulations 2000 • good waste management and hazardous materials housekeeping requirements • incident reporting requirements • incident response arrangements.

7.3 Focus areas and OE expectations

The OE expectations are organised into six focus areas (Figure 7-3). The OE expectations provide guidance to design, operate, maintain, improve, and assure the presence and effectiveness of safeguards. Common expectations also apply and support the OE expectations and focus areas Figure 7-3.

Figure 7-3: Focus areas and common expectations

The focus areas and common expectations relevant to this EP, and their key processes that demonstrate how CAPL is effective in reducing environmental impacts and risks to ALARP and an acceptable level, are listed in Table 7-3. Each of these focus areas and common expectations are described in further detail in the following subsections.

Table 7-3: Relevant focus areas and common expectations

Focus area or common expectation	Key processes
Focus area	
Workplace safety and health	• *Managing Safe Work (MSW): ABU Standardised OE Process* (Ref. 35) • *Marine Safety Reliability and Efficiency: ABU Standardised OE Process* (Ref. 36) • *ABU Hazardous Materials Management Procedure: ABU Standardised OE Procedure* (Ref. 37)
Process safety, reliability and integrity	• OE Information Management: ABU Standardised OE Process (Ref. 38) • *Management of Change for Facilities and Operations: ABU Standardised OE Process* (Ref. 39) • *ABU Surface Equipment Reliability and Integrity Process (SERIP) Base Business: Standardised OE Process (Ref. 40)*
Environment	• *Environmental Stewardship: ABU Standardised OE Process (Ref. 41)* • *Quarantine Procedure Marine Vessels. ABU Standardised OE Process (Ref. 42)*
Stakeholders	• *Stakeholder Engagement and Issues Management: ABU Standardised OE Process* (Ref. 43)
Common expectation	
Risk management	• *ABU OE Risk Management Process* (Ref. 29)
Assurance	• *OE Assurance Corporate Process* (Ref. 44) • *OE Corporate Standard Incident Investigation* (Ref. 47) • *OE Data Reporting Standard (Ref. 201)*
Incident investigation and reporting	• *Incident Investigation and Reporting (II&R) Execution Manual* (Ref. 48)
Emergency management	• *Emergency Management OE Process* (Ref. 49) • OPEP (Ref. 2) • *Operational and Scientific Monitoring Plan* (OSMP) (Ref. 3)

7.3.1 Workforce safety and health

7.3.1.1 Managing safe work

The MSW expectation is to assess workplace safety and health hazards and manage the risks associated with the execution and control of work performed by CAPL employees, their delegates, contractors, and subcontractors. The MSW system (Ref. 35) is implemented to ensure safe work practices are made available to the workforce. Standards and procedures relating to MSW relevant to this EP include the permit to work (PTW) system. The PTW system, which includes simultaneous operations (SIMOPS) and hazard analysis, is a way to identify, communicate, mitigate, and control hazards associated with work that have the potential to adversely affect HSE. As the potential consequence associated with each task increases, so does the level of controls and approval that are required.

7.3.1.2 Marine

The Marine Safety Reliability and Efficiency (MSRE) process (Ref. 36) identifies the requirements and activities necessary to deliver safe, reliable, and efficient third-party marine operations. This process describes key roles and responsibilities for managing marine safety and establishes measurement and verification activities designed to promote a process of continual improvement.

The MSRE process applies to all marine vessels, emergency response, and all other (non-bulk petroleum) vessels chartered, owned, or operated by CAPL. The process also applies to vessels contracted by an affiliate or contractor that provide marine support or marine services to CAPL.

Vessels are assured and endorsed for their intended work scope by the MSRE Process Authority (or delegate). Contractors and subcontractors are required to meet all requirements in the Corporate Marine Standard (Ref. 50), including the MSRE Marine Contractor HES (MarCHES) qualification and performance monitoring. Contractors and subcontractors are also required to meet any in-force global MSRE marine notices, which must be complied with until they are revoked or added to the CAPL Marine Standard.

The key elements of the MSRE process that apply to the activities outlined in this EP are:

- vessel inspections—vessels used by CAPL or its affiliates must undergo a vessel audit/inspection process before deployment to ensure that the vessels and the staffing levels meet safety requirements and are fit-for-purpose; inspections also ensure emergency procedures (such as SOPEP/SMPEP) are available and that the required standards are met for navigation equipment, lighting, waste systems, and other marine safety protocols including Marine Order 30 (Prevention of Collisions)
- competency management—vessels used by CAPL must be operated by competent personnel who meet applicable international and local regulations
- cargo handling—cargo transport and handling operations on marine vessels must comply with handling procedures and align to standard marine industry practices
- complicated and/or heavy lifts—all lifting and installing of heavy equipment near offshore infrastructure must meet the detailed requirements
- hose management—operations involving the transfer of bulk liquids using loading hoses must align to standard industry practice and safety of the environment
- vessel communication—vessels must have in place communications procedures for operations close to installations, or other mobile units to ensure that safe positioning and communications are maintained at all times.

Vessels provide an activity-specific operational guideline (ASOG), based on their use and specification, which must be accepted by CAPL.

7.3.1.3 Hazardous materials

CAPL's *Hazardous Materials Management Procedure* (Ref. 37) outlines the process for HSE assessment and approval of hazardous materials. Hazardous materials include those classified as 'hazardous substances or 'dangerous goods'.

The *Hazardous Materials Management Procedure* is designed to:

- assess hazardous materials requested for procurement for their HSE risks
- ensure that appropriate controls are identified for using procured hazardous materials and that these controls are communicated to the requestors of the materials and end users at locations within CAPL's operations
- ensure no product includes CAPL-prohibited ingredients
- ensure substitutes were considered if a product contains CAPL-restricted ingredients.

As part of the hazardous materials selection process, hazardous materials that will be discharged to the environment will undergo a detailed environmental assessment. This environmental assessment is guided by the methodology and classification system used by the Offshore Chemical Notification Scheme (OCNS) and Chemical Hazard Assessment and Risk Management (CHARM). Hazardous materials not listed on OCNS or CHARM, are still subject to the environmental assessment described below.

The environmental assessment includes an evaluation of the potential environmental risks that could be associated with the chemical, and considers the relevant dosage, quantity and frequency of the chemical discharge, the location and nature of the receiving environment, and the assessment criteria described in Table 7-4.

The chemical selection process ensures impacts and risks associated with chemical discharge are reduced to levels that are ALARP and acceptable, while meeting operational performance requirements.

Table 7-4: Chemical risk assessment criteria

Assessment criteria	Selection rationale
Potential for acute and/or chronic toxicity to aquatic life	The toxicity of a chemical is the fundamental consideration within this assessment. This reflects the UK OCNS system which ranks chemicals based on their toxicity, and then adjusts rankings depending on biodegradation and bioaccumulation properties. The scale for toxicity is based on the toxicity rating classification system used by DMIRS, from Hinwood et al. (Ref. 51).
Persistence or biodegradability	Biodegradation rate provides an indication of the potential persistence of the chemical within the environment, and therefore the potential duration of exposure for environmental sensitivities. The scale for biodegradation is based on adjustment criteria used by Centre for Environment, Fisheries and Aquaculture Science (CEFAS) to finalise chemical hazard assessment scores under the OCNS system.
Bioaccumulation or bio-concentration	Indicates the potential for the chemical (or components of the chemical) to accumulate within biological matrices and food chains. Chemicals which may not be toxic and are introduced to the environment in low concentrations can concentrate within biological matrices to the point where they become toxic and may have either acute or chronic effects. The scale for bioaccumulation is based on adjustment criteria used by CEFAS to finalise chemical hazard assessment scores under the OCNS system.

7.3.2 Process safety, reliability and integrity

7.3.2.1 OE information management

Under the OEMS, records (including compliance records to demonstrate environmental performance and compliance with commitments in this EP) will be retained in accordance with Regulation 27 of the OPGGS(E)R.

The OE information management process (Ref. 38) explains how critical information related to HSE, reliability, efficiency, and process safety is to be identified, developed, assessed, and maintained so that the workforce has access to, and is using, the most current information. This document describes key roles, responsibilities, and competencies associated with the process, and includes measurement and verification activities.

Vessel contractors will maintain records as above and are required to make these available upon request.

7.3.2.2 Management of change

Management of Change (MoC) expectations are to manage proposed changes to design, equipment, operations and products before they are implemented. In conjunction with the *ABU OE Risk Management Process* (Section 7.3.5), the *Management of Change for Facilities and Operations* process (Ref. 39) is followed to document and assess the impact of changes to activities described in this EP. These changes will be addressed to determine if there is potential for any new or increased environmental impact or risk not already provided for in this EP. If these changes do not trigger relevant petroleum regulations, as detailed below, this EP will be revised, and changes recorded in the EP without resubmission.

In accordance with Regulation 17 of the OPGGS(E)R this EP must be resubmitted to NOPSEMA under the relevant jurisdiction in the following circumstances:

- before commencing a new activity, or any significantly modification or new stage of the activity, not provided for in this EP
- if a change in the titleholder results in a change in the manner in which the impacts and risks of the activity are managed
- as soon as practicable after the occurrence of any significant new environmental impact or risk, or significant increase in an existing environmental impact or risk, that is not provided for in this EP
- as soon as practicable after the occurrence of a series of new environmental impacts or risks, or a series of increases in existing environmental impacts or risks, occur which, taken together, amount to the occurrence of a significant new environmental impact or risk, or a significant increase in an existing environmental impact or risk, not provided for in this EP.

7.3.2.3 Surface equipment reliability and integrity

The SERIP (Ref. 40) provides a systematic and staged approach to deploy and execute standardised surface equipment processes, sub-processes and procedures that enable operation and maintenance of facilities to sustain integrity and prevent incidents. The computerised maintenance management system (CMMS) is a key enabler for SERIP, used to prioritize, plan, schedule and complete necessary maintenance for all structures, equipment and protective devices. Each item (down to component level) is assessed, has a criticality assigned based on consequence of failure, and equipment whose failure may contribute to a major incident or event (MIE) is aligned to an operational performance standard with a start date and frequency for inspections and maintenance. Work orders for items of high consequence/criticality are to be completed by the due date, or managed under the deviation process. In 2021, CAPL are commencing the transition from the upstream SERIP process to the enterprise Facilities Integrity and Reliability Management (FIRM) process. The principles of managing high consequence equipment are similar across these two processes.

7.3.3 Environment

The Environment Focus Area provides CAPL's framework for the protection of the environment and community health using a risk-based approach that addresses potential environmental impacts.

7.3.3.1 Environmental Stewardship

The Environmental Stewardship process (Ref. 41) is designed to identify, assess, and manage potentially significant environmental impacts in a consistent manner and continually improve environmental performance. The objectives of the process are to:

- provide a consistent approach to Environmental Stewardship
- reduce the potential for environmental impacts
- support continual improvement in environmental performance throughout the lifecycle of Chevron's assets.

7.3.3.2 Quarantine

The *Quarantine Procedure Marine Vessels* (Ref. 42) defines the procedure for marine vessels intending to approach or access Barrow Island or undertake activities in title areas outside the boundaries of the Montebello/Barrow Island Marine Management Area. It provides information about quarantine compliance to CAPL, contractors, and others associated with marine vessels.

The purpose of this procedure in relation to the offshore title areas is to prevent offshore facilities and activities associated with CAPL title areas becoming staging areas for the introduction of marine pests into Australian waters and ports.

This procedure also outlines the requirements for vessels operating in title areas and details the premobilisation requirements and ongoing management of vessels operating in title areas.

7.3.4 Stakeholders

Stakeholder engagement expectations are to manage social, political, and reputational risks to CAPL (and Chevron), address potential business impacts, and generate business value by:

- identifying, assessing, and prioritising issues
- building and maintaining relationships with external stakeholders, including governments and the communities where CAPL operates

- developing and executing issue management and stakeholder engagement plans, tracking engagements and issues, and validating the effectiveness of plans.

The *Stakeholder Engagement and Issues Management Process* (Ref. 43) details an integrated approach for engaging stakeholders and managing external stakeholder issues. This process describes key roles and responsibilities for stakeholder engagement, establishes measurement and verification activities designed to monitor the effectiveness of the stakeholder engagement process and to promote continual improvement.

In accordance with Regulation 14(9) of the OPGGS(E)R, Section 2.6 describes the process undertaken for appropriate consultation with relevant authorities and relevant interested persons or organisations. CAPL will continue to engage with relevant stakeholders as described in Section 2.6.5.

7.3.5 Risk management

The risk management process (Ref. 29) assesses and identifies safeguards, which are the hardware and human actions designed to directly prevent or mitigate an incident or event and is designed to be consistent with the environmental risk management requirements of ISO 14001 *Environmental Management System* (Ref. 34) and ISO 31000:2018 *Risk management – Principles and guidelines* (Ref. 30).

This risk management process is summarised in Section 5 of this EP. Additional risk assessments must be undertaken if the MoC process (Section 7.3.2.2) is triggered. Risk assessments are undertaken in accordance with this process.

The *ABU OE Risk Management Process* (Ref. 29) and the *Management of Change for Facilities and Operations* process (Ref. 39) are the key systems CAPL use to ensure, that in accordance with Regulation 14(3)(a) of the OPGGS(E)R, the impacts and risks of the petroleum activity continue to be identified and reduced to ALARP.

7.3.6 Assurance

Within the OEMS, assurance is a common expectation that supports the OE objective of each focus area. The *ABU OE Assurance Process* (Ref. 44) enables CAPL to deliver assurance that safeguards are established and functioning; it details:

- a framework for managing safeguards and verification activities that assure that CAPL complies with applicable legal and OEMS requirements
- a process to identify and resolve potential noncompliance

the minimum qualifications and organisational capability to execute this process. The *ABU OE Assurance Plan* (Ref. 45) is a multi-year plan that documents the CAPL ABU integrated assurance system and associated assurance activities (Figure 7-4). The *ABU OE Assurance Plan* is reviewed and approved annually and includes:

- a list of OE assurance priorities based on risk
- a schedule of assurance activities to evaluate safeguards and verifications (e.g., safeguard assurance workshops, audits, and assurance programs)

- reference to asset assurance plans that outline asset specific assurance activities and risk-based frequency (i.e., field inspection programs, audits, compliance reviews, performance reviews).

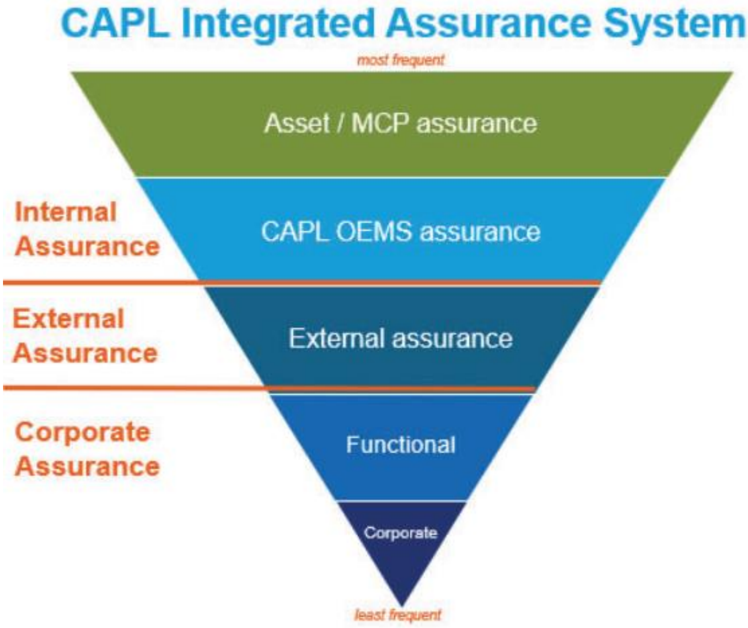


Figure 7-4: ABU integrated assurance system

To support the implementation of the *ABU OE Assurance Process*, CAPL have developed an ABU integrated assurance system (Figure 7-4), which integrates and leverages assurance activities across the various levels of CAPL business through to the corporate level—to provide confidence that safeguards are in place and functioning as intended. This integrated assurance system includes:

- asset / facility / function assurance: ongoing, routine, planned verifications of safeguards specific for the asset / facility (e.g., HSE inspections, audits, asset integrity inspections, preventive maintenance, emergency drills and exercises, compliance reviews, performance reviews)
- ABU OEMS assurance: implemented through the established system-based assurances within the OEMS and ABU OE processes (e.g., assessments, reviews, audits, inspections, workshops, engagements) that support the CAPL assets and major capital project assurance plans and identify and respond to the systemic deterioration of safeguards and progress areas for improvement
- external assurance: assurance activities undertaken by third-party entities (e.g., regulatory inspections, joint venture partner reviews)
- corporate and functional assurance: assurance activities of CAPL functional groups (e.g., drilling and completions, HSE, FE) and OEMS focus areas to address OEMS requirements, safeguards and areas for improvement.

The *Gorgon OE Assurance Plan* (Ref. 46) documents the specific assurance activities for this EP and is reviewed annually, however may be updated as required throughout the year based on asset / facility operational risk. Assurance activities are scheduled on a risk-based approach and conducted to verify the effectiveness of safeguards and verifications and the extent to which requirements are met by CAPL.

Assurance activities focus on in-field activities and administrative processes, depending on the activities being undertaken and assurance priorities (these priorities are based on risk) and provide sufficient demonstration that Environmental Performance Objectives and Environmental Performance Standards have been met and the activity implemented in accordance with this Implementation Strategy. A record of all assurance activities undertaken, and the outcomes, are maintained and actions are tracked until closure.

Field inspections are scheduled based on a risk-based assessment and conducted as documented in the asset assurance plan and may range from monthly, quarterly or six monthly depending on the risk assessment.

Field inspections undertaken by the asset / facility are scheduled based on a risk-based assessment and conducted as documented in the *Gorgon OE Assurance Plan* (Ref. 46). These are planned and may range from monthly, quarterly, six monthly or annual depending on the risk assessment and the type of assurance activity. Some inspections may be in response to a specific event such as cyclone or rainfall event. For example, a dangerous goods warehouse inspection may be assured monthly and a vegetation clearing permit audit may be assured quarterly.

Note that hydrocarbon system integrity inspections (as described in Section 3.5) also have a role in verifying environmental performance. The type and frequency of these inspections is documented in the *Gorgon and Jansz Subsea and Pipelines Inspection and Monitoring Plan (*IM Plan) (Ref. 160).

Environmental Performance Standards in the EP undergo an annual compliance review and evidence is gathered for each Environmental Performance Standard to support the annual environmental report. Assurance related to the Gorgon and Jansz Feed Gas Pipeline and well operations activities described in this EP will be summarised in the annual report submitted to NOPSEMA (Section 7.4.3).

7.3.6.1 Managing Instances of Potential Nonconformance

The reporting, investigation, and tracking of non-conformances are managed via Chevron’s OE Corporate Standard Incident Investigation (Ref. 47) and OE Data Reporting Standard (Ref. 201). These processes apply to instances where the requirements of this EP have not been met. This process is used if audit findings identify that activities in the scope of this EP are not being implemented in accordance with the risk and impact control measures identified in Section 6.

Audit findings and corrective actions are recorded and tracked in a CAPL compliance assurance database for timely closure of actions. Audit findings that identify a breach of an environmental performance outcome or environmental performance standard will be reported in accordance with Section 7.4.2.

Any suggested changes to activities or control measures arising from audit findings or instances of potential noncompliance will be subject to a MoC process in accordance with Section 7.3.2.2.

7.3.7 Incident investigation and reporting

Incident investigation and reporting (IIR) expectations are to identify, report, record and investigate incidents, analyse trends, correct deficiencies, and share and adopt relevant lessons learned.

The *Incident Investigation and Reporting (II&R) Execution Manual* (Ref. 48) defines the requirements to report, classify, record, and investigate incidents and near misses, including but not limited to injury, occupational illness, environmental impact, reliability, business disruption, and community concern.

The IIR process includes these requirements:

- training for employees and contractors to recognise and report events
- internal and external notification of events
- investigating incidents at the probable level of consequence, with the rigor of investigation based upon learning opportunity and incident severity
- allocating an incident management sponsor for selected investigations
- sharing alerts, lessons learned, and bulletins
- tracking recommended actions to closure
- analysing event trends.

Events that meet the required criteria are recorded in the CAPL incident management system (IMS). The system holds records of the associated investigation results. The lessons learned from selected investigations are shared to reduce the likelihood of future comparable events.

Specific incident reporting requirements for this EP are detailed in Section 7.4.2.

7.3.8 Emergency management

7.3.8.1 Emergency management arrangements

The emergency management arrangements outline a systematic approach for preventing, planning, responding to, and recovering from emergency events and are intended to provide a standardised corporate management and response structure that details emergency management documentation, Emergency Response Organisation (ERO), facilities and equipment, and training and exercises.

The ERO provides a standardised management and response structure for any emergency. Personnel filling roles within this structure may include full-time professionals, but most will be part-time volunteers drawn from across the workforce.

The system used to organise CAPL's emergency management teams (EMTs) is based on the Incident Command System and provides a standardised approach to the coordination of an emergency response across all hazards, including oil spill response. This program is compatible with the Australasian Inter-service Incident Management System (AIIMS), and the *National Plan for Maritime Environmental Emergencies* (National Plan; Ref. 52) and is consistent with the core aspects presented in the International Maritime Organisation (IMO) equivalent courses.

The ERO comprises the groups listed in Table 7-5; this table also describes the major functions of teams during an emergency.

Figure 7-5 to Figure 7-7 outline the organisational chart of the On-site Response Teams (ORTs) and EMTs. The Crisis Management Teams (CMTs), which focus on the business implications of incidents and events, are further described in the *ABU Crisis Management Plan* (Ref. 53).

As the incident escalates and the workload of each function increases, it may be necessary to delegate specific roles to additional people within each section. These roles may lead a team of people to fulfil the tasks under their control.

To establish emergency response arrangements that can be scaled up or down depending on the nature of the incident by integrating with other local, regional, national, and industry plans and resources, CAPL has adopted a tiered approach in its response system. This tiered-response model scales the number of resources mobilised for a response, and the emergency team activated, according to the severity of the incident. This approach is consistent with the *International Convention on Oil Pollution Preparedness, Response and Cooperation 1990*. The response tiers and resources that may be mobilised for an oil spill incident within CAPL are further described within the OPEP (Ref. 2).

Table 7-5: CAPL emergency management teams

Team	Description
Tier 1 (CAPL)	
On-site Response Teams (ORTs)	Trained responders at the installation who are responsible for on-scene tactical response operations during an incident. ORTs are led by an On-scene Commander (OC) who has incident control during smaller Level 1A incidents, which do not require further escalation to an incident management team. If the IEMT is activated, the OC will come under the direction of the Operations Section Chief (OSC).
Installation Emergency Management Team (IEMT)	The IEMT is led by an Incident Commander (IC) and operates out of an on-site emergency command centre. The IEMT may be activated to take control of Level 1B incidents and coordinate local resources and ORTs.
Perth Emergency Management Team (PEMT)	The PEMT is led by an IC and operates out of a Perth-based emergency command centre. The PEMT may be activated in a support role to assist IEMTs with the emergency response to major incidents that require coordination of further resources, personnel, and support. If required, incident control may also be transferred from the installation to the PEMT to manage the ongoing response (proactive phase) for long-duration, complex incidents such as a major oil spill. The PEMT stands up at the direction of the PEMT IC for Level 2 and 3 incidents.
CAPL Crisis Management Team (CMT)	Comprises senior CAPL executives and ensures emergency response and crisis management operations are carried out consistent with The Chevron Way, Chevron Corporation policies, and the tenets of OE. The CMT stands up at the direction of the CAPL Crisis Manager for Level 3 incidents.
Tier 2 (Regional Response)	
Chevron Corporation’s Asia–Pacific Regional Response Team	An enterprise-level team able to support CAPL during the initial response (reactive phase) to a significant incident and help manage the transition to the ongoing response (proactive phase).
Tier 3 (Global Response)	
Chevron Corporation’s Functional Response Teams	Enterprise-level teams with specific technical expertise in selected command staff positions and unit positions in the Planning, Logistics, and Finance sections. Team members are trained to support the management of global- and regional-level (Tier 2 and 3) incidents but are available to support any response.

Team	Description
Chevron Corporation's Worldwide Emergency Response Team	An enterprise-level team of Chevron Corporation's most highly trained and experienced personnel capable of filling IMS command and general staff roles of a response organisation, including Deputy IC. Team members are trained to support the management of global-level (Tier 3) incidents but are available to support any response.
Chevron Corporation's Advisory and Resource Team	An enterprise-level initial assessment and support team available to advise during the initial stages of a significant event, assess incident potential, and help the local response team marshal additional resources.

7.3.8.2 Emergency management process

The *Emergency Management OE Process* (Ref. 49) is CAPL's system for emergency management. The process ensures CAPL is prepared to respond immediately and effectively to all emergencies involving contractor- or CAPL-owned or -operated assets as defined in their scope of work.

The emergency management process (Ref. 49) comprises nine key elements.

- emergency scenarios, including worst case, have been identified; these scenarios are based on the findings from risk assessments of significant safety, health and environmental hazards and other sources (e.g., historical incidents)
- emergency response plans are developed and maintained to address emergency scenarios
- a reliability program is in place for inspection, testing and preventative maintenance of critical emergency response equipment and systems supporting emergency response plans
- an incident management system (IMS) is in place capable of immediately and effectively managing all emergencies
- a training and exercise program, including minimum training and exercise requirements, has been developed to establish and maintain emergency response capability
- crisis management plans have been developed to address a potential crisis or significant event
- business continuity plans have been developed in conformance with the Business Continuity Planning Corporate OE Process (Ref. 54).

The OPEP (Ref. 2) acts as an operational document to ensure an appropriate response to the emergency events described in this EP. Smaller spills will be monitored, evaluated, and cleaned up as part of routine duties, where relevant and appropriate to the nature and scale of the spill, and will not require activation of the ORT or OPEP. Several emergency management subprocesses are outlined below that are integral to emergency preparedness and management.

7.3.8.3 Chain of command (emergency response)

A well-delineated EMT chain of command has been established for emergency response (Figure 7-5 to Figure 7-7). As incidents grow in size or complexity, command may transfer several times. Within the response structure, command may transfer between On-scene Commanders (OC) at the tactical level. For a major incident, incident command may transfer to a designated Control Agency or to the Perth EMT, if required.

Although the identity of those filling command positions may change over the course of the incident, the continuity of responsibility and accountability will be maintained. Typically, specialists for particular response options will fulfil Task Leader positions in the ORT where they will be expected to oversee a team or particular response operations.

Throughout an incident, a formal handover will be conducted whenever any command or control position is transferred from one person to another.

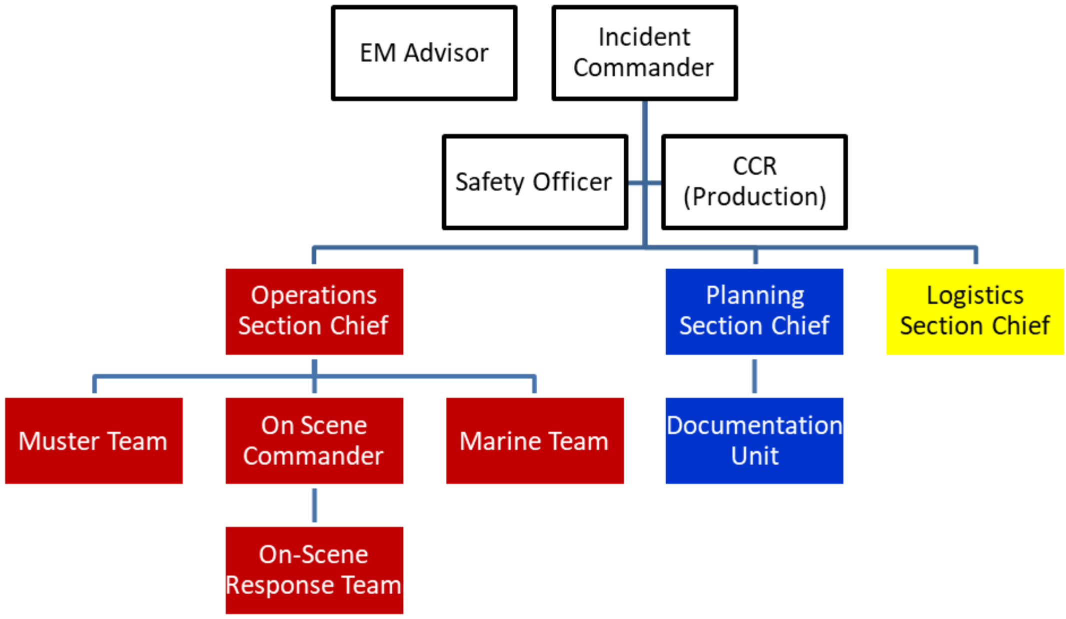


Figure 7-5: Basic installation EMT organisation chart

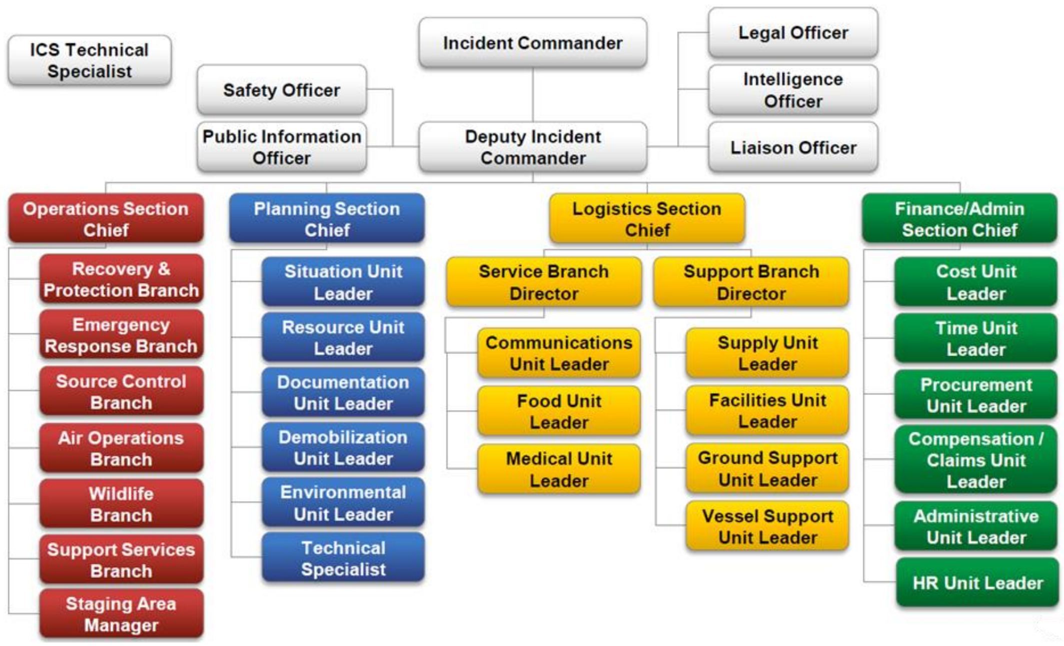


Figure 7-6: Expanded EMT organisation chart

Figure 7-7: Example expanded operations section organisation chart

7.3.8.4 Roles and responsibilities (emergency response)

Table 7-6 provides additional information about the structure of these teams and the key individual roles and responsibilities during emergency response.

Table 7-6: Key roles and responsibilities—emergency response

Role	Responsibilities
On-Site Response Team	
On-Scene Commander (OC) *(Vessel Master)*	• Safely and effectively organises and manages the ORT response operations • Keeps the EMT informed regarding the nature and status of the incident and on-site tactical response operations
Site Safety Officer	• Ensures that appropriate actions are taken to protect the safety and health of ORT response personnel
Task Leader	• Safely carries out their assignment consistent with directions received from the OC, branch director, division, or group supervisor
Emergency Management Team	
Incident Commander (IC)	• Manages the overall emergency response operations and ensures that they are carried out safely, effectively, and efficiently • Establishes direct line of communications with the OC • Mobilises the EMT and assigns additional support from other response teams (as appropriate to the incident) for Level 2 and 3 incidents that require support beyond the ORT
Operations Section Chief (OSC)	• Provides strategic direction and support to the OC and muster and/or shelter area managers • Receives information regarding the nature and status of the ORT and provides support for mustering and/or shelter-in-place operations • Disseminates information to the IC and other members of the EMT
Planning Section Chief	• Focuses on the incident's potential using the compilation and display of information regarding the nature and status of an incident and emergency response operations • Assists the IC in defining strategic objectives • Assists the IC in providing information to the Level 3 EMT • Compiles and retains documentation
Logistics Section Chief	• Obtains personnel, equipment, materials, and supplies needed to mount and sustain emergency response operations • Provides services necessary to ensure that emergency response operations are carried out safely and efficiently

7.3.8.5 Training and competency (emergency response)

Competencies and training requirements for the EMT, ORT, and other personnel during implementation of the OPEP (Ref. 2) are outlined in Table 7-7. Competency and training records for personnel, including contractors and subcontractors, are maintained.

Table 7-7: Competency and training requirements—emergency response

Role	Summary	Training Standard
Note: Personnel with no specialist emergency response duties should undergo training in line with their responsibilities as indicated below for 'All personnel'.		
All personnel	• Provide basic first response to an incident, including, but not limited to: conducting a quick assessment; making safe; notifying anyone else in danger; and raising the alarm • Complete basic procedures in response to an alarm and evacuate to a muster point (as necessary)	

Role	Summary	Training Standard
	• Frequency: every 3 years if not involved in response or drills/exercises	
In addition to the above, personnel responsible for roles with specialist oil spill response duties should undergo further training and practice in line with the responsibilities set out below. Training is provided to maintain the capability to respond to all hazards in line with the Incident Command System implemented by CAPL.		
Emergency Management Teams (EMTs)		
PEMT Incident Commander	• Selected Perth based personnel, would typically with a manager or senior manager role within CAPL • Competencies: overall management of emergency response operations and ensure operations are performed safely, effectively, and efficiently. Commands the EMT • Frequency: once a year (maintenance of competencies may be through response or training/drills/exercises)	• ICS-100 Introduction to the Incident Command System • ICS-200 Basic Incident Command System training • ICS-220 Initial Response Team • ICS-300 Intermediate Incident Command System Training (PEMT members only) • Oil Spill Awareness Training
PEMT Command and General Staff	• Selected Perth based personnel, typically a manager, or personnel with skills and knowledge appropriate to the function • Competencies: provides strategic direction, internal planning, logistics, and operational support. Operates from the emergency command centre and supports the IC who is responsible for the overall control of the incident • Frequency: once a year (maintenance of competencies may be through response or training/drills/exercises)	• ICS-100 Introduction to the Incident Command System • ICS-200 Basic Incident Command System training • ICS-220 Initial Response Team • ICS-300 Intermediate Incident Command System Training (PEMT members only) • Oil Spill Awareness Training

7.3.8.6 Oil spill exercise schedule

The CAPL *Oil Spill Response Multi-Year Exercise and Drill Schedule* (Ref. 55) describes the schedule of training and exercise required for all emergency events. The training and exercise program incorporates CAPL's oil spill exercise schedule for oil spill training, drills, and exercises. As CAPL'S response arrangements are common among its assets, and resource capabilities are shared, the testing and exercise schedule has been developed to test the various response options. The focus changes for each exercise to ensure any unique aspects of that location (e.g., resources at risk, first-strike equipment) are tested.

The objective is to test and maintain the capability to respond to emergency events. The exercises aim to test:

- notification, activation, and mobilisation of the ORT and EMT
- efficiency and effectiveness of equipment deployment
- efficiency and effectiveness of communication systems.

The testing schedule is a live document that is subject to change. The multi-year exercise schedule (Ref. 55) outlines the proposed testing arrangements to be completed, including the exercise types (Table 7-8) and proposed level of response to be tested (Table 7-9) that may be used to meet the defined objectives. A minimum of one test for each level will be conducted each year.

Table 7-8: Exercise types

Type	Details
Notification exercise	• Tests the procedures to notify and activate the EMTs, support organisations, and regulators
Tabletop exercise	• Normally involves interactive discussions of a simulated scenario amongst members of an EMT; personnel or equipment are not mobilised
Drill	• Conducts field activities such as equipment deployment, shoreline assessment, monitoring etc.
Functional exercise	• Activates at least one EMT to establish command, control, and coordination of a serious emergency event • Often more complex as it simulates several different aspects of an oil spill incident and may involve third parties.

Table 7-9: Exercise levels

Level	Details
Level 1 – ORT	• At least two ORT exercises held per year • May be held in conjunction with a Level 2 EMT exercise • Designed to evaluate the ability of ORTs to implement the Gorgon Emergency Management System as it applies to ORTs • ORTs are encouraged to conduct as many exercises as they want each year that do not include the ERT or a Level 2 EMT
Level 2 – EMT	• Exercises may include the participation of an ORT and may be held in conjunction with a Level 3 EMT exercise • Usual duration – one to two hours • Designed to evaluate a Level 2 EMT's ability to notify and activate team members, set up a Level 2 EMT emergency command centre, and implement the Gorgon Emergency Management System as it applies to Level 2 EMTs
Level 3 – EMT	• Each exercise may include the participation of a Level 2 EMT and/or ORT • Usual duration – three to six hours • Designed to evaluate the EMT's ability to notify and activate team members, transfer command to a Level 3 EMT Emergency Command Centre and implement the Gorgon Emergency Management System as it applies to incident escalation

The training and exercise program outlines the process for evaluating training, drills, and exercises against defined objectives, and incorporating lessons learned.

An after-action report is generated for all Level 2 (and above) exercises, which is used during spill exercises to assess the effectiveness of the exercise against its objectives and to record recommendations. Relevant actions are then assigned to the responsible party where they are tracked to completion using internal processes. Exercise planners will be required to refer to previous recommendations for continual review and improvement.

Response arrangements as detailed in the OPEP (Ref. 2) must be tested:

- when they are introduced
- when they are significantly amended
- not later than 12 months after the most recent test
- if a new location for the activity is added to this EP after the response arrangements have been tested, and before the next test is conducted: test the response arrangements in relation to the new location as soon as practicable after it is added to this EP

7.4 Environmental monitoring and reporting

7.4.1 Environmental monitoring

Regulation 14(7) of OPGGS(E)R requires that the implementation strategy provides for sufficient monitoring of, and maintaining a quantitative record of, emissions and discharges such that this record can be used to assess whether the environmental performance outcomes and standards in the EP are being met.

CAPL and vessel contractors will monitor and record emissions and discharges as detailed in Section 6 to ensure that that this record can be used to assess whether the environmental performance outcomes and standards in this EP are being met.

If an emergency condition resulting in a Level 2 or 3 spill event occurs, CAPL will implement the OSMP (Ref. 3), which is identified as a control measure in Section 6.13 and 6.14. The OSMP describes a program of monitoring, and is the principal tool for determining the extent, severity, and persistence of environmental impacts from an emergency condition and the emergency response activities to be undertaken by CAPL.

7.4.2 Incident reporting

Environmental incidents will be reported by CAPL in accordance with Table 7-10.

Table 7-10: Incident reporting

<table>
<tr><th colspan="2">Recordable Incident reporting – Regulation 26B</th></tr>
<tr><td colspan="2">Legislative definition of ‘recordable incident’:
‘Recordable incident, for an activity, means a breach of an environmental performance objective or environmental performance standard, in the environment plan that applies to the activity, that is not a reportable incident’
Recordable incidents are breaches of the environmental performance outcomes and standards described in Section 5.7.</td></tr>
<tr><td>Reporting requirements</td><td>Report to / Timing</td></tr>
<tr><td>Written notification to NOPSEMA by the 15th of each month</td><td>Submit written report to NOPSEMA by the 15th of each month</td></tr>
</table>

<table>
<tr><td>As a minimum, the written incident report must describe:
• the incidents and all material facts and circumstances concerning the incidents
• any actions taken to avoid or mitigate any adverse environmental impacts
• any corrective actions already taken, or that may be taken, to prevent a repeat of similar incidents.
If no recordable incidents occur during the reporting month, a 'nil report' will be submitted.</td><td></td></tr>
<tr><th colspan="2">Reportable Incident reporting – Regulations 26, 26A, and 26AA</th></tr>
<tr><td colspan="2">Legislative definition of 'reportable incident':
'Reportable incident, for an activity means an incident relating to an activity that has caused, or has the potential to cause an adverse environmental impact; and under the environmental risk assessment process the environmental impact is categorised as moderate or more serious than moderate.'
Therefore, reportable incidents under this EP are those events (not planned activities) that have a moderate or greater consequence (or risk) level. In accordance with this definition, the reportable incidents identified under this EP are:
• Introduction of an IMP (Section 6.8)
• Vessel collision emergency condition (Section 6.13)
• Major defect emergency condition (Section 6.14).</td></tr>
<tr><th>Reporting requirements</th><th>Report to</th></tr>
<tr><td>Verbal or written notification must be undertaken within two hours of the incident or as soon as practicable. This information is required:
• the incident and all material facts and circumstances known at the time
• any actions taken to avoid or mitigate any adverse environmental impacts.</td><td>Report verbally to NOPSEMA within two hours or as soon as practicable and provide written record of notification by email.
Phone: (08) 6461 7090
Email: submissions@nopsema.gov.au</td></tr>
<tr><td>Verbal notifications must be followed by a written report as soon as practicable, and not later than three days following the incident.
At a minimum, the written incident report will include:
• the incident and all material facts and circumstances
• actions taken to avoid or mitigate any adverse environmental impacts
• any corrective actions already taken, or that may be taken, to prevent a recurrence.
If the initial notification of the reportable incident was verbal, this information must be included in the written report.</td><td>Written report to be provided to:
• NOPSEMA: submissions@nopsema.gov.au
• National Offshore Petroleum Titles Authority: info@nopta.gov.au
• WA DMIRS: petroleum.environment@dmp.wa.gov.au</td></tr>
</table>

Additional Reporting Requirements	
Reporting requirements	**Report to**
An oil/gas pollution incident that occurs within a marine park or is likely to impact on a marine park. The notification should include: • titleholder details • time and location of the incident (including name of marine park likely to be affected) • proposed response arrangements as per the OPEP (e.g. dispersant, containment, etc.) • confirmation of providing access to relevant monitoring and evaluation reports when available • contact details for the response coordinator.	DNP (24-hour) Marine Compliance Duty Officer Phone: 0419 293 465.
Death or injury to individual(s) from an EPBC Act Listed Species as a result of the petroleum activities	Report injury to or mortality of EPBC Act Listed Threatened or Migratory species within seven business days of observation to DAWE or equivalent: • Phone: +61 2 6274 1111 • Email: EPBC.Permits@environment.gov.au
Vessel collision with marine mammals (whales)	Reported as soon as practicable. https://data.marinemammals.gov.au/report/shipstrike
Presence of any suspected IMP or disease within 24 hours	DPIRD: • Email: biosecurity@fish.wa.gov.au • Phone: FishWatch 24-hour hotline: 1800 815 507

7.4.3 Routine environmental reporting

Regulation 26C of the OPGGS(E)R requires environmental performance reporting for the activity described in this EP, as summarised in Table 7-11. Routine notifications required by Regulations 29 and 30 of the OPGGS(E)R and also included in Table 7-11.

Table 7-11: Routine external reporting requirements

Reporting requirement	Description	Reporting to	Timing
Environmental performance reporting (annual)	A report detailing environmental performance of the activity detailed in this EP	NOPSEMA submissions@nopsema.gov.au Phone: +61 8 6461 7090	Annually from commencement of activities
Notification of start of activity	CAPL must complete Form FM1405 and submit to NOPSEMA at least 10 days before activity commencement	NOPSEMA submissions@nopsema.gov.au or: https://securefile.nopsema.gov.au/filedrop/submissions	Once prior to activity commencement

Reporting requirement	Description	Reporting to	Timing
End of EP notification	CAPL must complete Form FM1405 and submit to NOPSEMA within 10 days of activity completion	NOPSEMA submissions@nopsema.gov.au or: https://securefile.nopsema.gov.au/filedrop/submissions	Once following completion of activity

7.5 Environment Plan review

As required under Regulation 19 of the OPGGS(E)R, CAPL will submit a proposed revision of this EP to NOPSEMA at least 14 days before the end of the five-year period since the EP was last accepted.

An additional review of the EP will be undertaken following:

- an emergency event
- the identification of additional response strategies to emergency events
- the identification of deficiencies within the EP or OPEP following the review of emergency response exercises or other activities.

CAPL is committed to continual improvement and adaptive management processes, and in recognition of the changing regulatory and scientific information related to GHG and carbon management, will annually review Australian regulatory and/or relevant international guidelines or standards, including:

- the periodic release of the Chevron's *Climate Change Resilience* report which considers corporate climate risk management with regard to established, contemporary climate science and/or carbon management guidance from intergovernmental bodies (e.g., UN IPCC, IEA)
- the release of new/revised policies or guidance from the Australian government
- the release of new/revised applicable guidelines or standards from international bodies (e.g., IMO) that have been adopted by the relevant authority (e.g., AMSA)
- the release of revised GHGAP for the Gorgon Gas Development
- the outcomes of CAPL emission reduction reviews and Chevron Corporate governance processes specific to the Gorgon Gas Development.

Where these annual reviews result in the identification of additional and/or revised control measures to ensure environmental impacts and risks are managed to ALARP, a review of this EP will be undertaken.

Additional revisions and/or resubmission of this EP to NOPSEMA, in accordance with Regulation 17 of the OPGGS(E), will be undertaken in accordance with the OEMS, and particularly the MoC process (Section 7.3.2.2).

8 acronyms and abbreviations

Table 8-1 defines the acronyms and abbreviations used in this document.

Table 8-1: Acronyms and abbreviations

Acronym or abbreviation	Definition
ABU	Australian Business Unit
AFMA	Australian Fisheries Management Authority
AHO	Australian Hydrographic Office
AIIMS	Australasian Inter-service Incident Management System
AIS	Automated identification system
ALARP	As low as reasonably practicable
AMSA	Australian Maritime Safety Authority
AMP	Australian Marine Park
API	American petroleum index
APPEA	Australian Petroleum Production and Exploration Association
AR5	Fifth Assessment Report (AR5) of the United Nations Intergovernmental Panel on Climate Change (IPCC)
AR6	Sixth Assessment Report (AR6) of the United Nations Intergovernmental Panel on Climate Change (IPCC)
ASOG	Activity-specific operational guideline
AUV	Autonomous underwater vehicle
bar	Metric unit of atmospheric pressure
BIAs	Biologically important areas
CAPL	Chevron Australia Pty Ltd
CDU	Central Distribution Unit
CEFAS	Centre for Environment, Fisheries and Aquaculture Science
CHARM	Chemical Hazard Assessment and Risk Management
CMMS	Computerised Maintenance Management System
CMT	Crisis Management Team
COVID	Coronavirus disease
CRA	Corrosion-resistant alloy
DAWE	Commonwealth Department of Agriculture, Water and the Environment
DC	Drill Centre
DoT	Western Australian Department of Transport
DP	Dynamic positioning
DPIRD	Western Australian Department of Primary Industries and Regional Development
EEA	Environmental exposure area
EHU	Electrohydraulic umbilical

Acronym or abbreviation	Definition
EIS	Environmental Impact Statement
EMBA	Environment that may be affected
EMT	Emergency Management Team
EOFL	End of facility life
EP	Environment Plan
EP Act	Western Australian *Environmental Protection Act 1986*
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
EPRS	Emergency pipeline repair system
ERMP	Environmental Review and Management Programme
ESD	Ecologically sustainable development
FE	Facilities Engineering
Feed Gas Pipeline	Pipeline system from the offshore gas wells to the Gas Treatment Plant
FIRM	Facilities Integrity and Reliability Management
FMT	Flow Management Tool
g/m2	Grams per square metre
GFP	Gorgon Foundation Project
GHG	Greenhouse gas
GHGAP	Greenhouse Gas Abatement Plan
GS2	Gorgon Stage 2
GTP	Gas Treatment Plant
GWP	Global warming potential
HB	Handbook
HSE	Health, safety, and environment
HFO	Heavy fuel oil
HIRA	Hazard Identification and Risk Assessment
IAPP	International Air Pollution Prevention
IC	Incident Commander
IEE	International energy efficiency
IEMT	Installation Emergency Management Team
IIR	Incident investigation and reporting
IMO	International Maritime Organisation
IMR	Inspection, maintenance, and repair
IMC	Incident management system
IOPP	International Oil Pollution Prevention
IPCC	Intergovernmental Panel on Climate Change

Acronym or abbreviation	Definition
ISO	International Organization for Standardisation
ITOPF	International Tanker Owners Pollution Federation Limited
JRCC	Joint Resource Coordination Centre
KEF	Key ecological feature
km	Kilometre
LC50	Lethal Concentration with the potential to result in a 50% mortality of a sample population
LOC	Loss of containment
LNG	Liquefied Natural Gas
m	Metre
MAOP	Maximum allowable operating pressure
MARPOL	The International Convention for the Prevention of Pollution From Ships, 1973 as modified by the Protocol of 1978; also known as MARPOL 73/78.
MARS	Maritime Arrivals Reporting System
MBES	Multibeam echo sounder
MDO	Marine Diesel Oil
MEG	Monoethylene glycol
MGO	Marine Gas Oil
MES	Monitoring, evaluation, and surveillance
MNES	Matters of national environmental significance
MoC	Management of change
MODU	Mobile offshore drilling unit
MSC	Management System Cycle
MSRE	Marine Safety Reliability and Efficiency
MSW	Managing Safe Work
N/A	Not Applicable
NEBA	Net Environmental Benefit Analysis
NEPM	National Environmental Protection Measure
NGER Act	Commonwealth *National Greenhouse and Energy Reporting Act 2007*
NMFS	National Marine Fisheries Service
NO_2	Nitrogen dioxide
NO_x	Nitrous oxides
NOPSEMA	National Offshore Petroleum Safety and Environment Management Authority
NOPTA	National Offshore Petroleum Titles Administrator
NWS	North West Shelf (of Western Australia)
OA	Operational area

Acronym or abbreviation	Definition
OC	On-Scene Commander
OCNS	Offshore Chemical Notification Scheme
OSC	Operations Section Chief
OE	Operational Excellence
OEMS	Operational Excellence Management System
OPEP	Oil Pollution Emergency Plan
OPGGS Act	Commonwealth *Offshore Petroleum and Greenhouse Gas Storage Act 2006*
OPGGS(E)R	Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
ORT	On-site Response Team
OSMP	Operational and Scientific Monitoring Plan
OWR	Oiled wildlife response
PAH	Polycyclic aromatic hydrocarbon
PCPT	Piezocone penetration test
PEMT	Perth Emergency Management Team
PFA	Pipeline flange adaptor
ppb	Parts per billion
ppm	Parts per million
PPP	Protection Prioritisation Process
PTS	Pipeline termination structure
PTS	Permanent threshold shift
PTW	Permit to Work
Q2	Quarter 2 (April to June)
ROV	Remotely operated vehicle
SDG	Sustainable Development Goal
SEEMP	Ship Energy Efficiency Management Plan
SEL	Sound exposure level
SERIP	Surface Equipment Reliability and Integrity Process
SHC	Shoreline Clean-up
SIMAP	Spill Impact Mapping and Analysis Program
SIMOPS	Simultaneous operations
SME	Subject matter expert
SOPEP	Ship Oil Pollution Emergency Plan
SO_2	Sulfur oxides
SPD	Shoreline protection and deflection
SPL	Sound pressure level

Acronym or abbreviation	Definition
SSS	Side scan sonar
TEC	Threatened ecological community
TRG	Tactical response guide
TTS	Temporary threshold shift
UK	United Kingdom
WA	Western Australia
WAFIC	Western Australian Fisheries Industry Council
WOMP	Well operations management plan

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The following documentation is either directly referenced in this document or is a recommended source of background information.

