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wheatstone 4D marine seismic survey environment plan

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1 environment plan summary

This *Wheatstone 4D Marine Seismic Survey 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
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 6.13, 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 publicly at: <https://docs.nopsema.gov.au/A798059>

^{*} Available publicly at: <https://docs.nopsema.gov.au/A748691>

2 introduction

2.1 Overview

Chevron Australia Pty Ltd (CAPL) proposes to conduct a 4-dimensional (4D)¹ marine seismic survey (MSS) over the Wheatstone and Iago gas fields in Commonwealth waters. The 4D MSS aims to repeat the acquisition of the 3-dimensional (3D) MSS conducted over the same area in 2011–2012.

This Environment Plan (EP) documents the assessment and management of potential environmental impacts and risks associated with the 4D MSS in Commonwealth waters.

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 4D MSS will be undertaken within Commonwealth waters north of Barrow Island, Western Australia (WA). The acquisition area includes the WA-46-L, WA-47-L, and WA-48-L production licences (Figure 2-1). There are no islands or other emergent features within or adjacent to the acquisition area.

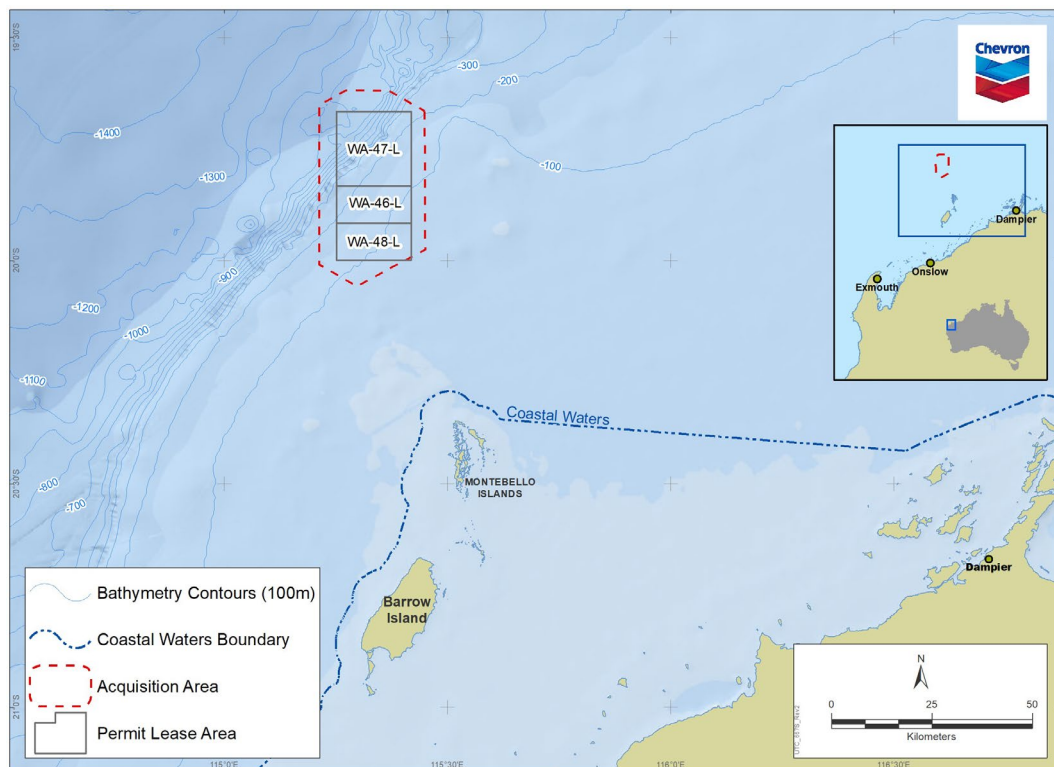


Figure 2-1: Wheatstone 4D MSS acquisition area

¹ Also known as a 'time-lapse' seismic survey.

2.3 Scope

This EP addresses the following activities in Commonwealth waters:

- seismic acquisition
- field support operations.

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

- vessels (including emergency response vessels) transiting to or from the Operational Area (OA); these vessels are deemed to be operating under the Commonwealth *Navigation Act 2012* and are not performing the petroleum activity.

2.4 Titleholder details

CAPL is the nominated titleholder of the production licences WA-46-L, WA-47-L, WA-48-L, on behalf of the titleholder companies listed in Table 2-1. The contact details for the nominated liaison person for this EP are listed in Table 2-2.

Regulation 15(3) of the OPGGS(E)R requires that CAPL notifies NOPSEMA of a change in the titleholder, a change to the titleholder's nominated liaison person, or a change in the contact details for either the titleholder or the nominated liaison person.

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 a registered titleholder or contact details for the registered titleholder; this notification is to occur within 30 days of such a change.

Table 2-1: Titleholder details

Title	Detail	Titleholders	Nominated titleholder	Address
WA-46-L	Production Licence	Chevron Australia Pty Ltd Chevron (TAPL) Pty Ltd	Chevron Australia Pty Ltd (ACN: 086 197 757)	250 St Georges Terrace Perth, WA, 6000
WA-47-L	Production Licence	PE Wheatstone Pty Ltd Kyushu Electric Wheatstone Pty Ltd		
WA-48-L	Production Licence	Chevron Australia Pty Ltd Kufpec Australia (Wheatstone Iago) Pty Ltd Chevron (TAPL) Pty Ltd PE Wheatstone Pty Ltd Kyushu Electric Wheatstone Pty Ltd		

Table 2-2: Nominated liaison person

Name	Birgit Cropp / Asten Roopra (public contact)
Company	Chevron Australia Pty Ltd
ACN	086 197 757
Position	Wheatstone Reservoir Development Team Lead / PGPA Operations Manager
Business Address	250 St Georges Terrace, Perth WA 6000
Telephone	+61 8 9216 4000
Email	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
<i>Australian Maritime Safety Authority Act 1990</i>	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).
<i>Biosecurity Act 2015</i> 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 <i>Australian Ballast Water Management Requirements</i> (Ref. 4)	Section 6.7
<i>Environment Protection and Biodiversity Conservation Act 1999</i> (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 EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans EPBC Act Policy Statement 2.1 – Interaction between Offshore Seismic Exploration and Whales (Ref. 5).	Section 4, and Section 6 Section 6.2, and Section 6.6 Section 6.5

Legislation	Description	Requirements relevant to the risks associated with the petroleum activity	Demonstration of how requirements are met
		Injury or fatality caused to EPBC-listed fauna shall be reported	Section 7.4.2
<i>Navigation Act 2012</i>	Provides for vessel and seafarer safety, and marine pollution prevention	Notice to Mariners	Section 6.1, and Section 6.12
<i>Navigation Act 2012</i>	Gives effect to the requirements under the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) in Australia	Marine order 30—Prevention of collisions	Section 6.12
<i>Protection of the Sea (Prevention of Pollution from Ships) Act 1983</i>		Marine order 91—Marine pollution prevention—oil	Section 6.8, Section 6.11, and Section 6.12
<i>Protection of the Sea (Harmful Anti-fouling Systems) Act 2006</i>		Marine order 95—Marine pollution prevention—garbage	Section 6.9
Various marine orders		Marine order 96—Marine pollution prevention—sewage	Section 6.8
		Marine order 97—Marine pollution prevention—air pollution	Section 6.3
		Marine order 98—Marine pollution prevention—anti-fouling systems	Section 6.7
<i>Offshore Petroleum and Greenhouse Gas Storage Act 2006</i> (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)
<i>Underwater Cultural Heritage Act 2018</i>	Provides protection for shipwrecks, sunken aircraft and other cultural heritage sites in Australian waters	Identification of the presence of protected cultural heritage sites and assessment of any impacts and risks to these sites	Section 4, and Section 6

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
<i>Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species</i> (Ref. 6)	International Maritime Organization (IMO) guidelines for global management of biofouling	Requires a biofouling management plan and record book to be available and maintained	Section 6.7
<i>National Light Pollution Guidelines for Wildlife, including Marine Turtles, Seabirds and Migratory Shorebirds</i> (Ref. 7)	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 6.4

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. 8)
- NOPSEMA's *Consultation with Commonwealth agencies with responsibilities in the marine area* guideline (Ref. 9)
- Australian Petroleum Production and Exploration Association's (APPEA's) draft *Stakeholder Consultation and Engagement Principles and Methodology for Environment Plans* (Ref. 10).