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appendix a operational excellence—policy 530

policy 530

operational excellence: achieving world-class performance

It is the policy of Chevron Corporation to protect the safety and health of people and the environment, and to conduct our operations reliably and efficiently. The Operational Excellence Management System (OEMS) is the way Chevron systematically manages workforce safety and health, process safety, reliability and integrity, environment, efficiency, security, and stakeholder engagement and issues. OEMS puts into action our Chevron Way value of Protecting People and the Environment, which places the highest priority on the safety and health of our workforce and the protection of communities, the environment and our assets. Compliance with the law is a foundation for the OEMS.

Our OEMS is a risk-based system used to understand and mitigate risks and maintain and assure safeguards. OEMS consists of three parts:

leadership and OE culture

Leadership is the largest single factor for success in OE. Leaders are accountable not only for achieving results, but achieving them in the right way. Leaders must demonstrate consistent and rigorous application of OE to drive performance and meet OE objectives.

focus areas and OE expectations

Chevron manages risks to our employees, contractors, the communities where we operate, the environment and our assets through focus areas and OE expectations that guide the design, management and assurance of safeguards.

management system cycle

Chevron takes a systematic approach to set and align objectives; identify, prioritize and close gaps; strengthen safeguards and improve OE results.

We will assess and take steps to manage OE risks within the following framework of focus areas and OE expectations:

Workforce Safety and Health: We provide a safe and healthy workplace for our employees and contractors. Our highest priorities are to eliminate fatalities and prevent serious injuries and illnesses.

Process Safety, Reliability and Integrity: We manage the integrity of operating systems through design principles and engineering and operating practices to prevent and mitigate process safety incidents. We execute reliability programs so that equipment, components and systems perform their required functions across the full asset lifecycle.

Environment: We protect the environment through responsible design, development, operations and asset retirement.

Efficiency: We use energy and resources efficiently to continually improve and drive value.

Security: We protect personnel, facilities, information, systems, business operations and our reputation. We proactively identify security risks, develop personnel and sustainable programs to mitigate those risks, and continually evaluate the effectiveness of these efforts.

Stakeholders: We engage stakeholders to foster trust, build relationships, and promote two-way dialogue to manage potential impacts and create business opportunities. We work with our stakeholders in a socially responsible and ethical manner, consistent with our respect for human rights, to create a safer, more inclusive business environment. We also work with our partners to responsibly manage Chevron's non-operated joint venture partnerships and third-party aviation and marine activities.

There are specific OE expectations which need to be met under each focus area. Additional expectations apply to all focus areas and address legal, regulatory and OE compliance; risk management; assurance; competency; learning; human performance; technology; product stewardship; contractor OE management; incident investigation and reporting; and emergency management.

Through disciplined application of the OEMS, we integrate OE processes, standards, procedures and behaviours into our daily operations. While leaders are responsible for managing the OEMS and enabling OE performance, every individual in Chevron's workforce is accountable for complying with the principles of 'Do it safely or not at all' and 'There is always time to do it right'.

Line management has the primary responsibility for complying with this policy and applicable legal requirements within their respective functions and authority limits. Line management will communicate this policy to their respective employees and will establish policies, processes, programs and standards consistent with expectations of the OEMS.

Employees are responsible for understanding the risks that they manage and the safeguards that need to be in place to mitigate those risks. Employees are responsible for taking action consistent with all Company policies, and laws applicable to their assigned duties and responsibilities. Accordingly, employees who are unsure of the legal or regulatory implications of their actions are responsible for seeking management or supervisory guidance.

M Hatfield

Mark Hatfield
Managing Director, Australasia Business Unit

the human Chevron energy company™

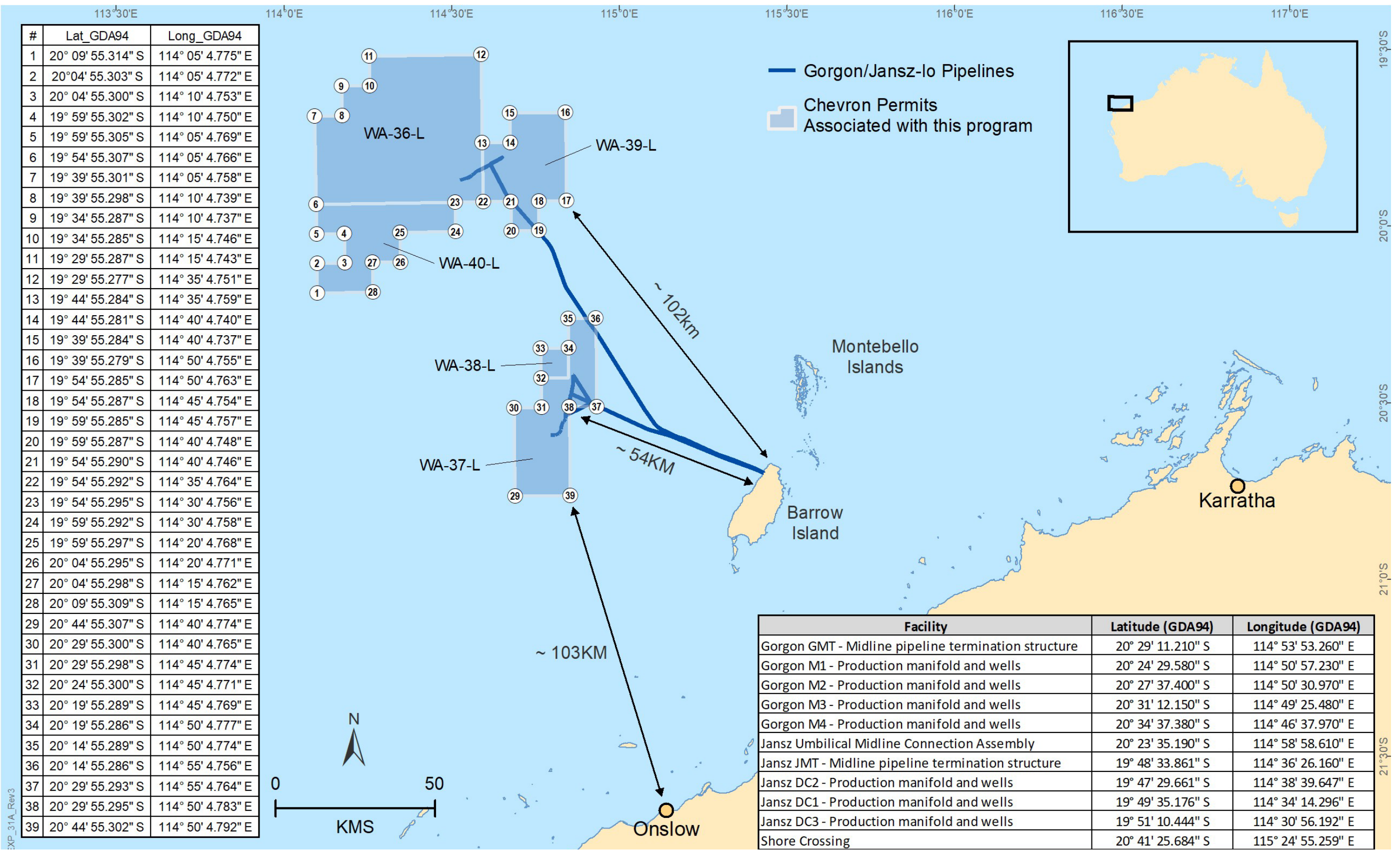
appendix b stakeholder engagement—fact sheets

the human energy company™ Chevron

gorgon and jansz feed gas pipeline and well operations

environment plan consultation

March 2021



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18	19° 54' 55.287" S	114° 45' 4.754" E
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23	19° 54' 55.295" S	114° 30' 4.756" E
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Facility	Latitude (GDA94)	Longitude (GDA94)
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Jansz Umbilical Midline Connection Assembly	20° 23' 35.190" S	114° 58' 58.610" E
Jansz JMT - Midline pipeline termination structure	19° 48' 33.861" S	114° 36' 26.160" E
Jansz DC2 - Production manifold and wells	19° 47' 29.661" S	114° 38' 39.647" E
Jansz DC1 - Production manifold and wells	19° 49' 35.176" S	114° 34' 14.296" E
Jansz DC3 - Production manifold and wells	19° 51' 10.444" S	114° 30' 56.192" E
Shore Crossing	20° 41' 25.684" S	115° 24' 55.259" E

overview

The Chevron Australia-operated Gorgon Project includes offshore production wells and subsea infrastructure associated with the Gorgon and Jansz–Io gas fields.

The Gorgon gas field is located within production licences WA-37-L and WA-38-L, and the Jansz-Io gas field is located within production licences WA-36-L, WA-39-L and WA-40-L.

Initial field development comprised of wells and subsea infrastructure, including feed gas pipelines, associated with the Gorgon Foundation Project.

This development is now being supplemented by the Gorgon Stage 2 Project, which comprises additional wells and subsea infrastructure within the Gorgon and Jansz-Io gas fields. The Gorgon Stage 2 Project was always envisaged as part of the original field development plans for the Gorgon Project.

Gas and fluids (hydrocarbons) from the offshore wells are transported by subsea gathering systems (flowlines and the feed gas pipelines) to the Gorgon Gas Treatment Plant on Barrow Island, where it is processed.

location and water depths

The subsea gathering system delivers hydrocarbons from the wells through the flowlines. Ocean depths in the hydrocarbon gathering area range from approximately 200 to 1300 metres.

The locations and depths of the manifolds and associated wells are provided below:

Infrastructure	Latitude South	Longitude East	Depth (m)
Gorgon GMT – Midline pipeline termination structure	20° 29' 11.21"	114° 53' 53.26"	130
Gorgon M1 – Production manifold and wells	20° 24' 29.58"	114° 50' 57.23"	215
Gorgon M2 – Production manifold and wells	20° 27' 37.40"	114° 50' 30.97"	200
Gorgon M3 – Production manifold and wells	20° 31' 12.15"	114° 49' 25.48"	200
Gorgon M4 – Production manifold and wells	20° 34' 37.38"	114° 46' 37.97"	250
Jansz Umbilical Midline Connection Assembly	20° 23' 35.19"	114° 58' 58.61"	107
Jansz Drill Centre 1 and wells	19° 49' 35.18"	114° 34' 14.30"	1338
Jansz Drill Centre 2 and wells	19° 47' 29.66"	114° 38' 39.65"	1349
Jansz Drill Centre 3 and wells	19° 51' 10.44"	114° 30' 56.19"	1315

The Gorgon feed gas pipeline runs for approximately 65 kilometres between the Gorgon gas field to the shore crossing at North Whites Beach on Barrow Island. The Jansz feed gas pipeline runs for approximately 134 kilometres between the Jansz–Io gas field to the same shore crossing at North Whites Beach on Barrow Island.

The feed gas pipelines are located predominately in Commonwealth waters. Water depth varies from approximately 50 metres (near the State waters maritime boundary) to 200 metres (within the Gorgon gas field) and 1300 metres (within the Jansz-Io gas field).

There are no exclusion zones over the subsea gas pipelines, Chevron Australia asks stakeholders to exercise due caution when fishing over these areas.

exclusion zones

The Gorgon GMT – Midline pipeline termination structure, Gorgon M1 – Production manifold and wells, Gorgon M2 – Production manifold and wells and Gorgon M3 – Production manifold and wells and Jansz Umbilical Midline Connection Assembly are subject to pre-existing site specific 500 metre radius petroleum safety exclusion zone (PSZ).

A new site specific 500 metre radius PSZ will be sought for the Gorgon M4 – Production manifold and wells.

environment plan approvals

installation approvals

Primary environment approval for installation of infrastructure for the Gorgon Project was received in 2009.

In 2019, NOPSEMA approved the installation of Gorgon Stage 2 infrastructure, and construction commenced in 2020.

operations approvals

In August 2016, the original *Gorgon and Jansz Feed Gas Pipeline and Wells Operations (Commonwealth Waters) Environment Plan* was approved by NOPSEMA.

In accordance with the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009, an Environment Plan is subject to a five-yearly review and resubmission to NOPSEMA.

Consequently, the *Gorgon and Jansz Feed Gas Pipeline and Wells Operations (Commonwealth Waters) Environment Plan* is being updated to reflect contemporary regulatory guidance, along with any learnings and risk reduction controls gained during the previous five years of operation.

In addition, start-up and operation of the wells and subsea infrastructure from the Gorgon Stage 2 Project have been included in the revised Environment Plan.

The Environment Plan describes the environment in which the petroleum activity takes place, provides an assessment of the impacts and risks arising from the activity, and identifies the control measures to manage the potential impacts and risks to levels that are acceptable and as low as reasonably practicable.

The Environment Plan is also required to outline how Chevron Australia has engaged with key stakeholders whose interests, functions, and activities may be affected. The Environment Plan must include how stakeholder feedback has been considered and addressed.

implications for stakeholders

The potential impacts and risks to the marine environment and key stakeholders, along with a list of the control measures currently being implemented are summarised in Table 1. No additional aspects have been identified in the revised Environment Plan as a result of the five-yearly review or the inclusion of the Gorgon Stage 2 Project.

Further details will be provided in the Environment Plan and will incorporate feedback received from stakeholders during this consultation process.

Table 1: Summary of relevant aspects and proposed controls

Aspect	Proposed Control
Physical Presence	• Relevant stakeholders will be advised of the commencement of key phases of activities and any relevant exclusion zone information. • Vessels will meet the crew competency, navigation equipment, and radar requirements as per the Chevron Australia's Marine, Safety Reliability and Efficiency process. • Vessels will implement caution and no approach zones in accordance with Australian National Guidelines for Whale and Dolphin Watching 2017.
Planned Discharges	• Oily bilge water is stored / retained on board for controlled disposal or discharged in accordance with MARPOL 73/78, Annex I • Offshore discharge of sewage from vessels in accordance with MARPOL Annex IV • Food waste discharged in accordance with MARPOL, Annex V, or taken to shore for disposal • Chevron Australia's Marine, Safety Reliability and Efficiency process for vessel inspections implemented
Air Emissions	• Vessels will hold a valid International Air Pollution Prevention certificate and a current international energy efficiency certificate. • All vessels (as appropriate to vessel class) will have a Ship Energy Efficiency Management Plan as per MARPOL 73/78 Annex VI. • Chevron Australia's Marine, Safety Reliability and Efficiency process for vessel inspections implemented
Introduced Marine Pests	• Chevron Australia's Quarantine Procedure – Marine Vessels is implemented • Maritime Arrivals Reporting System - Vessels coming from overseas will have Commonwealth Department of Agriculture, Water and the Environment clearance • In accordance with Australian Ballast Water Requirements, vessels coming from overseas will not discharge high-risk ballast water inside Australia's territorial sea (the area within 12 nautical miles of the Australian coastal baseline) • Marine vessels are to maintain an up-to-date international antifouling coating certification • Biofouling management plan, record book and risk assessment implemented
Vessel Spills	• Chevron Australia's Marine, Safety Reliability and Efficiency process implemented • Operational and scientific monitoring undertaken in accordance with the Operational and Scientific Monitoring Plan in the event of a spill

Aspect	Proposed Control
	• Spill response implemented in accordance with the response arrangements and strategies detailed in the Oil Pollution Emergency Plan
Infrastructure Spills	• Hydrocarbon system commissioned and tested according to industry standards (completed in the construction and commissioning phase) • A Flow Management Tool will be in place, functional, and maintained to identify potential leaks along the main production flowlines • Inspection Maintenance and Repair program implemented • Operational and scientific monitoring undertaken in accordance with the Operational and Scientific Monitoring Plan • Source control procedures developed and (the isolation steps) implemented • Spill response implemented in accordance with the response arrangements and strategies detailed in the Oil Pollution Emergency Plan
Waste	• Garbage managed in accordance with MARPOL 73/78, Annex V.

providing feedback

Feedback from stakeholders on potential or perceived impacts associated with Chevron Australia's activities will be carefully considered and assessed.

Please note that stakeholder feedback and Chevron Australia's response will be included in the Environment Plan.

If feedback is identified as sensitive by a stakeholder, Chevron Australia will make this known to NOPSEMA for the information to remain confidential.

Feedback can be directed to:

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Partnerships Advisor
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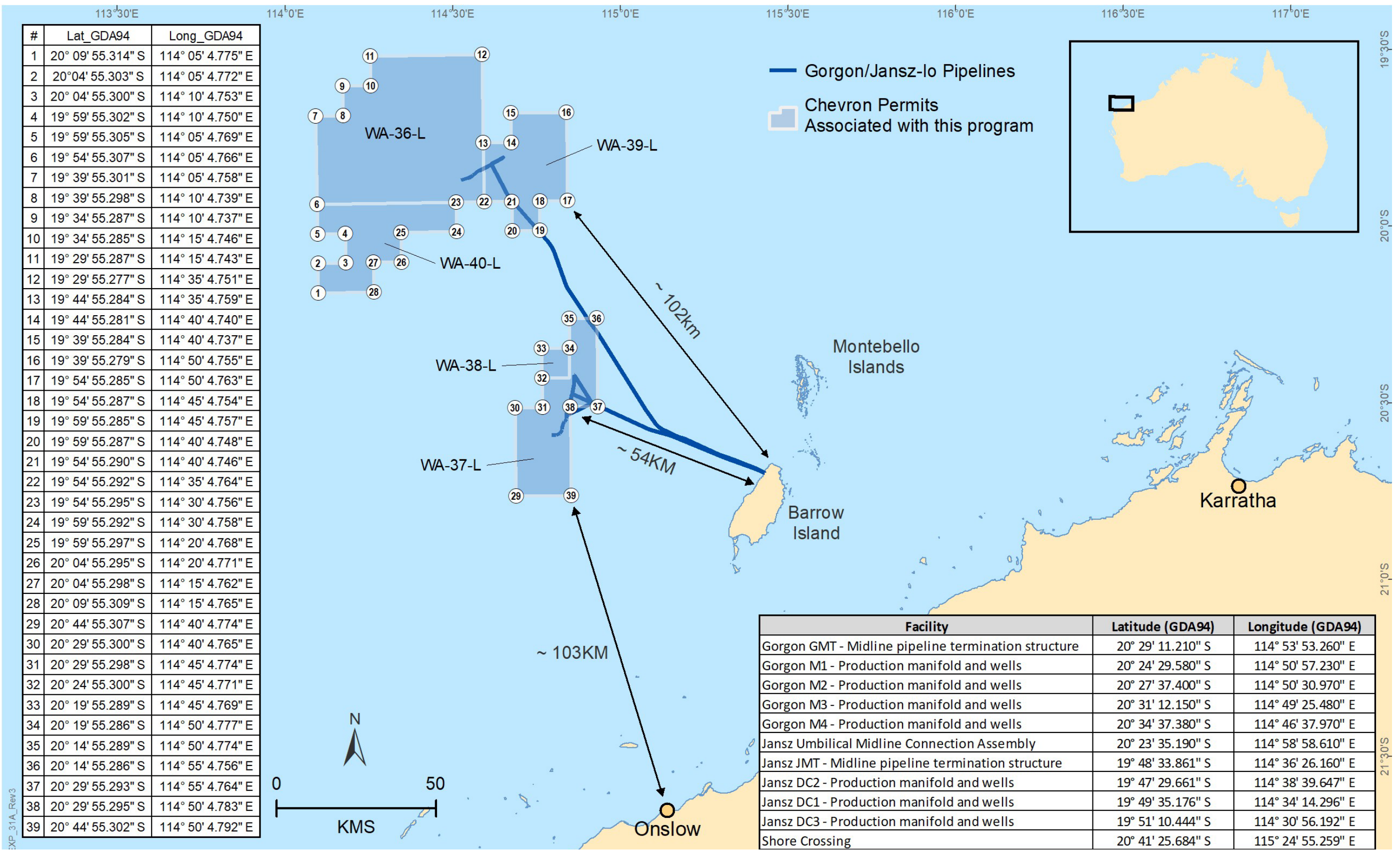
gorgon and jansz feed gas pipeline and well operations

environment plan commercial fishing consultation

March 2021



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The Environment Plan is also required to outline how Chevron Australia has engaged with the commercial fishing sector as key relevant stakeholders, whose interests, functions, and activities may be affected. The Environment Plan must include how commercial fisher feedback has been considered and addressed.

commercial fishing

Chevron Australia recognises the commercial fishing sector is an important and relevant stakeholder group whose members may have interests, functions, and activities that could be affected by the activities associated with this activity.

Chevron Australia is committed to engaging and working proactively with the commercial fishing sector, with information included in this fact sheet developed with advice from the Western Australia Fishing Industry Council.

On-the-water communications and cooperation between Chevron staff, contractors and sub-contractors and the commercial fishing sector is a Chevron Australia priority.

Chevron staff, contractors and sub-contractors will be made aware of the potential to engage with active commercial fishers, and where possible, support vessels will steer clear of commercial fishing activities and fish aggregations in the vicinity of active commercial fishing vessels.

Support vessel personnel will be prohibited from any recreational fishing activities.

implications for stakeholders

The potential impacts and risks to the marine environment and the commercial fishing sector, along with a list of the control measures currently being implemented are summarised in Table 1. No additional aspects have been identified in the revised Environment Plan as a result of the five-yearly review or the inclusion of the Gorgon Stage 2 Project.

Further details will be provided in the Environment Plan and will incorporate feedback received from commercial fishers during this consultation process.

Table 1: Summary of relevant aspects and proposed controls

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Physical Presence	• Relevant commercial fishers will be advised of the commencement of key phases of activities and any relevant exclusion zone information. • Vessels will meet the crew competency, navigation equipment, and radar requirements as per the Chevron Australia's Marine, Safety Reliability and Efficiency process. • Vessels will implement caution and no approach zones in accordance with Australian National Guidelines for Whale and Dolphin Watching 2017.
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Air Emissions	• Vessels will hold a valid International Air Pollution Prevention certificate and a current international energy efficiency certificate.

Aspect	Proposed Control
	• All vessels (as appropriate to vessel class) will have a Ship Energy Efficiency Management Plan as per MARPOL 73/78 Annex VI. • Chevron Australia's Marine, Safety Reliability and Efficiency process for vessel inspections implemented
Introduced Marine Pests	• Chevron Australia's Quarantine Procedure – Marine Vessels is implemented • Maritime Arrivals Reporting System - Vessels coming from overseas will have Commonwealth Department of Agriculture, Water and the Environment clearance • In accordance with Australian Ballast Water Requirements, vessels coming from overseas will not discharge high-risk ballast water inside Australia's territorial sea (the area within 12 nautical miles of the Australian coastal baseline) • Marine vessels are to maintain an up-to-date international antifouling coating certification • Biofouling management plan, record book and risk assessment implemented
Vessel Spills	• Chevron Australia's Marine, Safety Reliability and Efficiency process implemented • Operational and scientific monitoring undertaken in accordance with the Operational and Scientific Monitoring Plan in the event of a spill • Spill response implemented in accordance with the response arrangements and strategies detailed in the Oil Pollution Emergency Plan
Infrastructure Spills	• Hydrocarbon system commissioned and tested according to industry standards (completed in the construction and commissioning phase) • A Flow Management Tool will be in place, functional, and maintained to identify potential leaks along the main production flowlines • Inspection Maintenance and Repair program implemented • Operational and scientific monitoring undertaken in accordance with the Operational and Scientific Monitoring Plan • Source control procedures developed and (the isolation steps) implemented • Spill response implemented in accordance with the response arrangements and strategies detailed in the Oil Pollution Emergency Plan
Waste	• Garbage managed in accordance with MARPOL 73/78, Annex V.

providing feedback

Feedback from the commercial fishing sector on potential or perceived impacts associated with Chevron Australia's activities will be carefully considered and assessed.

Please note that stakeholder feedback and Chevron Australia's response will be included in the Environment Plan.

If feedback is identified as sensitive by a stakeholder, Chevron Australia will make this known to NOPSEMA for the information to remain confidential.

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appendix c subsea inventory summary

The following table provides the status of subsea infrastructure associated with the Gorgon Gas Development (current as of November 2021).

Item	Petroleum title	Status	IM Plan	EP reference
Wells				
Gorgon field				
GOR-1A	WA-37-L	Operational	In place	Section 3.2.2
GOR-1B	WA-37-L	Operational	In place	Section 3.2.2
GOR-1C	WA-37-L	Operational	In place	Section 3.2.2
GOR-1D	WA-37-L	Operational	In place	Section 3.2.2
GOR-1E	WA-37-L	Operational	In place	Section 3.2.2
GOR-1F	WA-37-L	Operational	In place	Section 3.2.2
GOR-1G	WA-37-L	Operational	In place	Section 3.2.2
GOR-2B	WA-37-L	Operational	In place	Section 3.2.2
GOR-2C	WA-37-L	Operational	In place	Section 3.2.2
GOR-3B	WA-37-L	Operational	In place	Section 3.2.2
GOR-3C	WA-37-L	Operational	In place	Section 3.2.2
GOR-4C	WA-37-L	Operational	In place	Section 3.2.2
GOR-4D	WA-37-L	Operational	In place	Section 3.2.2
GOR-4E	WA-37-L	Operational	In place	Section 3.2.2
GOR-4F	WA-37-L	Operational	In place	Section 3.2.2
Jansz–Io field				
JZI-1B	WA-36-L	Operational	In place	Section 3.2.2
JZI-1C	WA-36-L	Operational	In place	Section 3.2.2
JZI-1D	WA-36-L	Operational	In place	Section 3.2.2
JZI-1E	WA-36-L	Operational	In place	Section 3.2.2
JZI-1F	WA-36-L	Operational	In place	Section 3.2.2
JZI-2B	WA-39-L	Operational	In place	Section 3.2.2
JZI-2C	WA-39-L	Operational	In place	Section 3.2.2
JZI-2D	WA-39-L	Operational	In place	Section 3.2.2
JZI-2E	WA-39-L	Operational	In place	Section 3.2.2
JZI-2F	WA-39-L	Operational	In place	Section 3.2.2
JZI-3C	WA-36-L	Operational	In place	Section 3.2.2
JZI-3D	WA-36-L	Operational	In place	Section 3.2.2
JZI-3E	WA-36-L	Operational	In place	Section 3.2.2
JZI-3F	WA-36-L	Operational	In place	Section 3.2.2
Manifolds				
Gorgon field				
Gorgon M1 manifold	WA-37-L	Operational	In place	Section 3.2.2.1
Gorgon M2 manifold	WA-37-L	Operational	In place	Section 3.2.2.1

Item	Petroleum title	Status	IM Plan	EP reference
Gorgon M3 manifold	WA-37-L	Operational	In place	Section 3.2.2.1
Gorgon M4 manifold	WA-37-L	Operational	In place	Section 3.2.2.1
Jansz–Io field				
Jansz DC-1 manifold	WA-36-L	Operational	In place	Section 3.2.2.1
Jansz DC-2 manifold	WA-39-L	Operational	In place	Section 3.2.2.1
Jansz DC-3 combined manifold/PTS module	WA-36-L	Operational	In place	Section 3.2.2.1
Pipeline termination structures				
Gorgon field				
Gorgon Midline PTS	WA-37-L	Operational	In place	Section 3.2.4
Gorgon M4 PTS	WA-37-L	Operational	In place	Section 3.2.4
Jansz–Io field				
Jansz-Io Midline PTS	WA-39-L	Operational	In place	Section 3.2.4
Jansz DC-3 combined manifold/PTS module	WA-36-L	Operational	In place	Section 3.2.4
Production pipelines and support infrastructure				
Gorgon field				
Production pipeline (1)	WA-37-L, WA-50-R, WA-510-P, WA-63-L	Operational	In place	Section 3.2.7
8” MEG pipeline (1)	WA-37-L, WA-50-R, WA-510-P, WA-63-L	Operational	In place	Section 3.2.5
6” utility pipeline (1)	WA-37-L, WA-50-R, WA-510-P, WA-63-L	Operational	In place	Section 3.2.5
Jansz–Io field				
Production pipeline (1)	WA-14-R, WA-19-R, WA-20-R, WA-24-R, WA-29-L, WA-37-L, WA-39-L, WA-42-R, WA-510-P, WA-63-L	Operational	In place	Section 3.2.7
8” MEG pipeline (1)	WA-14-R, WA-19-R, WA-20-R, WA-24-R, WA-29-L, WA-37-L, WA-39-L, WA-42-R, WA-510-P, WA-63-L	Operational	In place	Section 3.2.5
6” utility pipeline (1)	WA-14-R, WA-19-R, WA-20-R, WA-24-R, WA-29-L, WA-37-L, WA-39-L, WA-42-R, WA-510-P, WA-63-L	Operational	In place	Section 3.2.5

Item	Petroleum title	Status	IM Plan	EP reference
Infield flowlines				
Gorgon field				
26” CRA infield production flowlines (3)	WA-37-L	Operational	In place	Section 3.2.5
24” M4 CRA infield production flowline	WA-37-L	Operational	In place	Section 3.2.5
8” MEG pipelines (4)	WA-37-L	Operational	In place	Section 3.2.5
6” utility pipelines (4)	WA-37-L	Operational	In place	Section 3.2.5
Jansz–Io field				
24” CRA infield production flowlines (2)	WA-36-L, WA-39-L	Operational	In place	Section 3.2.5
18” DC-3 CRA infield production flowline (2)	WA-36-L	Operational	In place	Section 3.2.5
6” MEG pipelines (3)	WA-36-L, WA-39-L	Operational	In place	Section 3.2.5
6” utility pipelines (3)	WA-36-L, WA-39-L	Operational	In place	Section 3.2.5

appendix d description of the environment (CAPL planning area)

description of the environment

CAPL planning area

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description of the environment

CAPL planning area

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1.0	Issued for use	01 May 2020	A Fertch	D Salins
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Approvals

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Approved:	David Smith HSE Regulatory Affairs Team Lead		

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1 introduction

1.1 Purpose

This document describes the environment within Chevron Australia Pty Ltd's (CAPL's) Planning Area (PA) (Figure 1-1), which is the total area in which CAPL's activities may interact with the environment. This document applies to all CAPL operations and is to be used for each Environment Plan (EP) submitted to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) after this document's initial acceptance.

Each EP will define an environment that may be affected (EMBA) by its specific petroleum activity. The EMBA for each activity will most likely be based on conservative stochastic spill modelling thresholds; based on the knowledge gained from previous stochastic modelling from CAPL's activities, all EMBAs are expected to fall within this PA. If an EMBA from an individual EP extends outside the PA, this document will be revised, and the PA extended to incorporate that EMBA.

1.2 Regulatory context

The Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 detail the information that must be included in an EP. Specifically:

Regulation 13(2) states that the environment plan must:

> *(a) describe the existing environment that may be affected by the activity; and*
>
> *(b) include details of the particular relevant values and sensitivities (if any) of that environment.*

Regulation 4 defines the environment as:

> *(a) ecosystems and their constituent parts, including people and communities; and*
>
> *(b) natural and physical resources; and*
>
> *(c) the qualities and characteristics of locations, places and areas; and*
>
> *(d) the heritage value of places;*
>
> *and includes*
>
> *(e) the social, economic and cultural features of the matters mentioned in paragraphs (a), (b), (c) and (d).*

Regulation 13(3) further provides that, without limiting paragraph (2)(b) of Regulation 13(2), particular relevant values and sensitivities may include any of these:

> (a) the world heritage values of a declared World Heritage property within the meaning *of the EPBC Act;*
>
> *(b) the national heritage values of a National Heritage place within the meaning of that Act;*
>
> *(c) the ecological character of a declared Ramsar wetland within the meaning of that Act;*

> *(d) the presence of a listed threatened species or listed threatened ecological community within the meaning of that Act;*
>
> *(e) the presence of a listed migratory species within the meaning of that Act;*
>
> *(f) any values and sensitivities that exist in, or in relation to, part or all of:*
>
> > *(i) a Commonwealth marine area within the meaning of that Act; or*
> >
> > *(ii) Commonwealth land within the meaning of that Act.*

Specific to the description of the environment, NOPSEMA's *Environment Plan Content Requirement* guidance (Ref. 1) states:

> *The level of detail within the plan should be appropriately scaled to the nature of the impacts and risks to the particular values and sensitivities. For example, the environment that may be affected by planned operations will need to be described in a greater level of detail than areas exposed to low levels of hydrocarbon in the unlikely event of a worst-case hydrocarbon release.*

Consequently, CAPL has taken the approach that this document provides information suitable for summarising the particular values and sensitivities in order to inform the impact and risk evaluation for CAPL operations. However, if additional information is available for specific locations (typically an operational area for a specific activity) and if this information can be used to further influence or inform the impact and risk assessment, this additional information will be included in the 'Description of the Environment' section of the individual EP.

1.3 Review and revision

The information provided in this document is derived from various referenced desktop sources. As a minimum, this document will be reviewed annually to include any relevant changes to source documents, which may include State (Western Australian [WA])/Commonwealth Management Plans, Recovery Plans, Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) status, or new published research.

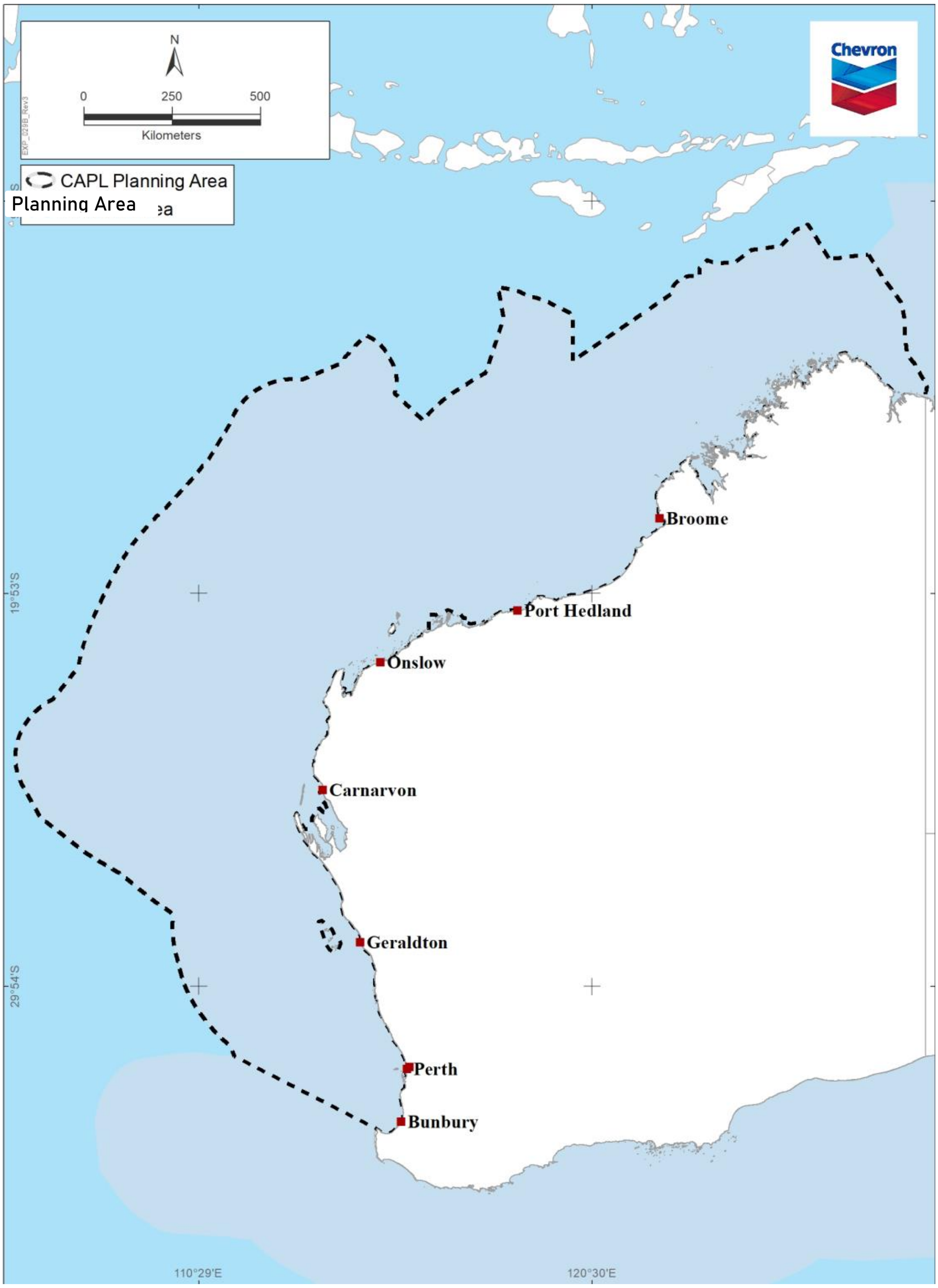

Figure 1-1: CAPL's planning area

2 matters of national environmental significance

2.1 World Heritage properties

Properties nominated for World Heritage listing are inscribed on the list only after they have been carefully assessed as representing the best examples of the world's cultural and natural heritage. At the time of writing this document, Australia has 20 properties on the World Heritage List (Ref. 2; Ref. 3).

The list of Australia's World Heritage areas (Ref. 2) and a protected matters search (Ref. 4; appendix a) show that two World Heritage properties are within the PA. Table 2-1 summarises value of these World Heritage properties (Ref. 2).

Table 2-1: World Heritage properties

World Heritage property	Brief overview of values^
Shark Bay	On the Indian Ocean coast at the most westerly point of Australia, Shark Bay's waters, islands, and peninsulas covering a large area of ~2.2 million hectares (of which about 70% are marine waters) have a number of exceptional natural features, including one of the largest and most diverse seagrass beds in the world. However, it is for its stromatolites (colonies of microbial mats that form hard, dome-shaped deposits, which are said to be the oldest life forms on earth), that the property is most renowned. The property is also famous for its rich marine life including a large population of dugongs and provides a refuge for a number of other globally threatened species.
The Ningaloo Coast	The Ningaloo Coast is located on WA's remote coast along the East Indian Ocean. The property holds a high level of terrestrial species endemism and high marine species diversity and abundance. An estimated 300 to 500 Whale Sharks aggregate annually coinciding with mass coral spawning events and seasonal localised increases in productivity. The marine portion of the nomination contains a high diversity of habitats that includes lagoon, reef, open ocean, the continental slope, and the continental shelf. Intertidal systems such as rocky shores, sandy beaches, estuaries, and mangroves are also found within the property. The most dominant marine habitat is the Ningaloo reef, which sustains both tropical and temperate marine fauna and flora, including marine reptiles and mammals. The main terrestrial feature of the Ningaloo Coast is the extensive karst system and network of underground caves and water courses of the Cape Range. The karst system includes hundreds of separate features such as caves, dolines, and subterranean water bodies and supports a rich diversity of highly specialised subterranean species. Above ground, the Cape Range Peninsula belongs to an arid ecoregion recognised for its high levels of species richness and endemism, particularly for birds and reptiles.

^ Source: Ref. 2.

2.2 National Heritage places

The National Heritage List is Australia's list of natural, historic, and Indigenous places of outstanding significance to the nation. The National Heritage List spatial database (Ref. 5) describes the place name, class (Indigenous, natural, historic), and status.

A search of the National Heritage List spatial database (Ref. 5) and a protected matters search (Ref. 4; appendix a) revealed that several National Heritage places occur in the PA (Table 2-2). The information presented in Table 2-2 outlines the nominator's Summary Statement of Significance sourced from the Australian Heritage Database (Ref. 6).

Table 2-2: National Heritage places

National Heritage place	Class	Summary of significance^
Batavia Shipwreck Site and Survivor Camps Area 1629 – Houtman Abrolhos	Historic	Wrecked on 4 June 1629, the *Batavia* is the oldest of the known Verenigde Oost-Indische Compagnie wrecks on the WA coast. Because of its relatively undisturbed nature, the archaeological investigation of the wreck itself has revealed a range of objects of considerable historical value. The recovered sections of the hull of the *Batavia* have been reconstructed in the Western Australian Maritime Museum and provides information on 17th century Dutch ship building techniques, while the remains of the cargo carried by the vessel have provided economic, and social evidence of the operation of the Dutch port at Batavia (now Jakarta) in the early 17th century.
Dampier Archipelago (including Burrup Peninsula)	Indigenous	The Dampier Archipelago located about 1,550 km north of Perth. On the magnificent Dampier Archipelago in WA, where the striking red earth of the Burrup Peninsula meets the blue Indian Ocean, rock engravings thought to number in the millions and other significant sites are helping us learn more about our Indigenous heritage. Made up of islands, reefs, shoals, channels and straits, and covering a land area of around 400 km^2, the Burrup Peninsula is 27 km long and 4 km wide. Many important native plants, animals and habitats are found in the area. The Archipelago was formed 6-8,000 years ago when rising sea levels flooded what were once coastal plains. The underlying rocks are amongst the oldest on earth, formed in the Archaean period more than 2,400 million years ago. The Dampier Archipelago was included in the National Heritage List on 3 July 2007.
Dirk Hartog Landing Site 1616 – Cape Inscription Area	Historic	Cape Inscription is the site of the oldest known landings of Europeans on the WA coastline, and is associated with a series of landings and surveys by notable explorers over a 250-year period. The first known European landing on the west coast of Australia was by Dirk Hartog of the Dutch East India Company's ship the *Eendracht* at Cape Inscription on 25 October 1616. Hartog left a pewter plate, inscribed with a record of his visit and nailed to a post left standing upright in a rock cleft on top of the cliff. This plate is the oldest extant record of a European landing in Australia. Hartog's discovery had a major impact on world cartography. After leaving the island, he sailed northwards charting the coastline of WA to 22° south. As a result, a known part of the coastline of WA appeared on world maps for the first time, replacing the mythical southern continent of 'Terra Australis Incognita'.
HMAS Sydney II and *HSK Kormoran* Shipwreck Sites	Historic	The naval battle fought between the Australian warship *HMAS Sydney II* and the German commerce raider *HSK Kormoran* off the WA coast during World War II (November 1941) was a defining event in Australia's cultural history. *HMAS Sydney II* was Australia's most famous warship of the time and this battle has forever linked the stories of these warships to each other. The tragic loss of *HMAS Sydney II* and its entire crew of 645 following the battle with *HSK Kormoran* remains Australia's worst naval disaster.
Lesueur National Park*	Natural	The Lesueur National Park (inland from Green Head, WA) contains an exceptional concentration of plant species richness and endemism. It is estimated to contain >900 plant species, including nine plant taxa that are endemic to the National Park and 111 taxa that are endemic to the surrounding region. A further 81 plant taxa are at the northern or southern limit of their distribution, which is significant for the evolution of new species (Ref. 7).