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. 9) 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 a department, person, or organisation functions, interests, or activities. 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 an emergency event (i.e., unplanned release from a vessel collision) that has 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.

CAPL have previously engaged with relevant stakeholders prior to the 2011–2012 3D MSS. The list of stakeholders from the previous MSS was reviewed to ensure that any new ‘relevant person’ was also included in the stakeholder consultation process as part of this EP. For this EP, CAPL have 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	<ul style="list-style-type: none"> • Australian Fisheries Management Authority (AFMA) • Australian Hydrographic Office (AHO) • Australian Maritime Safety Authority (AMSA) • Department of Agriculture, Water and the Environment (DAWE) <ul style="list-style-type: none"> – Fisheries – Director of National Parks • Department of Defence / Border Force
State departments or agencies	<ul style="list-style-type: none"> • Department of Biodiversity, Conservation and Attractions (DBCA) • Department of Primary Industries and Regional Development (DPIRD) • Department of Transport (DoT)

Group	Stakeholder
	<ul style="list-style-type: none"> • Department of Mines, Industry Regulation and Safety (DMIRS)
Commonwealth fisheries (peak bodies)	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • RecFishWest • Marine Tourism WA • Ashburton Anglers • Apache Charters • Blue Juice Charters • Blue Lightning Fishing Charters • Mahi Charters • Exmouth Deep Sea Fishing • Western Boat Charters • Go Diving • Surf Dive n Fish • Blue Sun 2 Boat Charters • Montebello Island Safaris • Pelican Charters • Point Samson Charters • Top Gun Charters • Exmouth Game Fishing Club • Nickol Bay Sport Fishing Club • Onslow Visitor Centre • Port Hedland Game Fishing Club
Other petroleum operators	<ul style="list-style-type: none"> • Santos Ltd • Woodside Energy Ltd • PGS Australia Pty Ltd • TGS-NOPEC Geophysical Company Pty Ltd
Emergency response	<ul style="list-style-type: none"> • AECOM • Australian Marine Oil Spill Response Centre • Gorgon HSE / Emergency Management Specialists • DoT Oil Spill Response Coordination Unit • Oil Spill Response Limited • BMT • GHD

Group	Stakeholder
	<ul style="list-style-type: none"> Cleanaway Port Authorities
Aboriginal	<ul style="list-style-type: none"> Buurabalayji Thalanyji Aboriginal Corporation (BTAC) Robe River Kuruma Aboriginal Corporation Wirrawandi Aboriginal Corporation RNTBC Native Title body for Yaburara and Coastal Mardudhunera Aboriginal Corporation (YACMAC) Yamatji Marlpa Aboriginal Corporation
Local	<ul style="list-style-type: none"> Shire of Ashburton Onslow Chamber of Commerce and Industry Onslow Community Reference Group Onslow Salt

2.6.3 Provision of material

Under NOPSEMA's *Environment plan decision making* guideline (Ref. 8), 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 8 June 2021, and again between 9–15 November 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 to the commercial fishing sector on 8 June 2021, and again on 9 November 2021. Given WAFIC is the peak industry body representing commercial fisheries in WA, their review and advice on the factsheet prior to release 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.

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.

Section 2.6.5 describes the process for ongoing consultation, including the triggers for when additional consultation is required.

2.6.4 Assessment and response

Table 2-6 summarises the matters, objections, and claims made during consultation with relevant stakeholders, assesses their merits, and describes how CAPL will manage the objection or claim in this EP.

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.

Table 2-6: Summary of stakeholder objections/claims and titleholder reponse

Stakeholder	Date	Sensitive information reference	Matter	Objection or claim	Assessment of merits	Titleholder response
Australian Fisheries Management Authority	16 June 2021	59	Response to Wheatstone 4D MSS factsheet	No objection or claim. AFMA provided a reminder to consult with fishers within the proposed area.	Not applicable	Acknowledged receipt of feedback, and CAPL confirmed that relevant fisheries within the OA have been identified and were included on relevant persons list for consultation.
AHO and AMSA	9 June 2021	63–64, 130, 152–153	Response to Wheatstone 4D MSS factsheet	No objection or claim. Requested that AMSA's Joint Rescue Coordination Centre (JRCC) be notified: <ul style="list-style-type: none"> at least 24–48 hours before operations commence when operations start and end Requested that the AHO be contacted no less than four working weeks before operations, with details relevant to the operations	AMSA have the authority to request such notifications given that their functions, interests, and activities have the potential to be affected by the activity. These requests are in line with standard industry practice.	Acknowledged receipt of feedback, and CAPL confirmed that notifications are included as control measures within this EP.
DBCA	16 June 2021	75–76	Response to Wheatstone 4D MSS factsheet	Request that CAPL undertake a risk assessment to determine the likelihood of potential impacts on marine fauna species within the project area commensurate with the scale and biological significance of the noise produced. DBCA note best practice methods should include:	DBCA is a State environmental regulator, thus the request is in line with their interests, functions, and activities.	Acknowledged receipt of feedback. CAPL confirmed that all concerns raised by DBCA would be addressed in the EP, including the following: <ul style="list-style-type: none"> undertake third-party noise modelling to inform impact and risk evaluation for all relevant receptors

Stakeholder	Date	Sensitive information reference	Matter	Objection or claim	Assessment of merits	Titleholder response
				<ul style="list-style-type: none"> underwater noise modelling management zones presence of Marine Fauna Observers <p>DBCA refers CAPL to the EPBC Act Policy Statement 2.1.</p> <p>DBCA also notes that night operations require consideration of artificial light and vessel strike, and refers to the <i>National Light Pollution Guidelines for Wildlife Including Marine Turtles, Seabirds and Migratory Shorebirds</i>.</p>		<ul style="list-style-type: none"> apply management zones consistent with relevant regulatory guidance commit to having MFOs on-vessel during the survey address potential impacts and risks from vessel lighting
DMIRS	30 June 2021	70–71	Response to Wheatstone 4D MSS factsheet	<p>DMIRS requested additional information on potential impacts of the activity on lands or waters under State jurisdiction, including</p> <ul style="list-style-type: none"> credible spill scenarios and response arrangements commitment for incident reporting to DMIRS for impacts relevant to WA. 	DMIRS is the State regulator for petroleum activities, thus the request is in line with their interests, functions, and activities.	Acknowledged receipt of feedback and confirmed that CAPL maintains response capability arrangements including interface and reporting to State departments and agencies in accordance with CAPL's Consolidated OPEP.
	28 July 2021	69–70	Response to Titleholder	<p>DMIRS requested additional information credible spill scenarios which may impact State lands or waters.</p>		Acknowledged receipt of feedback. CAPL provided some additional information from spill modelling and confirmed that full description

Stakeholder	Date	Sensitive information reference	Matter	Objection or claim	Assessment of merits	Titleholder response
						of the credible spill scenario and associated risk assessment would be available within the publicly available EP.
DoT (Oil Spill Response Unit)	22 June 2021	65, 154	Response to Wheatstone 4D MSS factsheet	No objection or claim. Requested that if there is a risk of a spill impacting State Waters from the activity, that DoT be consulted.	DoT are the response agency for State Waters thus the request is in line with their interests, functions, and activities.	Acknowledged receipt of feedback, and CAPL confirmed that notification for DoT are included as within the CAPL Consolidated OPEP.
Director of National Parks (DNP)	12 July 2021	98–101	Response to Wheatstone 4D MSS factsheet	DNP requested additional information regarding: <ul style="list-style-type: none"> proximity to the Montebello Marine Park and nearby marine parks are clearly identified detailed consideration given to the impacts on marine fauna (specifically Flatback, Green, Loggerhead and Hawksbill turtles; seabirds foraging within Marin Park; Whale Shark, Humpback Whale and Pygmy Blue Whale engagement with tourism and commercial fishing operators engagement with the Yamatji Marlpa Corporation. <p>Consideration should be given to the use of low power and</p>	DNP is responsible for the management of Australian Marine Parks, thus the request is in line with their interests, functions, and activities.	Acknowledged receipt of feedback, and CAPL confirmed that all questions raised by DNP would be addressed in the EP.