National Heritage place	Class	Summary of significance^
		The Lesueur National Park is one of the most important places in Australia for demonstrating species richness and endemism within the Proteaceae plant family, including the genera of Banksia, *Hakea*, *Dryandra*, *Grevillea*, and *Isopogon* (Ref. 8). The Lesueur National Park contains outstanding species richness and endemism in several other plant families such as: the Fabaceae family, including the genera of *Gastrolobium* (poison pea), *Daviesia* (bitter pea) and *Jacksonia* (dogwood); the Myrtaceae family, including the genera of *Verticordia* (feather flower) and *Melaleuca* (paper bark); the Haemodoraceae family (bloodroots, conostyles and kangaroo paws); the Stylidiaceae family (triggerplants); and the Droseraceae family (sundews) (Ref. 8).
Shark Bay, Western Australia	Natural	Shark Bay is on the most western point of the Australian coast. The region is one of the few properties inscribed on the World Heritage List (see Table 2-1) for all four outstanding natural universal values: • as an outstanding example representing the major stages in the Earth's evolutionary history • as an outstanding example representing significant ongoing ecological and biological processes • as an example of superlative natural phenomena • containing important and significant habitats for in situ conservation of biological diversity. 25% of vascular plants (283 species) are at the limits of their range in Shark Bay. Many vegetation formations and plant species are found only in the interzone area. The area south of Freycinet Estuary contains the unique type of vegetation known as tree heath. There are also at least 51 species endemic to the region and others that are considered new to science. The Shark Bay region is an area of major zoological importance, primarily due to habitats on peninsulas and islands being isolated from the disturbance that has occurred elsewhere. Of the 26 species of endangered Australian mammals, five are found on Bernier and Dorre Islands. These are the Boodie or Burrowing Bettong, Rufous Hare Wallaby, Banded Hare Wallaby, the Shark Bay Mouse, and the Western Barred Bandicoot. The Shark Bay region has a rich avifauna with over 230 species, or 35%, of Australia's bird species having been recorded. A number of birds attain their northern limit here, such as the Regent Parrot, Western Yellow Robin, Blue-breasted Fairy-wren, and Striated Pardalote. The region is also noted for the diversity of its amphibians and reptiles, supporting nearly 100 species. Again, many species are at the northern or southern limit of their range. The area is also significant for the variety of burrowing species, such as the Sandhill Frog, which, apparently, needs no surface water. Shark Bay contains three endemic sand-swimming skinks, and 10 of the 30 dragon lizard species found in Australia. The 12 species of seagrass in Shark Bay make it one of the most diverse seagrass assemblages in the world. Seagrass covers >4,000 km^2 of the bay, with the 1,030 km^2 Wooramel Seagrass Bank being the largest structure of its type in the world. Seagrass has contributed significantly to the evolution of Shark Bay as it has modified the physical, chemical, and biological environment as well as the geology and has led to the development of major marine features, such as Faure Sill. The barrier banks associated with the growth of seagrass over the last 5,000 years has, with low rainfall, high evaporation, and low

National Heritage place	Class	Summary of significance^
		tidal flushing, produced the hypersaline Hamelin Pool and L'Haridon Bight. This hypersaline condition is conducive to the growth of cyanobacteria, which trap and bind sediment to produce various mats and structures including stromatolites. Stromatolites represent the oldest form of life on Earth. They are representative of life forms from ~3,500 million years ago. Hamelin Pool contains the most diverse and abundant examples of stromatolite forms in the world. Shark Bay is renowned for its marine fauna. For example, the Shark Bay population of about 10,000 Dugong is one of the largest in the world, and dolphins abound, particularly at Monkey Mia. Humpback Whales use Shark Bay as a staging post in their migration along the WA coast. This species was reduced by past exploitation from an estimated population of 20,000 on the west coast to 500–800 whales in 1962; the population is now estimated at 2,000–3,000. Green and Loggerhead Turtles are found in Shark Bay near their southern limits; they nest on Dirk Hartog Island and Peron Peninsula beaches. Dirk Hartog Island is the most important nesting site for Loggerhead Turtles in WA. Shark Bay is also an important nursery ground for larval stages of crustaceans, fishes, and medusae (jellyfish).
The Ningaloo Coast	Natural	The integration of the Ningaloo Reef and Exmouth Peninsula karst system as a cohesive limestone structure is at the heart of the natural heritage significance of the Ningaloo Coast. The modern Ningaloo Reef, Exmouth Peninsula karst, and the wave-cut terraces, limestone plains, Pleistocene reef sediments of Exmouth Peninsula, and associated marine, terrestrial, and subterranean ecosystems, including the Muiron Islands, demonstrate a geological, hydrological, and ecological unity, which harmonises the region's present ecosystem functions with its evolutionary history as a time-series of coral reefs and an evolving karst system. The history of coral reefs during the last 26 million years is chronicled in the limestone parapets and wave-cut terraces of Cape Range, which record previous high water levels. Demonstrating late Quaternary deformation at a passive continental margin, the uplifted Neogene wave-cut terraces and fossil reefs that fringe Exmouth Peninsula, and the submerged fossil reef terraces that form the substrate of the modern reef, in immediate juxtaposition with the undeformed modern Ningaloo Reef, contribute to an understanding of the mechanisms that led to the modern character of the west coast of Australia. Archaeological deposits in the rock shelters on Cape Range show Aboriginal people had a comprehensive and sophisticated knowledge of edible and non-edible marine resources between 35,000 and 17,000 years ago. The rock shelters of Exmouth Peninsula are outstanding because they provide the best evidence in Australia for the use of marine resources during the Pleistocene, including their uses as food and for personal adornment. The evidence for standardisation in size and manufacture of the shell beads found at Mandu Creek rock shelter, coupled with the fact they provide the earliest unequivocal evidence for the creation of personal ornaments in Australia, demonstrates a high degree of creative and technical achievement.
The West Kimberley	Natural	The National Heritage listing of the West Kimberley recognises the natural, historic, and Indigenous stories of the region that are of outstanding heritage value to the nation. These and other fascinating stories about the west Kimberley are woven together in

National Heritage place	Class	Summary of significance^
		the following description of the region and its history, including a remarkable account of Aboriginal occupation and custodianship over the course of more than 40,000 years. The Kimberley occupies more than 420,000 km^2 on the north-western margin of the Australian continent. Its rocky coastline edges the Indian Ocean, and off the coast lie thousands of islands, many fringed with coral. The Mitchell Plateau (Ngauwudu) rises to nearly 800 m above sea level at its centre, in places dropping into steep escarpments, and losing altitude as it approaches the sea. Further south, Yampi Peninsula lies in a transitional area between the high rainfall of tropical north Kimberley and the drier conditions characteristic of central WA. These different environments meet in a complex landscape of plains, dissected sandstone plateaus, and rugged mountains. The central Kimberley, which includes the periphery of north Kimberley plateau country and the King Leopold Ranges, is very rugged; the physical structures here were formed by significant geological events, which folded rocks intensely, many thousands of millions of years ago. That such evidence of a distant past can today be seen so clearly in the landscape is due to the region's remarkable geological stability. This stability has also allowed the much more recent appearance of extensive limestone ranges, built from the remains of an extraordinary reef complex which, more than 300 million years ago, rivalled the Great Barrier Reef in size. The ranges have since eroded to form complex networks of caves and tunnels. Dinosaur footprints and tracks are another remarkable remnant of past life in the Kimberley; they are exposed in many places in the Broome sandstone, along the western length of Dampier Peninsula. This coastline is subject to one of the highest tidal ranges in the world, and many of the fossil footprints can only be seen for short periods during very low tides. Inland of Dampier Peninsula, south of the broad floodplains of the Fitzroy River, the distinctive red of the pindan country opens onto a vast expanse of desert. Throughout the Kimberley, where water meets land—in estuaries, mangroves and mudflats, in moist vine thickets, along the banks of rivers and creeks, around waterholes or soaks—there is an abundance of plants and animals, some of which live only in the Kimberley, while others may have travelled from the far side of the world to nest or breed here.

^ Source: Ref. 6.
** Identified in the protected matters search (appendix a) but located inland and thus not expected to be exposed to CAPL's activities.*

2.3 Commonwealth Heritage places

The Commonwealth Heritage List is a list of Indigenous, historic, and natural heritage places owned or controlled by the Australian Government. The Commonwealth Heritage List (Ref. 9) describes the place name, class (Indigenous, natural, historic), and status.

A search of the Commonwealth Heritage List and a protected matters search (appendix a; Ref. 4) revealed that Commonwealth Heritage Places occur in the PA (Table 2-3). The information presented in this table outlines the Nominator's Summary Statement of Significance sourced from the Australian Heritage Database (Ref. 6).

Table 2-3: Commonwealth Heritage places

Commonwealth Heritage place	Class	Summary of significance^
Ashmore Reef National Nature Reserve (External territories list)	Natural	Ashmore Reef (which is an atoll that includes four low-lying uninhabited sand islands) has major significance as a staging point for wading birds migrating between Australia and the northern hemisphere, including 43 species listed on the China–Australia Migratory Bird Agreement (CAMBA) and/or the Japan–Australia Migratory Bird Agreement (JAMBA). The place provides habitat for three species of sea snake; *Aipysurus apraefrontalis*, *A. foliosquama*, and *A. fuscus* with very restricted distributions. *Aipysurus fuscus* is endemic to Ashmore Reef. Ashmore Reef supports extremely high concentrations of breeding seabirds, many of which are nomadic and typically breed on small isolated islands. Breeding colonies of 17 species of seabirds have been recorded. The islands are regarded as supporting some of the most important seabird rookeries on the Sahul Shelf, including large (1,000 to 50,000 breeding pairs) breeding colonies of Sooty Tern (*Sterna fuscata*), Crested Tern (*S. bergii*), Bridled Tern (*S. anaethetus*) and Common Noddy (*Anous stolidus*), and smaller breeding colonies of Little Egret (*Egretta alba*), Eastern Reef Egret (*E. sacra*), Black Noddy (*Anous minutus*), White-tailed Tropic Bird (*Phaethon lepturus*), and Red-tailed Tropic Bird (*P. rubricauda*). The place is also important for providing breeding habitat for Green (*Chelonia mydas*) and Hawksbill Turtles (*Eretmochelys imbricata*). Ashmore Reef exhibits a higher diversity of marine habitats compared with other North West Shelf reefs. The place supports an exceptionally diverse marine fauna, particularly corals (255 species in 56 genera) and molluscs (433 species), and is regarded as having the highest diversity of sea snakes (12 species) in the world. Other highly diverse fauna include birds (78 species), decapod crustaceans (99 species), echinoderms (178 species), and fish (569 species). Species of conservation significance recorded at Ashmore Reef include: the nationally endangered Little Tern (*Sterna albifrons*) and Loggerhead Turtle (*Caretta caretta*), and the nationally vulnerable Green Turtle (*Chelonia mydas*) and Hawksbill Turtle (*Eretmochelys imbricata*). The place also includes species not previously recorded or only rarely recorded in Australia including: three bird species(Brown Hawk Owl [*Ninox scutulata*], White-tailed Tropic Bird [*Phaethon lepturus*], and Black Noddy [*Anous minutus*]); five hermatypic coral species; and 13 fish species. Ashmore Reef is an important scientific reference area for migratory seabirds, sea snakes, and marine invertebrates. It has been the site of several major scientific expeditions and is the subject of ongoing scientific monitoring of biological diversity, fauna populations, and breeding activity. Ashmore Reef is the type locality for two species of sea snake—*Aipysurus apraefrontalis* and *A. foliosquama*. Ashmore Reef is significant for its history of human occupation and use. Although the reef may have been known to the Rottinese people (Rote is an island in modern-day Indonesia) for many centuries, the first description is probably that contained in Eredia (1600) if accepted, this may be the first description of Ashmore Reef, which is now part of Australia. Ashmore Reef is believed to have been visited by fisherman from Rote Island since the early 18th century, as well as by Makassans and Bajau ('Sea Gypsies') and people from the island of Seram. The Ashmore Reef islands were used both for fishing and as a staging point for voyages to the southern reefs off Australia's coast. Occupation by these seafarers, particularly from the area east of Madura (Indonesia), on the islands

Commonwealth Heritage place	Class	Summary of significance^
		occurred intermittently during the 1930s. Visits recommenced in 1947 following World War II and have continued. The islands are also significant for phosphate mining, which lead to their annexation by Great Britain and ultimate transfer to the Australian Government in 1934. Physical evidence of these former occupations exists and would be particularly significant in archaeological terms. Such evidence may include original wells and grave sites and would include evidence of disturbance from early phosphate mining.
Cliff Point Historic Site (WA list)	Historic	The Cliff Point Historic Site, individually significant within the area of Garden Island, is important as it was the first site inhabited by Governor Stirling's party in 1829 when founding the colony of WA, and as WA's first official non-convict settlement. The site was initially occupied by Captain Charles Fremantle before the arrival of Captain Stirling. The party occupied the site for two months before a move was made to the Swan River settlement on the mainland. The Cliff Point Historic Site is important as the site of first settlement in WA and is highly valued by the community for its cultural associations. The Cliff Point Historic Site, also known as Sulphur Town, after *HMS Sulphur* was chosen in 1828 by Governor Stirling to transport settlers to the new colony and is important for its association with Governor Stirling and Captain Charles Fremantle.
Garden Island (WA list)	Natural	Garden Island was the first site occupied by Governor Stirling's party in 1829 when founding the colony of WA; it was also the site of the first official non-convict settlement in WA. The Cliff Point Historic Site on Garden Island, also known as Sulphur Town, was initially occupied by Captain Charles Fremantle before the arrival of Captain Stirling, and is listed separately in the Register (Reg. No. 10657). The party occupied the site for two months before they moved to the Swan River settlement on the mainland. Garden Island, and in particular the Cliff Point Historic Site, is highly valued for its cultural associations as the site of first settlement in WA and is important for its association with Governor Stirling and Captain Charles Fremantle. In 1911, the Commonwealth resumed Garden Island from WA for use as a naval base. The strategic role of Garden Island and Cockburn Sound, which was secured for coastal defence in World War II, is illustrated by defence installations including Challenger or J Gun Battery, and the Scriven, Beacon, and Collie Battery complexes, supported by a range of service structures. Challenger Battery is listed separately in the Register at Reg. No. 18968. The absence of feral predators means that Garden Island provides a significant refuge for animals vulnerable to predation on the mainland. Due to its isolation from the WA mainland, the island is relatively free of disturbance from humans or introduced animals. Species of particular interest include the Tammar Wallaby (*Macropus eugenii*), Carpet Python (*Morelia spilota*), and the Lined Skink (*Lerista lineata*). Populations of the 14 species of reptile and the Tammar Wallaby have been isolated from mainland populations for 6,000–7,000 years. In particular, the population of the Tammar Wallaby on Garden Island is morphologically distinct from all other populations. The vegetation on Garden Island differs in structure and composition from vegetation on nearby Rottnest Island and the adjacent mainland (e.g., eucalypts and banksia, which are common on the mainland, are absent from the island). Due to a low fire frequency, the vegetation on Garden Island is older and denser than that on the mainland. The northern end of the island supports

Commonwealth Heritage place	Class	Summary of significance^
		some of the oldest stands of the rare Rottnest Island Pine (*Callitris preissii*), with most trees dating from the 1920s. Other species that are now rare in the region include the Cheesewood (*Pittosporum phylliraeoides* var. *phylliraeoides*) and Rottnest Teatree (*Melaleuca lanceolata*). The parabolic sand dunes on the western side of Garden Island are among the best-preserved dunes of the Quindalup soil unit, which is widespread in coastal WA. It is likely that Indigenous values exist at this place. The Australian Heritage Commission (AHC) has not yet identified, documented, or assessed these values for National Estate significance.
HMAS Sydney II and *HSK Kormoran* Shipwreck Sites (External territories list)	Historic	The naval battle fought between the Australian warship *HMAS Sydney II* and the German commerce raider *HSK Kormoran* off the WA coast during World War II was a defining event in Australia's cultural history. *HMAS Sydney II* was Australia's most famous warship of the time and this battle has forever linked the stories of these warships to each other. The tragic loss of *HMAS Sydney II* and its entire crew of 645 following the battle with *HSK Kormoran*, remains Australia's worst naval disaster and sent shockwaves throughout the Australian community in November 1941. The battle between *HMAS Sydney II* and *HSK Kormoran* had far-reaching consequences for developing Australia's defences. The loss of *HMAS Sydney II* was the first and most significant in a succession of Australian naval losses that directly threatened the security of Australia and its surrounding seas, having occurred only 17 days before the Japanese launched their attacks in Southeast Asia and the Northern Pacific. The aftermath of the sinking of *HMAS Sydney II* and subsequent warship losses saw a major shift in Australian military and political doctrine away from defending Australia by defending the British Empire to that of direct defence of the Australian mainland and the development of a defence alliance with the United States. The discovery and inspection of *HMAS Sydney II* and *HSK Kormoran* in 2008 has enabled reconciliation of theory and known historical fact concerning the battle with the archaeological evidence present in the remains. This physical evidence was pivotal to the findings of the 2009 *HMAS Sydney II* Commission of Inquiry (Cole Inquiry), and allowed some circumstances of the loss of *HMAS Sydney II* to be better understood. It has also enabled the study of unique technological features that allowed *HSK Kormoran* to avoid identification as a warship when approaching *HMAS Sydney II* until reaching point blank range for the weapons of the time. The surprise achieved by using these technologies was a major factor in the destruction of *HMAS Sydney II*. During the relatively short but conspicuous career of *HMAS Sydney II*, it was commanded by two of the most highly regarded and respected officers serving in the Royal Australian Navy at that time (Captain J.A. Collins and Captain J. Burnett). Their association with *HMAS Sydney II* is significant in both their naval careers and of the ship itself. The 2008 discovery of *HMAS Sydney II* and *HSK Kormoran* has highlighted the ongoing importance of these shipwrecks and their stories to the wider Australian community. The stories of these two ships are not only valued by the family and friends of the servicemen who died but also by veterans, defence personnel, and the Australian community in general. The location, interpretation, and memorialisation of these shipwrecks also provides some closure for the families.
J Gun Battery	Historic	Garden Island is important as the first site occupied by Governor Stirling's party in 1829 when founding the colony of Western

Commonwealth Heritage place	Class	Summary of significance^
(WA list)		Australia and as the first official non-convict settlement in WA. The Cliff Point Historic Site, also known as Sulphur Town, was occupied in the first instance by Captain Charles Fremantle before the arrival of Captain Stirling, and is listed separately in the Register (Reg. No. 10657). The party occupied the site for two months before a move was made to the Swan River settlement on the mainland. Garden Island, and in particular the Cliff Point Historic Site, is highly valued by the community for its cultural associations as the site of first settlement in WA and is important for its association with Governor Stirling and Captain Charles Fremantle. Garden Island was selected as the base for a naval base in 1911 and resumed by the Commonwealth. The strategic role of the island and Cockburn Sound, secured for coastal defence in the Second World War 1939–1945, is illustrated by defences including Challenger or J Battery and the Scriven, Beacon, and Collie Battery complexes, supported by a range of service structures. Challenger battery is listed separately in the Register at Reg. No. 18968. The absence of feral predators means that Garden Island provides a significant refuge for animals vulnerable to predation on the mainland. Due to its isolation from the WA mainland, the island is relatively free of disturbance from humans or introduced animals. Species of particular interest include the Tammar Wallaby (*Macropus eugenii*), Carpet Python (*Morelia spilota*), and the Lined Skink (*Lerista lineata*). Populations of the 14 species of reptile and the Tammar Wallaby have been isolated from mainland populations for 6,000–7,000 years. In particular, the population of the Tammar Wallaby on Garden Island is morphologically distinct from all other populations. The vegetation on Garden Island differs in structure and composition from vegetation on nearby Rottnest Island and the adjacent mainland. For example, eucalypts and banksia, which are common on the mainland, are absent from the island. Due to a low fire frequency, the vegetation on Garden Island is older and denser than that on the mainland. The northern end of the island has some of the oldest stands of the rare Rottnest Island pine (*Callitris preissii*), with most trees dating from the 1920s. Other species that are now rare in the region include the Cheesewood (*Pittosporum phylliraeoides* var. *phylliraeoides*) and Rottnest Teatree (*Melaleuca lanceolata*). The parabolic sand dunes on the western side of the island are among the best-preserved dunes of the Quindalup soil unit, which is widespread in coastal WA. It is likely that Indigenous values exist at this place. The AHC has not yet identified, documented, or assessed these values for National Estate significance.
Lancelin Defence Training Area (WA list)	Natural	The Lancelin Defence Training Area (DTA) is at the northern end of the Swan Coastal Plain, an area of exceptionally diverse flora and fauna. Much of Lancelin is dominated by species-rich Banksia woodlands and Myrtaceous/Proteaceous heaths. The floristic mosaic of *Banksia attenuata – B. menziessi* low woodlands, wet heaths, and low-heath communities represent significant vegetation remnants that are poorly conserved and under-represented in the conservation reserve system. The Lancelin DTA contains wetlands that are important in the hydrogeological system of the region. The Namming freshwater wetland suite contains a high diversity of habitats, is an important breeding site for waterfowl, and acts as a drought refuge for both waterfowl and other fauna.

Commonwealth Heritage place	Class	Summary of significance^
		The Lancelin DTA is close to the boundary of two major zoogeographic regions, the semi-arid Eyrean zone, and the Bassean, or south-western zone of WA. This accounts in part for the high vertebrate fauna richness, particularly for reptiles and frogs, with eight frog species recorded in the large, seasonal Walyengarra Lake. Several species occur at the edge of their distribution range within the place. Reptile species that are at, or near, the southern limit of their distribution in the Lancelin DTA include the skink *Lerista planiventralis* and the snake *Simoselaps littoralis*. Many bird species are at or near their northern limit of distribution here, including the Southern Emu Wren (*Stipiturus malachurus*), and the Spotted Pardalote (*Pardalotus punctata*), while several are at their southern limits, including the Pied Butcherbird (*Cracticus nigrogularis*), and the Pied Honeyeater (*Certhionyx variegatus*). The vegetation community known as Tall Heath—comprising *Calothamnus quadrifidus*, *Dryandra sessilis*, and *Hakea trifurcata*—is near the southern limit of its distribution within the Lancelin DTA. Stands of Tuart (*Eucalyptus gomphocephala*) are significant as this area is close to this restricted species' northern limit. Several flora species found in the place are listed as poorly known or rare (Priority species) in WA, including species that are known from only a few populations that are under threat. The Lancelin DTA occurs within a narrow strip along the central and south WA coast where a number of reptile species have restricted distributions. Species with restricted distributions that occur here include the legless lizards *Aclys concinna*, *Pletholax gracilis*, and *Delma grayii* and the skinks *Ctenotus australis* and *Lerista praepedita.*
Learmonth Air Weapons Range Facility (WA list)	Natural	The geomorphology of Cape Range, of which the Learmonth Air Weapons Range (AWR) Facility is a part, is of considerable importance in documenting sea level and landform changes since the late Cenozoic Era (~1.8 million years ago). A series of emergent reef complexes, which represent several periods of coral reef development, are striking elements of the geomorphology of the western side of the Learmonth AWR Facility and Cape Range. The ages of these reef terraces are key to understanding of the timing of uplift events. The coastal plain of Cape Range contains a network of subterranean waterways, comprising caverns and fissures in the limestone beneath the coastal plain. Of these, Bundera Sinkhole, found within the Learmonth AWR Facility, is the only deep anchialine system known in Australia, and is the only continental anchialine system known in the southern hemisphere. Anchialine systems are cave systems with restricted exposure to open air, with subterranean connections to the sea, and showing marine and terrestrial influences. Anchialine systems are noted both for their relict fauna and their high species richness. The physicochemical environment in Bundera Sinkhole is very complex, and is associated with biogeochemical processes that are likely to be important for maintaining the unique community contained in this system. The cave fauna of Cape Range, including that within the Learmonth AWR Facility at Bundera Sinkhole, is of exceptional biogeographical importance. Much of the fauna developed a long time ago, with a number of species of the aquatic cave fauna (stygofauna) originating in the Tethys Sea ~170 million years ago. Bundera Sinkhole supports several species of aquatic stygofauna, many of which are endemic to the sinkhole or to Cape Range. Many of the stygofauna species have their closest known affinities

Commonwealth Heritage place	Class	Summary of significance^
		with the fauna of anchialine caves on either side of the North Atlantic. This narrow cave is also the only known southern hemisphere site for a crustacean from the class Remipedia (*Lasionectes exleyi*). *L. exleyi* is listed as endangered at both State and Commonwealth levels. This species is widely separated from related species found in the North Atlantic. Bundera Sinkhole is also the only known locality in the southern hemisphere for another crustacean species: *Danielopolina* sp. Nov. Several other crustacean species found in Bundera Sinkhole are likely to have originated from the Tethys Sea, including: *Stygiocaris lancifera* (the Lance-beaked Cave Shrimp); two copepods from the Calanoida order (*Bunderia* sp. and *Stygocyclopia* sp.); and another copepod, *Halicyclops spinifer*. Many of these species also have widely separated distributions (e.g. *Halicyclops* is confined in Australia to Cape Range, but is also found in Iran, Brazil, and India). The Lance-beaked Cave Shrimp is listed as rare or likely to become extinct at the State level. The gastropod *Iravadia* sp. is found in brackish water in Bundera Sinkhole, and represents the first marine/estuarine stygophile recorded from the region. A fish species, the Blind or Cave Gudgeon *Milyeringa veritas*, also occurs here—it is one of only two vertebrate species known in Australasia that is confined to caves. This species is listed as vulnerable at the national level. *Prionospio thalanji* sp. nov., a worm from the Spionidae family, has been described from Bundera Sinkhole. Other species from this genus are predominantly marine, and this is the first global record of a spionid occurring in a cave environment. The ecosystems represented in the caves of the Cape Range and subterranean waterways under the coastal plains of the peninsula, including in the Learmonth AWR Facility at Bundera Sinkhole, are rare in WA. Only a small number of cave ecosystems exist in WA, and Bundera Sinkhole, along with other caves at Cape Range, are the only example in Australia of an orogenic (formed during a mountain building phase) limestone from the Tertiary Period (between 65 million and 1.8 million years ago). Stygofauna throughout the world is of considerable scientific interest, yielding important information concerning the evolution of life on earth. The stygofauna at Cape Range, including species found within the Learmonth AWR Facility at Bundera Sinkhole, give insights into the origin of Australian fauna, changes in climate since the Miocene Epoch, and the biogeographical history of the continent Several species of vertebrate terrestrial fauna at Cape Range, including within the Learmonth AWR Facility, are of biogeographical importance because they form isolated populations, or populations at the limit of their range. The reptile fauna is of particular biogeographical significance, with a number of species or subspecies occurring here with highly restricted distributions. The Learmonth AWR Facility supports six southern reptile species that are at, or close to, their northern geographic limit: *Diplodactylus ornatus*, *Ctenotus fallens*, *Lerista lineopunctulata*, *L. praepedita*, *Morethia lineoocellata*, and *Vermicella littoralis*. All these species are found on the western coastal dunes, and are largely restricted to the coastal corridor. All are endemic to southern WA and restricted to sandy coastal habitats along the western coast. The Learmonth AWR Facility supports several plant species that are either endemic, or mainly limited to the Cape Range peninsula, with at least ten endemic flora species occurring here.

Commonwealth Heritage place	Class	Summary of significance^
Mermaid Reef – Rowley Shoals (WA list)	Natural	Mermaid Reef is characterised by environmental conditions that are rare for shelf-edge reefs and are known only in the Rowley Shoals in WA; these conditions include clear, deep oceanic water and large tidal ranges. Species of conservation significance recorded at the place include the nationally vulnerable Green Turtle (*Chelonia mydas*). The Rowley Shoals provide habitat for species not previously been recorded in WA, including 216 fish species, 39 mollusc species, and seven echinoderm species. The Rowley Shoals are regionally important for their fauna diversity, which includes: corals (184 species in 52 genera); molluscs (260 species); echinoderms (90 species); and fish (485 species). Mermaid Reef, together with Clerke and Imperieuse Reefs, has biogeographical significance due to the presence of species that are at, or close to, the limits of their geographic ranges, including fish known previously only from Indonesian waters (e.g. the apogonid *Cheilodipterus singapurensis*, the pomacentrid *Chrysiptera hemicyanea*, the blenniid *Escenius schroederi*, and several gobiids). The monotypic labrid *Conniella apterygia* is endemic to the region of Rowley Shoals and Seringapatam and Scott Reefs. Mermaid Reef is particularly significant as a stepping-stone in the spread of genetic material from the Indonesian archipelago to the reefs to the south. The Rowley Shoals are important for benchmark studies as they are one of the few places off the north-west coast of WA that have been the site of major biological collection trips by the WA Museum. The Rowley Shoals includes the type locality of several fish, including the genus and species of the wrasse *Conniella apterygia* and the serranid species *Pseudanthias sheni*. The place is one of the best morphological examples of shelf-edge reefs in Australian waters and is important for demonstrating their principal structural and developmental characteristics. A shipwreck off the western edge of Mermaid Reef is believed to be that of the British whaling vessel *Lively*, which was lost in the early 1800s.
Ningaloo Marine Area – Commonwealth Waters (WA list)	Natural	Whale Sharks (*Rhincodon typus*) congregate in the Ningaloo Marine Area after the mass coral spawning each autumn in the adjacent Ningaloo Reef (State waters). The place is an important feeding area for the Whale Shark and one of the few places in the world where they are known to congregate regularly in significant numbers. The place is part of the annual migration route for the endangered (Commonwealth) Humpback Whale. They migrate north to Kimberley (WA) breeding grounds in winter (June–August) and south to Antarctic feeding grounds in summer (August–November). Other Commonwealth listed threatened species found in the place are the endangered Blue Whale, Southern Right Whale (*Eubalaena australis*), Loggerhead Turtle, and Southern Giant Petrel (*Macronectes giganteus*); the vulnerable Fin Whale (*Balaenoptera physalis*), Sei Whale (*B. borealis*), Green Turtle, Hawksbill Turtle, Flatback Turtle, Soft-plumaged Petrel (*Pterodroma mollis*), Great White Shark (*Carcharodon carcharias*), and Grey Nurse Shark (*Carcharias taurus*). Other significant species include the Dugong, Spinner Dolphin (*Stenella longirostris*), Yellow-nosed Albatross (*Diomedea chlororhynchos*) and Osprey (*Pandion haliaetus*). Marine turtle density is exceptionally high in the place; Green Turtles are the most abundant, exceeding the highest densities recorded in the Great Barrier Reef Marine Park (Queensland). The place is on the migratory route of many trans-equatorial wader bird species, and provides valuable feeding grounds for many migratory seabirds, including 11 species protected under JAMBA and/or CAMBA including the Wedge-tailed Shearwater (*Puffinus pacificus*), Wilson's Storm Petrel (*Oceanites oceanicus*), Lesser

Commonwealth Heritage place	Class	Summary of significance^
		Frigatebird (*Fregata ariel*), Crested Tern (*Sterna bergii*), and White-winged Tern (*Chlidonias leucoptera*). The place is an important breeding area for billfish, and is one of the few areas in the world where aggregations of several species (Black Marlin, Blue Marlin, Striped Marlin, and sailfish) occur. The place is an important feeding area for manta rays in autumn and winter and significant for tuna migration and potentially important for juvenile Southern Bluefin Tuna (*Thunnus maccoyii*). The Ningaloo Marine Area provides opportunities for scientific research in many different fields related to aspects of the place's unique and interesting features. Past, current, and ongoing research is being undertaken by academic and research institutions, including: the Department of Biodiversity, Conservation and Attractions (WA), Commonwealth Scientific and Industrial Research Organisation (CSIRO), Australian Institute of Marine Science (AIMS), Murdoch University (WA), University of WA, Edith Cowan University (WA), and James Cook University (Queensland). Areas of research include tourism, marine ecology, whales, marine turtles, Whale Sharks, fish, and oceanography. The Ningaloo Marine Area has many historic associations for European exploration and development of the North West Cape and northern WA, including pearling and whaling activities. To date eight shipwrecks dating from 1811 to 1923 have been discovered in the area. Other Indigenous and non-Indigenous cultural values of National Estate significance may exist in this place, but the AHC has not yet identified, documented, or assessed these values.
Scott Reef and Surrounds – Commonwealth Area (External territories list)	Natural	Scott Reef is a significant component of a disjointed chain of shelf-edge reefs separated from Indonesia by the Timor Trough. It is regionally significant both because of its high representation of species not found in coastal waters off WA and for the unusual nature of its fauna, which has affinities with the oceanic reef habitats of the Indo-West Pacific as well as the reefs of the Indonesian region. Scott Reef is important for its contribution to understanding long-term geomorphological and reef formation processes and past environments—its sedimentary sequence extends back to include sediments from the Triassic Period. The place has biogeographical significance due to the presence of species that are at, or close to, the limits of their geographic ranges, including fish known previously only from Indonesian waters (e.g. *Cheilodipterus singapurensis*, *Chrysoptera hemicyanea*, *Ecsenius schroederi*, and several gobiids). In addition, some coral species may be endemic to Scott Reef. The reef's isolation and large size may predispose it for the evolution of genetically distinct subspecies or endemic species. Several species are currently only known from Scott Reef, including 51 fish species, 14 mollusc species, six echinoderm species, and the seagrass *Thalassia hemprichii*. Scott Reef is of biogeographical significance due to its connectivity in terms of gene flow and coral spore movement to surrounding reefs such as Ashmore Reef and Rowley Shoals. Scott Reef has enormous habitat diversity and is considered a hot spot of fish diversity. Scott Reef is characterised by environmental conditions that are rare for shelf atolls; these conditions include clear, deep oceanic water and large tidal ranges. Scott Reef has nationally vulnerable Green Turtles (*Chelonia mydas*), which are genetically distinct from those on near-coastal sites in WA, from the Lacepede Islands to North West Cape. The sand cays of the place are important habitat for migrating animals in the largely landless expanse of the Timor Sea. They are an important staging area for birds, particularly

Commonwealth Heritage place	Class	Summary of significance^
		migrants to and from Australia. Seventeen of the 25 bird species identified on Scott Reef are on CAMBA and/or JAMBA lists. Scott and Seringapatam Reefs together are regionally important for the diversity of their fauna, which includes corals (224 species in 56 genera); molluscs (279 species); decapod crustacea (56 species); echinoderms (117 species); and fish (558 species). Scott Reef is important for scientific research and benchmark studies due to its great age, the exceptional documentation of its geophysical and physical environmental characteristics, and its use as a site of major biological collection trips and surveys by the WA Museum and AIMS.
Yampi Defence Area (WA list)	Natural	The Yampi Defence Area displays a complex mosaic of landforms in the transition from the sandstone plateaus of the north-west Kimberley, to the broad plains and pindan scrub of the south-west Kimberley. The occurrence of such diverse landscapes within a relatively limited area is unusual. The strong relationship that exists between past orogenic events and the diverse landscape pattern of ridges and valleys is emphasised in the shape of the Yampi Fold Belt, and distinguished by the pronounced ria embayments that characterise the coastline. Landforms originating from rocks within the Yampi Fold Belt and the terrain associated with the Late Devonian Lillybooraroo Conglomerate are of considerable scientific importance. The erosion of the Lillybooraroo Conglomerate, which covers the Yampi Fold Belt, has partially exposed a pre-Devonian land surface, the attributes of which have enormous potential to aid our understanding of long-term geomorphological processes and evolution. Suggestions that the Lillybooraroo Conglomerate remains an original valley fill deposit would attest to very low rates of erosion and long-term landscape stability, reinforcing the scientific importance of the place. The Yampi Defence Area, which is at the crossroads of the Dampierland, Central, and Northern Kimberley biogeographical regions, has a diverse range of ecosystems, displaying an unusual richness of faunal associations and vegetation communities, with >800 plant species (approximately one-third of the described Kimberley flora) being recorded. Previous surveys of the Dampier Peninsula and Walcott Inlet, and the Kimberley Rainforest Survey enable the changing floristic composition to be compared between adjacent areas. On the basis of species richness, indications are that the Yampi Defence Area supports >1,000 species, including undescribed, rare, and fire-sensitive species that are declining elsewhere in the Kimberley. Similarly, the known distributions of vertebrates from the Yampi Peninsula, and locations to the north and south, indicate that a far richer fauna is likely to occur in the place. Fire-protected sandstone communities, typified by healthy mixed-age stands of cypress pine (*Callitris intratropica*) once common throughout the Kimberley are now very rare in northern Australia, and the occurrence of such stands around Secure Bay are important reference sites for similar Kimberley plant communities that are subject to more frequent fire regimes. The extensive sandstone landforms support small isolated patches of rainforest (the south-west limit in the Kimberley of the distribution of rainforest over sandstone), creating important nodes of diversity and refugia that contain many regionally endemic plants, animals, and invertebrates. Granite landforms are of restricted distribution in the Kimberley and mostly occur in drier areas. The high concentration of granite outcrop sequences at Yampi occurs in a higher rainfall zone

Commonwealth Heritage place	Class	Summary of significance^
		resulting in formation of diverse and specialised vegetation communities. Aquatic plants inhabit the ephemeral pools that form in granite depressions, while rock-colonisers populate the granite fissures and scree slopes where run-off water is high. Six plant taxa occur within the place that are endemic to the Yampi Peninsula. Yampi Defence Area is the type locality for the insectivorous plant *Byblis filifolia*, first collected in 1838 during the voyage of *HMS Beagle*. The close juxtaposition of three botanical regions within the place is highlighted by the presence of numerous tropical plant species and several animal taxa that are at the southern edge of their distribution. Merging with these are many arid zone plants at the northern and western edge of their distribution, recognisable as the pindan grades into the taller woodland structure of the north-western Kimberley. The sandstone mesa south of Kimbolton is the southernmost locality for several plant taxa restricted to the fire-protected sandstone ranges of the Kimberley. The diversity of landforms in the place and the resultant high concentration of small refugial habitats support a regionally rich vertebrate fauna and represent the most southerly known extant population of the nationally vulnerable Golden-backed Tree-rat (*Mesembriomys macrurus*) and the most southerly record in the Kimberley of the Sugar Glider (*Petaurus breviceps*). The bird fauna is significant as it represents a suite of species that are at, or near, the southern edge of their range in the semi-humid zone of the Kimberley including the Green-winged Pigeon (*Chalcophaps indica*); the Torres Strait Pigeon (*Ducula bicolor*); and the Little Shrike-thrush (*Colluricincla megarhyncha parvula*). The place is also an important zone of overlap between many northern and southern species and subspecies. The vertebrate fauna shows its closest similarity to those recorded from the wetter areas of the west Kimberley that lie further to the north. The place supports several fauna and flora species that are listed as specially protected, threatened, or having priority status in WA, as well as four fauna species that are nationally vulnerable and one species that is nationally endangered. Other Indigenous and non-Indigenous cultural values of National Estate significance may exist in this place, but the AHC has not yet identified, documented, or assessed these values.

^ Source: Ref. 6.

2.4 Wetlands of international importance (listed under the Ramsar Convention)

At the time of writing this document, Australia has 66 Ramsar wetlands that cover >8.3 million ha. Ramsar wetlands are those that are representative, rare, or unique wetlands, or that are important for conserving biological diversity. These are included on the List of Wetlands of International Importance held under the Ramsar Convention (Ref. 10).

The Ramsar Wetlands of Australia spatial dataset (Ref. 11) shows the Ramsar wetlands within the PA (Table 2-4). The Ramsar Convention defines ecological character as the combination of the ecosystem components, processes, benefits and services that characterise the wetland at a given point in time (Ramsar Convention 2005a, Resolution IX.1 Annex A). A summary of the ecological character of the wetlands is described in Table 2-4.

Table 2-4: Ramsar wetlands

Summary of the ecological character of Ramsar wetlands
Ashmore Reef Commonwealth Marine Reserve
Ashmore Reef Commonwealth Marine Reserve is located in the Indian Ocean on the edge of Australia's North West Shelf, ~610 km north of Broome and ~840 km west of Darwin. The Reserve is in Australia's External Territory of Ashmore and Cartier Islands. It is the largest of only three emergent oceanic reefs present within the north-eastern Indian Ocean. The Reserve is comprised of numerous marine habitats and supports a regionally important and diverse range of species. The following summary of ecosystem components, processes and services has been extracted from Hale and Butcher (Ref. 12). **Ecosystem components and processes** • Climate: Arid tropical monsoonal climate. Located outside the main belt of tropical cyclones in the Timor Sea. • Geomorphic setting: Located in an area of high oil and gas reserves, with active hydrocarbon seeps. Geomorphic groups within the site include reef slope, reef crest, reef flat, back reef sands, lagoons and islands. • Tides and currents: Strong seasonal influences of the Indonesian Throughflow and Holloway currents. Internal waves are a feature of the region and Ashmore Reef may act to break these resulting in increased nutrients from the bottom waters. High energy environment with spring tides over 4.5 m and large flushing on tidal cycles. • Water quality: Seasonal variations in temperature and salinity in ocean and lagoon water. Water clarity, turbidity and other water quality parameters remain a knowledge gap. • Vegetation: Five species of seagrass recorded with *Thalassia hemprichii* dominant, comprising over 85% of total cover. Total cover of 470 ha, over 3,000 ha of macroalgae, mostly on reed slope and crest areas. Algae dominated by turf and coralline algae with fleshy macroalgae comprising typically less than 10% of total algae cover. • Marine invertebrates: Ashmore Reef has a diversity of marine invertebrates including hard and soft corals, molluscs, echinoderms and crustaceans. 275 species of hard coral, covering an area of around 700 ha. 39 taxa of soft coral, covering an area of around 300 ha. Total coral cover was low around the time of listing following the 1998 bleaching event but recovered in recent years to baseline levels. Over 600 species of mollusc, including two endemic species. Over 180 species of echinoderm, including 18 species of sea cucumber. Sea cucumber density is highly variable, but on average exceeds 30 per hectare. 99 species of decapod crustacean. • Fish: Over 750 species of fish, including five species of fish and three species of shark listed as threatened. Predominantly shallow water, benthic taxa that are common throughout the Indo-Pacific. Density of small reef fishes is around 20,000 to 40,000 per hectare. Low density of sharks (less than one per hectare). • Seasnakes: Prior to listing there was a high diversity and population, peaking in 1998 with an estimated total population of 40,000 snakes in the site. However, by time of listing in 2002 the site was on a trajectory of decline and diversity and abundance was low. • Turtles: Three species of marine turtle: Green (*Chelonia mydas*), Hawksbill (*Eretmochelyis imbricata*) and Loggerhead (*Caretta caretta*) all of which are listed threatened species. Green Turtles are the most abundant, with a total estimated population of around 10,000. Nesting by two species; Green Turtles and Hawksbill Turtles. • Seabirds and shorebirds: Ashmore Reef supports an abundance and diversity of wetland birds. 72 species of wetland dependent bird recorded within the Ramsar site. 47 species listed under international migratory agreements. Average of around 48,000 seabirds and shorebirds annually. Six species are regularly recorded in numbers greater >1% of the population. Nesting of 20 species, 14 of which regularly breed in the site. • Dugong: Small but significant population, that may breed within the site. Data deficient. **Ecosystem services** • Provisioning services–Freshwater: Indonesian fishers use the freshwater lens at West Island. • Cultural services–Recreation and tourism: Although remote and access is controlled, the site is important for passive recreation such as diving and bird watching.

Summary of the ecological character of Ramsar wetlands
• Cultural services–Cultural heritage and identity: Ashmore Reef has been regularly visited and fished by Indonesians since the early 18th century. West Island contains some archaeological artefacts and graves. • Cultural services–Scientific and educational: The reef has high value for scientific research because it currently received relatively low use and is ecologically unique within the bioregion. • Supporting services–Near-natural wetland types: Ashmore Reef supports a number of largely unmodified wetland types. • Supporting services–Biodiversity: Ashmore Reef is a hotspot of biodiversity within the Timor Province bioregion. Highest biodiversity of reef building corals (275 species from 56 genera). Highest diversity of soft corals (39 taxa). More than 600 species of mollusc. Over 180 species of echinoderm, including 13 species of sea cucumber. Nearly 100 species of decapod crustacean. Over 750 species of finfish. High diversity of seasnakes. • Supporting services–Physical habitat: The site supports large breeding colonies of seabirds. • Supporting services–Priority wetland species: The Ramsar site supports 47 species of shorebirds listed under international migratory bird treaties. • Supporting services–Threatened species: Ashmore Reef supports 62 species listed as threatened at the national and/or international level.
Becher Point Wetlands
The Becher Point Wetlands Ramsar site is a system of about 60 small wetlands located near Rockingham in southwest WA. Over the past 5,000 years Becher Point advanced seaward, or westwards, in response to falling sea levels, with the new terrestrial land forming a stable beachridge plain. As the beachridge plain grew westwards, new wetlands formed to the west of the older wetlands. The older wetlands evolved from simple groundwater systems to more complex wetland systems with different hydrological and ecological character. The Becher Point Wetlands Ramsar site covers the younger wetlands in this progression, with the newest wetlands being <1,000 years old and the oldest ~3,000 years old. The wetlands support sedgelands, herblands, grasslands, open-shrublands, and low open-forests. The sedgelands that occur within the linear wetland depressions of the Ramsar site are a nationally listed threatened ecological community (TEC). At least four species of amphibians and 21 species of reptiles have been recorded on the site. The site also supports the Southern Brown Bandicoot. The site is gazetted as a reserve for conservation of flora and fauna. The site, which includes the Port Kennedy Scientific Park, is used for research, education, and recreation. A formal ecological character description report is currently not available for the Becher Point Wetlands.
Eighty-mile Beach
The Eighty-mile Beach Ramsar site comprises two separate areas: ~220 km of beach and associated intertidal mudflats from Cape Missiessy to Cape Keraudren, and the Mandora Salt Marsh ~40 km to the east. The beach is characterised by extensive (1–4 km wide) intertidal mudflats comprised of fine silt and clay, bounded to the east by a narrow strip of coarse quartz sand and then coastal dunes. The beach is a relatively linear stretch with a few tidal creeks with small extents of the grey mangrove (*Avicennia marina*). Mandora Salt Marsh comprises of a series of floodplain depressions within a linear dune system. The site contains two large seasonal depressional wetlands (Lake Walyarta and East Lake) and a series of small permanent mound springs. The following summary of ecosystem components, processes and services has been extracted from Hale and Butcher (Ref. 13). **Ecosystem components and processes** • Climate: Semi-arid monsoonal with a prolonged dry period. >80% of rainfall in the wet season (December to March). High inter-annual variability. High occurrence of tropical cyclones. • The Beach:

Summary of the ecological character of Ramsar wetlands
– Geomorphology: Extensive intertidal mudflats comprised of fine-grained sediments. Site is backed by steep dunes comprised of calcareous sand. – Hydrology: Macro-tidal regime. No significant surface water inflows. Groundwater interactions unknown (knowledge gap). – Primary production and nutrient cycling: Data deficient, but organic material deposited from ocean currents driving the system through bacterial or microphytobenthos driven primary production. – Invertebrates: Large numbers and diversity of invertebrates within the intertidal mudflat areas. – Fish: Data deficient, but anecdotal evidence of marine fish (including sharks and rays) using inundated mudflats. – Waterbirds: Significant site for stop-over and feeding by migratory shorebirds. Regularly supports >200,000 shorebirds during summer and >20,000 during winter. High diversity with 97 species of waterbird recorded from the beach. Regularly supports >1% of the flyway population of 20 species. – Marine turtles: Significant breeding site for the Flatback Turtle. • Mandora Salt Marsh: – Geomorphology: Wetland formation dominated by alluvial processes. Wetlands were once a part of an ancient estuary. Freshwater springs have been dated at 7,000 years old. – Hydrology: Lake Walyarta, East Lake and the surrounding intermittently inundated paperbark thickets are inundated by rainfall and local runoff. Extensive inundation occurs following large cyclonic events. Salt Creek and the mound springs are groundwater fed systems through the Broome Sandstone aquifer. – Water quality: Most wetlands are alkaline reflecting the influence of soils and groundwater. Salinity is variable, mound springs are fresh, Salt Creek hyper-saline and Lake Walyarta variable with inundation. Nutrient concentrations in groundwater and groundwater fed systems are high. – Primary production and nutrient cycling: Data deficient. However, evidence of boom-and-bust cycle at Lake Walyarta with seasonal inundation. – Vegetation: Inland mangroves (*Avicennia marina*) lining Salt Creek are one of only two occurrences of inland mangroves in Australia. Paperbark thickets dominated by the saltwater paperbark (*Melaleuca alsophila*) extend across the site on clay soils which retain moisture longer than the surrounding landscape. Samphire (*Tecticornia* spp.) occurs around the margins of the large lakes. Freshwater aquatic vegetation occurs at Lake Walyarta when inundated and at the mound spring sites year round. – Invertebrates: Data limited, but potentially unique species – Waterbirds: Significant site for waterbirds and waterbird breeding, particularly during extensive inundation events. 66 waterbirds recorded. Supports >1% of the population of at least two species. Breeding recorded for at least 24 species. **Ecosystem benefits and services** • Provisioning service–Freshwater: The freshwater springs at Mandora Salt Marsh provide drinking water for livestock. • Provisioning service–Genetic resources: Plausible, but as yet no documented uses. • Regulating service– Climate regulation: Plausible, but data deficient. • Regulating service–Biological control of pests: Evidence that many of the shorebirds feed on the adjacent pastoral land and that the incidence of 2.88 million oriental pratincole coincided with locusts in almost plague proportions, upon which the birds fed. • Cultural Services–Recreation and tourism: The beach portion of the site is important for recreational fishing, tourism, bird watching and shell collecting. • Cultural Services–Spiritual and inspirational: Spiritually significant for the Karajarri and Nyangumarta and contain a number of specific culturally significant sites. Site has inspirational, aesthetic and existence values at regional, state and national levels. • Cultural Services–Scientific and educational: Mandora Salt Marsh and Eighty-mile Beach have been the site of a number of significant scientific investigations. In addition, Eighty-mile

Summary of the ecological character of Ramsar wetlands
Beach is a significant site for migratory shorebird monitoring and is currently part of the Shorebirds 2020 program. • Supporting services: As evidenced by the listing of the Eighty-mile Beach Ramsar site as a wetland of international importance. The system provides a wide range of biodiversity related ecological services critical for the ecological character of the site including: – contains exceptionally large examples of wetland types and includes rare wetland types of special scientific interest – supports significant numbers of migratory shorebirds – supports waterbird breeding – supports marine turtles.
Ord River Floodplain
The Ord River Floodplain Ramsar site is located in the northeast of WA, ~8 km east of the town of Wyndham within the Victoria-Bonaparte bioregion. The site covers over 140,000 hectares and lies within the Shire of Wyndham–East Kimberley. The Ord River Floodplain site contains a wide range of wetland types and includes inland and marine components. The Ramsar site comprises: Parry Lagoons, Ord Estuary, and False Mouths of the Ord. The following summary of ecosystem components, processes and services has been extracted from Hale (Ref. 14). **Ecosystem components and processes** • Climate: semi-arid monsoonal; 80% of rainfall in the wet season (December to February); on average evaporation exceeds rainfall in 11 of 12 months • Geomorphology: estuarine reaches of river; tidal flat creek system (False Mouths of Ord); seasonally inundated floodplain with permanent waterholes (Parry Lagoons). • Hydrology: macro-tidal influence; modified flows from dams upstream; low flow during dry season; higher flows in wet season; overbank flows from the Ord River to Parry Lagoons now low frequency; Parry Creek major source of water for Parry Lagoons (and floodplains) • Water Quality: estuary is highly turbid; potentially high nutrient levels from upstream agriculture; estuary is a net exporter of nutrients; salinity in estuary varies seasonally (30–35 ppt in dry season; < 4 ppt in wet); Parry Lagoons predominantly fresh; levels of agrichemicals above ANZECC guidelines detected • Phytoplankton: estuary dominated by diatoms; plankton is predominantly epibenthic • Vegetation: extensive mangroves in intertidal areas – 15 species; saltmarsh at higher elevations; Parry Lagoons characterised by extensive sedge / grass lands (intermittent inundation); aquatic vegetation in permanent waterholes; wooded swamp surrounding • Invertebrates: commercially significant taxa include mud crabs and white banana prawns; data deficient for other communities and populations • Fish: > 50 species (estuarine, marine and freshwater); migratory route for ~17 species; supports threatened taxa listed under the EPBC Act (Freshwater Sawfish, Green Sawfish and Northern River Shark) • Birds: Regularly supports >20,000 waterbirds; breeding recorded for 16 species; regularly supports >1 % of the population of Plumed Whistling Duck and Little Curlew; supports the EPBC listed species the Australian Painted Snipe • Crocodiles: supports Saltwater and Freshwater Crocodiles **Ecosystem services** • Provisioning service–Wetland products: commercial fisheries for a number of species of fish, as well as prawns and crabs; genetic resources - plausible, but as yet no documented uses • Regulating services–Erosion control: mangroves • Regulating services–Climate regulation: plausible, but data deficient • Regulating services–Biological control of pests: support of predators of agricultural pests • Cultural services–Recreation and tourism: site is important for recreational fishing; tourism; bird watching and crocodile watching • Cultural services–Spiritual and inspirational: spiritually significant for the Miriuwung, Gajerrong and contain a number of specific culturally significant sites; site has inspirational,

Summary of the ecological character of Ramsar wetlands
aesthetic and existence values at regional, state and national levels; the site contains a number of non-indigenous historical sites • Cultural services–Scientific and educational: focus of scientific research (e.g. CSIRO investigation) • Supporting services: as evidenced by the listing of the Ord River Floodplain site as a wetland of international importance; the system provides a wide range of biodiversity related ecological services critical for the ecological character of the site including: – supporting diverse habitat types – supporting critical life stages – supporting threatened species – supporting waterbird populations – supporting fish populations.
Peel-Yalgorup System
The Peel-Yalgorup wetland system, in south-western Australia, is located ~80 km south of Perth within the Swan Coastal Plain bioregion. The 26,000 ha site includes shallow estuarine waters, saline, brackish and freshwater wetlands of the Peel Inlet, Harvey Estuary, several lake systems including Lake McLarty and Lake Mealup and the Yalgorup National Park. The following summary of ecosystem components, processes and services has been extracted from Hale and Butcher (Ref. 15). **Ecosystem components and processes** • Peel-Harvey Estuary – Geomorphology: Shallow bar-built estuary. Narrow connection to the Indian Ocean (Mandurah Channel). Organic sediments (black ooze). – Hydrology: Highly seasonal freshwater inflows from direct precipitation and rivers. Limited tidal exchange with the Indian Ocean. Limited groundwater inflows. – Water Quality: High concentrations of nutrients (eutrophic) from catchment. Seasonal variability in salinity. Stratification and deoxygenation of bottom waters. – Acid Sulfide Soils: Monosulphidic black ooze. Exposed via dredging. – Phytoplankton: Winter diatom blooms. Spring Nodularia blooms in the Harvey Estuary. – Benthic Plants: Excessive growth of green macroalgae (Cladophora and/or Chaetomorpha) in the Peel Inlet. Smothering of seagrass. – Littoral Vegetation: Samphire communities around the shorelines. Paperbark communities in the Harvey River delta. – Invertebrates: Commercially significant taxa include blue swimmer crabs and western king prawns. Diverse communities in the estuary and the intertidal zones – Fish: Estuarine and marine species. Migratory route for some species. – Birds: High diversity and abundance of waterbirds. Regularly supports >20,000 waterbirds (maximum recorded 150,000 individuals). Breeding recorded for 12 species. Regularly supports >1% of the population of 11 species. • Yalgorup Lakes – Geomorphology: Shallow depressional wetlands. No defined surface water inflow or outflow channels. – Hydrology: Highly seasonal freshwater in-flows predominantly from groundwater. No surface water outflows. – Water quality: Brackish to hypersaline conditions. Seasonal salinity cycles. Low nutrient concentrations. Some lakes exhibit stratification. Highly alkaline (calcium and bicarbonate). – Benthic microbial community: Thrombolites in Lake Clifton. Cyanobacterial algal mats across the sediment surface in some lakes. – Flora: Small buffer zones. Some areas of paperbark communities. – Fauna: Significant site for waterbirds. Large numbers of Shelduck and Black Swans annually. 1% of population of Banded Stilt, Red-necked Stint, Hooded Plover, Shelduck and Musk Duck. Breeding of eight species.