Stakeholder	Date	Sensitive information reference	Matter	Objection or claim	Assessment of merits	Titleholder response
				shut down zones, timing of the activity, and detailed adaptive management approaches.		
WAFIC	17 June 2021	16–26, 80–90, 121–129	Response to Wheatstone 4D MSS factsheet	<p>Referred CAPL to the recent risk assessment undertaken by DPIRD on seismic activities and impacts to marine finfish and invertebrates.</p> <p>WAFIC also shared feedback from commercial fishers regarding a notable change in catch levels of Mackerel species following seismic survey activity, and the economic impacts of this on fishers.</p> <p>WAFIC raised an opportunity to research into the indirect impacts of seismic.</p> <p>WAFIC requested that these concerns are assessed and included in the EP.</p>	WAFIC is the peak industry body for the WA commercial fishing, pearling and aquaculture sector; thus, the request is in line with their interests, functions, and activities.	Acknowledged receipt of feedback, and CAPL acknowledged the requirement to identify and assess all impacts and risks associated with the activity, and to apply control measures to reduce risks to ALARP and acceptable.
Fat Marine Pty Ltd	10 June 2021	85–87	Response to Wheatstone 4D MSS factsheet	<p>Fat Marine Pty Ltd advised it had concerns about the proposed activity but had limited reception whilst at sea and would like to discuss its concerns at a more convenient time. In a brief email, Fat Marine Pty Ltd noted a recent encounter with another operator on their seismic activity and the disruption it caused.</p>	Not applicable	<p>Acknowledged receipt of feedback. CAPL responded to Fat Marine Pty Ltd via email three times and via SMS on one occasion to arrange a time to listen to Fat Marine Pty Ltd's feedback and concerns, however CAPL received no response.</p> <p>WAFIC also attempted to contact Fat Marine Pty Ltd and advised of CAPL's attempts to make contact and understand</p>

Stakeholder	Date	Sensitive information reference	Matter	Objection or claim	Assessment of merits	Titleholder response
						the concerns and WAFIC was also unsuccessful.
Haysito Holdings Pty Ltd	11 Nov 2021	149–151	Response to Wheatstone 4D MSS factsheet	Haysito Holdings indicates that seismic surveys during previous three years in mackerel fishing areas off Port Hedland appear to have caused declines in catches from those areas. Raised concern that mackerel appears sensitive to seismic surveys and the same impact and catch decline may occur in the proposed survey area.	Management area for the Mackerel Managed Fishery intersects with the OA; thus, the request is in line with the commercial fishers interests, functions, and activities.	Acknowledged receipt of feedback. CAPL noted that a comprehensive impact and risk assessment will be included in the publicly available EP. CAPL noted that fishing effort data does not indicate any use of the acquisition area over the previous five years, and the proposed survey timing is outside main period of activity of the Mackerel Managed Fishery. CAPL also noted they will consider evidence-based adjustment protocols for commercial fishing should fishers be verifiably impacted to a commercial extent by the Wheatstone 4D MSS.
	18 Nov 2021	148–149	Response to Wheatstone 4D MSS factsheet	Haysito Holdings responded reiterating concerns about the declines in catch rates observed off Port Hedland. Also noted concern that mackerel species may leave and not return to an area previously impacted by a seismic survey.		Acknowledged receipt of feedback. CAPL responded that shallow reef systems closest to the Montebello Islands are >30 km away and beyond the predicted area of noise exposure. CAPL reiterated that an evidence-based adjustment protocol for commercial fishing would be considered.

Stakeholder	Date	Sensitive information reference	Matter	Objection or claim	Assessment of merits	Titleholder response
Yamatji Marlpa Aboriginal Association	30 July 2021	91–92	Response to Wheatstone 4D MSS factsheet	No objection or claim. Confirmation that CAPL are consulting with the correct Aboriginal stakeholder groups, and advice to continue to engage directly with the relevant Prescribed Body Corporates (PBC).	Not applicable	Acknowledged receipt of feedback, and CAPL confirmed it will continue to engage relevant PBCs directly.
PGS Australia Pty Ltd	18 January 2022	164–165	Response to Wheatstone 4D MSS factsheet	No objection or claim. Confirmation that there are no plans to undertake the Rollo seismic survey during the acquisition timing proposed for the Wheatstone 4D MSS.	Not applicable	Acknowledged receipt of feedback.
TGS-NOPEC Geophysical Company Pty Ltd	18 January 2022	166–168	Response to Wheatstone 4D MSS factsheet	No objection or claim. Confirmation that there are no plans to undertake the NWS seismic survey during the acquisition timing proposed for the Wheatstone 4D MSS.	Not applicable	Acknowledged receipt of feedback.

2.6.5 Ongoing consultation

The stakeholder notifications and ongoing consultation required for this petroleum activity is captured in Table 2-7.

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 2-7: 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 weeks before commencing activities, or as otherwise agreed with AHO	Once, prior to activities commencing
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	Once, prior to activities commencing
Interested other marine users including: <ul style="list-style-type: none"> • WAFIC • Commercial fisheries • RecFishWest • Marine Tourism WA • Woodside Energy Ltd • Santos Ltd • PGS Australia Pty Ltd • TGS-NOPEC Geophysical Company Pty Ltd 	CAPL to provide notification to other marine users of commencement of activities for the Wheatstone 4D MSS	At least four weeks before commencing activities	Once, prior to activities commencing
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
Interested parties, potentially affected parties, government agencies including:	CAPL to advise of any new or significant changes to activities or impacts/risks within the scope of the EP,	Prior to new or significant changes to activities or	As required

Stakeholder	Notification or ongoing consultation requirement	Timing	Frequency
<ul style="list-style-type: none"> • DNP • DMIRS 	following an evaluation as per Section 7.3.2.2, that may potentially impact marine users	impacts/risks occurring	

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 the following sections:

- seismic acquisition (Section 3.2)
- field support operations (Section 3.3).

3.1.1 Purpose

The purpose of the Wheatstone 4D MSS is to acquire new seismic survey data over the production licences (WA-46-L, WA-47-L, WA-48-L) as part of a monitoring program.

3.1.2 Operational area

The general location of the Wheatstone 4D MSS is described in Section 2.2.

Three areas, based on the types of activity occurring, have been defined for the 4D MSS: acquisition area (or full fold area), full power zone (FPZ), and the operational area (OA) (Table 3-1). The coordinates of each of these areas and their location relative to each other is shown in Table 3-2 and Figure 3-1.

It is within the OA that the petroleum activity defined within Section 3 of this EP will be undertaken. The OA is situated ~30 km from the Montebello Islands, and ~119 km from the mainland (Figure 3-1).

Table 3-1: Wheatstone 4D MSS areas

Name	Activity	Approximate water depth	Area
Acquisition (full fold) area	The target area where the full seismic dataset is required.	80–1,090 m	1,074 km ²
Full power zone (FPZ)	The FPZ is defined as a 4 km buffer around the acquisition area. Within the FPZ the source is discharged at full power in order to achieve the required data capture (i.e., includes run-ins and run-outs).	60–1,130 m	1,644 km ²
Operational area (OA)	The OA for the petroleum activity is defined as a 15 km buffer around the acquisition area. All planned activities within scope of this EP will occur within the OA, including source ramp-up, bubble testing, line changes, equipment maintenance, and the seismic acquisition. Seismic acquisition will not be undertaken during vessel turns.	50–1,250 m	3,730 km ²

Table 3-2: Coordinates and water depths for the acquisition area, full power zone, and operational area for the Wheatstone 4D MSS

Point ID	Latitude [^]	Longitude [^]	Water depth (m)
Acquisition area			
1	-20.05696	115.2963	82
2	-20.00816	115.2127	151

Point ID	Latitude [^]	Longitude [^]	Water depth (m)
3	-19.65069	115.2123	1085
4	-19.61834	115.2729	1061
5	-19.61905	115.3686	946
6	-19.66441	115.4486	227
7	-19.97503	115.4499	79
Full power zone			
1	-20.09307	115.2976	75
2	-20.03834	115.1917	144
3	-20.01725	115.1757	165
4	-19.6456	115.1746	1123
5	-19.62181	115.1894	1129
6	-19.58402	115.261	1108
7	-19.58327	115.3739	898
8	-19.6334	115.4682	229
9	-19.65492	115.4854	214
10	-19.98007	115.4877	67
11	-20.00561	115.4702	61
Operational area			
1	-20.19243	115.2985	61
2	-20.18022	115.2368	77
3	-20.12161	115.1343	132
4	-20.07739	115.0894	186
5	-20.02273	115.0703	312
6	-19.62264	115.0726	1231
7	-19.58924	115.085	1235
8	-19.55729	115.1087	1245
9	-19.49739	115.2085	1238
10	-19.48324	115.2619	1208
11	-19.48443	115.3849	969
12	-19.50276	115.442	662
13	-19.55349	115.5307	358
14	-19.59276	115.57	219
15	-19.64808	115.5905	186
16	-19.99043	115.5923	80
17	-20.04325	115.5738	75
18	-20.08456	115.5343	67
19	-20.17893	115.3588	49

[^] Coordinates provided in decimal degrees (GDA94)

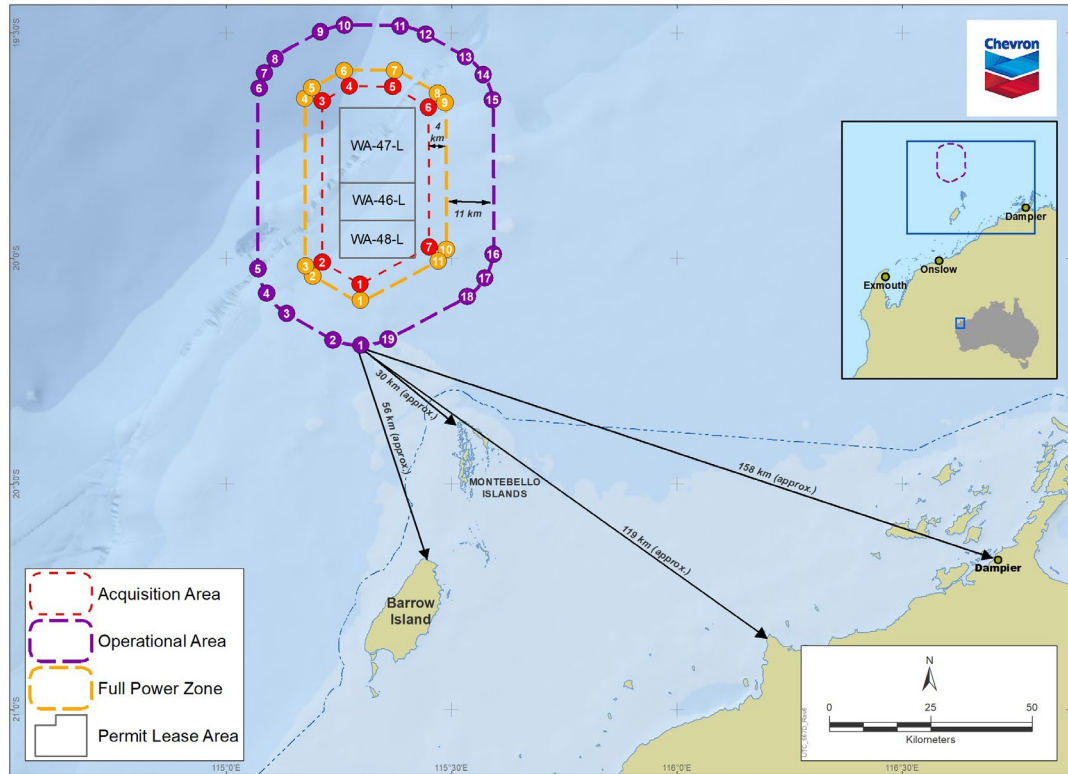


Figure 3-1: Acquisition area, full power zone, and operational area for the Wheatstone 4D MSS

3.1.3 Timing

The Wheatstone 4D MSS is scheduled to occur between mid-December 2022 and mid-April 2023, subject to vessel availability.

The MSS is estimated to take ~75 days to acquire the 120° azimuth survey lines and the optional 60° azimuth survey lines. This 75-day timeframe includes the deployment and retrieval of the equipment, testing, acquisition, and an allowance for typical standby and equipment downtime.

It is noted that should unforeseen circumstances eventuate during the survey (e.g., excessive downtime due to multiple cyclones, serious technical problems, etc.), the survey may take longer than this best estimate of ~75 days. The selection of a four-month window (mid-December 2022 to mid-April 2023) for acquisition is to allow for some contingency if required due to these unforeseen circumstances, and for the uncertainty of the seismic vessel's arrival in the survey area.

Seismic acquisition will be conducted 24 hours a day.

3.2 Seismic acquisition

The 4D MSS method is typical of seismic surveys conducted on the North West Shelf, and no unique equipment or acquisition methods are proposed.

This 4D MSS is aiming to repeat all 120° lines, and some of the 60° lines (specifically within the southern extent of the acquisition area to increase the data density around the Wheatstone Platform and Pluto Platform), from the previous 2011–2012 (Ref. 11) 3D MSS. A schematic of the proposed 120° and 60° azimuth acquisition lines is shown in Figure 3-2. The 4D MSS will most likely capture the

120° lines first, with the potential for subsequent capture of the 60° survey lines, depending on timing.

As shown in the schematic (Figure 3-2), the acquisition area extends beyond the boundaries of the Wheatstone and Iago gas fields. The survey has been designed this way to ensure that sufficient data is captured to develop an accurate and high-quality image of the reservoirs. In order to be able to detect the seismic signal for any given point at least a ~12 km diameter of surrounding recorded data is required, to allow that point to be fully imaged with fully processed (e.g., linear noise removal, demultiple, etc.) data.