Summary of the ecological character of Ramsar wetlands
• Lakes McLarty and Mealup – Geomorphology: Shallow depressional wetlands. No defined surface water inflow or outflow channels. – Hydrology: Highly seasonal freshwater inflows predominantly from groundwater. No natural surface water outflows (although there are drains present). – Water quality: Fresh to brackish conditions. Alkaline. – Flora: Typha across parts of each lake. Sedges on the margins. Paperbark community at higher elevations. – Fauna: Important habitat for freshwater invertebrates. Provides habitat for a large diversity and number of waterbirds. Breeding recorded for 12 species of waterbird. **Ecosystem services** • Provisioning services–Wetland products: Commercial fisheries for a number of species of fish, as well as prawns and crabs. • Regulating services–Pollution control and detoxification: Peel Inlet and Harvey Estuary act as sinks for nutrients from the catchment and a mechanism for discharges to the sea. • Regulating services–Climate regulation: Data deficient – plausible but not documented. Regulating service–Flood control: Site acts as a receiver for drainage water from the surrounding floodplain. • Cultural services–Recreation and tourism: The Peel Inlet and Harvey Estuary are important recreational fisheries. Passive recreational activities such as bird watching occur both in the estuarine and wetland areas within the site. The Peel Inlet and Harvey Estuary are important for water based recreational activities and water sports such as boating. • Cultural services–Spiritual and inspirational: Wetlands and estuarine areas are spiritually significant for the Nyoongar and contain a number of specific culturally significant sites. The site has inspirational, aesthetic and existence values at regional, state and national levels. • Cultural services–Scientific and educational: The Peel Inlet and Harvey Estuary are the sites for long-term monitoring dating back several decades. Lake Clifton represents one of very few places at which thrombolites can be studied. • Supporting services–Biodiversity: As evidence by the listing of the Peel-Yalgorup site as a wetland of international importance. The system provides a wide range of biodiversity values including: – supporting a wide range of ecological communities – supporting a number of regionally, nationally and internationally threatened species – supporting a high diversity of species (flora and fauna) – supporting a bio-regionally unique community (thrombolites). • Supporting services–Nutrient cycling: The Peel-Yalgorup system plays a large role in the recycling and discharge of nutrients from the surrounding catchment. Carbon sequestration – data deficient but plausible.
Roebuck Bay
The Roebuck Bay Ramsar site comprises 34,119 ha, mostly occupied by intertidal mudflats. Waters more than 6 m deep at low tide are excluded from the site, which stretches from Campsite (a location on the northern shore of Roebuck Bay) east of the town of Broome, to south of Sandy Point. The soft bottom intertidal mudflats of the northern and eastern shores of Roebuck Bay, and high tide roosts at Bush and Sandy Points are the most biologically significant parts of the site, which was listed for several reasons including, most notably, outstanding shorebird values. The following summary of ecosystem components, processes and services has been extracted from Bennelongia (Ref. 16). **Ecosystem components and processes** • Climate: The climate of the Broome region is semi-arid, monsoonal with a distinct wet (October to February) and dry season (March to September). Cyclonic flooding during the summer wet season results in periodic inundation of Roebuck Plains and drainage of freshwater off the Plains and through the mangroves. • Ocean currents: The Indonesian Flowthrough flows westwards from the Pacific to the Indian Ocean. This in turn provides a mass of warm water to the Leeuwin current off Western Australia as it sweeps south along the west coast and east along the south coast.

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• Tidal variation: Tides in the vicinity of Broome have a very large range (9.5 m), thus exchange through the Bay is high, tidal velocities are relatively high and large mudflats have developed. • Geomorphology: A megascale irregular curved embayment that contains a wide expanse of intertidal mud and sand flats indented by microscale linear tidal creeks. • Sediment structure: Three main sediment provinces have been identified: northern sands province, eastern silt and clay province and southern sands province. • Hydrology: The Broome Sandstone contains the most utilised (Broome water supply) and hence most threatened groundwater resource in the Canning Basin. The Broome Sandstone is generally an unconfined aquifer recharged by direct infiltration from rainfall. The Broome sandstone will be discharging groundwater to the surface or subsurface at the margins of the Roebuck plains and tidal creek systems. There will also be deep submarine groundwater discharge occurring at or below the low tide mark and within Roebuck deeps. The Broome Sandstone will be discharging groundwater to the coupled Roebuck Bay/Roebuck Plains system from all landward directions. This may create freshwater dependant ecological niches which could be threatened by regional water use or pollution. Roebuck Plains produces large amounts of sheetwash into the bay after large cyclonic events or prolonged wet season rains. This will be an important vector for nutrients, organic carbon and freshwater into the bay. • Water quality: Water quality appears poor, with TP levels, although there is limited information available from similar marine systems for comparison. Consideration has been given to the impact of urban run-off into the marine ecosystem. Agricultural activities may influence water quality from rangeland run-off during flood events. • Littoral vegetation: Along the sea edge there are mangrove communities. Mangrove detritus is a major source of energy for animals in the mangal and, perhaps, some mudflat species. Behind the mangal is an extensive plain of saline grassland that rises to the pindan plains typical of the western desert. Samphire occurs in the wetter zones. On beach dunes spinifex dominates. • Plankton and diatoms: Stable isotopes of carbon and nitrogen have shown that plankton and diatoms are a major source of energy for shellfish in the Bay. • Benthic invertebrates: Roebuck Bay has one of the most diverse arrays of benthic invertebrate infauna for any intertidal ecosystem. Species numbers are dominated by polychaetes. There is a rich assemblage of bivalves that provide an important source of accessible food for shorebirds. The average density of macrobenthic fauna is around 1287 animals per square metre. • Birds: The bay provides important food resources and refuge for migrating arctic shorebirds. A total of 43 species of waterbirds are recorded for the Bay including 22 species listed in migratory bird agreements. • Fish: The mudflats and mangrove creeks are nurseries for at least 4 fish species, for commercial prawn species and for mudcrabs • Marine fauna: Dugongs have been regular and important inhabitants of Roebuck Bay. Earlier records show evidence of Dugongs feeding on extensive seagrass beds in 1986. Loggerhead Turtles and Green Turtles regularly use the Ramsar site as a seasonal feeding area and as a transit area on migration. Flatback Turtles regularly nest in small numbers around Cape Villaret during the summer months. **Ecosystem services** • Provisioning services–Wetland products: Commercial and recreational fisheries for a number of species of fish, prawns and crabs. Aboriginal people continue to make extensive use of the Bay's natural resources. • Regulating Services–Pollution control and detoxification: No data • Regulating Services–Climate regulation: No data • Cultural service–Recreation and tourism: Major tourism and bird-watching venue. Broome is an important destination for national and international tourism. Active recreational fishing and crabbing activities, boating, hovercraft. • Cultural services–Spiritual and inspirational: Site has inspirational and aesthetic values that are both regional and nationally recognised through travel to Broome. Roebuck Bay is spiritually significant to Aboriginal people belonging to the Yawuru and Jukun groups and contains a number of specific culturally significant sites.

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• Cultural services–Scientific and educational: Many scientific research programs, especially on shorebirds and mudflat invertebrates, have been based at Roebuck Bay. they have often involved Broome Bird Observatory, near Fall Point. • Supporting Services–Biodiversity: Key location in global flyway for migratory waders. Nursery values for prawns and fish. Seagrass beds for Dugong.

2.5 Listed threatened and migratory species

The Species of National Environmental Significance (SNES) database (Ref. 17) stores maps and point distribution information about species related to the EPBC Act.

The Biologically Important Areas (BIAs) of Regionally Significant Marine Species database (Ref. 18) uses the marine bioregional planning program to identify, describe, and map 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).

The following information was generated from the Biologically Important Areas of Regionally Significant Marine Species database (Ref. 18), the Species of National Environmental Significance (Public Grids) database (Ref. 17), and a protected matters search (appendix a; Ref. 4).

2.5.1 Marine mammals

Table 2-5 lists the threatened and/or migratory marine mammals that may be present within the PA (Ref. 17; Ref. 4; appendix a).

Table 2-6 lists the individual BIAs for marine mammals and their known seasonal presence within the PA (Ref. 18); these are shown in Figure 2-1.

A review of the Conservation Advices and/or Recovery Plans identified key threats associated with threatened and/or migratory marine mammals that may be present within the PA. These threats and relevant management advice are listed in Table 2-7.

Table 2-5: Threatened and/or migratory marine mammals

Common name	Scientific name	Threatened status	Migratory
Antarctic Minke Whale, Dark-shoulder Minke Whale	*Balaenoptera bonaerensis*		Migratory
Sei Whale	*Balaenoptera borealis*	Vulnerable	Migratory
Bryde's Whale	*Balaenoptera edeni*		Migratory
Blue Whale	*Balaenoptera musculus*	Endangered	Migratory
Fin Whale	*Balaenoptera physalus*	Vulnerable	Migratory
Pygmy Right Whale	*Caperea marginata*		Migratory
Dugong	*Dugong dugon*		Migratory
Southern Right Whale	*Eubalaena australis*	Endangered	Migratory
Dusky Dolphin	*Lagenorhynchus obscurus*		Migratory
Humpback Whale	*Megaptera novaeangliae*	Vulnerable	Migratory

Common name	Scientific name	Threatened status	Migratory
Australian Sea-lion, Australian Sea Lion	*Neophoca cinerea*	Vulnerable	
Australian Snubfin Dolphin	*Orcaella heinsohni*		Migratory
Killer Whale, Orca	*Orcinus orca*		Migratory
Sperm Whale	*Physeter macrocephalus*		Migratory
Indo-Pacific Humpback Dolphin	*Sousa chinensis*		Migratory
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations)	*Tursiops aduncus* (Arafura/Timor Sea populations)		Migratory

Table 2-6: BIAs for regionally significant marine mammals

Common name	Behaviour	Seasonal presence	Occurrence descriptor
Australian Snubfin Dolphin	Breeding	Year-round	Known to occur
	Calving	Year-round	Known to occur
	Foraging	Year-round	Known to occur
	Foraging (high density prey)	Year-round	Known to occur
	Foraging likely	Year-round	Known to occur
	Resting	Year-round	Known to occur
Indo-Pacific Humpback Dolphin	Breeding	Year-round	Known to occur
	Breeding	Year-round	Likely to occur
	Calving	Year-round	Known to occur
	Calving	Year-round	Likely to occur
	Foraging	Year-round	Known to occur
	Foraging	Year-round	Likely to occur
	Foraging (high density prey)	Year-round	Known to occur
	Foraging (high density prey)	Year-round	Likely to occur
	Significant habitat	Year-round	Known to occur

Common name	Behaviour	Seasonal presence	Occurrence descriptor
	Significant habitat – unknown behaviour	Year-round	Likely to occur
Indo-Pacific/Spotted Bottlenose Dolphin	Breeding	Not possible to determine yet	Known to occur
	Calving	Not possible to determine yet	Known to occur
	Foraging	Not possible to determine yet	Known to occur
	Foraging likely	Not possible to determine yet	Known to occur
	Migration likely	Not possible to determine yet	Known to occur
Dugong	Breeding	April/May	Known to occur
	Breeding	Year-round	Known to occur
	Calving	April/May	Known to occur
	Calving	Year-round	Known to occur
	Foraging	April/May	Known to occur
	Foraging	May–September	Known to occur
	Foraging	Year-round	Likely to occur
	Foraging (high density seagrass beds)	April/May	Known to occur
	Foraging (high density seagrass beds)	Year-round	Known to occur
	Migration likely	Year-round	Known to occur
	Nursing	April/May	Known to occur
	Nursing	Year-round	Known to occur
Australian Sea Lion	Foraging (male)	Year-round	Likely to occur
	Foraging (male and female)	Year-round	Known to occur
Blue and Pygmy Blue Whale	Foraging (abundant food source)	Arrive as early as November, with number of animals steadily increasing to peak in March–May. After May the number of whales drops, by late June most animals have	Known to occur

Common name	Behaviour	Seasonal presence	Occurrence descriptor
		left, although a few acoustic detections are made into July (Ref. 19)	
	Foraging (high-density)	Arrive early as Nov with number of animals increasing to peak in March–May. After May the number of whales drops, late June most animals left, a few acoustic detections are made into July (Ref. 19). Satellite tracking data indicates use mid-March-late April,	Known to occur
	Foraging (on migration)	Arrive early as Nov with number of animals increasing to peak in March–May. After May the number of whales drops, late June most animals left, a few acoustic detections are made into July (Ref. 19). Satellite tracking data indicates use mid-March-late April.	Known to occur
Humpback Whale	Calving	Winter	Known to occur
	Migration	Northern migration, late July to September	Known to occur
	Migration	Winter	Known to occur
	Migration (north)	Northern migration, late July to September	Known to occur
	Migration (north and south)	Northern migration, late July to September	Known to occur
	Migration (north and south)	Northern peak July and southward peak October – November (Ref. 19)	Known to occur
	Migration (north and south)	Southbound peak late Sept to mid-Oct. Northward peak mid-June to mid-July	Known to occur
	Migration (south)	Southbound peak late Sept to mid-Oct	Known to occur
	Nursing	Winter	Known to occur
	Resting	Winter	Known to occur
Pygmy Blue Whale	Distribution		Known to occur
	Foraging		Known to occur
	Foraging area (annual high use area)		Known to occur
	Known foraging area		Known to occur

Common name	Behaviour	Seasonal presence	Occurrence descriptor
	Migration	Northern migration (enter Perth canyon January to May; pass Exmouth April to August; continue north to Indonesia). Southern migration (follow WA coastline from October to late December)	Known to occur
		Most use between October and December, peaking in November	Known to occur
Southern Right Whale	Calving buffer	Late autumn, winter, and spring	Known to occur
	Seasonal calving habitat	Late autumn, winter, and spring	Known to occur
Sperm Whale	Foraging (abundant food source)	Summer	Known to occur

Table 2-7: Summary of relevant conservation plans—marine mammals

Species	Relevant Plan / Advice	Key threats / Relevant management advice
Humpback Whale	Conservation Advice for the Humpback Whale 2015–2020 (Ref. 20)	Assessing and addressing anthropogenic noise; shipping, industrial, and seismic surveys • All seismic surveys must be undertaken consistently with the EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales. Should a survey be undertaken in or near a calving, resting, foraging area, or a confined migratory pathway then Part B. Additional Management Procedures must also be applied. • For actions involving acoustic impacts (example pile driving, explosives) on Humpback Whale calving, resting, feeding areas, or confined migratory pathways site-specific acoustic modelling should be undertaken (including cumulative noise impacts). • Should acoustic impacts on humpback calving, resting, foraging areas, or confined migratory pathways be identified a noise management plan should be developed. This can include: – the use of shutdown and caution zones – pre- and post-activity observations – the use of marine mammal observers and/or Passive Acoustic Monitoring – Implementation of an adaptive management program following verification of the noise levels produced from the action (i.e. if the noise levels created exceed original expectations). Minimising vessel collisions • Maximise the likelihood that all vessel strike incidents are reported in the national ship strike database. All cetaceans are protected in Commonwealth waters and, the EPBC Act requires that all collisions with whales in Commonwealth waters are reported. Vessel collisions can be submitted to the National Ship Strike Database at https://data.marinemammals.gov.au/report/shipstrike

Species	Relevant Plan / Advice	Key threats / Relevant management advice
		• 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. • Enhance education programs to inform vessel operators of best practice behaviours and regulations for interacting with Humpback Whales.
Blue Whale	Conservation Management Plan for the Blue Whale 2015–2025 (Ref. 21)	Key threats include: • whaling • climate variability and change • noise interference • habitat modification • vessel disturbance • overharvesting of prey. No relevant management advice has been identified.
Sei Whale	Conservation Advice *Balaenoptera borealis* Sei Whale (Ref. 22)	Assessing and addressing anthropogenic noise: • Once the spatial and temporal distribution (including biologically important areas) of Sei Whales is further defined an assessment of the impacts of increasing anthropogenic noise (including from seismic surveys, port expansion, and coastal development) should be undertaken on this species. Minimising vessel collisions: • Ensure all vessel strike incidents are reported in the national vessel strike database (https://data.marinemammals.gov.au/report/shipstrike).
Fin Whale	Conservation Advice *Balaenoptera physalus* Fin Whale (Ref. 23)	Assessing and addressing anthropogenic noise: • Once the spatial and temporal distribution (including biologically important areas) of Fin Whales is further defined an assessment of the impacts of increasing anthropogenic noise (including from seismic surveys, port expansion, and coastal development) should be undertaken on this species. Minimising vessel collisions: • Ensure all vessel strike incidents are reported in the national vessel strike database
Southern Right Whale	Conservation Management Plan for the Southern Right Whale: A Recovery Plan under the *Environment Protection and Biodiversity Conservation Act 1999* 2011–2021 (Ref. 24)	Key threats include: • entanglement • vessel disturbance • whaling • climate variability and change • noise interference • habitat modification. No relevant management advice has been identified.
Australian Sea Lion	Recovery Plan for the Australian Sea Lion	Key threats include: • interactions with the commercial gillnet fishing sector • mortality due to interactions with the rock lobster industry

Species	Relevant Plan / Advice	Key threats / Relevant management advice
	(*Neophoca cinerea*) (Ref. 25)	• deaths caused by fisheries-related marine debris. Other factors that may be contributing to the lack of recovery include: • habitat degradation and interactions with aquaculture operations • human disturbance to colonies • deliberate killings • disease • pollution and oil spills • prey depletion • climate change. No relevant management advice has been identified.

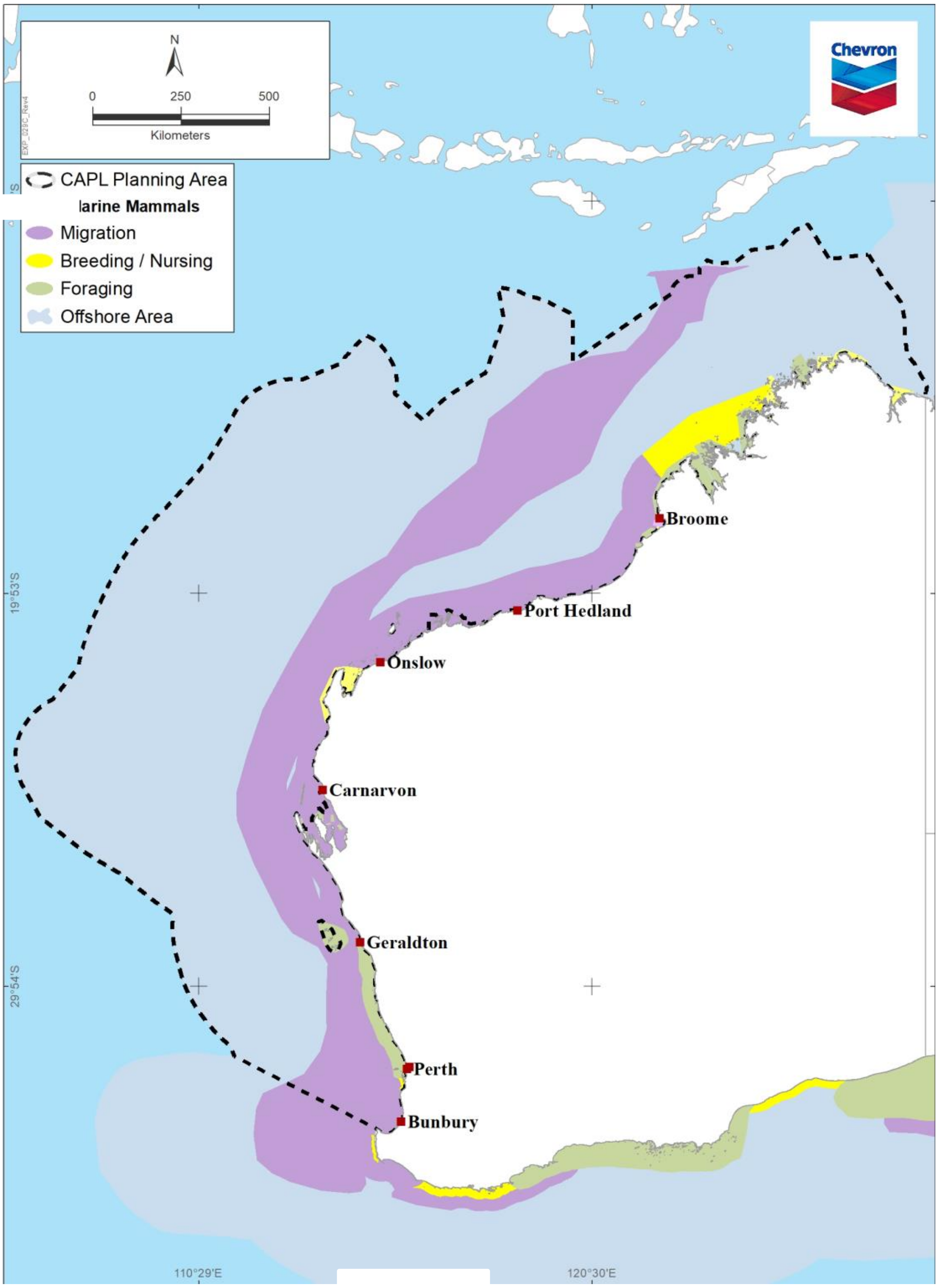


Figure 2-1: BIAs associated with marine mammals

2.5.2 Reptiles

Table 2-8 lists the threatened and/or migratory marine reptile species that may be present within the PA (Ref. 17; Ref. 4; appendix a).

Table 2-9 lists critical nesting habitats within the PA; these are shown on Figure 2-2 (Ref. 26).

Table 2-10 lists the BIAs for marine reptiles and their known seasonal presence within the PA; these are also shown on Figure 2-2 (Ref. 18).

A review of the Conservation Advices and Recovery Plans identified key threats associated with threatened and/or migratory marine reptiles that may be present within the PA. These threats and relevant management advice are listed in Table 2-11.

In addition to the threatened and/or migratory marine reptile species identified in the tables below, an additional 26 listed marine reptile species (all sea snakes except the Freshwater Crocodile [*Crocodylus johnstoni*]) were identified as having the potential to occur within the PA (Ref. 4). Cogger (Ref. 27; Ref. 28) notes that most sea snakes have shallow benthic feeding patterns and are rarely observed in water >30 m deep, indicating that these species are likely to be present in shallow waters.

Table 2-8: Threatened and/or migratory marine reptiles

Common name	Scientific name	Threatened status	Migratory
Short-nosed Seasnake	*Aipysurus apraefrontalis*	Critically Endangered	
Leaf-scaled Seasnake	*Aipysurus foliosquama*	Critically Endangered	
Loggerhead Turtle	*Caretta*	Endangered	Migratory
Green Turtle	*Chelonia mydas*	Vulnerable	Migratory
Salt-water Crocodile, Estuarine Crocodile	*Crocodylus porosus*		Migratory
Leatherback Turtle, Leathery Turtle, Luth	*Dermochelys coriacea*	Endangered	Migratory
Hawksbill Turtle	*Eretmochelys imbricata*	Vulnerable	Migratory
Olive Ridley Turtle, Pacific Ridley Turtle	*Lepidochelys olivacea*	Endangered	Migratory
Flatback Turtle	*Natator depressus*	Vulnerable	Migratory

Table 2-9: Critical habitat for marine turtles

Common name	Location	Seasonal presence	Occurrence descriptor
Loggerhead Turtle	Exmouth Gulf and Ningaloo Coast. 20 km internesting buffer	Nov–May	Known to occur
	Gnaraloo Bay and beaches. 20 km internesting buffer	Nov–May	Known to occur
	Shark Bay, all coastal and island beaches out to the northern tip of Dirk Hartog Island. 20 km internesting buffer	Nov–May	Known to occur
Green Turtle	Mainland east of Mary Island to mainland adjacent to Murrara Island including all offshore islands. 20 km internesting buffer	Nov–Mar	Known to occur
	Ashmore Reef and Cartier Reef. 20 km internesting buffer	Dec–Jan	Known to occur
	Browse Island. 20 km internesting buffer	Nov–Mar	Known to occur
	Scott Reef. 20 km internesting buffer	Nov–Mar	Known to occur
	Adele Island, Lacepede Islands	Nov–Mar	Known to occur

Common name	Location	Seasonal presence	Occurrence descriptor
	Dampier Archipelago. 20 km internesting buffer	Nov–Mar	Known to occur
	Barrow Island, Montebello Islands, Serrurier Island, and Thevenard Island. 20 km internesting buffer	Nov–Mar	Known to occur
	Exmouth Gulf and Ningaloo Coast. 20 km internesting buffer	Nov–Mar	Known to occur
Hawksbill Turtle	Dampier Archipelago, including Delambre Island and Rosemary Island. 20 km internesting buffer	Oct–Feb	Known to occur
	Cape Preston to mouth of Exmouth Gulf including Montebello Islands and Lowendal Islands. 20 km internesting buffer	Oct–Feb	Known to occur
Olive Ridley Turtle	Cape Leveque. 20 km internesting buffer	May–Jul	Known to occur
	Prior Point and Llanggi. 20 km internesting buffer	May–Jul	Known to occur
	Darcy Island. 20 km internesting buffer	May–Jul	Known to occur
	Vulcan Island. 20 km internesting buffer	May–Jul	Known to occur
Flatback Turtle	Cape Domett and Lacrosse Island in the Cambridge Gulf. 60 km internesting buffer	Aug–Sep	Known to occur
	Lacepede Islands. 60 km internesting buffer	Oct–Mar	Known to occur
	Eco Beach – coastal beach near Broome. 60 km internesting buffer	July	Known to occur
	Eighty Mile Beach – coastal beach. 60 km internesting buffer	July	Known to occur
	Cemetery Beach, Port Hedland. 60 km internesting buffer	Oct–Mar	Known to occur
	Mundabullangana Beach. 60 km internesting buffer	Oct–Mar	Known to occur
	Dampier Archipelago, including Delambre Island and Hauy Island. 60 km internesting buffer	Oct–Mar	Known to occur
	Barrow Island, Montebello Islands, coastal islands from Cape Preston to Locker Island. 60 km internesting buffer	Oct–Mar	Known to occur

Table 2-10: BIAs for regionally significant marine reptiles

Common name	Behaviour	Seasonal presence	Occurrence descriptor
Flatback Turtle	Aggregation		Known to occur
	Foraging	Green Turtle aggregation inside of NW Is. Early in summer	Known to occur
	Foraging	January – Flatbacks, Greens	Known to occur
	Foraging	Observations during July, no evidence of turtle activity Oct–Nov for Solitary, Steamboat,	Known to occur

Common name	Behaviour	Seasonal presence	Occurrence descriptor
		Carey, Preston Islands, and Cape Preston	
	Foraging	Year-round	Known to occur
	Internesting		Known to occur
	Internesting buffer	Green Turtle aggregation inside of NW Is. Early in summer	Known to occur
	Internesting buffer	January – Flatbacks, Greens	Known to occur
	Internesting buffer	Summer	Known to occur
	Internesting buffer	Summer (nesting /internesting), year-round	Known to occur
	Mating	Green Turtle aggregation inside of NW Is. Early in summer	Known to occur
	Migrating Corridor	Summer (nesting/interesting) year-round	Known to occur
	Nesting	Green Turtle aggregation inside of NW Is. Early in summer	Known to occur
	Nesting	January – Flatbacks, Greens	Known to occur
	Nesting	Short summer nesting season, predominantly Nov–Mar with peak in January	Known to occur
	Nesting	Summer	Known to occur
Green Turtle	Aggregation	Early summer	Known to occur
	Aggregation		Known to occur
	Basking	Summer	Known to occur
	Foraging	Green Turtle aggregation inside of NW Is. Early in summer	Known to occur
	Foraging	January – Flatbacks, Greens	Known to occur
	Foraging	March–May	Likely to occur
	Foraging	Observations during July, no evidence of turtle activity Oct–Nov for Solitary, Steamboat, Carey, Preston Islands, and Cape Preston	Known to occur
	Foraging	Summer	Known to occur
	Foraging	Summer / possibly year-round	Known to occur
	Foraging	Year-round	Known to occur
	Foraging	Year-round	Likely to occur
	Foraging		Known to occur
	Internesting	Dec–Feb	Known to occur

Common name	Behaviour	Seasonal presence	Occurrence descriptor
	Internesting	Peak season Dec–Jan	Known to occur
	Internesting	Summer	Known to occur
	Internesting	Year-round	Likely to occur
	Internesting		Known to occur
	Internesting buffer	Green Turtle aggregation inside of NW Is. Early in summer	Known to occur
	Internesting buffer	January – Flatbacks, Greens	Known to occur
	Internesting buffer	Peak season Dec–Jan	Known to occur
	Internesting buffer	Summer	Known to occur
	Internesting buffer	Summer (nesting /internesting) year-round	Known to occur
	Internesting buffer	Year-round	Known to occur
	Internesting buffer	Year-round	Likely to occur
	Internesting buffer		Known to occur
	Mating	Green Turtle aggregation inside of NW Is. Early in summer	Known to occur
	Mating	Summer	Known to occur
	Mating	Year-round	Likely to occur
	Mating		Known to occur
	Migrating Corridor	Summer (nesting/interesting) year-round	Known to occur
	Nesting	Green Turtle aggregation inside of NW Is. Early in summer	Known to occur
	Nesting	January – Flatbacks, Greens	Known to occur
	Nesting	Peak season Dec–Jan	Known to occur
	Nesting	Summer	Known to occur
	Nesting	Year-round	Known to occur
	Nesting	Year-round	Likely to occur
	Nesting		Known to occur
Hawksbill Turtle	Foraging	Aggregation inside of NW Is. Early in summer	Known to occur
	Foraging	Observations during July no evidence of turtle activity Oct–Nov for Solitary, Steamboat, Carey, Preston Islands, and Cape Preston	Known to occur

Common name	Behaviour	Seasonal presence	Occurrence descriptor
	Foraging	Year-round	Known to occur
	Foraging	Year-round	Likely to occur
	Internesting	Spring and early summer, peak nesting October	Known to occur
	Internesting buffer	Spring and early summer, peak nesting October	Known to occur
	Internesting buffer	Peak nesting in spring and early summer	Known to occur
	Internesting buffer		Known to occur
	Internesting buffer	Green Turtle aggregation inside of NW Is. Early in summer	Known to occur
	Internesting buffer	Year-round	Known to occur
	Internesting buffer	Year-round	Likely to occur
	Internesting buffer	Peak season Dec–Jan	Likely to occur
	Internesting buffer	Peak nesting in spring and early summer	Likely to occur
	Mating	Green Turtle aggregation inside of NW Is. Early in summer	Known to occur
	Mating	Spring and early summer, peak nesting October	Known to occur
	Mating	Year-round	Known to occur
	Nesting	Green Turtle aggregation inside of NW Is. Early in summer	Known to occur
	Nesting	Peak nesting in spring and early summer	Known to occur
	Nesting	Peak season Dec–Jan	Known to occur
	Nesting	Spring and early summer, peak nesting October	Known to occur
	Nesting	Year-round	Known to occur
	Nesting	Year-round	Likely to occur
	Nesting		Known to occur
Loggerhead Turtle	Foraging	Year-round	Known to occur
	Foraging		Known to occur
	Internesting	Dec–Mar	Known to occur
	Internesting buffer	Dec–Mar	Known to occur
	Internesting buffer	Peak season monitored	Known to occur

Common name	Behaviour	Seasonal presence	Occurrence descriptor
	Internesting buffer		Known to occur
	Nesting	Dec–Mar	Known to occur
	Nesting	Peak season monitored	Known to occur
	Nesting		Known to occur
Olive Ridley Turtle	Foraging		Known to occur

Table 2-11: Summary of relevant conservation plans—marine reptiles

Species	Relevant Plan / Advice	Key Threats / Relevant Management Advice
Caretta caretta (Loggerhead Turtle) *Chelonia mydas* (Green Turtle) *Dermochelys coriacea* (Leatherback Turtle, Leathery Turtle, Luth) *Eretmochelys imbricata* (Hawksbill Turtle) *Natator depressus* (Flatback Turtle)	Recovery Plan for Marine Turtles in Australia (Ref. 29)	Key threats include: • climate change and variability • marine debris • chemical and terrestrial discharge • international take • terrestrial predation • fisheries bycatch • light pollution • habitat modification • Indigenous take • vessel disturbance • noise interference • recreational activities • diseases and pathogens. Details regarding relevant threats: • A3: Reduce the impacts from marine debris • A4: Minimise chemical and terrestrial discharge: – Ensure spill risk strategies and response programs adequately include management for marine turtles and their habitats, particularly in reference to 'slow to recover habitats', e.g. nesting habitat, seagrass meadows, or coral reefs – Quantify the impacts of decreased water quality on stock viability – Quantify the accumulation and effects of anthropogenic toxins in marine turtles, their foraging habitats, and subsequent stock viability. • A8: Minimise light pollution: – 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 – Develop and implement best practice light management guidelines for existing and future developments

Species	Relevant Plan / Advice	Key Threats / Relevant Management Advice
		adjacent to marine turtle nesting beaches – Identify the cumulative impact on turtles from multiple sources of onshore and offshore light pollution.
Dermochelys coriacea (Leatherback Turtle, Leathery Turtle, Luth)	Approved Conservation Advice for *Dermochelys coriacea* (Leatherback Turtle) (Ref. 30)	Key threats include: • incidental capture in commercial fisheries • harvest of eggs and meat • ingestion of marine debris • vessel disturbance / boat strike • predation on eggs by wild dogs (*Canis familiaris*), pigs (*Sus scrofa*) and monitor lizards (*Varanus salvator*) • degradation of foraging areas • changes to breeding sites. No relevant management advice has been identified.
Aipysurus apraefrontalis (Short-nosed Sea Snake)	Approved Conservation Advice for *Aipysurus apraefrontalis* (Short-nosed Sea Snake) (Ref. 31)	Key threats include: • changes to the inner region of Ashmore Reef (sand encroachment) that has caused coral outcrops that previously supported high densities of sea snakes to be filled in with sand • increases in water temperatures observed in Ashmore and surrounding reefs associated with El Niño events, which may have impacted the species directly or indirectly by contributing to further habitat degradation • oil and gas exploration, including seismic surveys and exploration drilling • incidental catch and death in commercial prawn trawling fisheries. Unsustainable and illegal fishing practices are recognised as the most significant direct and indirect threat to natural processes and biological diversity in the Ashmore Reef region. No relevant management advice has been identified.
Aipysurus foliosquama (Leaf-scaled Sea Snake)	Approved Conservation Advice for *Aipysurus foliosquama* (Leaf-scaled Sea Snake) (Ref. 32)	Key threats include: • changes to the inner region of Ashmore Reef (sand encroachment) – coral outcrops that previously supported high densities of sea snakes are now filled with sand • increases in water temperatures observed in Ashmore and surrounding reefs associated with El Niño events, which may have impacted the species directly or indirectly by contributing to further habitat degradation • oil and gas exploration, including seismic surveys and exploration drilling • incidental catch and death in commercial prawn trawling fisheries. Unsustainable and illegal fishing practices are recognised as

Species	Relevant Plan / Advice	Key Threats / Relevant Management Advice
		the most significant direct and indirect threat to natural processes and biological diversity in the Ashmore Reef region. No relevant management advice has been identified.

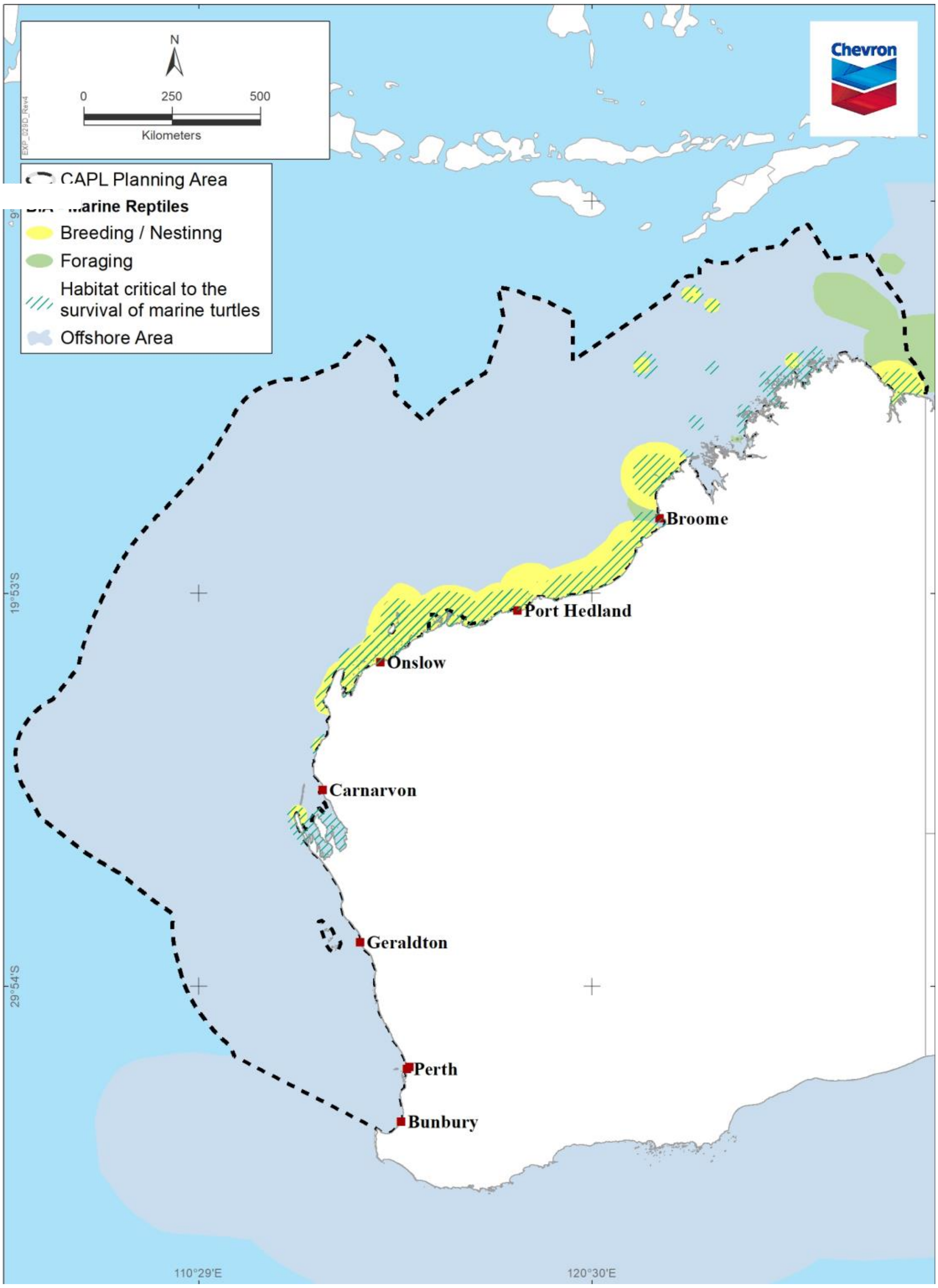


Figure 2-2: BIAs associated with marine reptiles

2.5.3 Fishes, including sharks and rays

Table 2-12 lists the threatened and/or migratory fishes (including sharks and rays) that may be present within the PA (Ref. 17; Ref. 4; appendix a).

Table 2-13 lists the BIAs for fishes (including sharks and rays) and their known seasonal presence within the PA (Ref. 18); these are shown in Figure 2-3.

Within the PA, 61 solenostomid and syngnathid species that are listed marine species have been identified as having the potential to occur (appendix a; Ref. 4).

Almost all syngnathids live in nearshore and inner shelf habitats, usually in shallow coastal waters, among seagrasses, mangroves, coral reefs, macroalgae-dominated reefs, and sand or rubble habitats (Ref. 33; Ref. 34; Ref. 35; Ref. 36). Although two species have been identified in the North-west Marine Region in deeper waters (Winged Seahorse [*Hippocampus alatus*] and Western Pipehorse [*Solegnathus* sp. 2]; Ref. 37), these species were not identified by the SNES search of the PA (Ref. 17).

A review of the Conservation Advices and Recovery Plans identified key threats associated with threatened and/or migratory fishes (including sharks and rays) that may be present within the PA. These threats and relevant management advice are included in Table 2-14.

Table 2-12: Threatened and migratory fishes, including sharks and rays

Common name	Scientific name	Threatened status	Migratory
Narrow Sawfish, Knifetooth Sawfish	*Anoxypristis cuspidata*		Migratory
Grey Nurse Shark (west coast population)	*Carcharias taurus* (west coast population)	Vulnerable	
Oceanic Whitetip Shark	*Carcharhinus longimanus*		Migratory
White Shark, Great White Shark	*Carcharodon carcharias*	Vulnerable	Migratory
Northern River Shark, New Guinea River Shark#	*Glyphis garricki*	Endangered	
Speartooth Shark#	*Glyphis glyphis*	Critically Endangered	
Shortfin Mako, Mako Shark	*Isurus oxyrinchus*		Migratory
Longfin Mako	*Isurus paucus*		Migratory
Porbeagle, Mackerel Shark	*Lamna nasus*		Migratory
Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray	*Manta alfredi*		Migratory
Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray	*Manta birostris*		Migratory
Blind Gudgeon*	*Milyeringa veritas*	Vulnerable	
Balston's Pygmy Perch^	*Nannatherina balstoni*	Vulnerable	
Blind Cave Eel*	*Ophisternon candidum*	Vulnerable	

Common name	Scientific name	Threatened status	Migratory
Dwarf Sawfish, Queensland Sawfish	*Pristis clavata*	Vulnerable	Migratory
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish#	*Pristis pristis*	Vulnerable	Migratory
Green Sawfish, Dindagubba, Narrowsnout Sawfish	*Pristis zijsron*	Vulnerable	Migratory
Whale Shark	*Rhincodon typus*	Vulnerable	Migratory
** Subterranean fauna species identified in the Protected Matters Search Report (appendix a; Ref. 4) but not expected to be exposed to CAPL's activities.* *# Species mainly located inland (freshwater and estuarine habitats) identified in the Protected Matters Search Report but with the potential to be present offshore (neritic and intertidal zones) and exposed to CAPL's activities.* *^ Freshwater species located inland identified in the Protected Matters Search Report but not expected to be exposed to CAPL's activities.*			

Table 2-13: BIAs for regionally significant fishes, including sharks and rays

Common name	Behaviour	Seasonal presence	Occurrence descriptor
Dwarf Sawfish	Foraging	All seasons	Known to occur
	Foraging	Use in dry season to early wet (Dec)	Known to occur
	Foraging		Known to occur
	Juvenile	All seasons	Known to occur
	Nursing	All seasons	Known to occur
	Nursing	Use in dry season to early wet (Dec)	Known to occur
	Nursing		Known to occur
	Pupping	All seasons	Known to occur
	Pupping		Known to occur
Freshwater Sawfish	Foraging	All seasons	Known to occur
	Foraging	Pupping occurs from Jan–May	Known to occur
	Foraging	Pupping occurs from Jan–May, more prevalent during the late wet season when mature animals have more water to manoeuvre in	Known to occur
	Juvenile	Pupping occurs from Jan–May	Known to occur
	Nursing	All seasons	Known to occur
	Nursing	All seasons	Likely to occur
	Pupping	Pupping occurs from Jan–May	Known to occur
	Pupping	Pupping occurs from Jan–May	Likely to occur
	Pupping	Pupping occurs from Jan–May, more prevalent during the late wet season when mature animals	Known to occur

Common name	Behaviour	Seasonal presence	Occurrence descriptor
		have more water to manoeuvre in	
Green Sawfish	Foraging		Known to occur
	Nursing		Known to occur
	Pupping		Known to occur
Whale Shark	Foraging	Spring	Known to occur
	Foraging (high density prey)	Apr–Jun, autumn	Known to occur
	Foraging		Known to occur

Table 2-14: Summary of relevant conservation plans—fishes, including sharks and rays

Species	Relevant Plan / Advice	Key Threats / Relevant Management Advice
Pristis zijsron (Green Sawfish, Dindagubba, Narrowsnout Sawfish) *Pristis clavata* (Dwarf Sawfish) *Glyphis garricki* (Northern River Shark) *Glyphis* (Speartooth Shark)	Sawfish and River Sharks Multispecies Recovery Plan (Ref. 38)	Key threats include: • fishing activities including: being caught as bycatch in the commercial and recreational sectors; through Indigenous fishing; and illegal, unreported, and unregulated fishing • habitat degradation and modification. Other potential threats to the species include the collection of animals for display in public aquaria and marine debris. No relevant management advice has been identified.
	Approved Conservation Advice for Green Sawfish (Ref. 39)	The main potential threats to Green Sawfish include: • incidental capture as bycatch and by-product in gillnet and trawl fisheries • illegal capture for fins and rostra • habitat degradation through coastal development. No relevant management advice has been identified.
	Approved Conservation Advice for *Pristis clavata* (Dwarf Sawfish) (Ref. 40)	The main identified threats to Dwarf Sawfish include: • incidental capture as bycatch in commercial and recreational net fishing • illegal, unreported, and unregulated fishing. No relevant management advice has been identified.
	Approved Conservation Advice for *Glyphis garricki* (Northern River Shark) (Ref. 41)	The main identified threats to Northern River Sharks include: • commercial, recreational, and Indigenous fishing activities • IUU fishing • habitat degradation and modification.

Species	Relevant Plan / Advice	Key Threats / Relevant Management Advice
		No relevant management advice has been identified.
	Approved Conservation Advice for *Glyphis* (Speartooth Shark) (Ref. 42)	The main identified threats to Speartooth Sharks include: • commercial, recreational, and Indigenous fishing activities • IUU fishing • habitat degradation and modification. No relevant management advice has been identified.
Rhincodon typus (Whale Shark)	Conservation Advice for the Whale Shark 2015–2020 (Ref. 43)	The most significant threat to Whale Sharks is intentional and unintentional mortality from fishing outside Australian waters. In Australian waters, threats to the recovery of the species include boat strike from large vessels and habitat disruption from mineral exploration, production, and transportation. Other less-important threats include disturbance from domestic tourism operations, marine debris, and climate change. Limited subsistence hunting of Whale Sharks still occurs in some parts of the world. Ecotourism in these regions could provide an alternative income, which would give these communities the means to stop hunting and a reason to conserve the species. No relevant management advice has been identified.
Carcharias taurus (west coast population) (Grey Nurse Shark [west coast population])	Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*) (Ref. 44)	Key threats include: • commercial fishing • recreational fishing • shark finning • shark control activities • ecotourism • aquarium trade.
Carcharodon Carcharias (Great White Shark)	Recovery Plan for the White Shark (*Carchorodon Carcharias*) (Ref. 45)	Key threats include: • mortality related to being caught accidentally (bycatch) or illegally (targeted) by commercial and recreational fisheries, including issues of post release mortality • mortality related to shark control activities such as beach meshing or drum lining (east coast population). Other potential threats to the species include the impacts of illegal trade in White Shark products; ecosystem effects as a result of habitat modification and climate change (including changes in sea temperature, ocean currents, and acidification); and ecotourism, including cage diving. No relevant management advice has been identified.

Species	Relevant Plan / Advice	Key Threats / Relevant Management Advice
Milyeringa veritas (Blind Gudgeon)	Approved Conservation Advice for *Milyeringa veritas* (Blind Gudgeon) (Ref. 46)	The main identified threats to the Blind Gudgeon include: • sedimentation from mining and construction • canal development • water abstraction • point source pollution from sewage • landfill • dumping and mining • diffuse pollution from urban development and petroleum infrastructure. No relevant management advice has been identified.
Nannatherina balstoni (Balston's Pygmy Perch)	Approved Conservation Advice for *Nannatherina balstoni* (Balston's Pygmy Perch) (Ref. 47)	The main identified threat to the Balston's Pygmy Perch is habitat alteration and the introduction of exotic fish species. Habitat alteration is likely to occur through any alterations to inflow and increased salinisation, siltation, and eutrophication that occur through changes to flow regimes (regulation and abstraction), road maintenance, mineral sand exploration and mining, groundwater extraction, and agricultural and forestry practices in the uppermost catchment. No relevant management advice has been identified.

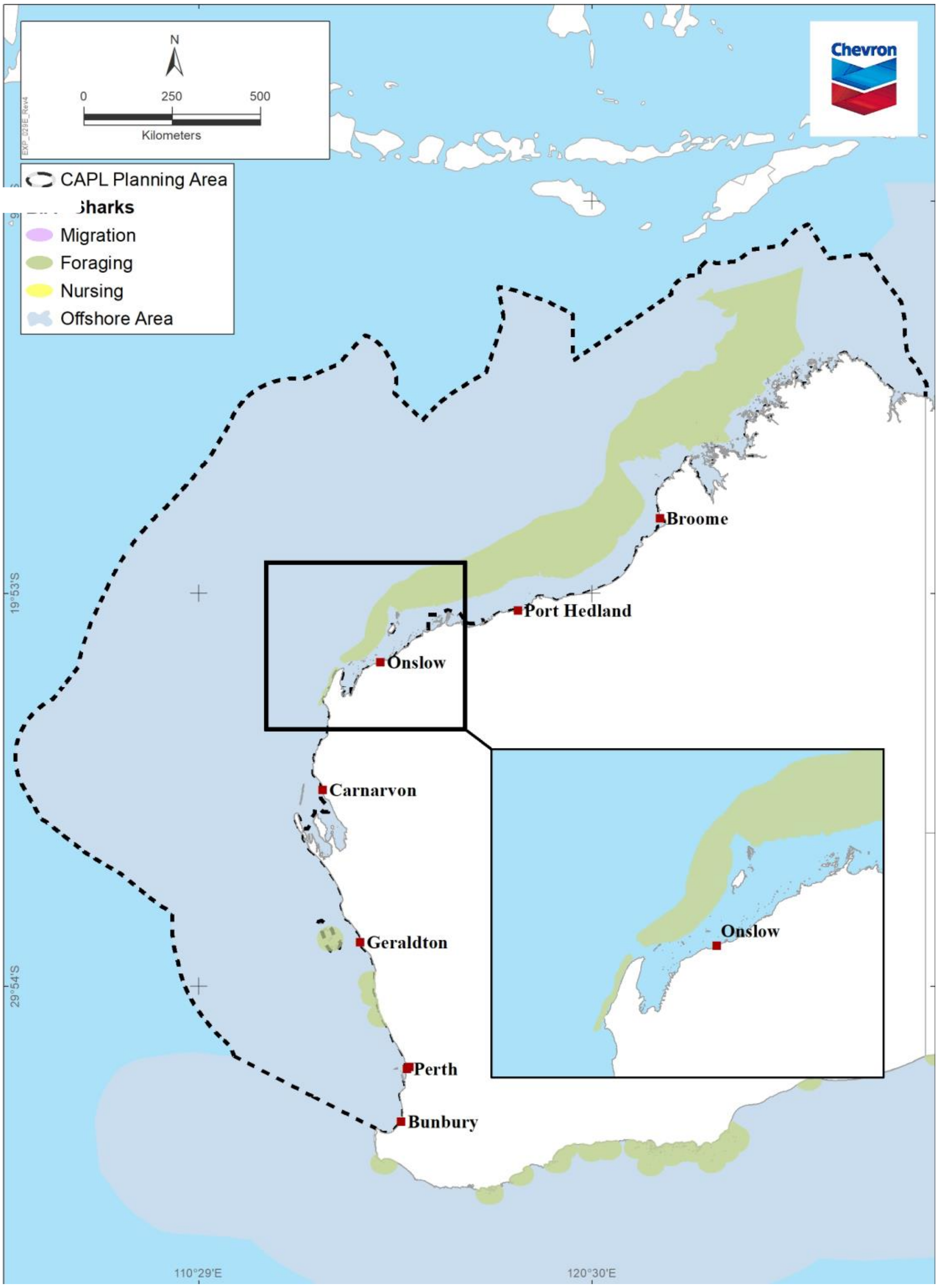


Figure 2-3: BIAs associated with fishes, including sharks and rays

2.5.4 Seabirds and shorebirds

Table 2-15 lists the threatened and/or migratory seabirds and shorebirds that may be present within the PA (Ref. 17; Ref. 4; appendix a).

Table 2-16 lists the BIAs for seabirds and shorebirds and their known seasonal presence within the PA (Ref. 18); these are shown in Figure 2-4.

A review of Conservation Advices and Recovery Plans identified key threats associated with threatened and/or migratory seabirds and shorebirds that may be present within the PA. These threats and relevant management advice are included in Table 2-17.

Table 2-15: Threatened and/or migratory seabirds and shorebirds

Common name	Scientific name	Threatened status	Migratory
Oriental Reed-warbler*	*Acrocephalus orientalis*		Migratory
Common Sandpiper*	*Actitis hypoleucos*		Migratory
Common Noddy	*Anous stolidus*		Migratory
Australian Lesser Noddy	*Anous tenuirostris melanops*	Vulnerable	
Fork-tailed Swift	*Apus pacificus*		Migratory
Flesh-footed Shearwater, Fleshy-footed Shearwater	*Ardenna carneipes*		Migratory
Wedge-tailed Shearwater	*Ardenna pacifica*		Migratory
Ruddy Turnstone*	*Arenaria interpres*		Migratory
Australasian Bittern	*Botaurus poiciloptilus*	Endangered	
Sharp-tailed Sandpiper*	*Calidris acuminata*		Migratory
Sanderling*	*Calidris alba*		Migratory
Red Knot, Knot*	*Calidris canutus*	Endangered	Migratory
Curlew Sandpiper*	*Calidris ferruginea*	Critically Endangered	Migratory
Pectoral Sandpiper*	*Calidris melanotos*		Migratory
Red-necked Stint*	*Calidris ruficollis*		Migratory
Long-toed Stint*	*Calidris subminuta*		Migratory
Great Knot*	*Calidris tenuirostris*	Critically Endangered	Migratory
Streaked Shearwater	*Calonectris leucomelas*		Migratory
Forest Red-tailed Black-Cockatoo, Karrak	*Calyptorhynchus banksii naso*	Vulnerable	
Baudin’s Cockatoo, Long-billed Black-Cockatoo	*Calyptorhynchus baudinii*	Vulnerable	
Carnaby’s Cockatoo, Short-billed Black-Cockatoo	*Calyptorhynchus latirostris*	Endangered	
Red-rumped Swallow#	*Cecropis daurica*		Migratory
Double-banded Plover*	*Charadrius bicinctus*		Migratory
Greater Sand Plover, Large Sand Plover	*Charadrius leschenaultii*	Vulnerable	Migratory

Common name	Scientific name	Threatened status	Migratory
Lesser Sand Plover, Mongolian Plover	*Charadrius mongolus*	Endangered	Migratory
Oriental Plover, Oriental Dotterel*	*Charadrius veredus*		Migratory
Oriental Cuckoo, Horsfield's Cuckoo	*Cuculus optatus*		Migratory
Amsterdam Albatross	*Diomedea amsterdamensis*	Endangered	Migratory
Tristan Albatross	*Diomedea dabbenena*	Endangered	
Southern Royal Albatross	*Diomedea epomophora*	Vulnerable	Migratory
Wandering Albatross	*Diomedea exulans*	Vulnerable	Migratory
Northern Royal Albatross	*Diomedea sanfordi*	Endangered	
Red Goshawk	*Erythrotriorchis radiatus*	Vulnerable	
Gouldian Finch	*Erythrura gouldiae*	Endangered	
Crested Shrike-tit (northern), Northern Shrike-tit	*Falcunculus frontatus whitei*	Vulnerable	
Lesser Frigatebird, Least Frigatebird	*Fregata ariel*		Migratory
Great Frigatebird, Greater Frigatebird	*Fregata minor*		Migratory
Swinhoe's Snipe*	*Gallinago megala*		Migratory
Pin-tailed Snipe*	*Gallinago stenura*		Migratory
Partridge Pigeon (western)	*Geophaps smithii blaauwi*	Vulnerable	
Oriental Pratincole*	*Glareola maldivarum*		Migratory
Blue Petrel	*Halobaena caerulea*	Vulnerable	
Barn Swallow[#]	*Hirundo rustica*		Migratory
Caspian Tern	*Hydroprogne caspia*		Migratory
Malleefowl	*Leipoa ocellata*	Vulnerable	
Broad-billed Sandpiper*	*Limicola falcinellus*		Migratory
Asian Dowitcher*	*Limnodromus semipalmatus*		Migratory
Bar-tailed Godwit*	*Limosa lapponica*		Migratory
Bar-tailed Godwit (baueri), Western Alaskan Bar-tailed Godwit*	*Limosa lapponica baueri*	Vulnerable	Migratory
Northern Siberian Bar-tailed Godwit, Bar-tailed Godwit (menzbieri)	*Limosa lapponica menzbieri*	Critically Endangered	Migratory
Black-tailed Godwit*	*Limosa limosa*		

Common name	Scientific name	Threatened status	Migratory
Southern Giant-Petrel, Southern Giant Petrel	*Macronectes giganteus*	Endangered	Migratory
Northern Giant Petrel	*Macronectes halli*	Vulnerable	Migratory
White-winged Fairy-wren (Barrow Island), Barrow Island Black-and-white Fairy-wren	*Malurus leucopterus edouardi*	Vulnerable	
White-winged Fairy-wren (Dirk Hartog Island), Dirk Hartog Black-and-White Fairy-wren	*Malurus leucopterus*	Vulnerable	
Grey Wagtail#	*Motacilla cinerea*		Migratory
Yellow Wagtail#	*Motacilla flava*		Migratory
Eastern Curlew, Far Eastern Curlew*	*Numenius madagascariensis*	Critically Endangered	Migratory
Little Curlew, Little Whimbrel*	*Numenius minutus*		Migratory
Whimbrel*	*Numenius phaeopus*		Migratory
Bridled Tern	*Onychoprion anaethetus*		Migratory
Fairy Prion (southern)	*Pachyptila turtur subantarctica*	Vulnerable	
Osprey*	*Pandion haliaetus*		Migratory
Abbott's Booby	*Papasula abbotti*	Endangered	
Night Parrot	*Pezoporus occidentalis*	Endangered	
White-tailed Tropicbird	*Phaethon lepturus*		Migratory
Red-tailed Tropicbird	*Phaethon rubricauda*		Migratory
Red-necked Phalarope*	*Phalaropus lobatus*		Migratory
Ruff (Reeve) *	*Philomachus pugnax*		Migratory
Sooty Albatross	*Phoebetria fusca*	Vulnerable	Migratory
Pacific Golden Plover*	*Pluvialis fulva*		Migratory
Grey Plover*	*Pluvialis squatarola*		Migratory
Princess Parrot, Alexandra's Parrot	*Polytelis alexandrae*	Vulnerable	
Soft-plumaged Petrel	*Pterodroma mollis*	Vulnerable	
Rufous Fantail#	*Rhipidura rufifrons*		Migratory
Australian Painted Snipe	*Rostratula australis*	Endangered	
Roseate Tern	*Sterna dougallii*		Migratory
Little Tern	*Sternula albifrons*		Migratory
Australian Fairy Tern	*Sternula nereis*	Vulnerable	

Common name	Scientific name	Threatened status	Migratory
Masked Booby	*Sula dactylatra*		Migratory
Brown Booby	*Sula leucogaster*		Migratory
Red-footed Booby	*Sula sula*		Migratory
Indian Yellow-nosed Albatross	*Thalassarche carteri*	Vulnerable	
Tasmanian Shy Albatross	*Thalassarche cauta*		Migratory
Shy Albatross, Tasmanian Shy Albatross	*Thalassarche cauta*	Vulnerable	
White-capped Albatross	*Thalassarche cauta steadi*	Vulnerable	
Campbell Albatross, Campbell Black-browed Albatross	*Thalassarche impavida*	Vulnerable	
Black-browed Albatross	*Thalassarche melanophris*	Vulnerable	Migratory
Crested Tern*	*Thalasseus bergii*		Migratory
Grey-tailed Tattler*	*Tringa brevipes*		Migratory
Wood Sandpiper*	*Tringa glareola*		Migratory
Common Greenshank, Greenshank*	*Tringa nebularia*		Migratory
Marsh Sandpiper, Little Greenshank*	*Tringa stagnatilis*		Migratory
Common Redshank, Redshank*	*Tringa totanus*		Migratory
Painted Button-quail (Houtman Abrolhos)	*Turnix varius scintillans*	Vulnerable	
Masked Owl (northern)	*Tyto novaehollandiae kimberli*	Vulnerable	
Terek Sandpiper*	*Xenus cinereus*		Migratory
** Migratory Wetland Species* *# Migratory Terrestrial Species (unlikely to be encountered in the PA)*			

Table 2-16: BIAs for regionally significant seabirds and shorebirds

Common name	Behaviour	Seasonal presence	Occurrence descriptor
Australian Lesser Noddy	Foraging (provisioning young)	Year-round	Known to occur
Bridled Tern	Foraging (in high numbers)	Almost entirely a breeding visitor, arriving late September or October and leaving between late February and early May	Known to occur

Common name	Behaviour	Seasonal presence	Occurrence descriptor
Brown Booby	Breeding	Breeding Feb–Oct (but mainly in autumn)	Known to occur
Caspian Tern	Foraging (provisioning young)		Known to occur
Common Noddy	Foraging	Breeding visitor in Abrolhos (mid-August to late April) and further north (May to at least November)	Known to occur
	Foraging (provisioning young)	Breeding visitor in Abrolhos (mid-August to late April) and further north (May to at least November)	Known to occur
Fairy Tern	Breeding	Breeding from July to late September; birds from South-West Marine Region (SWMR) dispersing northwards in winter	Known to occur
	Foraging (in high numbers)	Year-round, but southern birds disperse north in winter	Known to occur
Flesh-footed Shearwater	Aggregation	Late April to late June and late August to early November	Known to occur
Greater Frigatebird	Breeding	Breeding in May–June and August	Known to occur
Great-winged Petrel (macroptera race)	Foraging (provisioning young)	Late January to early December	Known to occur
Lesser Crested Tern	Breeding	Breeding Mar–Jun	Known to occur
Lesser Frigatebird	Breeding	Breeding Mar–Sep	Known to occur
Little Penguin	Foraging (provisioning young)		Known to occur
Little Shearwater	Foraging (in high numbers)	Early January to early December, mainly April to November	Known to occur
Little Tern	Breeding	Breeding recorded in June, July, and October	Known to occur
	Resting	Breeding recorded in June, July, and October	Known to occur
Pacific Gull	Foraging (in high numbers)		Former Range
	Foraging (in high numbers)		Known to occur
Red-footed Booby	Breeding	Breeding in May-June	Known to occur

Common name	Behaviour	Seasonal presence	Occurrence descriptor
Roseate Tern	Breeding	Breeding from mid-March to July; Also birds from SWMR dispersing north in winter	Known to occur
	Foraging	Winter	Known to occur
	Foraging (provisioning young)	Winter	Known to occur
	Resting	Breeding from mid-March to July; birds from SWMR dispersing north in winter	Known to occur
Soft-plumaged Petrel	Foraging (in high numbers)	Mainly March to late September	Known to occur
Sooty Tern	Foraging	Late Aug to early May	Known to occur
Wedge-tailed Shearwater	Breeding	Breeding visitor arriving in mid-August and leaving in April in Pilbara and mid-May in Shark Bay	Known to occur
	Foraging (in high numbers)	Mid-August–May	Known to occur
White-faced Storm Petrel	Foraging (in high numbers)		Known to occur
White-tailed Tropicbird	Breeding	Breeding recorded in May and October	Known to occur

Table 2-17: Summary of relevant conservation plans—seabirds and shorebirds

Species	Relevant Plan / Advice	Key Threats / Relevant Management Advice
Anous tenuirostris melanops (Australian Lesser Noddy)	Conservation Advice for *Anous tenuirostris melanops* Australian Lesser Noddy (Ref. 48)	The main potential threat to breeding colonies is catastrophic destruction of habitat by cyclones. Other threats include: • pollution • oil spills • over-fishing.
Calyptorhynchus banksii naso (Forest Red-tailed Black-Cockatoo) *Calyptorhynchus baudinii* (Baudin's Cockatoo, Long-billed Black-Cockatoo)	Forest Black-Cockatoo (Baudin's Cockatoo *Calyptorhynchus baudinii*) and Forest Red-tailed Black-Cockatoo (*Calyptorhynchus banksii naso*) Recovery Plan (Ref. 49)	Key threats are: • killing by illegal shooting • feral honeybees • habitat loss • nest hollow shortage • nest hollow competition.
	Approved Conservation Advice for *Calyptorhynchus banksii naso* (Forest Red-tailed Black-Cockatoo) (Ref. 50)	The main identified threats to the Forest Red-tailed Black-Cockatoo are: • illegal shooting • habitat loss

Species	Relevant Plan / Advice	Key Threats / Relevant Management Advice
		• nest hollow shortage and competition from other species • injury or death from *Apis mellifera* (European Honey Bees).
	Conservation Advice *Calyptorhynchus baudinii* Baudin's Cockatoo (Ref. 51)	Key threats include: • habitat loss, disturbance, and modifications • fire • invasive species • competition with native species • illegal killing • phytopathogens and pests • climate change.
Calyptorhynchus latirostris (Carnaby's Cockatoo)	Carnaby's Cockatoo (*Calyptorhynchus latirostris*) Recovery Plan (Ref. 52)	Key threats include: • loss of breeding habitat • loss of non-breeding foraging and night roosting habitat • tree health • mining and extraction activities • illegal shooting • illegal taking • climate change • collisions with motor vehicles • disease.
Leipoa ocellate (Malleefowl)	National Recovery Plan for Malleefowl *Leipoa ocellate* (Ref. 53)	Key threats include: • clearing • habitat fragmentation and isolation • grazing • predation • fire (wildfire and intentional burns) • disease, inbreeding, and chemical exposure • climate change.
Macronectes giganteus (Southern Giant Petrel) *Macronectes halli* (Northern Giant Petrel) *Thalassarche carteri* (Indian Yellow-nosed Albatross) *Thalassarche cauta* (Tasmanian Shy Albatross) *Thalassarche cauta* (Shy Albatross)	National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011–2016 (Ref. 54)	Key threats include: • incidental catch resulting from fishing operations • competition with fisheries for marine resources • dependence on discards • marine pollution • climate change • intentional shooting/killing • feral pest species • human disturbance at the nest • parasites and diseases

Species	Relevant Plan / Advice	Key Threats / Relevant Management Advice
Thalassarche cauta steadi (White-capped Albatross) *Thalassarche impavida* (Campbell Albatross, Campbell Black-browed Albatross) Thalassarche melanophris (Black-browed Albatross)		• loss of nesting habitat • competition for nest space • climate change.
Malurus leucopterus edouardi (White-winged Fairy-wren (Barrow Island)	Approved Conservation Advice for *Malurus leucopterus edouardi* (White-winged Fairy-wren [Barrow Island]) (Ref. 55)	The main potential threats to the White-winged Fairy-wren (Barrow Island) include: • introduction of non-endemic fauna, flora, or pathogens • inappropriate fire regime • vegetation clearing • destruction of birds • degradation of habitat by fire and development.
Malurus leucopterus (White-winged Fairy-wren (Dirk Hartog Island))	Approved Conservation Advice for *Malurus leucopterus* (White-winged Fairy-wren (Dirk Hartog Island)) (Ref. 56)	The main identified threats to the White-winged Fairy-wren (Dirk Hartog Island) are: • fire, which can kill birds and/or destroy habitat • degradation through grazing and trampling of habitat by feral goats (*Capra hircus*) • predation by feral cats (*Felis catus*) and house mice (*Mus* sp.)
Pachyptila turtur subantarctica (Fairy Prion (southern))	Conservation Advice *Pachyptila turtur subantarctica* Fairy Prion (southern) (Ref. 57)	Key threats include: • habitat loss, disturbance, and modification • predation.
Papasula abbotti (Abbott's Booby)	Conservation Advice *Papasula abbotti* Abbott's Booby (Ref. 58)	The Abbott's booby breeds only on Christmas Island. The principal reason for the decline of Abbott's Booby is thought to be the clearance of about a third of the former nesting rainforest habitat.
Pezoporus occidentalis (Night Parrot)	Conservation Advice *Pezoporus occidentalis* Night Parrot (Ref. 59)	There are no known threats to this species.
Polytelis alexandrae (Princess Parrot)	Conservation Advice *Polytelis alexandrae* Princess Parrot (Ref. 60)	Potential threats include: • increased intensity of bushfires • habitat degradation from introduced weeds and herbivores

Species	Relevant Plan / Advice	Key Threats / Relevant Management Advice
		• predation by introduced predators • competition with other bird species • disease • illegal collection.
Pterodroma mollis (Soft-plumaged Petrel)	Conservation Advice *Pterodroma Mollis* Soft-plumaged Petrel (Ref. 61)	Key threats include: • accidental introduction of predators to island populations.
Rostratula australis (Australian Painted Snipe)	Approved Conservation Advice for *Rostratula australis* (Australian Painted Snipe) (Ref. 62)	Key threats include: • habitat loss, disturbance, and modification • invasive weeds • trampling, browsing, or grazing • animal predation or competition • fire.
Sternula nereis (Australian Fairy Tern)	Approved Conservation Advice for *Sternula nereis* (Fairy Tern) (Ref. 63)	Key threats include: • predation by introduced animals • disturbance by humans and direct destruction of nests • increasing salinity in waters adjacent to colonies • irregular water management (flooding nests etc.) • weed encroachment • oil spills.
Turnix varius scintillans (Painted Button-quail (Houtman Abrolhos))	Approved Conservation Advice for *Turnix varia scintillans* (Painted Button-quail (Houtman Abrolhos)) (Ref. 64)	Key threats include: • inappropriate fire regimes • competition for food with, or predation of eggs by, the introduced House Mouse (*Mus musculus*) • introduction of non-endemic fauna, flora or pathogens • grazing and trampling of habitat.
Tyto novaehollandiae kimberli (Masked Owl (northern))	Conservation Advice *Tyto novaehollandiae kimberli* Masked Owl (northern) (Ref. 65)	Potential threats include: • decline in food availability • more intense, frequent, and extensive fires, which may also reduce the availability of large trees and hollows • competition for tree hollows • reduction in suitable habitat.

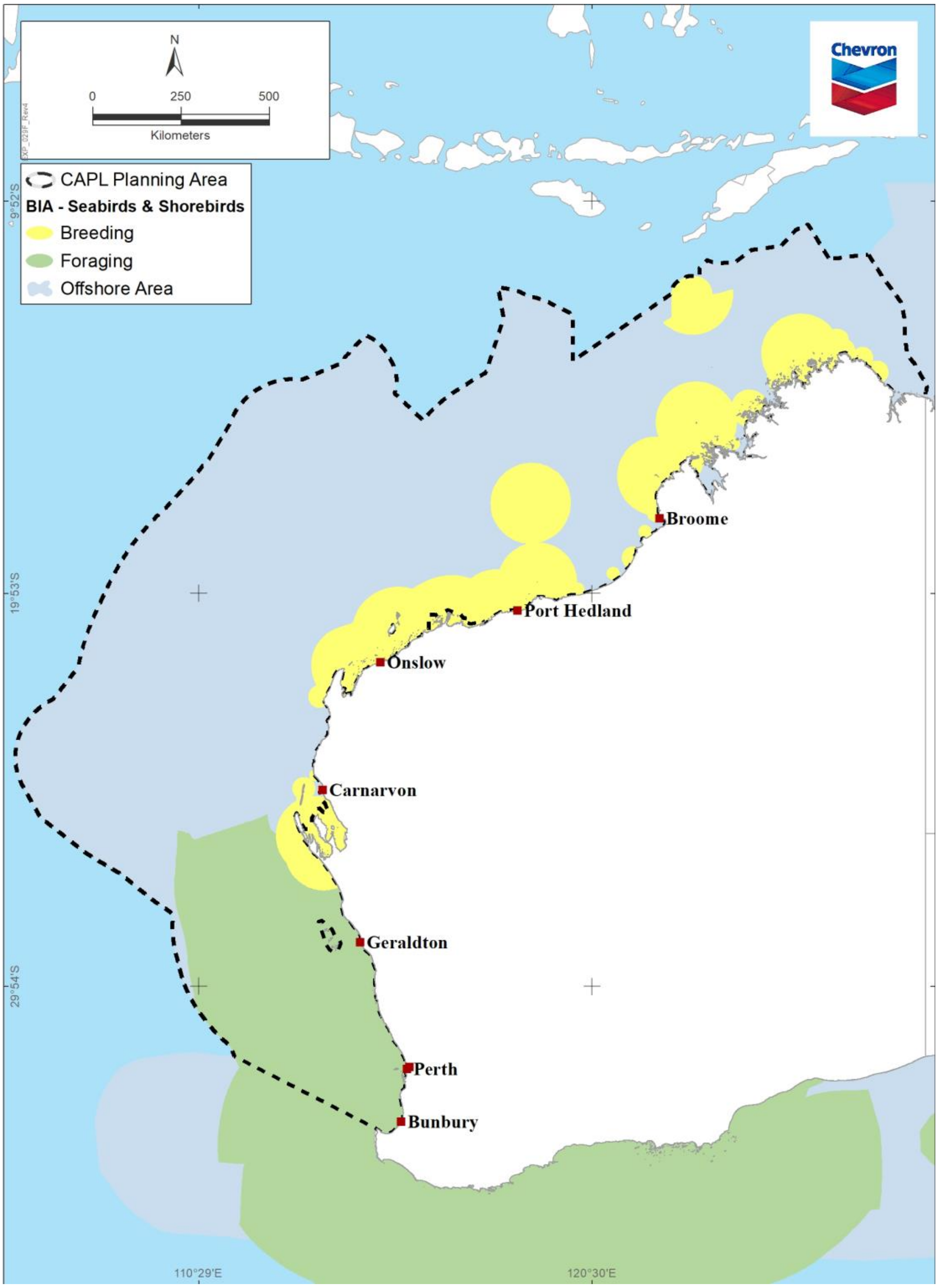


Figure 2-4: BIAs associated with seabirds and shorebirds

2.6 Listed threatened ecological communities

In Australia, three categories exist for listing threatened ecological communities (TECs) under the EPBC Act: critically endangered, endangered, and vulnerable.

In WA, TECs are present in the southwest and in the north around Broome. Table 2-18 summarises these communities (Ref. 66; Ref. 4; appendix a).

Table 2-18: Threated ecological communities

TEC	Summary of significance
Banksia Woodlands of the Swan Coastal Plain ecological community*	The ecological community is a woodland associated with the Swan Coastal Plain of southwest WA. A key diagnostic feature is a prominent tree layer of banksia, with scattered eucalypts and other tree species often present among or emerging above the banksia canopy. The understorey is a species-rich mix of sclerophyllous shrubs, graminoids, and forbs. The ecological community is characterised by a high endemism and considerable localised variation in species composition across its range. (Ref. 67)
Monsoon Vine Thickets on the coastal sand dunes of Dampier Peninsula	The Monsoon Vine Thickets on the coastal sand dunes of Dampier Peninsula ecological community represents certain occurrences of Monsoon Vine thickets in the south-west Kimberley region of WA (within the Dampierland bioregion). The ecological community is predominantly restricted to the coastlines of the Dampier Peninsula from Broome in the south to One Arm Point in the north and on the north-eastern coast of the Peninsula from One Arm Point to Goodenough Bay. The coastal dune environment, being largely of sand, has minimal soil development and is susceptible to erosion from various sources including rising tides, strong winds, and cyclonic activity. Tides of the Dampier Peninsula range up to 11 m and are a major factor affecting the coastal environment where the ecological community occurs. (Ref. 68)
Sedgelands in Holocene dune swales of the southern Swan Coastal Plain	The Rockingham-Becher Plain has been formed through the accumulation of Holocene sediments and contains a continuous depositional history from 7000 BP to present. Wetlands occur within the swales where the water table is close to or at the ground surface in the wetter months of the year. The most typical form is that of the Becher Suite, which is made up of over 250 very small to small sumplands and damplands, many of which contain occurrences of this community. The present known distribution of the sedgelands in Holocene dune swale community as is ~193 ha and is almost entirely located within linear wetland depressions (swales) occurring between parallel sand ridges of the Rockingham-Becher Plain. Additional occurrences include a small area at Yanchep and a small area at Dalyellup. Holocene dunes with wetlands around Preston Beach, south of Lancelin, and at Cheynes Beach may also contain occurrences of this community. (Ref. 69)
Subtropical and Temperate Coastal Saltmarsh	The Subtropical and Temperate Coastal Saltmarsh ecological community occurs within a relatively narrow margin of the Australian coastline, within the subtropical and temperate climatic zones south of the South-east Queensland IBRA bioregion boundary at 23° 37′ latitude along the east coast and south of (and including) Shark Bay at 26° on the west coast. Coastal saltmarsh occurring on islands within the geographic range is also included within the ecological community. The Coastal Saltmarsh ecological community consists mainly of salt-tolerant vegetation (halophytes) including: grasses, herbs, sedges, rushes, and shrubs. Succulent herbs, shrubs, and grasses generally dominate, and vegetation is generally <0.5 m high (with the exception of some reeds and sedges). (Ref. 70)
Thrombolite (microbialite) Community of a Coastal Brackish Lake (Lake Clifton)*	The Lake Clifton thrombolite community is restricted to Lake Clifton, which occurs within the South West Natural Resource Management Region. This ecological community is situated in the Swan Coastal Plain IBRA Bioregion of WA. Lake Clifton is situated within the Yalgorup National Park and is the northernmost lake in the Peel-Yalgorup Lakes System. The main known occurrence of the ecological community is a stretch, ~15 km long and up to 15 m wide, along the north-eastern shoreline of Lake Clifton. There are other small clusters of thrombolites within the lake, also at the northern end. This structure is the largest known example of a living, non-marine microbialite reef in the southern hemisphere. (Ref. 71)

TEC	Summary of significance
Tuart (*Eucalyptus gomphocephala*) Woodlands and Forests of the Swan Coastal Plain ecological community*	The ecological community occurs as woodlands or forests or other structural forms where the primary defining feature is the presence of *Eucalyptus gomphocephala* (Tuart) trees in the uppermost canopy layer. The ecological community includes the assemblage of plants, animals, and other organisms that occur in association with Tuart. The ecological community has a discontinuous distribution in the west of the Swan Coastal Plain, of southwest WA. The Tuart woodlands and forests occur on the Swan Coastal Plain in WA, from Jurien, ~200 km north of Perth, to the Sabina River, near Busselton, 225 km south of Perth. The ecological community occurs mainly on the Spearwood and Quindalup dune systems, which are underlain by Tamala Limestone. (Ref. 72)

** Identified in the protected matters search (appendix a) but located inland and thus not expected to be exposed to CAPL's activities.*

2.7 Commonwealth marine areas

The Commonwealth marine area is any part of the sea, including the waters, seabed, and airspace, within Australia's exclusive economic zone (EEZ) and/or over the continental shelf of Australia, which is not State or Territory waters.

The Commonwealth marine area stretches from three to 200 nautical miles from the coast. Marine protected areas are marine areas that are recognised to have high conservation value (Ref. 73).

2.7.1 Australian Marine Parks

Australian Marine Parks (AMPs), proclaimed under the EPBC Act in 2007 and 2013, are located in Commonwealth waters that start at the outer edge of state and territory waters, generally three nautical miles (~5.5 km) from the shore, and extend to the outer boundary of Australia's EEZ, 200 nautical miles (~370 km) from the shore (Ref. 75).

Table 2-19, Table 2-20, and Table 2-21 summarise the north-west, south-west, and north AMPs present within the PA, including their zones, areas, and International Union for Conservation of Nature (IUCN) categories (Ref. 74; Ref. 4; appendix a).

Table 2-19: Summary of AMPs (North-west Marine Parks)

AMP	Zones, IUCN categories, and zone area	Description	Natural values^
Argo–Rowley Terrace	National Park Zone (II) 36 050 km² Multiple Use Zone (VI) 108 812 km² Special Purpose Zone (Trawl) (VI) 1141 km²	The Argo–Rowley Terrace Marine Park is ~270 km north-west of Broome, WA, and extends to the limit of Australia's EEZ. The Marine Park is adjacent to the Mermaid Reef Marine Park and the WA Rowley Shoals Marine Park. The Marine Park covers an area of 146 003 km² and has	The Marine Park includes examples of ecosystems representative of: • Northwest Transition—an area of shelf break, continental slope, and the majority of the Argo Abyssal Plain. Key topographic features include Mermaid, Clerke, and Imperieuse reefs, which collectively are a biodiversity hotspot • Timor Province—an area dominated by warm, nutrient-poor waters. Canyons are an important feature in this area of the Marine Park and are generally associated with high productivity and aggregations of marine life.

AMP	Zones, IUCN categories, and zone area	Description	Natural values^
		water depths between 220 m and 6000 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Argo–Rowley Terrace Marine Park on 9 October 2017.	Key ecological features of the Marine Park are: • Canyons linking the Argo Abyssal Plain with the Scott Plateau—an area likely to result in upwelling of nutrient-rich water and aggregations of marine life • Mermaid Reef and Commonwealth waters surrounding Rowley Shoals—an area of enhanced productivity and high species richness, thought to be facilitated by internal wave action generated by internal tides. The Marine Park supports a range of species including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include resting and breeding habitat for seabirds and a migratory pathway for the Pygmy Blue Whale.
Ashmore Reef	Sanctuary Zone (Ia) 550 km² Recreational Use Zone (IV) 34 km²	The Ashmore Reef Marine Park is ~630 km north of Broome and 110 km south of the Indonesian island of Roti. The Marine Park is in Australia's External Territory of Ashmore and Cartier Islands and is within an area subject to a Memorandum of Understanding (MoU) between Indonesia and Australia, known as the MoU Box. The Marine Park covers an area of 583 km² and water depths from <15 m to 500 m. The Marine Park has three vegetated sand cays that are permanently above water: West, Middle, and East islands. The Marine Park was originally proclaimed under the Commonwealth *National Parks and Wildlife Conservation Act 1975* on 16 August 1983 as the Ashmore Reef National Nature	The Marine Park includes examples of ecosystems representative of the Timor Province—a bioregion with a depth range from ~200 m near the shelf break to 5920 m over the Argo Abyssal Plain. The reefs and islands of the bioregion are regarded as biodiversity hotspots. Ashmore Reef is an important feature of the bioregion. Endemism in demersal fish communities of the continental slope is high with two distinct communities identified: one on the upper slope, the other mid slope. Key ecological features of the Marine Park are: • Ashmore Reef and Cartier Island and surrounding Commonwealth waters—areas of enhanced productivity in an otherwise low-nutrient environment, of regional importance for feeding and breeding aggregations of birds and marine life • continental slope demersal fish communities—an area of high-diversity demersal fish assemblages. The marine environment of the Marine Park includes habitats associated with two extensive lagoons, sand flats, shifting sand cays, extensive reef flat, and large areas of seagrass. The reef ecosystems are comprised of hard and soft corals, gorgonians, sponges, and a range of encrusting organisms, with the highest number of coral species of any reef off the Western Australian coast. The Marine Park supports a range of species, including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the

AMP	Zones, IUCN categories, and zone area	Description	Natural values^
		Reserve, and proclaimed under the EPBC Act on 14 December 2013; it was renamed Ashmore Reef Marine Park on 9 October 2017.	Marine Park include breeding, foraging, and resting habitat for seabirds; resting and foraging habitat for migratory shorebirds; foraging, mating, nesting, and internesting habitat for marine turtles; foraging habitat for Dugong; and a migratory pathway for Pygmy Blue Whales. Ashmore Reef Ramsar site The Ashmore Reef Ramsar site includes the largest of the atolls in the region. West Island, Middle Island, and East Island represent the only vegetated islands in the region. Ashmore Reef Ramsar site supports internationally significant populations of seabirds and shorebirds, is important for turtles (Green, Hawksbill and Loggerhead) and Dugong, and has the highest diversity of hermatypic (reef-building) corals on the West Australian coast. It is known for its abundance and diversity of sea snakes. However, since 1998 populations of sea snakes at Ashmore Reef have been in decline.
Carnarvon Canyon	Habitat Protection Zone (IV) 6177 km²	The Carnarvon Canyon Marine Park is ~300 km north-west of Carnarvon. It covers an area of 6177 km² with a water depth range of 1500–6000 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Carnarvon Canyon Marine Park on 9 October 2017.	The Marine Park includes examples of ecosystems representative of the Central Western Transition — a bioregion characterised by large areas of continental slope; a range of topographic features such as terraces, rises, and canyons; seasonal and sporadic upwelling; and benthic slope communities comprising tropical and temperate species. It includes the Carnarvon Canyon, a single-channel canyon covering the entire depth range of the Marine Park. Ecosystems of the Marine Park are influenced by tropical and temperate currents, deep-water environments, and proximity to the continental slope and shelf. The soft-bottom environment at the base of the Carnarvon Canyon is likely to support species that are typical of the deep sea floor (e.g. holothurians, polychaetes, sea pens). The Marine Park supports a range of species, including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. There is limited information about species' use of this Marine Park.
Cartier Island	Sanctuary Zone (Ia) 172 km²	The Cartier Island Marine Park is ~45 km south-east of Ashmore Reef Marine Park and 610 km north of Broome, WA. Both Marine Parks are located in Australia's External Territory of	The Marine Park includes examples of ecosystems representative of the Timor Province—a bioregion with a depth range from ~200 m near the shelf break to 5920 m over the Argo Abyssal Plain. The reefs and islands of the bioregion are regarded as biodiversity hotspots. Endemism of demersal fish communities of the continental slope is high with two distinct communities identified, one on the upper

AMP	Zones, IUCN categories, and zone area	Description	Natural values^
		Ashmore and Cartier Islands and are also within an area subject to a Memorandum of Understanding (MoU) between Indonesia and Australia, known as the MoU Box. The Marine Park covers an area of 172 km² with water depths from <15 m to 500 m. The Marine Park was originally proclaimed under the Commonwealth *National Parks and Wildlife Conservation Act 1975* on 21 June 2000 as the Cartier Island Marine Reserve, and proclaimed under the EPBC Act on 14 December 2013; it was renamed Cartier Island Marine Park on 9 October 2017.	slope, the other mid slope. Key ecological features represented in the Marine Park are: • Ashmore Reef and Cartier Island and surrounding Commonwealth waters—areas of enhanced productivity in an otherwise low-nutrient environment, of regional importance for feeding and breeding aggregations of birds and marine life • Continental slope demersal fish communities—an area of high diversity in demersal fish assemblages. The Marine Park includes an unvegetated sand island (Cartier Island); mature reef flat; a small, submerged pinnacle (Wave Governor Bank); and two shallow pools to the north-east of the island. It is also an area of high diversity and abundance of hard and soft corals, gorgonians (sea fans), sponges, and a range of encrusting organisms. The reef crests are generally algal dominated, while the reef flats feature ridges of coral rubble and large areas of seagrass. The Marine Park supports a range of species, including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include breeding and foraging habitat for seabirds; internesting, nesting, and foraging habitat for marine turtles; and foraging habitat for Whale Sharks. The Marine Park is important for a range of other species and internationally significant for its abundance and diversity of sea snakes, some of which are listed species under the EPBC Act.
Dampier	National Park Zone (II) 73 km² Habitat Protection Zone (IV) 104 km² Multiple Use Zone (VI) 1074 km²	The Dampier Marine Park is ~10 km north-east of Cape Lambert and 40 km from Dampier extending westwards from the WA state water boundary. The Marine Park covers an area of 1252 km² and a water depth range between <15 m and 70 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Dampier Marine Park on 9 October 2017.	The Marine Park includes examples of ecosystems representative of the Northwest Shelf Province—a dynamic environment influenced by strong tides, cyclonic storms, long-period swells, and internal tides. The bioregion includes diverse benthic and pelagic fish communities, and ancient coastline thought to be an important sea floor feature and migratory pathway for Humpback Whales. The Marine Park supports a range of species including those listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include breeding and foraging habitat for seabirds, internesting habitat for marine turtles, and a migratory pathway for Humpback Whales.