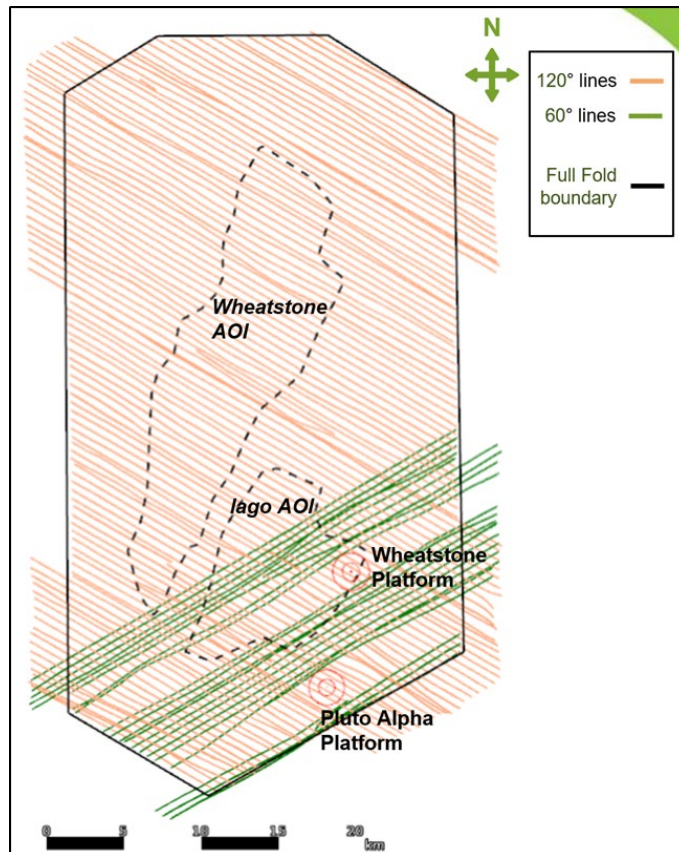


Figure 3-2: Schematic showing the proposed 120° and 60° azimuth acquisition lines for the 4D MSS

The 4D MSS acquisition parameters are provided in Table 3-3, and aim to replicate the acquisition parameters of the 3D MSS (Ref. 11) conducted over the same area in 2011–2012 in order to generate a comparable dataset. The data acquired will show the change in the Wheatstone and Iago gas reservoirs since the start of production in 2017. Figure 3-3 shows a schematic of the proposed acquisition configuration for the seismic survey. Seismic acquisition will be undertaken by a specialist geophysical contractor using a purpose-built seismic vessel (Section 3.3). The seismic vessel will tow seismic equipment along predetermined acquisition lines within the FPZ, to acquire the ~1,074 km² of seismic data from within the acquisition area (Figure 3-1). Seismic acquisition will not be undertaken during vessel turns.

For the 4D MSS to be successful, acquisition parameters and ambient environmental conditions need to be the same as the previous 3D MSS. The previous 3D MSS was acquired mid-November 2011 to mid-April 2012. The

selected window for the 4D MSS acquisition is therefore similar (mid-December 2022 to mid-April 2023; Section 3.1.3). The reason for the Wheatstone 4D MSS starting in December rather than November is to limit the overlap with the predicted Pygmy Blue Whale migration timings (Section 4.3.1.1; Section 4.7).

It is intended that the seismic energy source will be the same as that used in the previous 2011–2012 3D MSS: a dual source with a source volume of ~4,130 cubic inches (cu.in) and mean operating pressure of ~2000 psi (Table 3-3). The use of a different or reduced source volume would affect the quality and useability of the 4D MSS data. For example, a reduced energy source will result in a weaker signal penetrating the subsurface resulting in an inferior signal to ambient noise ratio which diminishes the detectability of signals in the subsurface.

The acoustic source array will be towed astern of the vessel at a depth of ~5–8 m (+/-1 m). Acoustic signals will be produced at ~18.75 m intervals, achieved by alternating the powering of the dual sources. This corresponds to an acoustic signal being produced approximately every ~7–9 seconds.

Seismic reflections from subsurface layers will be detected by an array of up to 12 solid hydrophone streamers, which will extend up to 7 km behind the seismic vessel. The streamers will be towed at a depth of ~15–25 m below the sea surface and spaced ~100 m apart.

The streamers are equipped with steering devices which enables depth control and horizontal steering to reduce influence of wind and currents and maintain streamer separation. Streamer recovery devices (SRDs) are fitted to the streamers, whereby if the streamers go below a certain depth (generally 50 m), the SRDs automatically activate to raise the streamer to the surface for retrieval. Each streamer has a tail buoy and navigational light to delineate the end of the streamer.

Table 3-3: 4D MSS acquisition parameters

Parameter	Proposed specification
Source configuration	Dual source, ~50 m apart, flip flop arrangement
Maximum source volume	~4,130 cu.in.
Source operating pressure	~2,000 psi
Source tow depth	~5–8 m (+/-1 m)
Shot point interval	~18.75 m
No. of streamers	Up to 12
Streamer length	Up to 7 km
Streamer spacing	~100 m
Streamer array width	~1,100 m
Nominal streamer depth	~15–25 m
Line spacing	~500 m
Line direction	Two azimuths: 120°, 60°
Swath width	~7.5–8 km
Vessel speed during acquisition	~4–5 knots

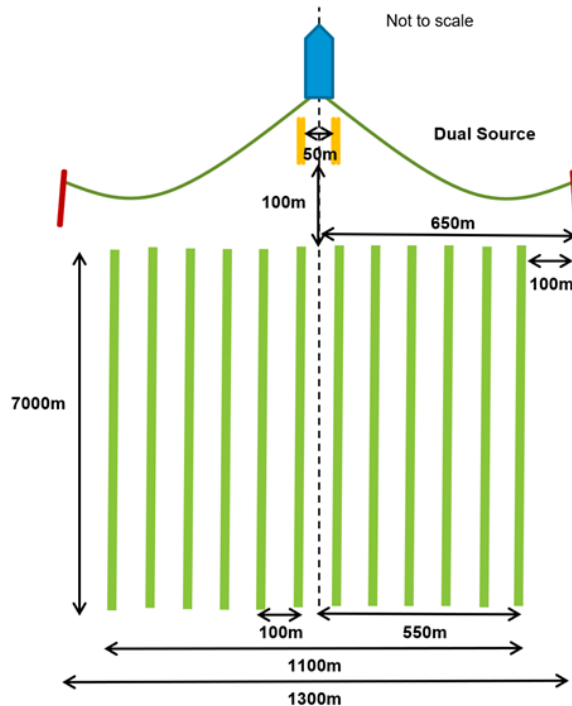


Figure 3-3: Schematic showing proposed acquisition configuration for the 4D MSS

3.3 Field support operations

Seismic acquisition will be undertaken using a purpose-built seismic vessel. Two dedicated support vessels will be used for logistical, safety and equipment management support during the 4D MSS, with at least one support vessel to always be with the seismic vessel. The seismic vessel will also have an onboard workboat, which may be launched to assist with equipment deployment, retrieval, or maintenance activities. There will be a 500 m radius Safe Navigation Area (SNA) requested around the seismic vessel and towed array for the duration of activities. This SNA will be maintained at all times except by those vessels providing supply to the seismic vessel like refuelling, resupply, etc.

The seismic and support vessels will operate from Dampier and/or Exmouth, and crew changes are planned to be conducted on a 2.5 or 5 weekly basis by helicopter (weather permitting for the seismic vessel), or port call.

Vessel anchoring within the OA shall not be permitted except during emergencies (if 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). If refuelling is required, the seismic vessel will be refuelled at sea by the support vessel. Both support vessels will return to port to bunker.

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.

In the event of unsafe environmental conditions (e.g., a cyclone passing over or close to survey area), equipment may be retrieved, and/or both the seismic and support vessels may transit away from the OA to a safer location. As per Section 2.3, once a vessel leaves the OA, it is no longer undertaking a petroleum activity.

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 6-11])
- 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 6-10]).

These areas are shown in Figure 4-1.

CAPL’s *Description of the Environment: CAPL Planning Area* (Ref. 1) 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.