AMP	Zones, IUCN categories, and zone area	Description	Natural values^
Eighty Mile Beach	Multiple Use Zone (VI) 10 785 km²	The Eighty Mile Beach Marine Park is located ~74 km north-east of Port Hedland, adjacent to the Western Australian Eighty Mile Beach Marine Park. The Marine Park covers an area of 10 785 km² and a water depth ranges between less than 15 m and 70 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Eighty Mile Beach Marine Park on 9 October 2017.	The Marine Park includes examples of ecosystems representative of the Northwest Shelf Province—a dynamic environment influenced by strong tides, cyclonic storms, long-period swells, and internal tides. The bioregion includes diverse benthic and pelagic fish communities, and ancient coastline thought to be an important sea floor feature and migratory pathway for Humpback Whales. The Marine Park supports a range of species including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include breeding, foraging, and resting habitat for seabirds; internesting and nesting habitat for marine turtles; foraging, nursing, and pupping habitat for sawfish; and a migratory pathway for Humpback Whales.
Gascoyne	National Park Zone (II) 9132 km² Habitat Protection Zone (IV) 38 982 km² Multiple Use Zone (VI) 33 652 km²	The Gascoyne Marine Park is located ~20 km off the west coast of the Cape Range Peninsula, adjacent to the Ningaloo Reef Marine Park and the Western Australian Ningaloo Marine Park, and extends to the limit of Australia's EEZ. The Marine Park covers an area of 81 766 km² and water depths between 15 m and 6000 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Gascoyne Marine Park on 9 October 2017.	The Marine Park includes examples of ecosystems representative of: • Central Western Shelf Transition—continental shelf with water depths up to 100 m, and a significant transition zone between tropical and temperate species • Central Western Transition—characterised by large areas of continental slope; a range of topographic features such as terraces, rises, and canyons; seasonal and sporadic upwelling; and benthic slope communities comprising tropical and temperate species • Northwest Province—an area of continental slope comprising diverse and endemic fish communities. Key ecological features of the Marine Park are: • Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula—an area resulting in upwelling of nutrient-rich water and aggregations of marine life • Commonwealth waters adjacent to Ningaloo Reef—an area where the Leeuwin and Ningaloo currents interact resulting in enhanced productivity and aggregations of marine life • Continental slope demersal fish communities—an area of high diversity of demersal fish assemblages on the continental slope

AMP	Zones, IUCN categories, and zone area	Description	Natural values^
			• Exmouth Plateau—a regionally and nationally unique deep-sea plateau in tropical waters. Ecosystems represented in the Marine Park are influenced by the interaction of the Leeuwin Current, Leeuwin Undercurrent, and the Ningaloo Current. The Marine Park supports a range of species including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include breeding habitat for seabirds; internesting habitat for marine turtles; a migratory pathway for Humpback Whales; and foraging habitat and migratory pathway for Pygmy Blue Whales.
Kimberley	National Park Zone (II) 6392 km² Habitat Protection Zone (IV) 5665 km² Multiple Use Zone (VI) 62 411 km²	The Kimberley Marine Park is located ~100 km north of Broome, extending from the Western Australian state water boundary north from the Lacepede Islands to the Holothuria Banks offshore from Cape Bougainville. The Marine Park is adjacent to the Western Australian Lalang-garram/Camden Sound Marine Park and the North Kimberley Marine Park. The Marine Park covers an area of 74 469 km² and water depths from less than 15 m to 800 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Kimberley Marine Park on 9 October 2017.	The Marine Park includes examples of ecosystems representative of: • Northwest Shelf Province—a dynamic environment influenced by strong tides, cyclonic storms, long-period swells, and internal tides. The bioregion includes diverse benthic and pelagic fish communities, and an ancient coastline thought to be an important sea floor feature and migratory pathway for Humpback Whales. • Northwest Shelf Transition—straddles the North-west and North Marine Regions and in the Northwest includes shelf break, continental slope, and the majority of the Argo Abyssal Plain and is subject to a high incidence of cyclones. Benthic biological communities in the deeper parts of the bioregion have not been extensively studied, although high levels of species diversity and endemism occur among demersal fish communities on the continental slope. • Timor Province—water depths (of the bioregion) ranging from ~200 m near the shelf break to 5920 m over the Argo Abyssal Plain. The reefs and islands of the bioregion are regarded as biodiversity hotspots. Endemism in demersal fish communities of the continental slope is high; two distinct communities have been identified on the upper and mid slopes. Key ecological features of the Marine Park are: • the ancient coastline at the 125 m depth contour—where rocky escarpments are thought to provide

AMP	Zones, IUCN categories, and zone area	Description	Natural values^
			biologically important habitats in areas otherwise dominated by soft sediments • the continental slope demersal fish communities—characterised by high diversity of demersal fish assemblages. The Marine Park supports a range of species, including protected species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include breeding and foraging habitat for seabirds; internesting and nesting habitat for marine turtles; breeding, calving, and foraging habitat for inshore dolphins; calving, migratory pathway, and nursing habitat for Humpback Whales; migratory pathway for Pygmy Blue Whales; foraging habitat for dugong; and foraging habitat for Whale Sharks.
Mermaid Reef	National Park Zone (II) 540 km²	The Mermaid Reef Marine Park is located ~280 km north-west of Broome, adjacent to the Argo–Rowley Terrace Marine Park and ~13 km from the Western Australian Rowley Shoals Marine Park. The Marine Park covers an area of 540 km² and water depths from less than 15 m to 500 m. The Marine Park was originally proclaimed under the Commonwealth *National Parks and Wildlife Conservation Act 1975* on 10 April 1991 as the Mermaid Reef Marine National Nature Reserve, and proclaimed under the EPBC Act on 14 December 2013 and renamed Mermaid Reef Marine Park on 9 October 2017.	The Marine Park includes examples of ecosystems representative of the Northwest Transition—an area of shelf break, continental slope, and the majority of the Argo Abyssal Plain. Together with Clerke Reef and Imperieuse Reef, Mermaid Reef is a biodiversity hotspot and key topographic feature of the Argo Abyssal Plain. A key ecological feature of the Marine Park is the Mermaid Reef and Commonwealth waters surrounding Rowley Shoals—an area of enhanced productivity and high species richness thought to be facilitated by internal wave action generated by internal tides in the lagoon. Ecosystems of the Marine Park are associated with emergent reef flat, deep reef flat, lagoon, and submerged sand habitats. The Marine Park supports a range of species, including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include breeding habitat for seabirds and a migratory pathway for the Pygmy Blue Whale.
Montebello	Multiple Use Zone (VI) 3413 km²	The Montebello Marine Park is located offshore of Barrow Island and 80 km west of Dampier extending from the Western	The Marine Park includes examples of ecosystems representative of the Northwest Shelf Province—a dynamic environment influenced by strong tides, cyclonic storms, long-period swells, and internal tides. The bioregion includes diverse benthic and pelagic fish communities, and ancient

AMP	Zones, IUCN categories, and zone area	Description	Natural values^
		Australian state water boundary, and is adjacent to the Western Australian Barrow Island and Montebello Islands Marine Parks. The Marine Park covers an area of 3413 km² and water depths from <15 m to 150 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Montebello Marine Park on 9 October 2017.	coastline thought to be an important sea floor feature and migratory pathway for Humpback Whales. A key ecological feature of the Marine Park is the ancient coastline at the 125 m depth contour where rocky escarpments are thought to provide biologically important habitat in areas otherwise dominated by soft sediments. The Marine Park supports a range of species including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include breeding habitat for seabirds; internesting, foraging, mating, and nesting habitat for marine turtles; a migratory pathway for Humpback Whales; and foraging habitat for Whale Sharks.
Ningaloo	National Park Zone (II) 116 km² Recreational Use Zone (IV) 2319 km²	The Ningaloo Marine Park stretches ~300 km along the west coast of the Cape Range Peninsula, and is adjacent to the Western Australian Ningaloo Marine Park and Gascoyne Marine Park. The Marine Park covers an area of 2435 km² and a water depth range of 30 m to more than 500 m. The Marine Park was originally proclaimed under the *National Parks and Wildlife Conservation Act 1975* on 20 May 1987 as the Ningaloo Marine Park (Commonwealth Waters), and proclaimed under the EPBC Act on 14 December 2013 and renamed Ningaloo Marine Park on 9 October 2017.	The Marine Park includes examples of ecosystems representative of: • Central Western Shelf Transition—continental shelf of water depths up to 100 m, and a significant transition zone between tropical and temperate species • Central Western Transition—characterised by large areas of continental slope; a range of topographic features such as terraces, rises, and canyons; seasonal and sporadic upwelling; and benthic slope communities comprising tropical and temperate species • Northwest Province—an area of continental slope comprising diverse and endemic fish communities • Northwest Shelf Province—a dynamic environment, influenced by strong tides, cyclonic storms, long-period swells, and internal tides. The bioregion includes diverse benthic and pelagic fish communities, and ancient coastline thought to be an important sea floor feature and migratory pathway for Humpback Whales. Key ecological features of the Marine Park are: • Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula—an area resulting in upwelling of nutrient-rich water and aggregations of marine life • Commonwealth waters adjacent to Ningaloo Reef—an area where the Leeuwin and Ningaloo currents interact,

AMP	Zones, IUCN categories, and zone area	Description	Natural values^
			resulting in enhanced productivity and aggregations of marine life • Continental slope demersal fish communities—an area of high diversity among demersal fish assemblages on the continental slope. Ecosystems represented in the Marine Park are influenced by interaction of the Leeuwin Current, Leeuwin Undercurrent, and the Ningaloo Current. The Marine Park supports a range of species including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include breeding and or foraging habitat for seabirds; internesting habitat for marine turtles; a migratory pathway for Humpback Whales; foraging habitat and migratory pathway for Pygmy Blue Whales; breeding, calving, foraging, and nursing habitat for dugong; and foraging habitat for Whale Sharks.
Roebuck	Multiple Use Zone (VI) 304 km²	The Roebuck Marine Park is located ~12 km offshore of Broome, and is adjacent to the Western Australian Yawuru Nagulagun/Roebuck Bay Marine Park. The Marine Park covers an area of 304 km² and a water depth range of less than 15 m to 70 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Roebuck Marine Park on 9 October 2017.	The Marine Park includes examples of ecosystems representative of the Northwest Shelf Province—a dynamic environment influenced by strong tides, cyclonic storms, long-period swells, and internal tides. The bioregion includes diverse benthic and pelagic fish communities, and ancient coastline thought to be an important sea floor feature and migratory pathway for Humpback Whales. The Marine Park supports a range of species including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include breeding and resting habitat for seabirds; foraging and internesting habitat for marine turtles; a migratory pathway for Humpback Whales; and foraging habitat for dugong.
Shark Bay	Multiple Use Zone (VI) 7443 km²	The Shark Bay Marine Park is located ~60 km offshore of Carnarvon, adjacent to the Shark Bay World Heritage Property and National Heritage place. The Marine Park covers an area of 7443 km²,	The Marine Park includes examples of ecosystems representative of: • Central Western Shelf—a predominantly flat, sandy, and low-nutrient area, in water depths 50–100 m. The bioregion is a transitional zone between tropical and temperate species • Central Western Transition—characterised by large areas of continental slope; a range of topographic features such as terraces,

AMP	Zones, IUCN categories, and zone area	Description	Natural values^
		extending from the Western Australian state water boundary, and a water depth range between 15 m and 220 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Shark Bay Marine Park on 9 October 2017.	rises, and canyons; seasonal and sporadic upwelling; and benthic slope communities comprising tropical and temperate species. Ecosystems represented in the Marine Park are influenced by the Leeuwin, Ningaloo, and Capes currents. The Marine Park supports a range of species including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include breeding habitat for seabirds, internesting habitat for marine turtles, and a migratory pathway for Humpback Whales. The Marine Park and adjacent coastal areas are also important for Shallow-water Snapper.

^ Source: Ref. 75.

Table 2-20: Summary of AMPs (South-west Marine Parks)

AMP	Zones, IUCN categories and zone area	Description	Natural values^
Abrolhos	Habitat Protection Zone (IV) 23,239 km² Multiple Use Zone (VI) 56,545 km² National Park Zone (II) 2548 km² Special Purpose Zone (VI) 5729 km²	Abrolhos Marine Park is located adjacent to the Western Australian Houtman Abrolhos Islands, covering a large offshore area extending from the Western Australian state water boundary to the edge of Australia's exclusive economic zone. It is located ~27 km south-west of Geraldton and extends north to ~330 km west of Carnarvon. The northernmost part of the shelf component of the Marine Park, north of Kalbarri, is adjacent to the Shark Bay World Heritage Area. The Marine Park covers an area of 88,060 km² and a water depth range between less than 15 m and 6000 m.	The Marine Park includes examples of ecosystems representative of: • Central Western Province—characterised by a narrow continental slope incised by many submarine canyons and the most extensive area of continental rise in any of Australia's marine regions. A significant feature within the area are several eddies that form off the Leeuwin Current at predictable locations, including west of the Houtman Abrolhos Islands • Central Western Shelf Province—a predominantly flat, sandy, and low-nutrient area, in water depths between 50 and 100 m. Significant sea floor features of this area include a deep hole and associated area of banks and shoals offshore of Kalbarri. The area is a transitional zone between tropical and temperate species • Central Western Transition—a deep ocean area characterised by large areas of continental slope, a range of significant sea floor features including the Wallaby Saddle, seasonal and sporadic upwelling, and benthic slope communities comprising tropical and temperate species • South-west Shelf Transition—a narrow continental shelf that is noted for its

AMP	Zones, IUCN categories and zone area	Description	Natural values^
		The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Abrolhos Marine Park on 9 October 2017.	physical complexity. The Leeuwin Current has a significant influence on the biodiversity of this nearshore area as it pushes subtropical water southward along the area's western edge. The area contains a diversity of tropical and temperate marine life including a large number of endemic fauna species.
Geographe	National Park Zone (II) 15 km² Habitat Protection Zone (IV) 21 km² Multiple Use Zone (VI) 291 km² Special Purpose Zone (Mining Exclusion) (VI) 650 km²	The Geographe Marine Park is located in Geographe Bay, ~8 km west of Bunbury and 8 km north of Busselton, adjacent to the Western Australian Ngari Capes Marine Park. The Marine Park covers an area of 977 km², extending from the Western Australian state water boundary, and a water depth range between 15 m and 70 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Geographe Marine Park on 9 October 2017.	The Marine Park includes examples of ecosystems representative of the South-west Shelf Province—an area of diverse marine life, influenced by the warm waters of the Leeuwin Current. The bioregion includes globally important biodiversity hotspots, such as the waters off Geographe Bay. Key ecological features of the Marine Park are: • Commonwealth marine environment within and adjacent to Geographe Bay—the sheltered waters of Geographe Bay support extensive seagrass beds that in turn provide important nursery habitat for a range of marine species • Western Rock Lobster—plays an important trophic role in many of the inshore ecosystems of the South-west Marine Region. Western Rock Lobsters are an important part of the food web on the inner shelf, particularly as juveniles. The Marine Park supports a range of species including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include foraging habitat for seabirds, a migratory pathway for Humpback and Pygmy Blue Whales, and a calving buffer area for Southern Right Whales.
Jurien	National Park Zone (II) 31 km² Special Purpose Zone (VI) 1820 km²	The Jurien Marine Park is located ~148 km north of Perth and 155 km south of Geraldton, adjacent to the Western Australian Jurien Bay Marine Park. The Marine Park covers an area of 1851 km² of continental shelf, extending from the Western Australian state water boundary, and a water depth	The Marine Park includes examples of ecosystems representative of: • South-west Shelf Transition—consists of a narrow continental shelf that is noted for its physical complexity. The Leeuwin Current has a significant influence on the biodiversity of this nearshore area as it pushes subtropical water southward along the bioregion's western edge. The area contains a diversity of tropical and temperate marine life including a large number of endemic fauna species. Key ecological features of the Marine Park are:

AMP	Zones, IUCN categories and zone area	Description	Natural values^
		range between 15 m and 220 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Jurien Marine Park on 9 October 2017.	• Ancient coastline between 90 m and 120 m depth—high benthic biodiversity and productivity occur where the ancient coastline forms a prominent escarpment • Demersal slope and associated fish communities of the Central Western Province—an area that provides important habitat for demersal fish communities and is characterised by high species diversity and endemism • Western Rock Lobster—plays an important trophic role in many of the inshore ecosystems of the South-west Marine Region. Western Rock Lobsters are an important part of the food web on the inner shelf, particularly as juveniles. The Marine Park supports a range of species including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include foraging habitat for seabirds, Australian Sea Lions, and White Sharks; and a migratory pathway for Humpback and Pygmy Blue Whales.
Perth Canyon	National Park Zone (II) 1241 km² Habitat Protection Zone (IV) 4352 km² Multiple Use Zone (VI) 1816 km²	The Perth Canyon Marine Park is located ~52 km west of Perth and ~19 km west of Rottnest Island. The Marine Park covers an area of 7409 km² and water depths range between 120 m and 5000 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Perth Canyon Marine Park on 9 October 2017.	The Marine Park includes examples of ecosystems representative of: • Central Western Province—characterised by a narrow continental slope incised by many submarine canyons, including Perth Canyon, and the most extensive area of continental rise in any of Australia's marine regions. A significant feature within the area are the several eddies that form off the Leeuwin Current at predictable locations, including the Perth Canyon • South-west Shelf Province—marine life in this area is diverse and influenced by the warm waters of the Leeuwin Current • South-west Transition—significant features of this area include the submarine canyons that incise the northern parts of the slope and the deep-water mixing that results from the dynamics of major ocean currents when these meet the sea floor, particularly in the Perth Canyon • South-west Shelf Transition—consists of a narrow continental shelf that is noted for its physical complexity. The Leeuwin Current has a significant influence on the biodiversity of this

AMP	Zones, IUCN categories and zone area	Description	Natural values^
			nearshore area as it pushes subtropical water southward along the area’s western edge. The area contains a diversity of tropical and temperate marine life including a large number of endemic fauna species. Key ecological features of the Marine Park are: • Perth Canyon and adjacent shelf break, and other west coast canyons—unique sea floor features give rise to ecologically important events of localised productivity and aggregations of marine life. The Perth Canyon is prominent among these canyons because of its large size and ecological importance. The upwelling of deep ocean currents in the canyon creates a nutrient-rich cold-water habitat that attracts feeding aggregations of deep-diving mammals, such as Pygmy Blue Whales and large predatory fish that feed on aggregations of small fish, krill, and squid • Demersal slope and associated fish communities of the Central Western Province—an area that provides important habitat for demersal fish communities and is characterised by high species diversity and endemism • Western Rock Lobster—plays an important trophic role in many of the inshore ecosystems of the South-west Marine Region. Western Rock Lobsters are an important part of the food web on the inner shelf, particularly as juveniles • Mesoscale eddies—important transporters of nutrients and plankton communities that form at predictable locations off the western and south-western shelf break. The Marine Park supports a range of species including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include foraging habitat for seabirds, Antarctic Blue, Pygmy Blue, and Sperm Whales; a migratory pathway for Humpback, Antarctic Blue, and Pygmy Blue Whales; and a calving buffer area for Southern Right Whales.
South-west Corner	National Park Zone	The South-west Corner Marine Park is located adjacent to	The Marine Park includes examples of ecosystems representative of:

AMP	Zones, IUCN categories and zone area	Description	Natural values^
	(II) 54 841 km² Habitat Protection Zone (IV) 95 088 km² Multiple Use Zone (VI) 106 602 km² Special Purpose Zone (Mining Exclusion) (VI) 9550 km² Special Purpose Zone (VI) 5753 km²	the Western Australian Ngari Capes Marine Park, covering an extensive offshore area that is closest to Western Australia state waters ~48 km west of Esperance, 73 km west of Albany, and 68 km west of Bunbury, and extends to the edge of Australia's exclusive economic zone. The Marine Park covers an area of 271 833 km² and a water depth range from <15 m to 6400 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed South-west Corner Marine Park on 9 October 2017.	• Southern Province—includes the deepest ocean areas of the Australian EEZ, reaching depths of ~5900 m, and is characterised by a long continental slope incised by numerous, well-developed submarine canyons, and the Diamantina Fracture Zone, a rugged area of deep sea floor comprising seamounts and many ridges and troughs • South-west Transition—the main features of this area are the Naturaliste Plateau, the deepest submarine plateau along Australia's continental margins. The Plateau supports rich and diverse biological communities. Deep-water mixing results from the dynamics of major ocean currents when these meet the sea floor South-west Shelf Province—marine life in this area is diverse and influenced by the warm waters of the Leeuwin Current. A small upwelling of nutrient-rich water off Cape Mentelle during summer increases productivity locally, attracting aggregations of marine life. Key ecological features of the Marine Park are: • Albany Canyon group and adjacent shelf break—a feature consisting of 32 canyons cut deeply into the steep continental slope. The canyons are believed to be associated with small periodic upwellings that enhance productivity and attract aggregations of marine life • Cape Mentelle upwelling—draws relatively nutrient-rich water from the base of the Leeuwin Current, up the continental slope, and onto the inner continental shelf, where it results in phytoplankton blooms at the surface • Diamantina Fracture Zone—a unique sea floor feature consisting of a rugged, deep-water environment of seamounts and many closely spaced troughs and ridges. The ridges and seamounts can affect water dynamics and flow, enhancing productivity, and may act as 'stepping stones' for species dispersal and migration across the region and the wider abyssal plain • Naturaliste Plateau—the combination of this unique sea floor feature's structural complexity, mixed water dynamics, and relative isolation indicate that it supports deep-water

AMP	Zones, IUCN categories and zone area	Description	Natural values^
			communities with high species diversity and endemism • Western Rock Lobster—plays an important trophic role in many of the inshore ecosystems of the South-west Marine Region. Western Rock Lobsters are an important part of the food web on the inner shelf, particularly as juveniles • Ancient coastline between 90 m and 120 m depth—high benthic biodiversity and productivity occur where the ancient coastline forms a prominent escarpment. The Marine Park supports a range of species including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include foraging habitat for seabirds, Australian Sea Lions, White Sharks, and Sperm Whales; a migratory pathway for Antarctic Blue, Pygmy Blue, and Humpback Whales; and a calving buffer area for Southern Right Whales.
Two Rocks	National Park Zone (II) 15 km² Multiple Use Zone (VI) 867 km²	The Two Rocks Marine Park is located 25 km north-west of Perth, to the north-west of the Western Australian Marmion Marine Park. The Marine Park covers an area of 882 km², extending from the Western Australian state water boundary, and a water depth range from 15 m to 120 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Two Rocks Marine Park on 9 October 2017.	The Marine Park includes examples of ecosystems representative of the South-west Shelf Transition—an area of narrow continental shelf that is noted for its physical complexity. The Leeuwin Current has a significant influence on the biodiversity of this nearshore area as it pushes subtropical water southward along the area's western edge. The area contains a diversity of tropical and temperate marine life including a large number of endemic fauna species. The inshore lagoons are thought to be important areas for benthic productivity and recruitment for a range of marine species. Key ecological features of the Marine Park are: • Commonwealth marine environment within and adjacent to the west coast inshore lagoons—an area that is regionally important for enhanced benthic productivity, including macroalgae and seagrass communities, and breeding and nursery aggregations for many temperate and tropical marine species • Western Rock Lobster—plays an important trophic role in many of the inshore ecosystems of the South-west Marine Region. Western Rock Lobsters are an important part of the

AMP	Zones, IUCN categories and zone area	Description	Natural values^
			food web on the inner shelf, particularly as juveniles • Ancient coastline between 90 m and 120 m depth—high benthic biodiversity and productivity occur where the ancient coastline forms a prominent escarpment. The Marine Park supports a range of species including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include foraging habitat for seabirds and Australian Sea Lions, a migratory pathway for Humpback and Pygmy Blue Whales, and a calving buffer area for Southern Right Whales.

^ Source: Ref. 76.

Table 2-21 Summary of AMPs (North Marine Parks)

AMP Name	Zones, IUCN categories and zone area	Description	Natural values^
Oceanic Shoals	National Park Zone (II) 406 km² Habitat Protection Zone (IV) 6929 km² Multiple Use Zone (VI) 39 964 km² Special Purpose Zone (Trawl) (VI) 24 444 km²	The Oceanic Shoals Marine Park is located west of the Tiwi Islands, ~155 km north-west of Darwin, Northern Territory and 305 km north of Wyndham, Western Australia. It extends to the limit of Australia's exclusive economic zone. The Marine Park covers an area of 71 743 km² and water depths from <15 m to 500 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Oceanic Shoals Marine Park on 9 October 2017.	The Marine Park includes examples of ecosystems representative of the Northwest Shelf Transition— a dynamic environment influenced by strong tidal currents, upwellings of nutrient-rich waters, and a range of prominent sea floor features. The pinnacles, carbonate banks, and shoals are sites of enhanced biological productivity. Key ecological features of the Marine Park are: • Carbonate bank and terrace systems of the Van Diemen Rise—an area characterised by terraces, banks, channels, and valleys supporting sponges, soft coral, polychaetes, ascidians, turtles, snakes, and sharks • Carbonate bank and terrace system of the Sahul Shelf—an area characterised by terraces, banks, channels, and valleys, supporting sponges, soft corals, sessile filter feeders, polychaetes, and ascidians • Pinnacles of the Bonaparte Basin—an area that contains the largest concentration of pinnacles along the Australian margin, where local upwellings of nutrient-rich water attract aggregations of fish, seabirds, and turtles • Shelf break and slope of the Arafura Shelf—an area characterised by

AMP Name	Zones, IUCN categories and zone area	Description	Natural values^
			continental slope, patch reefs, and hard substrate pinnacles that support >280 demersal fish species. • The Marine Park supports a range of species, including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include foraging and internesting habitat for marine turtles.
Joseph Bonaparte Gulf	Multiple Use Zone (VI) 6346 km² Special Purpose Zone (VI) 2251 km²	The Joseph Bonaparte Gulf Marine Park is located ~15 km west of Wadeye, Northern Territory, and ~90 km north of Wyndham, Western Australia, in the Joseph Bonaparte Gulf. It is adjacent to the Western Australian North Kimberley Marine Park. The Marine Park covers an area of 8597 km² and water depth ranges between <15 m and 100 m. The Marine Park was proclaimed under the EPBC Act on 14 December 2013 and renamed Joseph Bonaparte Gulf Marine Park on 9 October 2017.	The Marine Park includes examples of ecosystems representative of the Northwest Shelf Transition— a dynamic environment influenced by strong tidal currents, monsoonal winds, cyclones, and wind-generated waves. The large tidal ranges and wide intertidal zones near the Marine Park create a physically dynamic and turbid marine environment. The key ecological feature in the Marine Park is the carbonate bank and terrace system of the Sahul Shelf—characterised by terraces, banks, channels, and valleys supporting sponges, soft corals, sessile filter feeders, polychaetes, and ascidians. The Marine Park supports a range of species, including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. Biologically important areas within the Marine Park include foraging habitat for marine turtles and the Australian Snubfin Dolphin.

^ Source: Ref. 77.

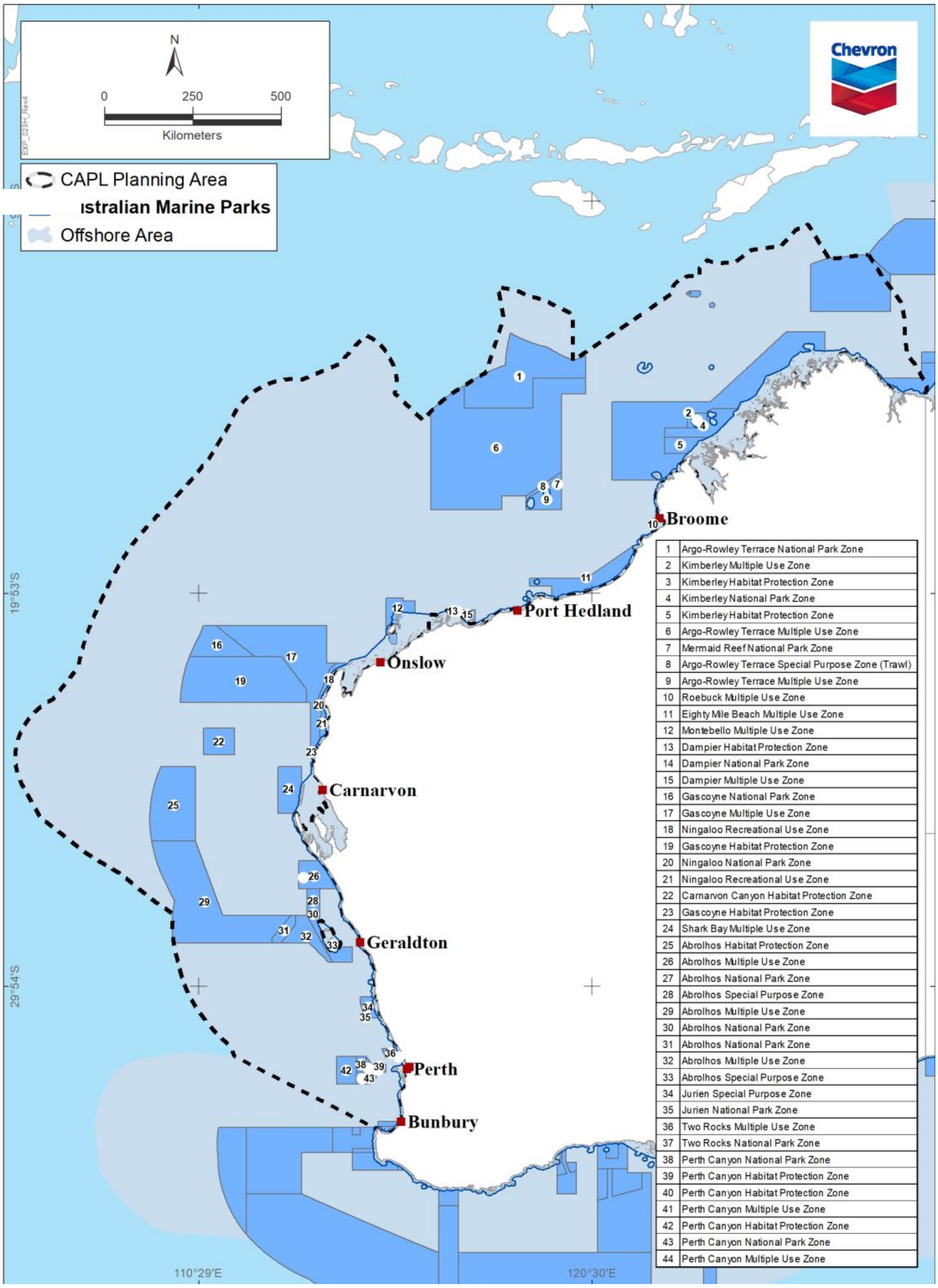


Figure 2-5: Australian Marine Parks

2.7.2 Key ecological features

Key ecological features (KEFs) are elements of the Commonwealth marine environment that are considered to be of regional importance for a region's biodiversity or its ecosystem function and integrity. KEFs meet one or more of these criteria (Ref. 78):

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

KEFs have been identified by the Australian Government on the basis of advice from scientists about the ecological processes and characteristics of the area (Ref. 78).

Table 2-22, Table 2-23, and Table 2-24 list the KEFs located within the PA (Ref. 78; Ref. 4; appendix a).

Table 2-22: Key ecological features of the North-west Marine Bioregion

KEF	Value	Description^
Ancient coastline at 125 m depth contour	Unique sea floor feature with ecological properties of regional significance	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 these escarpments may also facilitate vertical mixing of the water column, providing relatively nutrient-rich local environments.
Ashmore Reef and Cartier Island and surrounding Commonwealth waters	High productivity and aggregations of marine life	Ashmore Reef 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. Ashmore Reef and Cartier Island and the surrounding Commonwealth waters are regionally important for feeding and breeding aggregations of birds and other marine life; they are areas of enhanced primary productivity in an otherwise low-nutrient environment. Ashmore Reef supports the highest number of coral species of any reef off the west Australian coast.
Canyons linking the Argo Abyssal Plain with the Scott Plateau	High productivity and aggregations of marine life	The canyons linking the Argo Abyssal Plain and Scott Plateau are important features likely to be associated with aggregations of marine life.
Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	Unique sea floor features with ecological properties of regional significance	The canyons are associated with upwelling as they channel deep water from the Cuvier Abyssal Plain up onto the slope. This nutrient-rich water interacts with the Leeuwin Current at the canyon heads. Aggregations of Whale Sharks, manta rays, sea snakes, sharks, large predatory fish, and seabirds are known to occur in this area.

KEF	Value	Description^
Carbonate bank and terrace system of the Sahul Shelf	Unique sea floor feature with ecological properties of regional significance	Little is known about the bank and terrace system of the Sahul Shelf, but it is regionally important because of its likely ecological role in enhancing biodiversity and local productivity relative to its surrounds. The banks are thought to support a high diversity of organisms (including reef fish, sponges, soft and hard corals, gorgonians, bryozoans, ascidians, and other sessile filter feeders). The banks are known to be foraging areas for Loggerhead, Olive Ridley, and Flatback Turtles. Cetaceans and Green and Freshwater Sawfish are likely to occur in the area.
Commonwealth waters adjacent to Ningaloo Reef	High productivity and aggregations of marine life	The Leeuwin and Ningaloo currents interact, leading to areas of enhanced productivity in the Commonwealth waters adjacent to Ningaloo Reef. Aggregations of Whale Sharks, manta rays, Humpback Whales, sea snakes, sharks, large predatory fish, and seabirds are known to occur in this area.
Continental Slope Demersal Fish Communities	High levels of endemism	The diversity of demersal fish assemblages on the continental slope in the Timor Province, the Northwest Transition, and the Northwest Province is high compared to elsewhere along the continental slope.
Exmouth Plateau	Unique sea floor feature with ecological properties of regional significance	The Exmouth Plateau is a regionally and nationally unique deep-sea plateau in tropical waters. The plateau is a very large topographic obstacle that may modify the flow of deep waters, generating internal tides and may contribute to upwelling of deeper water nutrients closer to the surface, thus serving an important ecological role.
Glomar Shoals	High productivity and aggregations of marine life	The Glomar Shoals are regionally important for their high biological diversity and high localised productivity. Biological data specific to Glomar Shoals is limited; however, the fish of Glomar Shoals are probably a subset of reef-dependent species and anecdotal and fishing industry evidence suggests they are particularly abundant.
Mermaid Reef and Commonwealth waters surrounding Rowley Shoals	High productivity and aggregations of marine life	The reefs of the Rowley Shoals (including Mermaid Reef) are areas of enhanced productivity and high species richness. Enhanced productivity that contributes to this species richness is thought to be facilitated by the breaking of internal waves in the waters surrounding the reefs, causing mixing and resuspension of nutrients from water depths of 500–700 m into the photic zone. The steep changes in slope around the reef also attract a range of migratory pelagic species such as dolphins, tuna, billfish, and sharks.
Pinnacles of the Bonaparte Basin	Unique sea floor feature with ecological properties of regional significance	As they provide areas of hard substrate in an otherwise relatively featureless environment, the pinnacles are likely to support a high number of species, although a better understanding of the species richness and diversity associated with these structures is required. Covering >520 km^2 within the Bonaparte Basin, this feature contains the largest concentration of pinnacles along the Australian margin. The pinnacles of the Bonaparte Basin are thought to be the eroded remnants of

KEF	Value	Description^
		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.
Seringapatam Reef and Commonwealth waters in the Scott Reef Complex	High productivity and aggregations of marine life	Seringapatam Reef and the Commonwealth waters in the Scott Reef complex are regionally important in supporting the diverse aggregations of marine life, high primary productivity, and high species richness associated with the reefs themselves. As two of the few offshore reefs in the north-west, they provide an important biophysical environment in the region.
Wallaby Saddle	High productivity and aggregations of marine life	The Wallaby Saddle may be an area of enhanced productivity. Historical whaling records provide evidence of Sperm Whale aggregations in the area of the Wallaby Saddle, possibly due to the enhanced productivity of the area and aggregations of baitfish.

^ Source: Ref. 79.

Table 2-23: Key ecological features of the North Marine Bioregion

KEF	Value	Description^
Carbonate bank and terrace system of the Van Diemen Rise	Unique sea floor feature with ecological properties of regional significance	The bank and terrace system of the Van Diemen Rise is part of the larger system associated with the Sahul Banks to the north and Londonderry Rise to the east; it is characterised by terrace, banks, channels, and valleys. The variability in water depth and substrate composition may contribute to the presence of unique ecosystems in the channels. Species present include sponges, soft corals, and other sessile filter feeders associated with hard substrate sediments of the deep channels; epifauna and infauna include polychaetes and ascidians. Olive Ridley Turtles, sea snakes, and sharks are also found associated with this feature.
Pinnacles of the Bonaparte Basin	Unique sea floor feature with ecological properties of regional significance	As they provide areas of hard substrate in an otherwise relatively featureless environment, the pinnacles are likely to support a high number of species, although a better understanding of the species richness and diversity associated with these structures is required. Covering >520 km^2 within the Bonaparte Basin, this feature contains the largest concentration of pinnacles along the Australian margin. 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.

^ Source: Ref. 80.

Table 2-24: Key ecological features of the South-west Marine Bioregion

KEF	Value	Description^
Ancient coastline at 90–120 m depth	Relatively high productivity and aggregations of marine life, and high levels of biodiversity and endemism	Benthic biodiversity and productivity occur where the ancient coastline forms a prominent escarpment, such as in the western Great Australian Bight, where the sea floor is dominated by sponge communities of significant biodiversity and structural complexity.
Cape Mentelle upwelling	High productivity and aggregations of marine life	The Cape Mentelle upwelling draws relatively nutrient-rich water from the base of the Leeuwin Current, up the continental slope, and onto the inner continental shelf, where it results in phytoplankton blooms at the surface. The phytoplankton blooms provide the basis for an extended food chain characterised by feeding aggregations of small pelagic fish, larger predatory fish, seabirds, dolphins, and sharks.
Commonwealth marine environment surrounding the Houtman Abrolhos Islands	High levels of biodiversity and endemism	The Houtman Abrolhos Islands and surrounding reefs support a unique mix of temperate and tropical species, resulting from the southward transport of species by the Leeuwin Current over thousands of years. The Houtman Abrolhos Islands are the largest seabird breeding station in the eastern Indian Ocean. They support more than one million pairs of breeding seabirds.
Commonwealth marine environment within and adjacent to Geographe Bay	High productivity and aggregations of marine life, and high levels of biodiversity and endemism	Geographe Bay is known for its extensive beds of tropical and temperate seagrass that support a diversity of species, many of them not found anywhere else. The bay provides important nursery habitat for many species. It is also an important migratory area for Humpback Whales.
Commonwealth marine environment within and adjacent to the west coast inshore lagoons	High productivity and aggregations of marine life	These lagoons are important for benthic productivity, including macroalgae and seagrass communities, and breeding and nursery aggregations for many temperate and tropical marine species. They are important areas for the recruitment of commercially and recreationally important fishery species. Extensive schools of migratory fish visit the area annually, including herring, garfish, tailor, and Australian Salmon.
Naturaliste Plateau	Unique sea floor feature with ecological properties of regional significance	The Naturaliste Plateau is Australia's deepest temperate marginal plateau. The combination of its structural complexity, mixed water dynamics, and relative isolation indicate that it supports deep-water communities with high species diversity and endemism.
Meso-scale eddies (several locations)	High productivity and aggregations of marine life	Driven by interactions between currents and bathymetry, persistent meso-scale eddies form in predictable locations within the meanders of the Leeuwin Current. They are important transporters of nutrients and plankton communities and are likely to attract a range of organisms from the higher trophic levels, such as marine mammals, seabirds, tuna and billfish. The eddies play a critical role in determining species distribution, as they influence the southerly range boundaries of tropical and subtropical species, the transport of

KEF	Value	Description^
		coastal phytoplankton communities offshore and recruitment to fisheries.
Perth Canyon and adjacent shelf break, and other west coast canyons	High biological productivity and aggregations of marine life, and unique sea floor features with ecological properties of regional significance	The Perth Canyon is the largest known undersea canyon in Australian waters. Deep ocean currents rise to the surface, creating a nutrient-rich cold-water habitat attracting feeding aggregations of deep-diving mammals, such as Pygmy Blue Whales and large predatory fish that feed on aggregations of small fish, krill, and squid.
Western demersal slope and associated fish communities	Species groups that are nationally or regionally important to biodiversity	The western demersal slope provides important habitat for demersal fish communities, with a high level of diversity and endemism. A diverse assemblage of demersal fish species below a depth of 400 m is dominated by relatively small benthic species such as grenadiers, dogfish, and cucumber fish. Unlike other slope fish communities in Australia, many of these species display unique physical adaptations to feed on the sea floor (such as a mouth position adapted to bottom feeding), and many do not appear to migrate vertically in their daily feeding habits.
Western Rock Lobster	A species that plays a regionally important ecological role	This species is the dominant large benthic invertebrate in the region. The lobster plays an important trophic role in many of the inshore ecosystems of the South-west Marine Region. Western rock lobsters are an important part of the food web on the inner shelf, particularly as juveniles.

^ *Source: Ref. 81.*

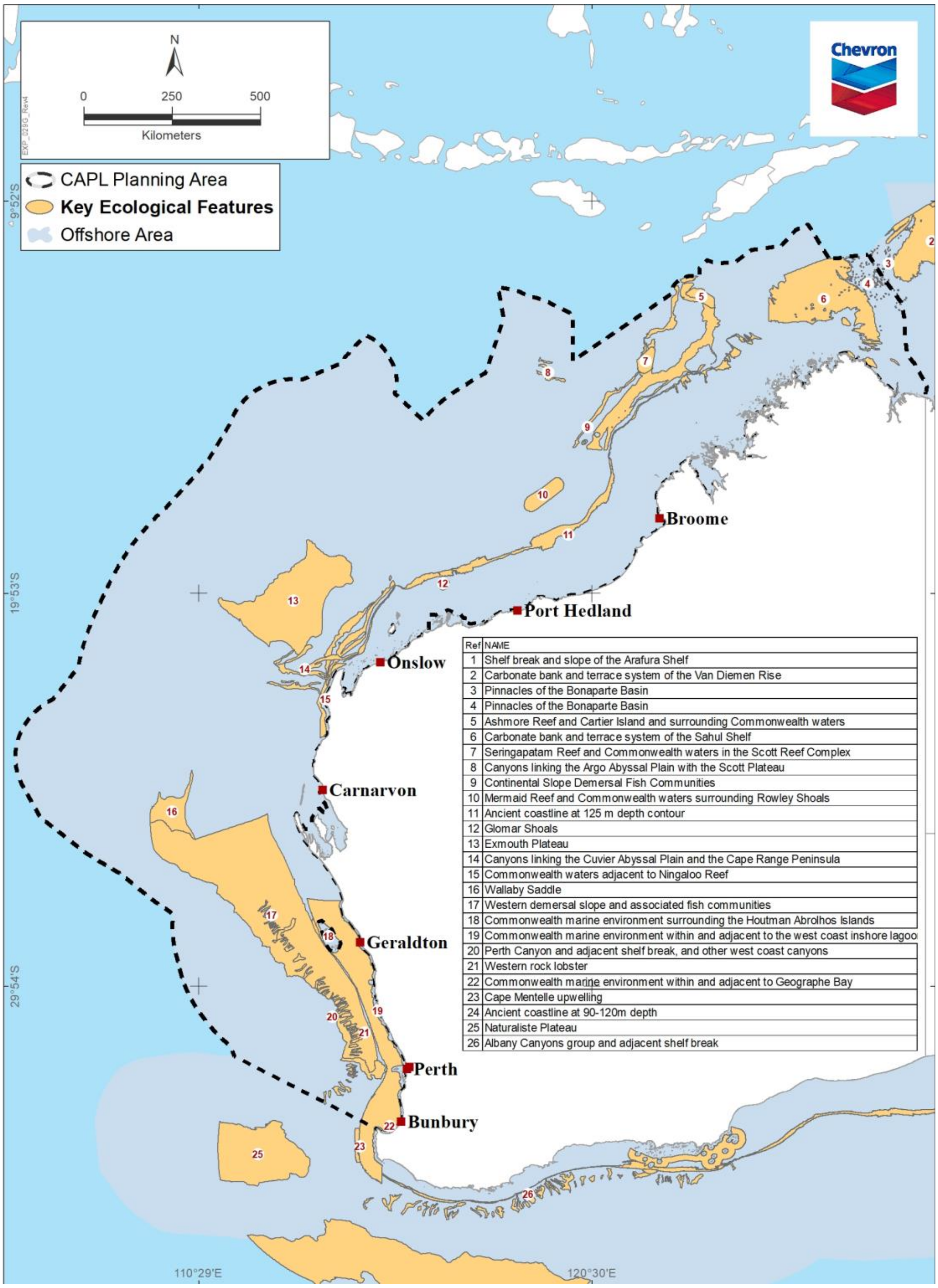


Figure 2-6: Key ecological features

3 Physical environment

3.1 Meteorology

Northwest WA is characterised by an arid, subtropical climate. In summer (between September and March), average daily temperatures range from 21 °C to 36 °C. During winter (May to July), mean daily temperatures range from 14 °C to 29 °C (Ref. 82; Ref. 83). April and August are considered transitional months during which either the summer or winter weather regime may dominate, or conditions may vary between the two (Ref. 83). The area receives relatively low rainfall, although heavy downpours can occur during tropical cyclones and depressions.

Wind patterns in north-west WA are dictated by the seasonal movement of atmospheric pressure systems. During summer, high-pressure cells produce prevailing winds from the north-west and south-west, which vary between 10 and 13 ms^{-1}. During winter, high-pressure cells over central Australia produce north-easterly to south-easterly winds with average speeds of between 6 and 8 ms^{-1}.

The cyclone season in north-west WA runs from November to April, with an average of five tropical cyclones per year (Ref. 84). Summer thunderstorms can have associated winds with gusts exceeding 20 ms^{-1}, but these winds are usually of short duration.

The air quality in the North-west Marine Region is largely unpolluted due to the Region's relative remoteness.

3.2 Oceanography

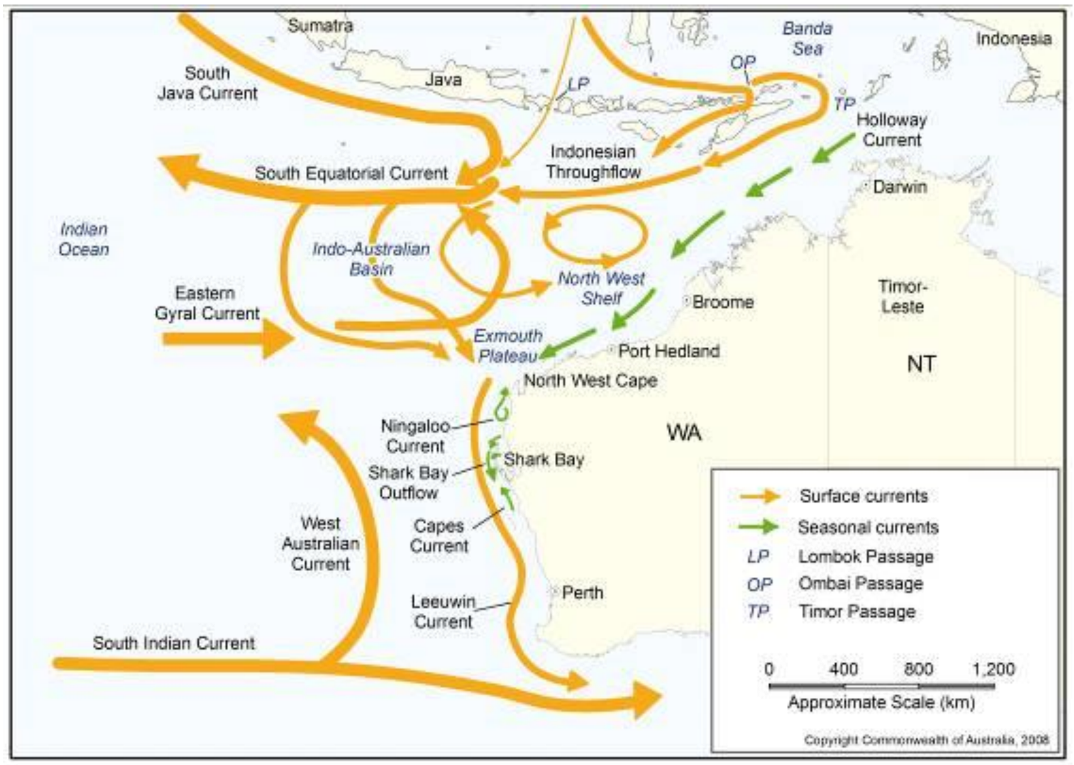
3.2.1 Water temperature

Waters in north-west WA are tropical year-round, with sea surface temperature in open shelf waters reaching ~26 °C in summer, and dropping to ~22 °C in winter. Nearshore temperatures of north-west WA fluctuate through a higher temperature range from ~17 °C in winter to ~31 °C in summer (Ref. 85).

3.2.2 Circulation and currents

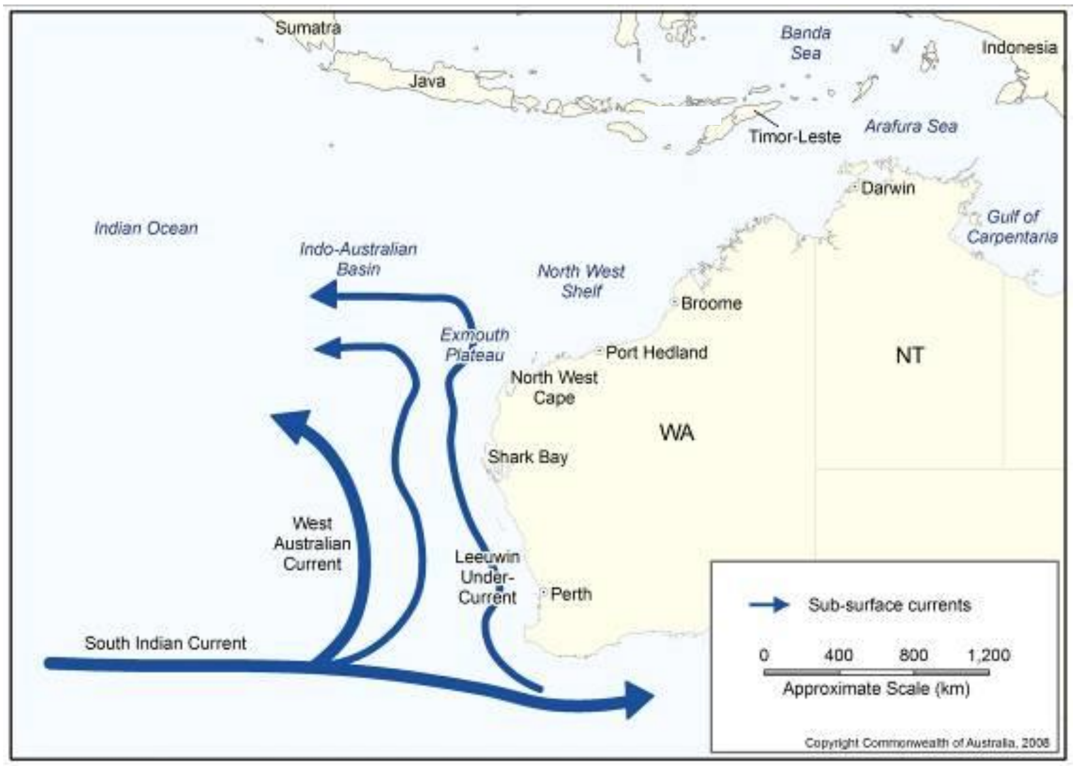
The major surface currents influencing north-west WA flow towards the poles and include the Indonesian Throughflow, the Leeuwin Current, the South Equatorial Current, and the Eastern Gyral Current. The Ningaloo Current, the Holloway Current, the Shark Bay Outflow, and the Capes Current are seasonal surface currents in the region. Below these surface currents are several subsurface currents, the most important of which are the Leeuwin Undercurrent and the West Australian Current. These subsurface currents flow towards the equator in the opposite direction to surface currents (Ref. 79). Figure 3-1 and Figure 3-2 show the main surface and subsurface currents in north-west WA.

Water circulation in north-west WA is strongly influenced by the southward-flowing Indonesian Throughflow. The strength of the Throughflow, and its influence in north-west WA, varies seasonally in association with the north-west monsoon (Ref. 79).



(Source: Ref. 79)

Figure 3-1: Surface and seasonal currents in the region



(Source: Ref. 79)

Figure 3-2: Subsurface currents in the region

3.2.3 Waves

The prevailing oceanic conditions in north-west WA are governed by a combination of sea and swell waves. Local wind-generated seas have variable wave heights, typically ranging from 0 to 4 m under non-tropical cyclone conditions. North-west WA typically experiences a persistent winter swell of ~2 m, generated by low-pressure systems in southern latitudes.

3.2.4 Tides

North-west WA has some of the largest tides along a coastline adjoining an open ocean in the world. Tides increase in amplitude from south to north, corresponding with the increasing width of the continental shelf (Ref. 79). Tidal movements are larger and stronger in the nearshore waters compared to the offshore waters. Tides in the region are broadly categorised as semidiurnal (i.e. two high tides and two low tides per day) with a spring/neap cycle (Ref. 79).

3.3 Marine water quality

3.3.1 Nutrients

North-west WA's surface waters are nutrient-poor due to the Indonesian Throughflow dominating the surface waters of the entire region.

Sporadic and variable nutrient loadings may occur within coastal waters due to changes in river run-off (e.g. Ashburton River), blooms of nitrogen-fixing microbes, tidal mixing, low-frequency circulation, and habitat influences (i.e. mangroves) (Ref. 86).

3.3.2 Turbidity

Water clarity in north-west WA varies according to water movement, depth, and seabed sediment type. Nearshore waters in the region may be relatively turbid as a result of local current-induced resuspension of fine sediments and episodic run-off from adjacent rivers, although there is high spatial and temporal variation. However, some protected coastal areas, such as the lagoon system of the fringing Ningaloo Reef, can be characterised by relatively clear water with low turbidity.

3.3.3 Water chemistry

Salinity varies spatially and temporally in the waters across north-west WA. Water salinity varies between 34.4 and 36.3 g/L in offshore waters around the North West Shelf (Ref. 87).