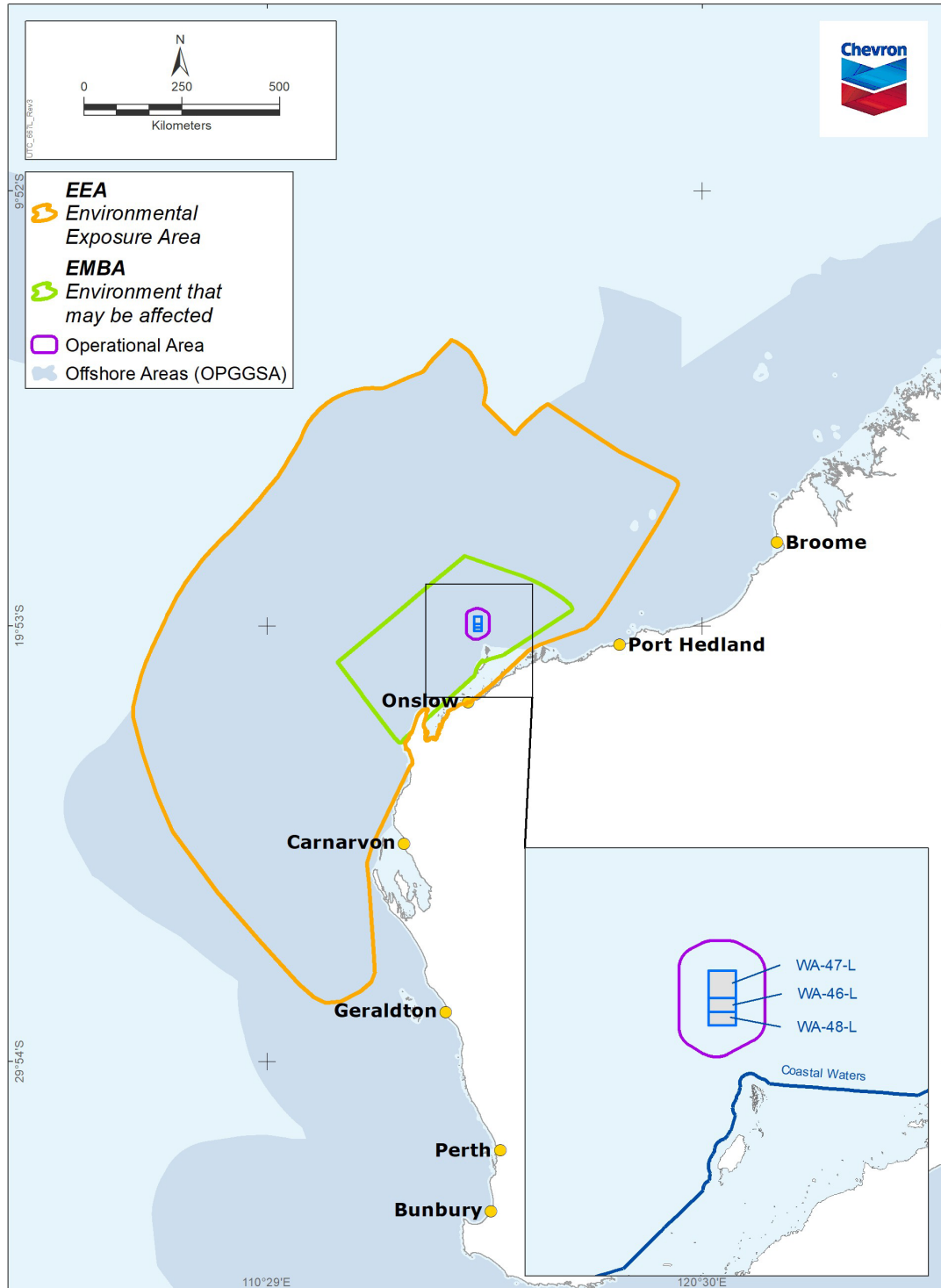


Figure 4-1: OA, EMBA, and EEA for the Wheatstone 4D MSS

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. No specific presence of physical values or sensitivities within the OA, EMBA, or EEA have been identified.

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. 12; appendix c), 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)	✓	✓	✓

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

4.3.1.1 Pygmy blue whales

A migration and distribution BIA for the Pygmy Blue Whale overlaps with the OA and FPZ.

Pygmy Blue Whales migrate along the west coast of Australia in the northern direction to their breeding grounds near the Indonesian Archipelago from mid-February to early June, and in the southern direction to the feeding grounds in the Southern Ocean from mid-November to early January (Ref. 13). Recent information collected from satellite tags showing that the Banda and Molucca seas in Indonesia are the likely destination for the northern migration of whales that feed off the Perth Canyon (Ref. 14; Ref. 15; Ref. 16).

Acoustic monitoring conducted by McCauley and Jenner (Ref. 17) in the Exmouth and northern Montebello Islands region identified a peak period in the northern migration of Pygmy Blue Whales from April to August, and from November through to late December during the southern migration. It was estimated by McCauley and Jenner (Ref. 17) that between seven and fifteen hundred Pygmy Blue Whales migrated southward past Exmouth in 2004.

CAPL noise loggers deployed for a full year period in 2019 detected Pygmy Blue Whales on their northern and southern migration. The noise loggers were located at various locations ~40–50 km west of the OA, and in ~ 1300 m water depth. The majority of Pygmy Blue Whales detected on their northern migration occurred from mid-April to the end July, then again on their southern migration in November through to early-December (Ref. 18). These peaks correspond with previously identified northern and southern migration periods of Pygmy Blue Whales.

It is known the Pygmy Blue Whales tend to follow the WA continental shelf edge between their feeding grounds of the Perth Canyon and the North West Cape. However, the migratory pathway of whales north of the North West Cape is less defined. The migration BIA for Pygmy Blue Whales has been historically described as occurring along the continental shelf edge between 500 m and 1,000 m water depths (Ref. 76; Ref. 68). However, more recent studies (e.g., Ref. 14; Ref. 13) suggest that Pygmy Blue Whales are likely to transit through deeper and further offshore waters north of the North West Cape. Satellite tracking data showed Pygmy Blue Whales on their northern migration travelled relatively near to the Australian coastline (100 ± 1.7 km) in water depths of $1,369.5 \pm 47.4$ m, until reaching the North West Cape, after which they travelled offshore (238 ± 14 km) into progressively deeper water ($2,617 \pm 143.5$ m) (Ref. 14). Gavrilov et al. (Ref. 13) conducted a study using an array of ocean bottom seismographs to detect Pygmy Blue Whales traversing the area to the northwest of the North West Cape during their southern migration. This study found that Pygmy Blue Whales migrated southward much further from the WA coast compared to the northbound migration, at distances of up to 400 km from shore (Ref. 13).

McCauley and Jenner (Ref. 17) recorded 24-hour average counts of Pygmy Blue Whales along the WA coast during their migrations periods and found that the migratory habits are short and sharp pulses for the southbound Pygmy Blue Whales and a more protracted pulse of northbound Pygmy Blue Whales. This suggests that the southern migration Pygmy Blue Whales are swimming purposefully through the area to reach their southern feeding grounds, thus resulting in the data collected for Pygmy Blue Whales migrating through the area is not confounded by lingering Pygmy Blue Whales but they are swimming steadily past. This highlights that Pygmy Blue Whales may be present through the OA, however they are not expected to display any sedentary behaviours, as they are expected to travel through the area quickly.

The OA is located in water depths ranging from ~50–1,250 m. The defined BIA for Pygmy Blue Whales overlaps the northern part of the OA and FPZ; however, it is expected based on satellite tracking and acoustic detection studies that Pygmy Blue Whales are likely to travel predominantly to the northwest of the OA in deeper waters, particularly on their southern migration (November to December), but also during the northern migration (April to August).

4.3.1.2 Humpback whales

The migration (north and south) BIA for Humpback Whales is located ~5 km south of the OA, and ~16 km from the FPZ.

Humpback Whales migrate north annually (from June to October) between their feeding grounds in Antarctic waters and their calving grounds in Pilbara/Kimberley waters (Ref. 19). Northbound Humpback Whales tend to remain around the 200 m water depth contour, while southbound Humpback Whales tend to travel closer to Barrow Island and generally occur between 50 m and 200 m water depths (Ref. 19).