Wenziker *et al.* (Ref. 87) estimated natural background concentrations for a range of potential contaminants in the waters around the Dampier Archipelago, thus providing baseline information as to the water quality within nearshore waters of the North West Shelf. The contaminants investigated encompassed a range of heavy metals (e.g. cadmium, chromium, copper, lead, mercury, and zinc) and organic chemicals (e.g. polycyclic aromatic hydrocarbons, total petroleum hydrocarbons). The survey identified low background concentrations of metals and organic chemicals, with localised elevations of some contaminants (metals) near the coastal industrial centres and ports (e.g. Dampier). Except for a few select constituents, such as relatively high natural levels of cadmium, the concentrations of metals were low by world standards. Wenziker *et al.* (Ref. 87) recommended that guideline water quality trigger values from the Australian and New Zealand Environment and Conservation Council and Agriculture and

Resource Management Council of Australia and New Zealand (Ref. 88) are suitable for use in the North West Shelf.

3.3.4 Marine geomorphology

The sea floor of north-west WA comprises four general feature types: continental shelf, continental slope, continental rise, and abyssal plain. Most of the region is either continental slope or continental shelf.

3.4 Seabed features

The geomorphology of Australia's continental margin is varied, with several geomorphic features present, including basins, canyons, terraces, seamounts, and plateaus. The key geomorphic features (Ref. 89) that were mapped as potentially occurring within the PA, are:

- abyssal plain/deep ocean floor
- apron/fan
- bank/shoals
- basin
- canyon.

3.5 Marine habitat

The Seamap Australia spatial data layer is a nationally synthesised data product of sea floor marine habitat data (Ref. 90). Australian continental shelf benthic habitat layers in GIS format were collected from various stakeholders around the country, compiled and reviewed by Australian National Data Service and external independent assessors, to produce a national classification of marine habitats.

Seamap Australia spatial data were used to indicate the types of marine habitat present within the PA. Table 3-1 summarises the areas of marine habitat associated with the matters of NES identified in this document.

Table 3-1: Marine habitat and key sensitivities

Matter of national environmental significance	Key sensitivities							Habitat type				
	AMP	KEF	Ramsar wetland	National Heritage	Commonwealth Heritage	World Heritage	TEC	Seagrass	Mangrove	Coral	Saltmarsh	Macroalgae
Ashmore Reef	☒							☒		☒		
Ashmore Reef and Cartier Island and surrounding Commonwealth waters		☒								☒		
Ashmore reef National Nature Reserve			☒							☒		

Matter of national environmental significance	Key sensitivities							Habitat type				
	AMP	KEF	Ramsar wetland	National Heritage	Commonwealth Heritage	World Heritage	TEC	Seagrass	Mangrove	Coral	Saltmarsh	Macroalgae
Ashmore Reef National Nature Reserve					☒					☒		
Carbonate bank and terrace system of the Sahul Shelf		☒								☒		
Carbonate bank and terrace system of the Van Diemen Rise		☒								☒		
Cartier Island	☒							☒		☒		
Commonwealth marine environment in and adjacent to Geographe Bay		☒						☒				
Commonwealth marine environment in and adjacent to the west coast inshore lagoons		☒						☒				☒
Eighty-mile Beach			☒						☒		☒	
Geographe	☒							☒				
Joseph Bonaparte Gulf	☒									☒		
Mermaid Reef – Rowley Shoals					☒					☒		
Ningaloo Coast				☒						☒		
Ningaloo Coast						☒			☒	☒		
Ningaloo Marine Area – Commonwealth Waters					☒					☒		
Oceanic Shoals	☒									☒		
Ord River Floodplain			☒						☒		☒	
Roebuck Bay			☒					☒	☒			
Scott Reef and Surrounds – Commonwealth Area					☒			☒		☒		
Shark Bay						☒		☒				
Shark Bay (Wooramel Seagrass Bank)				☒				☒				
Subtropical and Temperate Coastal Saltmarsh							☒				☒	

Matter of national environmental significance	Key sensitivities							Habitat type				
	AMP	KEF	Ramsar wetland	National Heritage	Commonwealth Heritage	World Heritage	TEC	Seagrass	Mangrove	Coral	Saltmarsh	Macroalgae
The West Kimberley				☒					☒	☒		
Thrombolite (microbial) community of coastal freshwater lakes of the Swan Coastal Plain (Lake Richmond)							☒					☒
Two Rocks	☒							☒				☒

3.6 Shoreline type

The Smartline Coastal Geomorphic Map of Australia (Ref. 91) is a detailed map of the coastal landform types—or geomorphology—of continental Australia and most of its adjacent islands. Using the intertidal classifications provided by the Smartline database, the types of shoreline that are present within the PA, their overall length, and percentage present in the PA is listed in Table 3-2.

Table 3-2: Shoreline type and length within PA

Shoreline type	Length (100 kms)
Unclassified	4608.46
Muddy tidal flats	2162.74
Hard bedrock shore	2151.61
Tidal flats (sediment undifferentiated)	1811.23
Sandy beach undifferentiated	966.09
Fine-medium sand beach	400.78
Hard rock cliff (>5 m)	248.45
Tidal sediment flats (inferred from mangroves)	192.49
Beach (sediment type undifferentiated)	161.49
Fine-medium sandy tidal flats	137.94
Sandy shore undifferentiated	102.32
Sandy tidal flats	68.28
Mixed sandy shore undifferentiated	37.96
Hard rocky shore platform	21.59
Artificial shoreline undifferentiated	13.87
Rocky shore (undifferentiated)	8.84
Boulder revetment	6.98
Sandy tidal flats with coarse stony debris	3.87

Shoreline type	Length (100 kms)
Perched sandy beach (undifferentiated)	2.81
Soft ‘bedrock’ shore	0.39
Concrete dock structures	0.23
Coral shingle beach	0.21

4 Socioeconomic environment

4.1 Commercial shipping

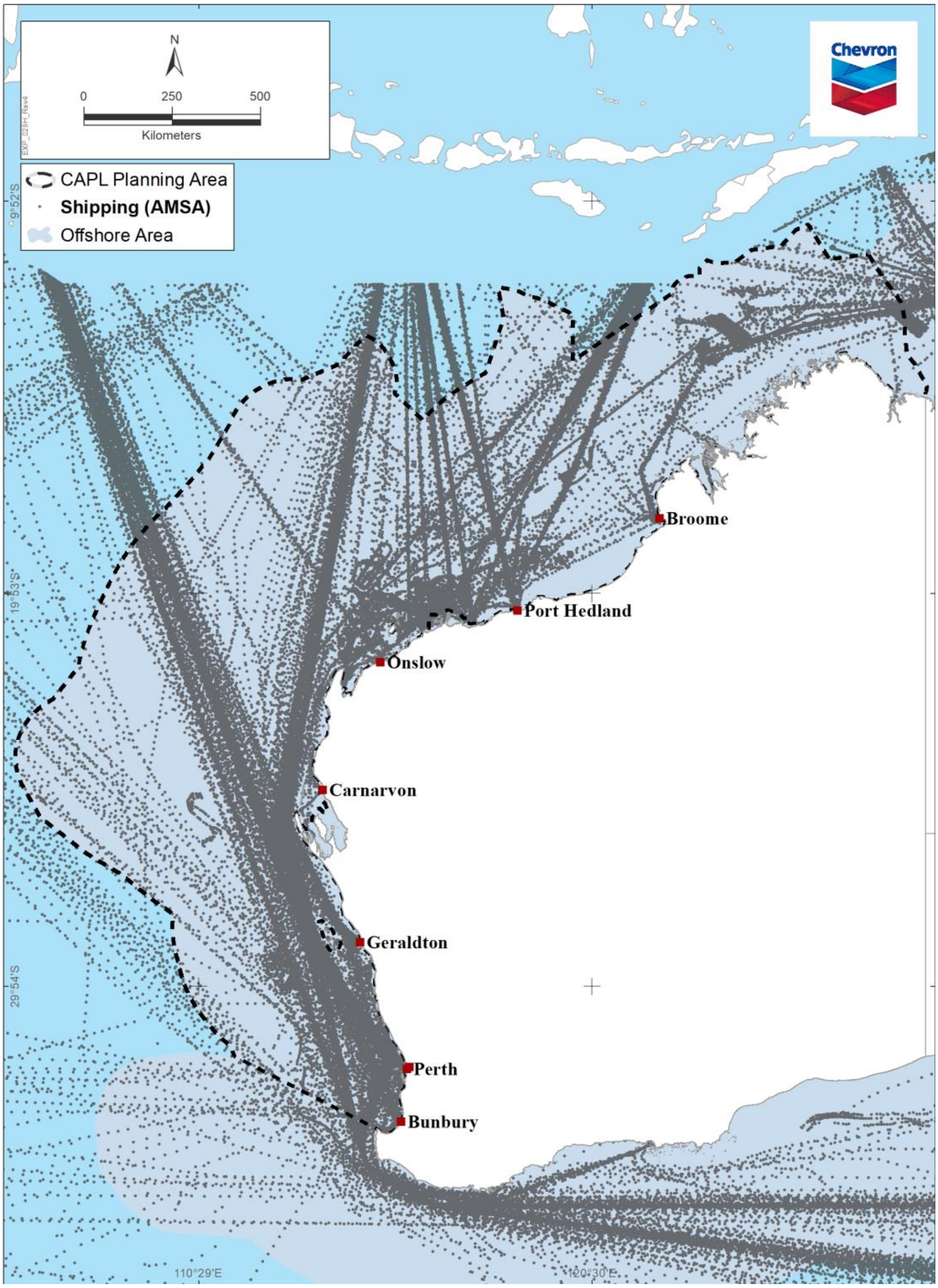
The Australian Maritime Safety Authority (AMSA) uses a satellite automatic identification system (AIS) service that provides AIS data across the Indo-Pacific and Indonesian region. The AIS can send and receive ship information (such as identity, position, course, speed, ship particulars, and cargo information) to and from other ships, suitably equipped aircraft, and shore. It can handle >2,000 reports per minute and updates information as often as every two seconds. Although the AIS is conventionally a line-of-sight radio broadcast system for communication between ships, and between ships and shore stations, recent technological developments have seen satellites adapted for receiving AIS messages from low Earth orbit.

Data provided by shipborne AISs were used to build a point density map from filtered satellite AIS data collected between 1 January 2016 and 31 December 2016 to indicate the level of shipping activity in Australian waters (Ref. 92).

Given the size of the PA, CAPL has reviewed this shipping density information to understand areas within the PA that comprise high activity and are important for the WA economy. Based on this data, the key shipping channels are those between:

- Fremantle, Dampier, and Port Hedland ports to Indonesia
- Fremantle, Dampier, and Port Hedland ports to Timor
- Port of Dampier to various offshore oil and gas developments.

The map also reflects the vessel density in and around known oil and gas facilities and developments within the PA (Figure 4-1).



(Source: Ref. 92)

Figure 4-1: Commercial shipping

4.2 Commercial fishing and aquaculture

Fishing and aquaculture activities are managed under various State and Commonwealth agencies. Table 4-1 and Table 4-2 list and summarise the State and Commonwealth managed fisheries that overlap the PA (Ref. 93; Ref. 94)

Table 4-1: State managed fisheries

Fishery	2019–2020 season summary^
Abalone	The 2019–2020 fishing season reported a commercial catch of 47 t. Catch was below TACC due to low catches in regional areas resulting from economic and accessibility issue.
Abrolhos Islands and Mid-West Trawl	The 2019–2020 fishing season reported a commercial catch of 796 t. Catch within acceptable range. The commercial fishery is in a planned expansion phase.
Broome Prawn	The 2019–2020 fishing season reported a negligible commercial catch. Minimal fishing occurred in 2019.
Cockburn Sound (Crab)	The fishery has been closed since April 2014. In 2019 recruitment and egg production remained below limit reference levels. Decline is consistent with an environmentally limited stock.
Cockburn Sound (Fish Net)	The 2019–2020 fishing season reported a commercial catch of 253 t (nearshore fisheries, total finfish). Metro Zone Garfish fishery closed in 2017. Declines in Garfish and Whitebait consistent with an environmentally limited stock. Review of acceptable catch ranges is required.
Cockburn Sound (Line and Pot)	The Cockburn Sound Line and Pot Managed Fishery record a catch of 32 t during 2018/10.
Exmouth Gulf Prawn	The 2019–2020 fishing season reported a commercial catch of 821 t. All species were within their acceptable catch ranges.
Inner Shark Bay Demersal	The 2019–2020 fishing season reported a commercial catch of 1 t. Incidental catch. Not considered a risk to stocks.
Gascoyne Demersal Scalefish	The 2019–2020 fishing season reported a commercial catch of 33.2 t of Snapper, and 139 t of other demersal species. Snapper spawning biomass was around the limit level. Additional management action undertaken in 2018 including TACC reduction. Management for other demersals adequate.
Kimberley Crab	The 2019–2020 fishing season reported a commercial catch of 7.4 t (Mud Crab). Catch rate: Below threshold, above limit.
Kimberley Gillnet and Barramundi	The 2019–2020 fishing season reported a commercial catch of 47 t (barramundi), and 73 t (total). Catch is above the acceptable range. The level of catch is lower than previous years, and is not considered a risk to stocks as the catch rate remains high.
Kimberley Prawn	The 2019–2020 fishing season reported a commercial catch of 100 t. Banana prawn catch well below acceptable and predicted range. Low effort in 2019.
Mackerel Fishery	The 2019–2020 fishing season reported a commercial catch of 291 t. The Spanish Mackerel catch is within tolerance range due to increased effort in 2019. Nominal catch rates declined in each area.
Marine Aquarium	The 2019 fishing season reported a commercial catch of 11.925 fish.
Nickol Bay Prawn	The 2019–2020 fishing season reported a commercial catch of 254 t. Catch within acceptable range. Banana prawn catches higher than predicted.
Northern Demersal Scalefish	The 2019–2020 fishing season reported a commercial catch of 1,507 t (total), 602 t (Goldband Snapper), 192 t (Red Emperor). Goldband Snapper and Red Emperor catches are above their catch ranges. Catches will be monitored closely in 2020.
Octopus	The 2019–2020 fishing season reported a commercial catch of 453 t. Catch was below TACC due to low catches in regional areas resulting from economic and accessibility issues.

Fishery	2019–2020 season summary^
Onslow Prawn	The 2019–2020 fishing season reported a commercial catch <60 t. Low effort by one boat in 2019.
Pearl Oyster Wildstock	The 2019–2020 fishing season reported a commercial catch of 611,816 oysters (14,022 dive hours). Catch below quota as MOP component was not fully utilised. Catch rates increased from 2018 to 2019.
Pilbara Crab	The 2019 fishing season reported a commercial catch of 19.3 t (Blue Swimmer Crab). Catch rate: Above threshold.
Pilbara Fish Trawl	The 2019–2020 fishing season reported a commercial catch of 2,142 t. Catches are increasing as the demersal scalefish assemblage in the Pilbara region recovers following effort reductions.
Pilbara Trap	The 2019–2020 fishing season reported a commercial catch of 680 t. Catches are increasing as the demersal scalefish assemblage in the Pilbara region recovers following effort reduction.
Pilbara Line	The 2019–2020 fishing season reported a commercial catch of 148 t. Catches are increasing as the demersal scalefish assemblage in the Pilbara region recovers following effort reduction.
Shark Bay Beach Seine and Mesh Net	The 2019–2020 fishing season reported a commercial catch of 175 t. Catch below the acceptable range due to ongoing low levels of effort.
Shark Bay Crab	The 2019–2020 fishing season reported a commercial catch of 529 t. Catch within acceptable range. Spawning and recruitment levels have further increased under the current environmental conditions and harvest levels.
Shark Bay Prawn	The 2019–2020 fishing season reported a commercial catch of 1.214 t. Brown tiger and western king prawn catches below the acceptable range due to lower recruitment levels. Additional management measures were implemented within the season to protect breeding stocks.
Shark Bay Scallop	The 2019–2020 fishing season reported a commercial catch of 657 t (to end of December). . Quota season extended to 30 April. Catch achieved to end of February from Denham Sound is estimated to be 1,370 t and that >90% of the total will be achieved. Northern Shark Bay closed to fishing due to recruitment below limit reference level. Decline is consistent with an environmentally limited stock and continues to be investigated.
Southern Demersal Gillnet & Demersal Longline West Coast Demersal Gillnet & Demersal Longline	The Temperate Demersal Gillnet and Demersal Longline Fishery (TDGDLF) comprises the West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery (WCDGDLF), which operates between 26° and 33°S, and the Joint Authority Southern Demersal Gillnet and Demersal Longline Managed Fishery (JASDGDLF), which operates from 33°S to the WA/SA border. The 2018–2019 fishing season reported a commercial catch of 838 t (sharks and rays) and 132 t (scalefish).
South West Coast Salmon / South Coast Salmon	The 2017–2018 fishing season for the South West Coast Salmon and South Coast Salmon reported a commercial catch of 50 t and 93 t respectively. In 2017, there were ~12 commercial fishers employed in the South Coast Salmon Fishery.
South West Trawl	Only one boat fished in the SWTMF in 2019 for a total of 32 boat days.
Specimen Shell	The 2019 fishing season reported a commercial catch of 7,232 shells.
West Coast Deep Sea Crustacean	The 2019–2020 fishing season reported a commercial catch of 155.7 t. TAC achieved with effort within acceptable range. The standardised catch rate of retained legal crabs is within the acceptable range.

Fishery	2019–2020 season summary^
West Coast Demersal Scalefish	The 2019–2020 fishing season reported a commercial catch of 270 t. Demersal suite catch within range.
West Coast Estuarine	The 2019–2020 fishing season reported a commercial catch of 66 t (Peel Harvey crab), 121 t (Peel Harvey finfish), and 35 t (other West Coast estuaries, crabs, and finfish). Catch and catch rates within acceptable ranges.
West Coast Purse Seine	The 2019–2020 fishing season reported a commercial catch of 527 t (all species). Catch was below quota.
West Coast Rock Lobster	The 2019–2020 fishing season reported a commercial catch of 6400 t. Catch within TACC plus 1.5% water loss i.e. 6400 t.
Western Australian Sea Cucumber	The 2019–2020 fishing season reported a commercial catch of 2 t (Sandfish), and 5 t (Redfish). Limited fishing due to due to planned rotational harvest schedule by industry.

^ *Source: Ref. 95.*

Table 4-2: Commonwealth managed fisheries

Fishery	2018–2019 season summary^
North-West Slope Trawl Fishery	The 2018–2019 fishing season reported a commercial catch of 41.1 t (scampi) and 67.4 t (total), with economic value withheld. The fishery recorded 151 active days comprising 2,869 trawl-hours. Seven permits were in place with four vessels active for the season.
Small Pelagic Fishery	The 2018–2019fishing season reported a commercial catch of 16,093 t. The fishery recorded 197 search-hours with 448 midwater trawl shots. In 2018–2019, 31 entities held quota statutory fishing right (SFRs), with three vessels actively using purse seine methods and one using trawl methods.
Southern Bluefin Tuna Fishery	The 2018–2019fishing season reported a commercial catch of 6,074 t worth an estimated AU$43.41 million. The fishery recorded 1,366 search-hours with 166 shots. In 2018–2019, 82 entities held quota SFRs, with seven vessels actively using purse seine methods and 20 using longline methods.
Western Deepwater Trawl Fishery	The 2018–2019fishing season reported a commercial catch of 53 t with economic value withheld. The fishery recorded 53 active days comprising 492.3 trawl-hours. Four permits were in place with one vessels active for the season.
Western Skipjack Fishery	There has been no fishing effort in the Skipjack Tuna Fishery (STF) since the 2008–2009 fishing season. Variability in the availability of skipjack tuna in the Australian Fishing Zone and the prices received for product influence participation levels in the fishery.
Western Tuna and Billfish Fishery	The 2018–2019fishing season reported a commercial catch of 218 t with the economic value withheld. The fishery recorded 366,821 hooks for the season. 94 entities held quota SFRs, with two vessels actively using pelagic longline and two vessels using minor line methods.

^ *Source: Ref. 96.*

4.3 Recreational fisheries

The WA Department of Primary Industries and Regional Development (DPIRD) conducts state-wide recreational fishing surveys every two years, with the first survey completed in 2011. The survey collects information from more than 3,000 recreational fishers who record their catches in logbooks over a 12-month period with DPIRD also conducting interviews throughout the State and monitoring the number of boat launches and retrievals using cameras at various boat ramps.

Key findings of the 2017–2018 survey report (Ref. 97) are included in Table 4-3.

Table 4-3: Recreational fishing survey outcomes

Component	Number
Number of participants	~6,000
Number of recreational fishing boat licences issued	~135 000
Most popular species	
Blue Swimmer Crab	Number caught ~667 000
School Whiting	Number caught ~259 000
Fishing effort by bioregion	
West Coast	76%
Gascoyne Coast	11%
North Coast	8%
South Coast	5%

Source: Ref. 97

4.4 Underwater cultural heritage

The Australasian Underwater Cultural Heritage Database (Ref. 98) records all known maritime cultural heritage (shipwrecks, aircraft, relics, and other underwater cultural heritage) in Australian waters. Historic shipwrecks and sunken aircraft (older than 75 years) are protected under the Commonwealth *Underwater Cultural Heritage Act 2018*. Shipwrecks and aircraft that have been underwater <75 years, and other types of underwater cultural heritage, can be protected through individual declaration based on an assessment of heritage significance.

Approximately 667 shipwrecks are present within the PA. Given this number, no additional detail is provided in this document. If shipwrecks are present within an EMBA described in a project-specific EP, CAPL will identify and detail the significance of these shipwrecks in that EP.

4.5 Defence

Table 4-4 lists the Australian Department of Defence's prohibited and training areas that are within the PA (Ref. 99).

Table 4-4: Department of Defence Prohibited and Training Areas

Area Type	Area Name
Practice Areas	Darwin AWR Central
	Learmonth AWR
	North-West Australian Exercise Area
Training Areas	North Australian Exercise Area
	Yampi Field Training Area
	Learmonth AWR
	West Australian Exercise Area

4.6 Tourism

Tourism is an important industry for WA, directly employing 73 200 people and indirectly employing a further 35,600 (Ref. 100). The value of the WA tourism industry is AU$12.9 billion by Gross State Product (Ref. 100). Table 4-5 lists the value of tourism to the state's economy.

Table 4-5: Western Australian Tourism Statistics

	WA Direct Tourism Gross Value Added ($million)	% of WA Direct Tourism Gross Value Added ($million)
Tourism characteristic industries		
Travel agency and tour operator services	$1138	19.1%
Air, water, and other transport	$823	13.8%
Accommodation	$654	11.0%
Cafes, restaurants, and takeaway food services	$552	9.3%
Ownership of dwellings	$370	6.2%
Clubs, pubs, taverns, and bars	$339	5.7%
Motor vehicle hiring	$157	2.6%
Other road transport	$87	1.5%
Casinos and other gambling services	$88	1.5%
Other sports and recreation services	$85	1.4%
Cultural services	$74	1.2%
Rail transport	$64	1.1%
Taxi transport	$56	0.9%
Tourism connected industries		
Automotive fuel retailing	$51	0.9%
Other retail trade	$631	10.6%
Education and training	$384	6.4%
All other industries	$413	6.9%
Total Gross Value Added	**$5966**	**100%**

Source: Ref. 100

5 terms, acronyms, and abbreviations

Table 5-1 defines the acronyms and abbreviations used in this document.

Table 5-1: Term, acronyms and abbreviations

Term, acronym, or abbreviation	Definition
~	Approximately
<	Less/fewer than
>	Greater/more than
AHC	Australian Heritage Commission
AIMS	Australian Institute of Marine Science
AIS	Automatic identification System
AMP	Australian Marine Park
AMSA	Australian Maritime Safety Authority
AU$	Australian dollar
AWR	Air Weapons Range
BIA	Biologically Important Area; a spatially defined area where aggregations of individuals of a species are known to display biologically important behaviours such as breeding, foraging, resting, or migration
BP	Before Present (present = 1950)
CAMBA	China–Australia Migratory Bird Agreement
CAPL	Chevron Australia Pty Ltd
CSIRO	Commonwealth Scientific and Industrial Research Organisation
Diadromous	Fish that spend portions of their life cycles partially in fresh water and partially in salt water
Doline	A shallow depression, either funnel- or saucer-shaped, with a floor covered by cultivated soil, formed by solution in limestone country
DPIRD	Western Australian Department of Primary Industries and Regional Development
DTA	Defence Training Area
EEZ	Exclusive Economic Zone
EMBA	Environment that May Be Affected
Endangered Species	A species that is not critically endangered, but is facing a very high risk of extinction in the wild in the near future.
EP	Environment Plan
EPBC Act	Commonwealth *Environment Protection and Biodiversity Conservation Act 1999*
g/L	Grams per litre
GIS	Geographic Information System
GVP	Gross Value of Product
ha	Hectare
HMAS	His Majesty’s Australian Ship (during World War II)
HMS	His (or Her) Majesty’s Ship (British)

Term, acronym, or abbreviation	Definition
HSK	Ship of the German Navy (during World War II)
IBRA	Interim Biogeographic Regionalisation for Australia
IUCN	International Union for Conservation of Nature
IUU	Illegal, unreported, and unregulated
JAMBA	Japan–Australia Migratory Bird Agreement
JASDGDLF	Joint Authority Southern Demersal Gillnet and Demersal Longline Managed Fishery
Karst	An area of irregular limestone in which erosion has produced fissures, sinkholes, underground streams, and caverns.
KEF	Key Ecological Feature
km	Kilometre
km^2	Square kilometre
m	Metre
MoU	Memorandum of Understanding
ms^{-1}	Metres per second
NES	[Matters of] National Environmental Significance, as defined in Part 3, Division 1 of the EPBC Act.
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
PA	Planning Area
PDSF	Pilbara Demersal Scalefish Fisheries
Photic zone	The depth of the water in a lake or ocean that is exposed to sufficient sunlight for photosynthesis to occur. The depth of the photic zone can be greatly affected by turbidity.
Priority Species	A species that does not meet the criteria for listing as Threatened Fauna or Declared Rare Flora, but which either may be suspected to be threatened; or is not threatened, but is rare and in need of ongoing monitoring; or is dependent on ongoing management intervention to prevent it from becoming threatened.
Prokaryote	A unicellular organism without a nucleus
Sessile	Permanently attached directly to the substratum by its base (i.e. immobile), without a stalk or stem
SFR	Statutory fishing right
SNES	Species of National Environmental Significance
Stochastic	Random
Swale	A low place in a tract of land, usually moister than the adjacent higher land
SWMR	South-West Marine Region
t	Tonne
TDGDLF	Temperate Demersal Gillnet and Demersal Longline Fishery
TEC	Threatened Ecological Community
Trophic	Relating to food or nutrition / nutritive processes
Vulnerable Species	A species is listed as vulnerable under the EPBC Act if it is not critically endangered or endangered and it is facing a high risk of extinction in the wild in

Term, acronym, or abbreviation	Definition
	the medium-term future, as determined in accordance with the prescribed criteria.
WA	Western Australia
WCB	West Coast Bioregion
WCDGDLF	West Coast Demersal Gillnet and Demersal Longline (Interim) Managed Fishery

6 references

The following documentation is either directly referenced in this document or is a recommended source of background information.

Where references and citations have been copied from Government Database sources, the database has been referenced but the references as cited by the databases have not been specified here. For source material, please refer to the governmental databases for specific source references.

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appendix a protected matters search report

Australian Government
Department of Agriculture, Water and the Environment

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

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

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

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Coordinates
Buffer: 0.0Km

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	2
National Heritage Places:	8
Wetlands of International Importance:	6
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	6
Listed Threatened Species:	139
Listed Migratory Species:	106

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:	11
Commonwealth Heritage Places:	11
Listed Marine Species:	197
Whales and Other Cetaceans:	41
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	43

Extra Information

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

State and Territory Reserves:	103
Regional Forest Agreements:	1
Invasive Species:	62
Nationally Important Wetlands:	17
Key Ecological Features (Marine)	24

Details

Matters of National Environmental Significance

World Heritage Properties [Resource Information]

Name	State	Status
Shark Bay, Western Australia	WA	Declared property
The Ningaloo Coast	WA	Declared property

National Heritage Properties [Resource Information]

Name	State	Status
Natural		
Lesueur National Park	WA	Listed place
Shark Bay, Western Australia	WA	Listed place
The Ningaloo Coast	WA	Listed place
The West Kimberley	WA	Listed place
Indigenous		
Dampier Archipelago (including Burrup Peninsula)	WA	Listed place
Historic		
Batavia Shipwreck Site and Survivor Camps Area 1629 - Houtman Abrolhos	WA	Listed place
Dirk Hartog Landing Site 1616 - Cape Inscription Area	WA	Listed place
HMAS Sydney II and HSK Kormoran Shipwreck Sites	EXT	Listed place

Wetlands of International Importance (Ramsar) [Resource Information]

Name	Proximity
Ashmore reef national nature reserve	Within Ramsar site
Becher point wetlands	Within 10km of Ramsar
Eighty-mile beach	Within Ramsar site
Ord river floodplain	Within Ramsar site
Peel-yalgorup system	Within Ramsar site
Roebuck bay	Within 10km of Ramsar

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
South-west

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Name	Status	Type of Presence
Banksia Woodlands of the Swan Coastal Plain ecological community	Endangered	Community likely to occur within area
Monsoon vine thickets on the coastal sand dunes of Dampier Peninsula	Endangered	Community likely to occur within area
Sedgelands in Holocene dune swales of the southern Swan Coastal Plain	Endangered	Community likely to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area
Thrombolite (microbialite) Community of a Coastal Brackish Lake (Lake Clifton)	Critically Endangered	Community known to occur within area
Tuart (Eucalyptus gomphocephala) Woodlands and Forests of the Swan Coastal Plain ecological community	Critically Endangered	Community likely to occur within area

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Breeding known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat likely to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Calyptorhynchus banksii naso Forest Red-tailed Black-Cockatoo, Karrak [67034]	Vulnerable	Species or species habitat known to occur within area
Calyptorhynchus baudinii Baudin's Cockatoo, Long-billed Black-Cockatoo [769]	Endangered	Breeding known to occur within area
Calyptorhynchus latirostris Carnaby's Cockatoo, Short-billed Black-Cockatoo [59523]	Endangered	Breeding known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Vulnerable	Species or species habitat likely to occur within area
Erythrura gouldiae Gouldian Finch [413]	Endangered	Species or species habitat known to occur

Name	Status	Type of Presence
		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
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Leipoa ocellata Malleefowl [934]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Critically Endangered	Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Malurus leucopterus edouardi White-winged Fairy-wren (Barrow Island), Barrow Island Black-and-white Fairy-wren [26194]	Vulnerable	Species or species habitat likely to occur within area
Malurus leucopterus leucopterus White-winged Fairy-wren (Dirk Hartog Island), Dirk Hartog Black-and-White Fairy-wren [26004]	Vulnerable	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	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
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Name	Status	Type of Presence
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Turnix varius scintillans Painted Button-quail (Houtman Abrolhos) [82451]	Vulnerable	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
Fish		
Milyeringa veritas Blind Gudgeon [66676]	Vulnerable	Species or species habitat known to occur within area
Nannatherina balstoni Balston's Pygmy Perch [66698]	Vulnerable	Species or species habitat likely to occur within area
Ophisternon candidum Blind Cave Eel [66678]	Vulnerable	Species or species habitat known to occur within area
Insects		
Hesperocolletes douglasi Douglas' Broad-headed Bee, Rottnest Bee [66734]	Critically Endangered	Species or species habitat may occur within area
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Bettongia lesueur Barrow and Boodie Islands subspecies Boodie, Burrowing Bettong (Barrow and Boodie Islands) [88021]	Vulnerable	Species or species habitat known to occur within area
Bettongia lesueur lesueur Burrowing Bettong (Shark Bay), Boodie [66659]	Vulnerable	Species or species habitat known to occur

Name	Status	Type of Presence
		within area
Bettongia penicillata ogilbyi Woylie [66844]	Endangered	Species or species habitat known to occur within area
Conilurus penicillatus Brush-tailed Rabbit-rat, Brush-tailed Tree-rat, Pakooma [132]	Vulnerable	Species or species habitat likely to occur within area
Dasyurus geoffroii Chuditch, Western Quoll [330]	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
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Isoodon auratus auratus Golden Bandicoot (mainland) [66665]	Vulnerable	Species or species habitat likely to occur within area
Isoodon auratus barrowensis Golden Bandicoot (Barrow Island) [66666]	Vulnerable	Species or species habitat known to occur within area
Lagorchestes conspicillatus conspicillatus Spectacled Hare-wallaby (Barrow Island) [66661]	Vulnerable	Species or species habitat known to occur within area
Lagorchestes hirsutus Central Australian subspecies Mala, Rufous Hare-Wallaby (Central Australia) [88019]	Endangered	Translocated population known to occur within area
Lagorchestes hirsutus bernieri Rufous Hare-wallaby (Bernier Island) [66662]	Vulnerable	Species or species habitat known to occur within area
Lagorchestes hirsutus dorreae Rufous Hare-wallaby (Dorre Island) [66663]	Vulnerable	Species or species habitat known to occur within area
Lagostrophus fasciatus fasciatus Banded Hare-wallaby, Merrnine, Marnine, Munning [66664]	Vulnerable	Species or species habitat known to occur within area
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat known to occur within area
Macrotis lagotis Greater Bilby [282]	Vulnerable	Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Mesembriomys gouldii gouldii Black-footed Tree-rat (Kimberley and mainland Northern Territory), Djintamoonga, Manbul [87618]	Endangered	Species or species habitat may occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Endangered	Breeding known to occur within area
Osphranter robustus isabellinus Barrow Island Wallaroo, Barrow Island Euro [89262]	Vulnerable	Species or species habitat likely to occur within area
Parantechinus apicalis Dibbler [313]	Endangered	Species or species habitat known to occur

Name	Status	Type of Presence
		within area
Perameles bougainville bougainville Western Barred Bandicoot (Shark Bay) [66631]	Endangered	Species or species habitat known to occur within area
Petrogale concinna monastria Nabarlek (Kimberley) [87607]	Endangered	Species or species habitat known to occur within area
Petrogale lateralis lateralis Black-flanked Rock-wallaby, Moororong, Black-footed Rock Wallaby [66647]	Endangered	Species or species habitat known to occur within area
Phascogale tapoatafa kimberleyensis Kimberley brush-tailed phascogale, Brush-tailed Phascogale (Kimberley) [88453]	Vulnerable	Species or species habitat likely to occur within area
Pseudocheirus occidentalis Western Ringtail Possum, Ngwayir, Womp, Woder, Ngoor, Ngoolangit [25911]	Critically Endangered	Species or species habitat known to occur within area
Pseudomys fieldi Shark Bay Mouse, Djoongari, Alice Springs Mouse [113]	Vulnerable	Species or species habitat likely to occur within area
Rhinonicteris aurantia (Pilbara form) Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat known to occur within area
Saccolaimus saccolaimus nudicluniatus Bare-rumped Sheath-tailed Bat, Bare-rumped Sheathtail Bat [66889]	Vulnerable	Species or species habitat likely to occur within area
Setonix brachyurus Quokka [229]	Vulnerable	Species or species habitat known to occur within area
Trichosurus vulpecula arnhemensis Northern Brushtail Possum [83091]	Vulnerable	Species or species habitat likely to occur within area
Xeromys myoides Water Mouse, False Water Rat, Yirrkoo [66]	Vulnerable	Species or species habitat may occur within area
Other		
Idiosoma nigrum Shield-backed Trapdoor Spider, Black Rugose Trapdoor Spider [66798]	Vulnerable	Species or species habitat may occur within area
Kumonga exleyi Cape Range Remipede [86875]	Vulnerable	Species or species habitat known to occur within area
Plants		
Andersonia gracilis Slender Andersonia [14470]	Endangered	Species or species habitat likely to occur within area
Androcalva bivillosa Straggling Androcalva [87807]	Critically Endangered	Species or species habitat may occur within area
Banksia nivea subsp. uliginosa Swamp Honeypot [82766]	Endangered	Species or species habitat may occur within area
Caladenia bryceana subsp. cracens Northern Dwarf Spider-orchid [64556]	Vulnerable	Species or species habitat may occur within area
Caladenia elegans Elegant Spider-orchid [56775]	Endangered	Species or species

Name	Status	Type of Presence
		habitat likely to occur within area
Caladenia hoffmanii Hoffman's Spider-orchid [56719]	Endangered	Species or species habitat may occur within area
Caladenia huegelii King Spider-orchid, Grand Spider-orchid, Rusty Spider-orchid [7309]	Endangered	Species or species habitat known to occur within area
Caladenia viridescens Dunsborough Spider-orchid [56776]	Endangered	Species or species habitat may occur within area
Chamelaucium sp. Gingin (N.G.Marchant 6) Gingin Wax [88881]	Endangered	Species or species habitat likely to occur within area
Chorizema varium Limestone Pea [16981]	Endangered	Species or species habitat known to occur within area
Conostylis micrantha Small-flowered Conostylis [17635]	Endangered	Species or species habitat may occur within area
Diuris drummondii Tall Donkey Orchid [4365]	Vulnerable	Species or species habitat likely to occur within area
Diuris micrantha Dwarf Bee-orchid [55082]	Vulnerable	Species or species habitat known to occur within area
Diuris purdiei Purdie's Donkey-orchid [12950]	Endangered	Species or species habitat likely to occur within area
Drakaea elastica Glossy-leafed Hammer Orchid, Glossy-leaved Hammer Orchid, Warty Hammer Orchid [16753]	Endangered	Species or species habitat likely to occur within area
Drakaea micrantha Dwarf Hammer-orchid [56755]	Vulnerable	Species or species habitat likely to occur within area
Drummondita ericoides Morseby Range Drummondita [9193]	Endangered	Species or species habitat likely to occur within area
Eucalyptus argutifolia Yanchep Mallee, Wabling Hill Mallee [24263]	Vulnerable	Species or species habitat known to occur within area
Eucalyptus beardiana Beard's Mallee [18933]	Vulnerable	Species or species habitat may occur within area
Eucalyptus x phylacis Meelup Mallee [87817]	Endangered	Species or species habitat likely to occur within area
Grevillea batrachioides Mt Lesueur Grevillea [21735]	Endangered	Species or species habitat may occur within area
Grevillea humifusa Spreading Grevillea [61182]	Endangered	Species or species habitat may occur within area
Hemiandra gardneri Red Snakebush [7945]	Endangered	Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Leucopogon obtectus Hidden Beard-heath [19614]	Endangered	Species or species habitat may occur within area
Marianthus paralius [83925]	Endangered	Species or species habitat known to occur within area
Minuria tridens Minnie Daisy [13753]	Vulnerable	Species or species habitat known to occur within area
Pityrodia augustensis Mt Augustus Foxglove [4962]	Vulnerable	Species or species habitat likely to occur within area
Seringia exastia Fringed Fire-bush [88920]	Critically Endangered	Species or species habitat may occur within area
Synaphea sp. Fairbridge Farm (D. Papenfus 696) Selena's Synaphea [82881]	Critically Endangered	Species or species habitat may occur within area
Synaphea sp. Serpentine (G.R. Brand 103) [86879]	Critically Endangered	Species or species habitat may occur within area
Thelymitra stellata Star Sun-orchid [7060]	Endangered	Species or species habitat likely to occur within area
Wurmbea calcicola Naturaliste Nancy [64691]	Endangered	Species or species habitat likely to occur within area
Reptiles		
Acanthophis hawkei Plains Death Adder [83821]	Vulnerable	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 foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Ctenotus lancelini Lancelin Island Skink [1482]	Vulnerable	Species or species habitat known to occur within area
Ctenotus zastictus Hamelin Ctenotus [25570]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Egernia stokesii badia Western Spiny-tailed Skink, Baudin Island Spiny-tailed Skink [64483]	Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Foraging, feeding or related behaviour known to occur within area
Liasis olivaceus barroni Olive Python (Pilbara subspecies) [66699]	Vulnerable	Species or species habitat likely to occur within area
Liopholis pulchra longicauda Jurien Bay Skink, Jurien Bay Rock-skink [83162]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Sharks		
Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Glyphis garricki Northern River Shark, New Guinea River Shark [82454]	Endangered	Breeding known to occur within area
Glyphis glyphis Speartooth Shark [82453]	Critically Endangered	Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Breeding known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Listed Migratory Species

[Resource Information]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Breeding known to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna pacifica Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Breeding known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Breeding known to occur within area
Hydroprogne caspia Caspian Tern [808]		Breeding known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Onychoprion anaethetus Bridled Tern [82845]		Breeding known to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Breeding known to occur within area
Phaethon rubricauda Red-tailed Tropicbird [994]		Breeding known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons Little Tern [82849]		Breeding known to occur within area
Sula dactylatra Masked Booby [1021]		Breeding known to occur within area
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
Sula sula Red-footed Booby [1023]		Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat known to occur within area
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Breeding known to occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Dugong dugon Dugong [28]		Breeding known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area

Name	Threatened	Type of Presence
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Foraging, feeding or related behaviour known to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat known to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	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]		Foraging, feeding or related behaviour known to occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Breeding known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Breeding known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Breeding known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Cecropis daurica Red-rumped Swallow [80610]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
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 likely to occur within area
Migratory Wetlands Species		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat known to occur within area
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Critically Endangered	Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area

Name	Threatened	Type of Presence
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Roosting known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Phalaropus lobatus Red-necked Phalarope [838]		Roosting known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Thalasseus bergii 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 nebularia Common Greenshank, Greenshank [832]		Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area
Tringa totanus Common Redshank, Redshank [835]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Defence - EXMOUTH ADMIN & HF TRANSMITTING
Defence - EXMOUTH NAVAL HF RECEIVING STATION (H/F Receiving Station, Learmonth, WA)
Defence - EXMOUTH VLF TRANSMITTER STATION
Defence - HMAS STIRLING-ROCKINGHAM ;HMAS STIRLING - GARDEN ISLAND
Defence - LEARMONTH - AIR WEAPONS RANGE
Defence - LEARMONTH - RAAF BASE
Defence - LEARMONTH RADAR SITE - TWIN TANKS EXMOUTH
Defence - LEARMONTH RADAR SITE - VLAMING HEAD EXMOUTH
Defence - LEARMONTH TRANSMITTING STATION
Defence - YAMPI SOUND TRAINING AREA

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Natural		
Ashmore Reef National Nature Reserve	EXT	Listed place
Garden Island	WA	Listed place
Lancelin Defence Training Area	WA	Listed place
Learmonth Air Weapons Range Facility	WA	Listed place
Mermaid Reef - Rowley Shoals	WA	Listed place
Ningaloo Marine Area - Commonwealth Waters	WA	Listed place
Scott Reef and Surrounds - Commonwealth Area	EXT	Listed place
Yampi Defence Area	WA	Listed place
Historic		
Cliff Point Historic Site	WA	Listed place
HMAS Sydney II and HSK Kormoran Shipwreck Sites	EXT	Listed place
J Gun Battery	WA	Listed place

Listed Marine Species [Resource Information]

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

Name	Threatened	Type of Presence
Birds		
Acrocephalus orientalis Oriental Reed-Warbler [59570]		Species or species habitat known to occur within area
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous minutus Black Noddy [824]		Breeding known to occur within area
Anous stolidus Common Noddy [825]		Breeding known to occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	Breeding known to occur within area
Anseranas semipalmata Magpie Goose [978]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Arenaria interpres Ruddy Turnstone [872]		Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
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
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Roosting known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea dabbenena Tristan Albatross [66471]	Endangered	Species or species habitat likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Name	Threatened	Type of Presence
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Eudyptula minor Little Penguin [1085]		Breeding known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Breeding known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Breeding known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Glareola maldivarum Oriental Pratincole [840]		Roosting known to occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Heteroscelus brevipes Grey-tailed Tattler [59311]		Roosting known to occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area
Hirundo daurica Red-rumped Swallow [59480]		Species or species habitat may occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area
Larus novaehollandiae Silver Gull [810]		Breeding known to occur within area
Larus pacificus Pacific Gull [811]		Breeding known to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Roosting known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]		Roosting known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area

Name	Threatened	Type of Presence
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat 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
Pelagodroma marina White-faced Storm-Petrel [1016]		Breeding known to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Breeding known to occur within area
Phaethon rubricauda Red-tailed Tropicbird [994]		Breeding known to occur within area
Phalacrocorax fuscescens Black-faced Cormorant [59660]		Breeding likely to occur within area
Phalaropus lobatus Red-necked Phalarope [838]		Roosting known to occur within area
Philomachus pugnax Ruff (Reeve) [850]		Roosting known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]		Roosting known to occur within area
Pterodroma macroptera Great-winged Petrel [1035]		Foraging, feeding or related behaviour known to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Puffinus assimilis Little Shearwater [59363]		Breeding known to occur within area

Name	Threatened	Type of Presence
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Puffinus huttoni Hutton's Shearwater [1025]		Foraging, feeding or related behaviour known to occur within area
Puffinus pacificus Wedge-tailed Shearwater [1027]		Breeding known to occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting known to occur within area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat likely to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat known to occur within area
Sterna albifrons Little Tern [813]		Breeding known to occur within area
Sterna anaethetus Bridled Tern [814]		Breeding known to occur within area
Sterna bengalensis Lesser Crested Tern [815]		Breeding known to occur within area
Sterna bergii Crested Tern [816]		Breeding known to occur within area
Sterna caspia Caspian Tern [59467]		Breeding known to occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sterna fuscata Sooty Tern [794]		Breeding known to occur within area
Sterna nereis Fairy Tern [796]		Breeding known to occur within area
Stiltia isabella Australian Pratincole [818]		Roosting known to occur within area
Sula dactylatra Masked Booby [1021]		Breeding known to occur within area
Sula leucogaster Brown Booby [1022]		Breeding known to occur within area
Sula sula Red-footed Booby [1023]		Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thinornis rubricollis Hooded Plover [59510]		Species or species habitat known to occur within area
Tringa glareola Wood Sandpiper [829]		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
Tringa totanus Common Redshank, Redshank [835]		Roosting known to occur within area
Xenus cinereus Terek Sandpiper [59300]		Roosting known to occur within area
Fish		
Acentronura australe Southern Pygmy Pipehorse [66185]		Species or species habitat may occur within area
Acentronura larsonae Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
Bhanotia fasciolata Corrugated Pipefish, Barbed Pipefish [66188]		Species or species habitat may occur within area
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within area
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys latispinosus Muiron Island Pipefish [66196]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys intestinalis Australian Messmate Pipefish, Banded Pipefish		Species or species

Name	Threatened	Type of Presence
[66202]		habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Doryrhamphus multiannulatus Many-banded Pipefish [66717]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		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

Name	Threatened	Type of Presence
		area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Hippocampus subelongatus West Australian Seahorse [66722]		Species or species habitat may occur within area
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Mitotichthys meraculus Western Crested Pipefish [66259]		Species or species habitat may occur within area
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
Phoxocampus belcheri Black Rock Pipefish [66719]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammals		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Dugong dugon Dugong [28]		Breeding known to occur within area
Neophoca cinerea Australian Sea-lion, Australian Sea Lion [22]	Endangered	Breeding known to occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus fuscus Dusky Seasnake [1119]		Species or species habitat known to occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Aipysurus pooleorum Shark Bay Seasnake [66061]		Species or species habitat may occur within area
Aipysurus tenuis Brown-lined Seasnake [1121]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Crocodylus johnstoni Freshwater Crocodile, Johnston's Crocodile, Johnstone's Crocodile [1773]		Species or species habitat may occur within area
Crocodylus porosus Salt-water Crocodile, Estuarine Crocodile [1774]		Species or species habitat likely to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Enhydrina schistosa Beaked Seasnake [1126]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area

Name	Threatened	Type of Presence
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis atriceps Black-headed Seasnake [1101]		Species or species habitat may occur within area
Hydrophis coggeri Slender-necked Seasnake [25925]		Species or species habitat may occur within area
Hydrophis czeblukovi Fine-spined Seasnake [59233]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis inornatus Plain Seasnake [1107]		Species or species habitat may occur within area
Hydrophis mcdowelli null [25926]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Lapemis hardwickii Spine-bellied Seasnake [1113]		Species or species habitat may occur within area
Lepidochelys olivacea Olive Ridley Turtle, Pacific Ridley Turtle [1767]	Endangered	Foraging, feeding or related behaviour known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Foraging, feeding or related behaviour known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Hyperoodon planifrons Southern Bottlenose Whale [71]		Species or species habitat may occur within area
Indopacetus pacificus Longman's Beaked Whale [72]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area
Lagenodelphis hosei Fraser's Dolphin, Sarawak Dolphin [41]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lissodelphis peronii Southern Right Whale Dolphin [44]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Mesoplodon bowdoini Andrew's Beaked Whale [73]		Species or species habitat may occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon ginkgodens Gingko-toothed Beaked Whale, Gingko-toothed Whale, Gingko Beaked Whale [59564]		Species or species habitat may occur within area

Name	Status	Type of Presence
Mesoplodon grayi Gray's Beaked Whale, Scamperdown Whale [75]		Species or species habitat may occur within area
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area
Mesoplodon mirus True's Beaked Whale [54]		Species or species habitat may occur within area
Orcaella brevirostris Irrawaddy Dolphin [45]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Foraging, feeding or related behaviour known to occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		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
Abrolhos	Habitat Protection Zone (IUCN IV)
Abrolhos	Multiple Use Zone (IUCN VI)
Abrolhos	National Park Zone (IUCN II)
Abrolhos	Special Purpose Zone (IUCN VI)
Argo-Rowley Terrace	Multiple Use Zone (IUCN VI)
Argo-Rowley Terrace	National Park Zone (IUCN II)
Argo-Rowley Terrace	Special Purpose Zone (Trawl) (IUCN VI)
Ashmore Reef	Recreational Use Zone (IUCN IV)
Ashmore Reef	Sanctuary Zone (IUCN Ia)
Carnarvon Canyon	Habitat Protection Zone (IUCN IV)
Cartier Island	Sanctuary Zone (IUCN Ia)
Dampier	Habitat Protection Zone (IUCN IV)
Dampier	Multiple Use Zone (IUCN VI)
Dampier	National Park Zone (IUCN II)
Eighty Mile Beach	Multiple Use Zone (IUCN VI)
Gascoyne	Habitat Protection Zone (IUCN IV)
Gascoyne	Multiple Use Zone (IUCN VI)
Gascoyne	National Park Zone (IUCN II)
Geographe	Multiple Use Zone (IUCN VI)
Geographe	Special Purpose Zone (Mining
Joseph Bonaparte Gulf	Multiple Use Zone (IUCN VI)
Joseph Bonaparte Gulf	Special Purpose Zone (IUCN VI)
Jurien	National Park Zone (IUCN II)
Jurien	Special Purpose Zone (IUCN VI)
Kimberley	Habitat Protection Zone (IUCN IV)
Kimberley	Multiple Use Zone (IUCN VI)
Kimberley	National Park Zone (IUCN II)
Mermaid Reef	National Park Zone (IUCN II)
Montebello	Multiple Use Zone (IUCN VI)
Ningaloo	National Park Zone (IUCN II)
Ningaloo	Recreational Use Zone (IUCN IV)
Oceanic Shoals	Multiple Use Zone (IUCN VI)
Oceanic Shoals	Special Purpose Zone (Trawl) (IUCN VI)
Perth Canyon	Habitat Protection Zone (IUCN IV)
Perth Canyon	Multiple Use Zone (IUCN VI)
Perth Canyon	National Park Zone (IUCN II)
Roebuck	Multiple Use Zone (IUCN VI)
Shark Bay	Multiple Use Zone (IUCN VI)
South-west Corner	Multiple Use Zone (IUCN VI)
South-west Corner	National Park Zone (IUCN II)
South-west Corner	Special Purpose Zone (Mining
Two Rocks	Multiple Use Zone (IUCN VI)
Two Rocks	National Park Zone (IUCN II)

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Adele Island	WA
Airlie Island	WA
Balanggarra	WA
Bardi Jawi	WA
Barrow Island	WA
Bedout Island	WA
Beekeepers	WA
Bernier And Dorre Islands	WA
Bessieres Island	WA
Boodie, Double Middle Islands	WA
Boullanger, Whitlock, Favourite, Tern And Osprey Islands	WA
Browse Island	WA
Bundegi Coastal Park	WA
Burnside And Simpson Island	WA
Cape Range	WA
Carnac Island	WA
Coulomb Point	WA
Dambimangari	WA

Name	State
Dirk Hartog Island	WA
Escape Island	WA
Giralia	WA
Gnandaroo Island	WA
Houtman Abrolhos Islands	WA
Jarrkunpungu	WA
Jinmarnkur	WA
Jinmarnkur Kulja	WA
Jurabi Coastal Park	WA
Karajarri	WA
Koks Island	WA
Kooljerrenup	WA
Lacepede Islands	WA
Lancelin And Edwards Islands	WA
Leeuwin-Naturaliste	WA
Len Howard	WA
Lesueur	WA
Lesueur Island	WA
Little Rocky Island	WA
Locker Island	WA
Low Rocks	WA
Lowendal Islands	WA
McLarty	WA
Mealup Point	WA
Mijing	WA
Montebello Islands	WA
Muiron Islands	WA
Nambung	WA
Niiwalarra Islands	WA
Nilgen	WA
North Sandy Island	WA
North Turtle Island	WA
Ord River	WA
Pelican Island	WA
Penguin Island	WA
Rottnest Island	WA
Round Island	WA
Serrurier Island	WA
Southern Beekeepers	WA
Swan Island	WA
Tanner Island	WA
Tent Island	WA
Unnamed WA11883	WA
Unnamed WA26400	WA
Unnamed WA28968	WA
Unnamed WA34039	WA
Unnamed WA36913	WA
Unnamed WA36915	WA
Unnamed WA37168	WA
Unnamed WA37338	WA
Unnamed WA37383	WA
Unnamed WA40322	WA
Unnamed WA40828	WA
Unnamed WA40877	WA
Unnamed WA41080	WA
Unnamed WA41160	WA
Unnamed WA41775	WA
Unnamed WA42030	WA
Unnamed WA44665	WA
Unnamed WA44667	WA
Unnamed WA44669	WA
Unnamed WA44672	WA
Unnamed WA44673	WA
Unnamed WA44677	WA
Unnamed WA44682	WA
Unnamed WA44688	WA
Unnamed WA46982	WA
Unnamed WA46983	WA
Unnamed WA46984	WA
Unnamed WA48205	WA
Unnamed WA48858	WA
Unnamed WA48968	WA
Unnamed WA49994	WA
Unnamed WA51162	WA
Unnamed WA51943	WA
Uunguu	WA
Victor Island	WA
Wanagarren	WA
Wedge Island	WA
Weld Island	WA
Whalebone Island	WA
Whitmore,Roberts,Doole Islands And Sandalwood Landing	WA
Y Island	WA
Yalgorup	WA
Yampi	WA

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included.