The Humpback Whale breeding and calving grounds in the southern Kimberley region extend from Broome to the northern end of Camden Sound, particularly between Lacepede Islands and Camden Sound (Ref. 69). Breeding and calving occurs in the region between mid-August and early-September (Ref. 69), followed by the start of the southern migration. Exmouth Gulf and Shark Bay are both important resting areas for migrating Humpback Whales, particularly for cow-calf pairs on the southern migration (Ref. 78). The southerly migration, from around the Lacepede Islands (north of Broome) extends parallel to the coast on approximately the 20–30 m depth contour (Ref. 19, Ref. 20). Southbound migration is more diffuse and irregular, lacking an obvious peak. An increase in southerly migrating individuals may be observed between the North West Cape and the Montebello Islands between August to early September (Ref. 19; Ref. 18). Females and calves are known to stop and rest in Exmouth Gulf and Shark Bay (Ref. 69).

4.3.2 Reptiles

Based on searches of the protected matters database (Ref. 12; appendix c), 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	Interesting 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, Serrier 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		✓	✓
	Interesting			✓	✓
	Interesting buffer	Summer	✓	✓	✓
	Mating	Summer		✓	✓
	Nesting	Summer		✓	✓
Green Turtle	Aggregation			✓	✓

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

4.3.2.1 Flatback turtles

The Montebello Islands supports Flatback Turtle nesting, occurring from October to March, with a peak in December to January. The Montebello Islands are identified as nesting habitat critical to the survival of the species, as is the 60 km interesting buffer around the Montebello Islands (Ref. 59). Both the interesting critical habitat and the interesting BIA overlap with the OA and FPZ.

During interesting, turtles remain close to the nesting beach or rookery (Ref. 59). The 60 km interesting buffer defined within the Recovery Plan is based primarily on the movements of tagged interesting Flatback Turtles in WA (Ref. 21). The study tracked 56 turtles from 4 different rookeries, which demonstrated varying interesting movements, with distances ranging from 3–62 km, with some turtles at all four rookeries remaining within 10 km of their nesting beaches. However, tracking data showed these movements were largely longshore movements in nearshore coastal waters or travel between island rookeries and the adjacent mainland, which represent the greater distances (Ref. 21). There is no evidence to suggest that Flatback Turtles move to deep offshore waters during interesting periods.

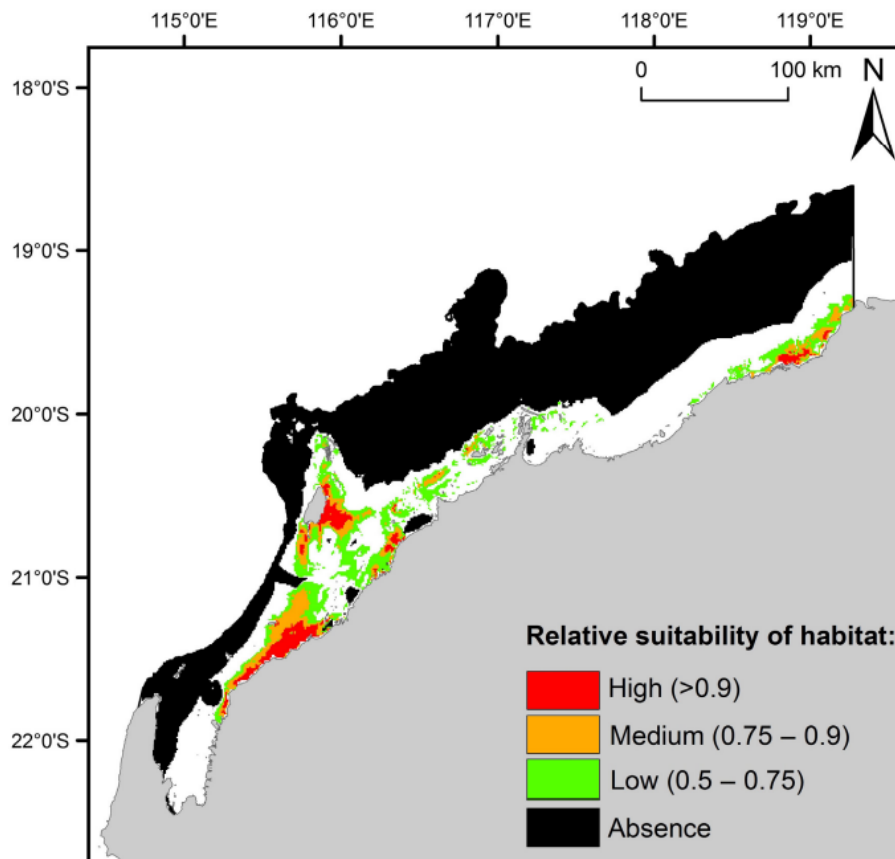
A habitat suitability modelling study for interesting Flatback Turtles in the NWS region of WA (Ref. 69) was conducted to identify areas of suitable Flatback Turtle interesting habitat and determine overlap with identified industrial hazards. The study used a turtle tracking dataset of 47 nesting female turtles from five important rookeries in the NWS study area, including Barrow Island, located ~55 km from the OA. The results showed interesting Flatback Turtles from all rookeries remained within water depths of <44 m, with a mean depth of <10 m (Ref. 69). Results also showed interesting turtles from all rookeries remained within <28 km of the nearest coast, with a mean distance from the coast of <6.1 km. The habitat suitability modelling study defined suitable Flatback Turtle interesting habitat as water depths of 0–16 m within 5–10 km of the coast. Unsuitable Flatback Turtle

interesting habitat was defined as waters >25 m deep and >27 km from the coast (Ref. 69; Figure 4-2). The OA is located in waters classified as unsuitable for interesting Flatback Turtles.

Consultation undertaken with the lead author of the aforementioned studies (Ref. 21; Ref. 69) and of papers outlined in the Woodside North-west Australia 4D Marine Seismic Survey Environment Plan (Ref. 22) has confirmed that the OA does not support suitable interesting habitat:

“...the location... [is] highly unlikely to host interesting Flatback Turtles from the Montebellos and do not represent important interesting habitat. Flatback turtles are known to spend their interesting time resting on the seabed, the areas you describe are simply too deep to support this behaviour (>73 m).” (Paul Whittock, Pendoley Environmental Pty Ltd, personal communication, October 2019).

Another recent study involving satellite tracking data for 11 Flatback Turtles following nesting on the Lacepede Islands (Ref. 23) found that Flatback Turtles remained at an average distance of 15.75 ± 12.25 km from the nesting beach in water depths of <20 m. Given the OA is located in water depths of greater than ~50 m, and is >25 km from the Montebello Islands, it is considered highly unlikely that interesting turtles will occur within the OA.



Source: Ref. 69

Figure 4-2: Relative suitability of habitat for interesting Flatback Turtles

4.3.3 Fishes, including sharks and rays

Based on searches of the protected matters database (Ref. 12; appendix c), 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
Blind Cave Eel		✓	✓
Blind Gudgeon		✓	✓
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)	✓	✓	✓
Longfin Mako	✓	✓	✓
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		✓	✓

4.3.3.1 Whale shark

The foraging BIA for Whale Sharks overlaps with both the OA and FPZ. The BIA is associated with foraging behaviours during northward migration from Ningaloo Reef / North West Cape along the 200 m isobath during July to November (Ref. 64).

The Whale Shark is widely distributed in Australian waters (Ref. 24); but Ningaloo Reef is the main known seasonal aggregation area (Ref. 75). Whale sharks aggregate off Ningaloo Reef between March and July each year to feed (Ref. 24; Ref. 25). Their presence off Ningaloo Reef has been linked to coral mass spawning timing (Ref. 24). The Whale Shark is a suction filter feeder, with a diet consisting of planktonic and nektonic prey, and feeds at or close to the water's surface by swimming forward with mouth agape, sucking in prey (Ref. 24). While the species is generally encountered close to or at the surface, it will regularly dive

and move through the water column. Following the aggregation period around Ningaloo Reef, their distribution is largely unknown, although three migration routes from Ningaloo reef have been identified through various surveys (Ref. 26):

- north-west, into Indian Ocean
- directly north, towards Sumatra and Java
- north-west, passing through the North West Shelf (NWS) region, travelling along the shelf break and continental slope.