Name	State
South West WA RFA	Western Australia

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Acridotheres tristis Common Myna, Indian Myna [387]		Species or species habitat likely to occur within area
Anas platyrhynchos Mallard [974]		Species or species habitat likely to occur within area
Carduelis carduelis European Goldfinch [403]		Species or species habitat likely to occur within area
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Passer domesticus House Sparrow [405]		Species or species habitat likely to occur within area
Passer montanus Eurasian Tree Sparrow [406]		Species or species habitat likely to occur within area
Pavo cristatus Indian Peafowl, Peacock [919]		Species or species habitat likely to occur within area
Phasianus colchicus Common Pheasant [920]		Species or species habitat likely to occur within area
Streptopelia chinensis Spotted Turtle-Dove [780]		Species or species habitat likely to occur within area

Name	Status	Type of Presence
Streptopelia senegalensis Laughing Turtle-dove, Laughing Dove [781]		Species or species habitat likely to occur within area
Sturnus vulgaris Common Starling [389]		Species or species habitat likely to occur within area
Turdus merula Common Blackbird, Eurasian Blackbird [596]		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
Camelus dromedarius Dromedary, Camel [7]		Species or species habitat likely to occur within area
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Equus asinus Donkey, Ass [4]		Species or species habitat likely to occur within area
Equus caballus Horse [5]		Species or species habitat likely to occur within area
Felis catus Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Feral deer Feral deer species in Australia [85733]		Species or species habitat likely to occur within area
Funambulus pennantii Northern Palm Squirrel, Five-striped Palm Squirrel [129]		Species or species habitat likely to occur within area
Mus musculus House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus exulans Pacific Rat, Polynesian Rat [79]		Species or species habitat likely to occur within area
Rattus norvegicus Brown Rat, Norway Rat [83]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur

Name	Status	Type of Presence
		within area
Sus scrofa Pig [6]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Andropogon gayanus Gamba Grass [66895]		Species or species habitat likely to occur within area
Anredera cordifolia Madeira Vine, Jalap, Lamb's-tail, Mignonette Vine, Anredera, Gulf Madeiravine, Heartleaf Madeiravine, Potato Vine [2643]		Species or species habitat likely to occur within area
Asparagus aethiopicus Asparagus Fern, Ground Asparagus, Basket Fern, Sprengi's Fern, Bushy Asparagus, Emerald Asparagus [62425]		Species or species habitat likely to occur within area
Asparagus asparagoides Bridal Creeper, Bridal Veil Creeper, Smilax, Florist's Smilax, Smilax Asparagus [22473]		Species or species habitat likely to occur within area
Asparagus declinatus Bridal Veil, Bridal Veil Creeper, Pale Berry Asparagus Fern, Asparagus Fern, South African Creeper [66908]		Species or species habitat likely to occur within area
Asparagus plumosus Climbing Asparagus-fern [48993]		Species or species habitat likely to occur within area
Brachiaria mutica Para Grass [5879]		Species or species habitat may occur within area
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Chrysanthemoides monilifera Bitou Bush, Boneseed [18983]		Species or species habitat may occur within area
Chrysanthemoides monilifera subsp. monilifera Boneseed [16905]		Species or species habitat likely to occur within area
Cylindropuntia spp. Prickly Pears [85131]		Species or species habitat likely to occur within area
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
Genista linifolia Flax-leaved Broom, Mediterranean Broom, Flax Broom [2800]		Species or species habitat likely to occur within area
Genista monspessulana Montpellier Broom, Cape Broom, Canary Broom, Common Broom, French Broom, Soft Broom [20126]		Species or species habitat likely to occur within area
Genista sp. X Genista monspessulana Broom [67538]		Species or species habitat may occur within area
Hymenachne amplexicaulis Hymenachne, Olive Hymenachne, Water Stargrass, West Indian Grass, West Indian Marsh Grass		Species or species habitat likely to occur

Name	Status	Type of Presence
[31754]		within area
Jatropha gossypifolia		
Cotton-leaved Physic-Nut, Bellyache Bush, Cotton-leaf Physic Nut, Cotton-leaf Jatropha, Black Physic Nut [7507]		Species or species habitat likely to occur within area
Lantana camara		
Lantana, Common Lantana, Kamara Lantana, Large-leaf Lantana, Pink Flowered Lantana, Red Flowered Lantana, Red-Flowered Sage, White Sage, Wild Sage [10892]		Species or species habitat likely to occur within area
Lycium ferocissimum		
African Boxthorn, Boxthorn [19235]		Species or species habitat likely to occur within area
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
Olea europaea		
Olive, Common Olive [9160]		Species or species habitat may occur within area
Opuntia spp.		
Prickly Pears [82753]		Species or species habitat likely to occur within area
Parkinsonia aculeata		
Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Pinus radiata		
Radiata Pine Monterey Pine, Insignis Pine, Wilding Pine [20780]		Species or species habitat may occur within area
Prosopis spp.		
Mesquite, Algaroba [68407]		Species or species habitat likely to occur within area
Rubus fruticosus aggregate		
Blackberry, European Blackberry [68406]		Species or species habitat likely to occur within area
Salix spp. except S.babylonica, S.x calodendron & S.x reichardtii		
Willows except Weeping Willow, Pussy Willow and Sterile Pussy Willow [68497]		Species or species habitat likely to occur within area
Salvinia molesta		
Salvinia, Giant Salvinia, Aquarium Watermoss, Kariba Weed [13665]		Species or species habitat likely to occur within area
Solanum elaeagnifolium		
Silver Nightshade, Silver-leaved Nightshade, White Horse Nettle, Silver-leaf Nightshade, Tomato Weed, White Nightshade, Bull-nettle, Prairie-berry, Satansbos, Silver-leaf Bitter-apple, Silverleaf-nettle, Trompillo [12323]		Species or species habitat likely to occur within area
Tamarix aphylla		
Athel Pine, Athel Tree, Tamarisk, Athel Tamarisk, Athel Tamarix, Desert Tamarisk, Flowering Cypress, Salt Cedar [16018]		Species or species habitat likely to occur within area
Vachellia nilotica		
Prickly Acacia, Blackthorn, Prickly Mimosa, Black Piquant, Babul [84351]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus		
Asian House Gecko [1708]		Species or species habitat likely to occur within area
Ramphotyphlops braminus		
Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat likely to occur within area

Nationally Important Wetlands

[Resource Information]

Name	State
Ashmore Reef	EXT
Bunda-Bunda Mound Springs	WA
Bundera Sinkhole	WA
Cape Range Subterranean Waterways	WA
De Grey River	WA
Eighty Mile Beach System	WA
Exmouth Gulf East	WA
Lake MacLeod	WA
Lake Thetis	WA
Learmonth Air Weapons Range - Saline Coastal Flats	WA
Leslie (Port Hedland) Saltfields System	WA
Mermaid Reef	EXT
Ord Estuary System	WA
Rottnest Island Lakes	WA
Shark Bay East	WA
Yalgorup Lakes System	WA
Yampi Sound Training Area	WA

Key Ecological Features (Marine)

[Resource Information]

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

Name	Region
Carbonate bank and terrace system of the Van	North
Pinnacles of the Bonaparte Basin	North
Ancient coastline at 125 m depth contour	North-west
Ashmore Reef and Cartier Island and surrounding	North-west
Canyons linking the Argo Abyssal Plain with the	North-west
Canyons linking the Cuvier Abyssal Plain and the	North-west
Carbonate bank and terrace system of the Sahul	North-west
Commonwealth waters adjacent to Ningaloo Reef	North-west
Continental Slope Demersal Fish Communities	North-west
Exmouth Plateau	North-west
Glomar Shoals	North-west
Mermaid Reef and Commonwealth waters	North-west
Pinnacles of the Bonaparte Basin	North-west
Seringapatam Reef and Commonwealth waters in	North-west
Wallaby Saddle	North-west
Ancient coastline at 90-120m depth	South-west
Cape Mentelle upwelling	South-west
Commonwealth marine environment surrounding	South-west
Commonwealth marine environment within and	South-west
Commonwealth marine environment within and	South-west
Naturaliste Plateau	South-west
Perth Canyon and adjacent shelf break, and other	South-west
Western demersal slope and associated fish	South-west
Western rock lobster	South-west

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-31.6854 111.3838,-30.4214 110.3839,-28.7096 109.8133,-27.9563 109.7791,-27.0319 108.5808,-26.4157 107.4738,-25.6396 106.4352,-24.5212 105.8532,-23.7338 105.8418,-23.1175 106.1271,-22.5697 106.789,-21.7823 107.3825,-20.0248 107.9645,-18.4156 108.8775,-16.4413 110.7377,-15.2658 111.3996,-14.4327 112.4952,-14.4099 113.1457,-14.0333 114.1043,-13.2686 114.6978,-13.6681 115.2456,-14.7637 115.4852,-15.437 116.2042,-15.049 116.5123,-14.2615 117.7677,-12.8161 118.2231,-12.1161 118.1014,-12.6944 120.0491,-13.9421 120.013,-11.8068 122.8951,-11.3553 123.3054,-11.4466 124.0054,-11.1118 124.5227,-10.9292 125.3748,-10.5336 126.0444,-11.2336 126.5922,-11.2031 127.6573,-10.4119 128.1442,-10.0771 128.1442,-10.0547 128.9033,-15.0663 129.0006,-15.0735 128.0863,-14.7089 128.1617,-13.9731 127.4448,-13.7461 126.9637,-14.1871 126.6423,-14.5893 125.2646,-15.4957 124.4516,-16.4216 124.6089,-16.186 123.5687,-17.1833 123.7342,-16.5875 122.9672,-17.3596 122.1501,-17.9493 122.2039,-19.2063 121.4347,-19.625 120.9721,-20.0762 119.5873,-20.6548 117.4099,-20.3016 116.83,-21.4925 115.4626,-21.8484 114.644,-22.4302 114.3765,-22.6288 113.668,-23.5261 113.755,-24.0899 113.4187,-25.1243 113.5933,-25.9153 113.0411,-26.9189 113.775,-28.0932 114.1696,-29.4877 114.9961,-30.5785 115.0875,-31.7296 115.7179,-33.2752 115.6808,-33.5316 115.0036,-33.4303 110.9954,-31.966 111.5089,-31.6854 111.3838

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

-Office of Environment and Heritage, New South Wales
-Department of Environment and Primary Industries, Victoria
-Department of Primary Industries, Parks, Water and Environment, Tasmania
-Department of Environment, Water and Natural Resources, South Australia
-Department of Land and Resource Management, Northern Territory
-Department of Environmental and Heritage Protection, Queensland
-Department of Parks and Wildlife, Western Australia
-Environment and Planning Directorate, ACT
-Birdlife Australia
-Australian Bird and Bat Banding Scheme
-Australian National Wildlife Collection
-Natural history museums of Australia
-Museum Victoria
-Australian Museum
-South Australian Museum
-Queensland Museum
-Online Zoological Collections of Australian Museums
-Queensland Herbarium
-National Herbarium of NSW
-Royal Botanic Gardens and National Herbarium of Victoria
-Tasmanian Herbarium
-State Herbarium of South Australia
-Northern Territory Herbarium
-Western Australian Herbarium
-Australian National Herbarium, Canberra
-University of New England
-Ocean Biogeographic Information System
-Australian Government, Department of Defence
Forestry Corporation, NSW
-Geoscience Australia
-CSIRO
-Australian Tropical Herbarium, Cairns
-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the Contact Us page.

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appendix e protected matters search reports

Australian Government
Department of Agriculture, Water and the Environment

OPERATIONAL AREA

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

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

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

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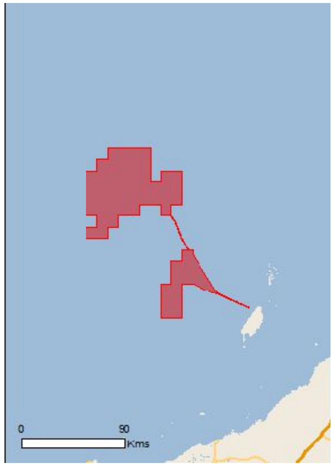

Coordinates
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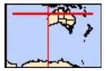

Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	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:	66
Whales and Other Cetaceans:	28
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	1

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	None
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	3

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
North-west

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding known to occur within area
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Reptiles		
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Congregation or aggregation known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Congregation or aggregation 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	Congregation or aggregation known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Sharks		
Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Listed Migratory Species [Resource Information]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Sterna dougallii Roseate Tern [817]		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 bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		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	Migration route known 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 likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Congregation or aggregation known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Congregation or aggregation known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Dugong dugon Dugong [28]		Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Congregation or aggregation known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat known to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat likely to occur within area

Name	Threatened	Type of Presence
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species

[Resource Information]

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

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Sterna bengalensis Lesser Crested Tern [815]		Breeding known to occur within area
Sterna dougallii Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area
Fish		
Acentronura larsonae Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys latispinosus Muiron Island Pipefish [66196]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Doryrhamphus multiannulatus Many-banded Pipefish [66717]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Phoxocampus belcheri Black Rock Pipefish [66719]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
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 known to occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Congregation or aggregation known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Congregation or aggregation known 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
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Congregation or aggregation known to occur within area
Hydrophis czeblukovi Fine-spined Seasnake [59233]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Delphinus delphis Common 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
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat may occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species 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 likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Name	Label
Montebello	Multiple Use Zone (IUCN VI)

Extra Information

Key Ecological Features (Marine) [Resource Information]

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

Name	Region
Ancient coastline at 125 m depth contour	North-west
Continental Slope Demersal Fish Communities	North-west
Exmouth Plateau	North-west

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-19.66536 114.084652,-19.665359 114.167985,-19.582025 114.167985,-19.582025 114.251318,-19.498691 114.251317,-19.498688 114.58465,-19.74869 114.584652,-19.748689 114.667986,-19.665355 114.667985,-19.665354 114.834651,-19.915356 114.834654,-19.915356 114.75132,-19.99869 114.751321,-19.99869 114.748165,-20.035091 114.78027,-20.044486 114.786515,-20.054413 114.791779,-20.064736 114.795989,-20.14358 114.823588,-20.150577 114.826384,-20.157293 114.829786,-20.163747 114.833784,-20.221656 114.87326,-20.238205 114.884551,-20.239926 114.885651,-20.241882 114.886716,-20.24354 114.887577,-20.248691 114.890028,-20.248691 114.917981,-20.28578 114.917981,-20.544169 115.08989,-20.548525 115.093077,-20.552581 115.096628,-20.556337 115.100526,-20.559762 115.104758,-20.562836 115.109279,-20.565556 115.114101,-20.614358 115.210543,-20.642192 115.293468,-20.643311 115.296387,-20.659554 115.336146,-20.660489 115.338298,-20.665404 115.348338,-20.66943 115.356542,-20.670502 115.359256,-20.671638 115.364188,-20.675158 115.363322,-20.675013 115.362656,-20.676159 115.362374,-20.675108 115.357916,-20.673765 115.354562,-20.668923 115.344929,-20.666832 115.340769,-20.665845 115.338403,-20.656266 115.310262,-20.654929 115.307263,-20.653421 115.304394,-20.650997 115.300132,-20.648856 115.296033,-20.647006 115.291823,-20.645435 115.287449,-20.623268 115.218546,-20.621323 115.213455,-20.620162 115.21101,-20.579541 115.130866,-20.577762 115.126123,-20.576337 115.121239,-20.57527 115.116214,-20.568492 115.078604,-20.566871 115.073177,-20.547721 115.028401,-20.498231 114.917976,-20.498694 114.917976,-20.49958 114.839087,-20.507028 114.834645,-20.748696 114.834639,-20.748698 114.667978,-20.498695 114.667984,-20.498695 114.751315,-20.332026 114.751318,-20.332026 114.834649,-20.248692 114.834651,-20.248691 114.885778,-20.24334 114.883246,-20.241711 114.882323,-20.240117 114.881303,-20.165637 114.830523,-20.158988 114.826406,-20.151998 114.822865,-20.144785 114.819982,-20.065952 114.792389,-20.055876 114.788281,-20.046261 114.783184,-20.037158 114.777133,-19.99869 114.743144,-19.998691 114.667988,-19.915395 114.667987,-19.915358 114.501321,-19.998692 114.501322,-19.998694 114.334655,-20.082028 114.334656,-20.082028 114.251323,-20.165362 114.251323,-20.165364 114.084657,-20.08203 114.084656,-20.082029 114.167989,-19.998695 114.167989,-19.998696 114.084655,-19.66536 114.084652

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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EMBA

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: 21/07/21 16:00:34

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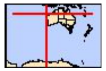
Coordinates
Buffer: 0.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	1
National Heritage Places:	1
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	45
Listed Migratory Species:	58

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:	3
Commonwealth Heritage Places:	2
Listed Marine Species:	104
Whales and Other Cetaceans:	31
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	7

Extra Information

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

State and Territory Reserves:	25
Regional Forest Agreements:	None
Invasive Species:	15
Nationally Important Wetlands:	2
Key Ecological Features (Marine)	5

Details

Matters of National Environmental Significance

World Heritage Properties [Resource Information]

Name	State	Status
The Ningaloo Coast	WA	Declared property

National Heritage Properties [Resource Information]

Name	State	Status
Natural		
The Ningaloo Coast	WA	Listed place

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea
Extended Continental Shelf

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
North-west

Listed Threatened Species [Resource Information]

Name	Status	Type of Presence
Birds		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Critically Endangered	Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Malurus leucopterus edouardi White-winged Fairy-wren (Barrow Island), Barrow Island Black-and-white Fairy-wren [26194]	Vulnerable	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding known to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Species or species habitat may occur within area
Fish		
Milyeringa veritas Blind Gudgeon [66676]	Vulnerable	Species or species habitat known to occur within area
Ophisternon candidum Blind Cave Eel [66678]	Vulnerable	Species or species habitat known to occur within area
Mammals		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Bettongia lesueur Barrow and Boodie Islands subspecies Boodie, Burrowing Bettong (Barrow and Boodie Islands) [88021]	Vulnerable	Species or species habitat known to occur within area
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat likely to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Isoodon auratus barrowensis Golden Bandicoot (Barrow Island) [66666]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
Lagorchestes conspicillatus conspicillatus Spectacled Hare-wallaby (Barrow Island) [66661]	Vulnerable	Species or species habitat known to occur within area
Lagorchestes hirsutus Central Australian subspecies Mala, Rufous Hare-Wallaby (Central Australia) [88019]	Endangered	Translocated population known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Osphranter robustus isabellinus Barrow Island Wallaroo, Barrow Island Euro [89262]	Vulnerable	Species or species habitat likely to occur within area
Petrogale lateralis lateralis Black-flanked Rock-wallaby, Moororong, Black-footed Rock Wallaby [66647]	Endangered	Species or species habitat known to occur within area
Pseudomys fieldi Shark Bay Mouse, Djoongari, Alice Springs Mouse [113]	Vulnerable	Species or species habitat likely to occur within area
Rhinonicteris aurantia (Pilbara form) Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Ctenotus zastictus Hamelin Ctenotus [25570]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Sharks		
Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Listed Migratory Species [Resource Information]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area
Ardenna pacifica Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Hydroprogne caspia Caspian Tern [808]		Breeding known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Onychoprion anaethetus Bridled Tern [82845]		Breeding known to occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Species or species habitat may occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat likely to occur within area
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species

Name	Threatened	Type of Presence
		habitat likely to occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Dugong dugon Dugong [28]		Breeding known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat known to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Thalasseus bergii Greater Crested Tern [83000]		Breeding known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Defence - EXMOUTH VLF TRANSMITTER STATION
Defence - LEARMONTH - RAAF BASE

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Natural		
Learmonth Air Weapons Range Facility	WA	Listed place
Ningaloo Marine Area - Commonwealth Waters	WA	Listed place

Listed Marine Species [Resource Information]

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

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardea ibis Cattle Egret [59542]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area
Larus novaehollandiae Silver Gull [810]		Breeding known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour likely

Name	Threatened	Type of Presence
		to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Species or species habitat likely to occur within area
Puffinus pacificus Wedge-tailed Shearwater [1027]		Breeding known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Sterna anaethetus Bridled Tern [814]		Breeding known to occur within area
Sterna bengalensis Lesser Crested Tern [815]		Breeding known to occur within area
Sterna bergii Crested Tern [816]		Breeding known to occur within area
Sterna caspia Caspian Tern [59467]		Breeding known to occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sterna fuscata Sooty Tern [794]		Breeding known to occur within area
Sterna nereis Fairy Tern [796]		Breeding known to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Fish		
Acentronura larsonae Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within area
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied		Species or species

Name	Threatened	Type of Presence
Pipefish [66194]		habitat may occur within area
Choeroichthys latispinosus Muiron Island Pipefish [66196]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Doryrhamphus multiannulatus Many-banded Pipefish [66717]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
Phoxocampus belcheri Black Rock Pipefish [66719]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
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

Name	Threatened	Type of Presence
		area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus 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	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis czeblukovi Fine-spined Seasnake [59233]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis mcdowelli null [25926]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans

[Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Indopacetus pacificus Longman's Beaked Whale [72]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area

Name	Status	Type of Presence
Lagenodelphis hosei Fraser's Dolphin, Sarawak Dolphin [41]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	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
Mesoplodon ginkgodens Gingko-toothed Beaked Whale, Gingko-toothed Whale, Gingko Beaked Whale [59564]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks

[Resource Information]

Name	Label
Carnarvon Canyon	Habitat Protection Zone (IUCN IV)
Gascoyne	Habitat Protection Zone (IUCN IV)
Gascoyne	Multiple Use Zone (IUCN VI)
Gascoyne	National Park Zone (IUCN II)
Montebello	Multiple Use Zone (IUCN VI)
Ningaloo	National Park Zone (IUCN II)
Ningaloo	Recreational Use Zone (IUCN IV)

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Airlie Island	WA
Barrow Island	WA
Bessieres Island	WA
Boodie, Double Middle Islands	WA
Bundegi Coastal Park	WA
Burnside And Simpson Island	WA
Cape Range	WA
Giralia	WA
Gnandaroo Island	WA
Jurabi Coastal Park	WA
Locker Island	WA
Lowendal Islands	WA
Montebello Islands	WA
Muiron Islands	WA
Round Island	WA
Serrurier Island	WA
Tent Island	WA
Unnamed WA40322	WA
Unnamed WA40828	WA
Unnamed WA41080	WA
Unnamed WA44665	WA
Victor Island	WA
Whalebone Island	WA
Whitmore,Roberts,Doole Islands And Sandalwood Landing	WA
Y Island	WA

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Mammals		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Equus 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
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Prosopis spp. Mesquite, Algaroba [68407]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area
Ramphotyphlops braminus Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat may occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Cape Range Subterranean Waterways	WA
Exmouth Gulf East	WA

Key Ecological Features (Marine) [Resource Information]

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

Name	Region
Ancient coastline at 125 m depth contour	North-west
Canyons linking the Cuvier Abyssal Plain and the	North-west
Commonwealth waters adjacent to Ningaloo Reef	North-west
Continental Slope Demersal Fish Communities	North-west
Exmouth Plateau	North-west

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-18.7354 108.6727,-17.8634 109.4095,-17.6816 109.6473,-16.4459 110.7245,-15.5832 111.2374,-15.3034 111.3633,-14.8651 111.6851,-14.6319 111.9835,-14.4827 112.3425,-14.3988 112.7436,-14.4035 113.1353,-16.3013 115.2429,-18.4836 116.4973,-20.1541 116.1942,-21.3339 115.2593,-21.8453 114.6496,-21.9138 114.6467,-21.9444 114.6172,-21.9791 114.6149,-22.0018 114.5706,-22.0155 114.5758,-22.0272 114.5543,-22.0625 114.547,-22.0648 114.5327,-22.1216 114.5222,-22.1286 114.5006,-22.1697 114.505,-22.1551 114.4814,-22.1598 114.4563,-22.2119 114.4943,-22.2091 114.4526,-22.2339 114.4515,-22.2414 114.4593,-22.2381 114.451,-22.2465 114.4596,-22.2426 114.443,-22.2716 114.458,-22.274 114.4295,-22.293 114.4558,-22.3004 114.4238,-22.3313 114.408,-22.3466 114.4247,-22.3429 114.4433,-22.3517 114.4308,-22.3571 114.4397,-22.355 114.4283,-22.3644 114.4022,-22.3836 114.3965,-22.3934 114.4153,-22.3903 114.3933,-22.4267 114.3973,-22.4326 114.3847,-22.4393 114.3942,-22.4422 114.3799,-22.4594 114.3914,-22.5007 114.355,-22.479 114.3247,-22.4868 114.3194,-22.4347 114.3087,-22.457 114.2253,-22.4967 114.2186,-22.5238 114.1806,-22.5246 114.1551,-22.4738 114.1217,-22.413 114.1223,-22.41 114.1401,-22.3974 114.1463,-22.3976 114.1312,-22.3563 114.1772,-22.3058 114.1778,-22.3015 114.1501,-22.3295 114.115,-22.2619 114.1329,-22.192 114.0847,-22.155 114.0802,-21.9582 114.1383,-21.865 114.15,-21.8125 114.1908,-21.7857 114.164,-21.802 114.1366,-21.8067 114.1214,-21.8032 114.1092,-21.8183 114.0748,-21.872 113.9978,-21.9728 113.9326,-22.1485 113.8731,-22.2261 113.8475,-22.3126 113.8177,-22.4079 113.7495,-22.4717 113.7382,-22.4962 113.7245,-22.4965 113.7087,-22.5169 113.7134,-22.5499 113.665,-22.5775 113.6542,-22.5942 113.6723,-22.628 113.6673,-22.6644 113.6857,-22.7171 113.67,-22.7151 113.7099,-22.7542 113.7557,-22.8393 113.7851,-23.8086 113.0081,-24.4588 112.253,-22.3878 109.9503,-20.6845 107.6935,-19.6307 108.1785,-18.7354 108.6727

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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EEA

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.

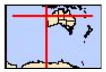
Information on the coverage of this report and qualifications on data supporting this report are contained in the caveat at the end of the report.

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

Report created: 21/07/21 16:15:19

This map may contain data which are ©Commonwealth of Australia (Geoscience Australia), ©PSMA 2015

Coordinates
Buffer: 0.0Km



Summary

Matters of National Environmental Significance

This part of the report summarises the matters of national environmental significance that may occur in, or may relate to, the area you nominated. Further information is available in the detail part of the report, which can be accessed by scrolling or following the links below. If you are proposing to undertake an activity that may have a significant impact on one or more matters of national environmental significance then you should consider the Administrative Guidelines on Significance.

World Heritage Properties:	1
National Heritage Places:	2
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	51
Listed Migratory Species:	65

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	4
Commonwealth Heritage Places:	3
Listed Marine Species:	122
Whales and Other Cetaceans:	36
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	12

Extra Information

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

State and Territory Reserves:	27
Regional Forest Agreements:	None
Invasive Species:	15
Nationally Important Wetlands:	2
Key Ecological Features (Marine)	9

Details

Matters of National Environmental Significance

World Heritage Properties [Resource Information]

Name	State	Status
The Ningaloo Coast	WA	Declared property

National Heritage Properties [Resource Information]

Name	State	Status
Natural		
The Ningaloo Coast	WA	Listed place
Historic		
HMAS Sydney II and HSK Kormoran Shipwreck Sites	EXT	Listed place

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside the Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area. Generally the Commonwealth Marine Area stretches from three nautical miles to two hundred nautical miles from the coast.

Name
EEZ and Territorial Sea
Extended Continental Shelf

Marine Regions [Resource Information]

If you are planning to undertake action in an area in or close to the Commonwealth Marine Area, and a marine bioregional plan has been prepared for the Commonwealth Marine Area in that area, the marine bioregional plan may inform your decision as to whether to refer your proposed action under the EPBC Act.

Name
North-west
South-west

Listed Threatened 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 known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat may occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Critically Endangered	Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Malurus leucopterus edouardi White-winged Fairy-wren (Barrow Island), Barrow Island Black-and-white Fairy-wren [26194]	Vulnerable	Species or species habitat likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Papasula abbotti Abbott's Booby [59297]	Endangered	Species or species habitat may occur within area
Pezoporus occidentalis Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Fish		
Milyeringa veritas Blind Gudgeon [66676]	Vulnerable	Species or species habitat known to occur within area
Ophisternon candidum Blind Cave Eel [66678]	Vulnerable	Species or species habitat known to occur within area
Mammals		

Name	Status	Type of Presence
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Bettongia lesueur Barrow and Boodie Islands subspecies Boodie, Burrowing Bettong (Barrow and Boodie Islands) [88021]	Vulnerable	Species or species habitat known to occur within area
Dasyurus hallucatus Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat likely to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Isoodon auratus barrowensis Golden Bandicoot (Barrow Island) [66666]	Vulnerable	Species or species habitat known to occur within area
Lagorchestes conspicillatus conspicillatus Spectacled Hare-wallaby (Barrow Island) [66661]	Vulnerable	Species or species habitat known to occur within area
Lagorchestes hirsutus Central Australian subspecies Mala, Rufous Hare-Wallaby (Central Australia) [88019]	Endangered	Translocated population known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Osphranter robustus isabellinus Barrow Island Wallaroo, Barrow Island Euro [89262]	Vulnerable	Species or species habitat likely to occur within area
Petrogale lateralis lateralis Black-flanked Rock-wallaby, Moororong, Black-footed Rock Wallaby [66647]	Endangered	Species or species habitat known to occur within area
Pseudomys fieldi Shark Bay Mouse, Djoongari, Alice Springs Mouse [113]	Vulnerable	Species or species habitat likely to occur within area
Rhinonicteris aurantia (Pilbara form) Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Ctenotus zastictus Hamelin Ctenotus [25570]	Vulnerable	Species or species habitat known to occur within area

Name	Status	Type of Presence
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Sharks		
Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Listed Migratory Species [Resource Information]

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

Name	Threatened	Type of Presence
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna pacifica Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat may occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area

Name	Threatened	Type of Presence
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Hydroprogne caspia Caspian Tern [808]		Breeding known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Onychoprion anaethetus Bridled Tern [82845]		Breeding known to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Breeding likely to occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons Little Tern [82849]		Congregation or aggregation known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat known to occur within area
Balaena glacialis australis Southern Right Whale [75529]	Endangered*	Species or species habitat likely to occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area

Name	Threatened	Type of Presence
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat likely to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Dugong dugon Dugong [28]		Breeding known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat known to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known

Name	Threatened	Type of Presence
		to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Thalasseus bergii Greater Crested Tern [83000]		Breeding known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Land [Resource Information]

The Commonwealth area listed below may indicate the presence of Commonwealth land in this vicinity. Due to the unreliability of the data source, all proposals should be checked as to whether it impacts on a Commonwealth area, before making a definitive decision. Contact the State or Territory government land department for further information.

Name
Commonwealth Land -
Defence - EXMOUTH ADMIN & HF TRANSMITTING
Defence - EXMOUTH VLF TRANSMITTER STATION
Defence - LEARMONTH - RAAF BASE

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Natural		
Learmonth Air Weapons Range Facility	WA	Listed place
Ningaloo Marine Area - Commonwealth Waters	WA	Listed place
Historic		
HMAS Sydney II and HSK Kormoran Shipwreck Sites	EXT	Listed place

Listed Marine Species [Resource Information]

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

Name	Threatened	Type of Presence
Birds		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Anous tenuirostris melanops Australian Lesser Noddy [26000]	Vulnerable	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
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Catharacta skua Great Skua [59472]		Species or species habitat may occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species

Name	Threatened	Type of Presence
		habitat may occur within area
Chrysococcyx osculans Black-eared Cuckoo [705]		Species or species habitat known to occur within area
Diomedea amsterdamensis Amsterdam Albatross [64405]	Endangered	Species or species habitat likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Species or species habitat may occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Species or species habitat may occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat known to occur within area
Larus novaehollandiae Silver Gull [810]		Breeding known to occur within area
Larus pacificus Pacific Gull [811]		Breeding known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area

Name	Threatened	Type of Presence
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 likely to occur within area
Pterodroma macroptera Great-winged Petrel [1035]		Foraging, feeding or related behaviour known to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Puffinus assimilis Little Shearwater [59363]		Foraging, feeding or related behaviour likely to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [1043]		Foraging, feeding or related behaviour likely to occur within area
Puffinus pacificus Wedge-tailed Shearwater [1027]		Breeding known to occur within area
Rostratula benghalensis (sensu lato) Painted Snipe [889]	Endangered*	Species or species habitat likely to occur within area
Sterna albifrons Little Tern [813]		Congregation or aggregation known to occur within area
Sterna anaethetus Bridled Tern [814]		Breeding known to occur within area
Sterna bengalensis Lesser Crested Tern [815]		Breeding known to occur within area
Sterna bergii Crested Tern [816]		Breeding known to occur within area
Sterna caspia Caspian Tern [59467]		Breeding known to occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sterna fuscata Sooty Tern [794]		Breeding known to occur within area
Sterna nereis Fairy Tern [796]		Breeding known to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Fish		
Acentronura larsonae Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
Bhanotia fasciolata Corrugated Pipefish, Barbed Pipefish [66188]		Species or species habitat may occur within area
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within area
Campichthys galei Gale's Pipefish [66191]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys latispinosus Muiron Island Pipefish [66196]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys amplexus Fijian Banded Pipefish, Brown-banded Pipefish [66199]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Corythoichthys intestinalis Australian Messmate Pipefish, Banded Pipefish [66202]		Species or species habitat may occur within area
Corythoichthys schultzi Schultz's Pipefish [66205]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within

Name	Threatened	Type of Presence
		area
Doryrhamphus multiannulatus Many-banded Pipefish [66717]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Lissocampus fatiloquus Prophet's Pipefish [66250]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Nannocampus subosseus Bonyhead Pipefish, Bony-headed Pipefish [66264]		Species or species habitat may occur within area
Phoxocampus belcheri Black Rock Pipefish [66719]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammals		
Dugong dugon Dugong [28]		Breeding known to occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Aipysurus pooleorum Shark Bay Seasnake [66061]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Aipysurus tenuis Brown-lined Seasnake [1121]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis czeblukovi Fine-spined Seasnake [59233]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis mcdowelli null [25926]		Species or species habitat may occur within area
Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [1111]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and other Cetaceans [Resource Information]

Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area

Name	Status	Type of Presence
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Indopacetus pacificus Longman's Beaked Whale [72]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia simus Dwarf Sperm Whale [58]		Species or species habitat may occur within area
Lagenodelphis hosei Fraser's Dolphin, Sarawak Dolphin [41]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Mesoplodon bowdoini Andrew's Beaked Whale [73]		Species or species habitat may occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon ginkgodens Gingko-toothed Beaked Whale, Gingko-toothed Whale, Gingko Beaked Whale [59564]		Species or species habitat may occur within

Name	Status	Type of Presence
		area
Mesoplodon grayi Gray's Beaked Whale, Scamperdown Whale [75]		Species or species habitat may occur within area
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area
Mesoplodon mirus True's Beaked Whale [54]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Peponocephala electra Melon-headed Whale [47]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Name	Label
Abrolhos	Habitat Protection Zone (IUCN IV)

Name	Label
Abrolhos	Multiple Use Zone (IUCN VI)
Argo-Rowley Terrace	Multiple Use Zone (IUCN VI)
Argo-Rowley Terrace	Special Purpose Zone (Trawl) (IUCN VI)
Carnarvon Canyon	Habitat Protection Zone (IUCN IV)
Gascoyne	Habitat Protection Zone (IUCN IV)
Gascoyne	Multiple Use Zone (IUCN VI)
Gascoyne	National Park Zone (IUCN II)
Montebello	Multiple Use Zone (IUCN VI)
Ningaloo	National Park Zone (IUCN II)
Ningaloo	Recreational Use Zone (IUCN IV)
Shark Bay	Multiple Use Zone (IUCN VI)

Extra Information

State and Territory Reserves [Resource Information]

Name	State
Airlie Island	WA
Barrow Island	WA
Bessieres Island	WA
Boodie, Double Middle Islands	WA
Bundegi Coastal Park	WA
Burnside And Simpson Island	WA
Cape Range	WA
Giralia	WA
Gnandaroo Island	WA
Jurabi Coastal Park	WA
Locker Island	WA
Lowendal Islands	WA
Montebello Islands	WA
Muiron Islands	WA
North Sandy Island	WA
Round Island	WA
Serrurier Island	WA
Tent Island	WA
Unnamed WA40322	WA
Unnamed WA40828	WA
Unnamed WA41080	WA
Unnamed WA44665	WA
Unnamed WA44667	WA
Victor Island	WA
Whalebone Island	WA
Whitmore,Roberts,Doole Islands And Sandalwood Landing	WA
Y Island	WA

Invasive Species [Resource Information]

Weeds reported here are the 20 species of national significance (WoNS), along with other introduced plants that are considered by the States and Territories to pose a particularly significant threat to biodiversity. The following feral animals are reported: Goat, Red Fox, Cat, Rabbit, Pig, Water Buffalo and Cane Toad. Maps from Landscape Health Project, National Land and Water Resouces Audit, 2001.

Name	Status	Type of Presence
Birds		
Columba livia Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Mammals		
Canis lupus familiaris Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus Goat [2]		Species or species habitat likely to occur within area
Equus 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
Oryctolagus cuniculus Rabbit, European Rabbit [128]		Species or species habitat likely to occur within area
Rattus rattus Black Rat, Ship Rat [84]		Species or species habitat likely to occur within area
Vulpes vulpes Red Fox, Fox [18]		Species or species habitat likely to occur within area
Plants		
Cenchrus ciliaris Buffel-grass, Black Buffel-grass [20213]		Species or species habitat likely to occur within area
Parkinsonia aculeata Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		Species or species habitat likely to occur within area
Prosopis spp. Mesquite, Algaroba [68407]		Species or species habitat likely to occur within area
Reptiles		
Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area
Ramphotyphlops braminus Flowerpot Blind Snake, Brahminy Blind Snake, Cacing Besi [1258]		Species or species habitat may occur within area

Nationally Important Wetlands [Resource Information]

Name	State
Cape Range Subterranean Waterways	WA
Exmouth Gulf East	WA

Key Ecological Features (Marine) [Resource Information]

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

Name	Region
Ancient coastline at 125 m depth contour	North-west
Canyons linking the Cuvier Abyssal Plain and the	North-west
Commonwealth waters adjacent to Ningaloo Reef	North-west
Continental Slope Demersal Fish Communities	North-west
Exmouth Plateau	North-west

Name	Region
Glomar Shoals	North-west
Mermaid Reef and Commonwealth waters	North-west
Wallaby Saddle	North-west
Western demersal slope and associated fish	South-west

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc) together with point locations and described habitat; or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells; by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull); or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
- marine

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

- threatened species listed as extinct or considered as vagrants
- some species and ecological communities that have only recently been listed
- some terrestrial species that overfly the Commonwealth marine area
- migratory species that are very widespread, vagrant, or only occur in small numbers

The following groups have been mapped, but may not cover the complete distribution of the species:

- non-threatened seabirds which have only been mapped for recorded breeding sites
- seals which have only been mapped for breeding sites near the Australian continent

Such breeding sites may be important for the protection of the Commonwealth Marine environment.

Coordinates

-20.8682 107.6137,-18.8057 108.6309,-17.303 109.9392,-16.4445 110.7028,-14.8766 111.5988,-14.3913 112.4294,-14.3913 113.148,-14.0179 114.0533,-13.2993 114.7159,-13.4206 115.1079,-14.2233 115.5652,-14.7599 115.4812,-15.4319 116.1858,-14.9419 116.6991,-17.4104 119.3263,-19.8183 117.4691,-20.3409 116.6478,-20.5194 116.3672,-20.709 116.0913,-21.1348 115.6387,-21.4235 115.2934,-21.6813 114.9364,-21.6892 114.9157,-21.7922 114.7748,-21.798 114.7223,-21.8435 114.6491,-21.9149 114.6453,-21.945 114.6165,-21.9794 114.6147,-22.0019 114.5698,-22.0159 114.5759,-22.0263 114.5532,-22.0625 114.5473,-22.0666 114.5159,-22.0841 114.5293,-22.1223 114.5223,-22.1287 114.501,-22.1695 114.5054,-22.1556 114.482,-22.1596 114.4552,-22.2113 114.494,-22.2089 114.4531,-22.2334 114.4517,-22.241 114.4587,-22.2375 114.452,-22.2471 114.459,-22.2419 114.4429,-22.2713 114.4575,-22.2737 114.4298,-22.2923 114.4552,-22.2996 114.4237,-22.332 114.4074,-22.3466 114.4246,-22.3428 114.4426,-22.3504 114.4316,-22.3568 114.4386,-22.3539 114.4243,-22.3626 114.403,-22.3836 114.3963,-22.3932 114.4149,-22.39 114.3934,-22.4262 114.3969,-22.4323 114.3852,-22.4385 114.3937,-22.442 114.3802,-22.4594 114.3913,-22.5003 114.3552,-22.4799 114.3248,-22.4857 114.3196,-22.435 114.3091,-22.4562 114.226,-22.4974 114.2184,-22.5236 114.1819,-22.5248 114.1542,-22.4734 114.121,-22.4142 114.1224,-22.4105 114.1399,-22.3973 114.146,-22.3979 114.1315,-22.3571 114.177,-22.3052 114.1787,-22.3011 114.1501,-22.3282 114.1151,-22.262 114.132,-22.1914 114.0845,-22.1561 114.0804,-21.9628 114.1376,-21.8655 114.1485,-21.8126 114.191,-21.7837 114.1647,-21.8158 114.0787,-21.8738 113.995,-21.9765 113.9317,-22.1499 113.8735,-22.3154 113.8171,-22.407 113.7509,-22.4708 113.7386,-22.4959 113.7231,-22.4962 113.7071,-22.5172 113.7124,-22.551 113.6642,-22.5796 113.6537,-22.5948 113.673,-22.628 113.668,-22.6633 113.6855,-22.717 113.6707,-22.7155 113.7103,-22.7563 113.7561,-22.9541 113.8273,-23.034 113.8302,-23.0833 113.813,-23.1206 113.7611,-23.1568 113.7678,-24.107 113.26,-24.1216 113.2559,-24.2096 113.2142,-24.3208 113.1559,-24.4969 113.0891,-24.5004 113.085,-25.0216 112.9062,-25.5734 112.7231,-25.6901 112.7067,-26.5148 112.7919,-26.8742 112.4618,-28.8889 109.8451,-28.6112 109.7961,-28.3009 109.7891,-28.0629 109.8101,-27.6359 109.2035,-27.0573 108.5035,-26.4693 107.5352,-25.6387 106.4596,-24.8688 105.9533,-24.0615 105.7573,-23.5668 105.8623,-22.9602 106.189,-22.7316 106.4969,-22.5388 106.8017,-21.7548 107.3897,-20.8682 107.6137

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-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
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-Australian Government, Department of Defence
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-eBird Australia
-Australian Government – Australian Antarctic Data Centre
-Museum and Art Gallery of the Northern Territory
-Australian Government National Environmental Science Program
-Australian Institute of Marine Science
-Reef Life Survey Australia
-American Museum of Natural History
-Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
-Tasmanian Museum and Art Gallery, Hobart, Tasmania
-Other groups and individuals

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Please feel free to provide feedback via the Contact Us page.

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sensitive information report