Given that Whale Shark foraging within the BIA typically occurs between July and November, it is not expected that large numbers of Whale Sharks will be encountered within the OA during the 4D MSS.

4.3.3.2 Continental slope demersal fish communities

The OA overlaps with small areas of the Continental Slope Demersal Fish Communities key ecological feature (KEF) (Section 4.5). Fish communities of the upper slope (225–500 m depth) and mid-slope (750–1,000 m depth) display a high degree of endemism, supporting more than 500 fish species, of which up to 76 are endemic (Ref. 27). The high number of species is believed to be associated with areas of enhanced biological productivity as a result of the interaction between seasonal currents and seabed topography.

4.3.4 Seabirds and shorebirds

Based on searches of the protected matters database (Ref. 12; appendix c), 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 seabirds and shorebirds 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		✓	✓
Asian Dowitcher		✓	✓
Australian Fairy Tern	✓	✓	✓
Australian Lesser Noddy			✓
Australian Painted Snipe		✓	✓
Bar-tailed Godwit		✓	✓
Barn Swallow		✓	
Black-browed Albatross			✓
Black-eared Cuckoo		✓	
Bridled Tern		✓	✓
Campbell Albatross, Campbell Black-browed Albatross		✓	✓
Caspian Tern		✓	✓
Cattle Egret		✓	
Christmas Island White-tailed Tropicbird, Golden Bosunbird	✓	✓	✓
Common Greenshank, Greenshank		✓	✓

Common name	OA	EMBA	EEA
Common Noddy	✓	✓	✓
Common Sandpiper	✓	✓	✓
Crested Tern		✓	
Curlew Sandpiper	✓	✓	✓
Eastern Curlew, Far Eastern Curlew	✓	✓	✓
Fairy Tern		✓	
Flesh-footed Shearwater		✓	✓
Fork-tailed Swift		✓	✓
Great Frigatebird, Greater Frigatebird	✓	✓	✓
Greater Crested Tern		✓	✓
Greater Sand Plover, Large Sand Plover			✓
Grey Falcon		✓	✓
Grey Wagtail		✓	✓
Indian Yellow-nosed Albatross			✓
Lesser Frigatebird, Least Frigatebird	✓	✓	✓
Little Tern			✓
Night Parrot		✓	✓
Northern Giant Petrel			✓
Northern Siberian Bar-tailed Godwit, Russkoye Bartailed Godwit		✓	✓
Oriental Plover, Oriental Dotterel		✓	✓
Oriental Pratincole		✓	✓
Osprey	✓	✓	✓
Pectoral Sandpiper	✓	✓	✓
Rainbow Bee-eater		✓	
Red Knot	✓	✓	✓
Red-tailed Tropicbird			✓
Roseate Tern		✓	✓
Sharp-tailed Sandpiper	✓	✓	✓
Shy Albatross			✓
Silver Gull		✓	
Soft-plumaged Petrel		✓	✓
Sooty Tern		✓	
Southern Giant Petrel	✓	✓	✓
Southern Royal Albatross			✓
Streaked Shearwater	✓	✓	✓
Wandering Albatross			✓
Wedge-tailed Shearwater		✓	✓
White-bellied Sea-Eagle		✓	

Common name	OA	EMBA	EEA
White-capped Albatross			✓
White-tailed Tropicbird			✓
White-winged Fairy-wren (Barrow Island), Barrow Island Black-and-white Fairy-wren		✓	✓
Yellow Wagtail		✓	✓

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 Shearwater	Foraging	Early January to early December, mainly April to November			✓
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			✓
White-faced Storm petrel	Foraging (in high numbers)	(not defined in BIA database)			✓
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			✓				✓	✓
Mermaid Reef - Rowley Shoals ³			✓					✓

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

4.3.5.1 Operational area

CAPL has conducted extensive surveys within the WA-46-L, WA-47-L, and WA-48-L production licences, and within the vicinity of the Wheatstone platform, to understand the nature and composition of habitat and seabed sediments, and thus provide accurate bathymetry for geohazard assessment and engineering design. These surveys comprise high-resolution geophysical surveys, predominantly supported by seabed sampling campaigns. Data from these surveys were interpreted to characterise benthic substrate.

The benthic habitat within the production licences predominantly comprise soft substrate (Ref. 90). For example, imagery from these surveys indicate that the seabed around the Wheatstone LNG Project subsea infrastructure such as flowlines and drill centres, mostly comprises unvegetated, soft, and unconsolidated sediments with a low but varying degree of benthic invertebrate habitation (Figure 4-3, Figure 4-4) (Ref. 90).

The Wheatstone platform is on a ridgeline (~11 km long), in an area of hard substratum. Much of the seafloor at the Wheatstone platform and its immediate vicinity comprises hard rock with a thin veneer of sand (Ref. 91). The ridgeline is not an isolated area of hard substratum; with additional areas of hard substratum known to occur to the northeast and southeast of the Wheatstone platform. Hard substratum may support higher amounts of benthic fauna (such as sponges and soft corals), relative to soft substratum (Ref. 92).

Based on studies undertaken for the Wheatstone LNG Project, the categories of marine habitats and associated benthic fauna identified around the Wheatstone platform are described in more detail below.

Surveys for the Wheatstone LNG Project completed during 2010 indicated that benthic habitats were characterised by 2–10% cover of sessile benthic invertebrates (Ref. 90). The dominant sessile benthic invertebrates on the ridgeline were gorgonians and sponges (Ref. 90). A subsequent survey in 2016 found the dominant benthic organisms on the ridgeline included gorgonians, antipatharians (black coral) and hydrozoans (Ref. 94). Overall, the percentage cover and density of benthic organisms were low and spatially variable (Ref. 94). Findings reported in 2010 (Ref. 90) and 2016 (Ref. 94) are similar to those of other surveys conducted on the NWS, which found hard substratum to be

characterised by epifauna assemblages dominated by gorgonians and sponges (Ref. 95).

The ridgeline will support fish communities that may differ to that found on the adjacent soft substratum, but are likely to be similar to other hard substratum on the NWS. According to Last et al (Ref. 97) there are 1,090 species of fishes in Australia's shelf demersal habitat defined as depths between 40 and 200 m. The exact number found in these depths on the NWS is unclear. Sainsbury et al. (Ref. 98) listed 732 species from shelf waters (30–150 m) between Exmouth and the Gulf of Carpentaria. Allen and Swainston (Ref. 99) listed 1062 species for shelf waters (mainland to outer NWS) of northern WA. Only a small sub-set of these species would be demersal that would largely be restricted to hard substratum. Such species would include groupers (*Epinephelus*) and some species of snapper belonging to the genus *Lutjanus* (Ref. 100).

Seagrasses and macroalgae, which are characteristic of sand habitats and reefs, are unlikely to occur within the Commonwealth waters of the OA (Ref. 101). This is most likely due to low benthic light levels characteristic of deep waters.

Based on available information, the level of diversity does not appear to be greater in the platform area than the remaining area of the ridgeline (Ref. 90). There are no identified ecologically isolated or regionally significant marine habitats found around the Wheatstone platform or in the wider OA (Ref. 90; Ref. 102).

4.3.5.2 Other marine habitat

Rankin Bank is located ~1 km east of the OA and ~12 km east of the FPZ. While Rankin Bank is not protected and is not a KEF, it is the only large, complex bathymetrical feature on the outer western shelf of the West Pilbara region and represents habitats that are likely to play an important role in the productivity of the Pilbara region (Ref. 104). Rankin Bank consists of three submerged shoals delineated by the 50 m depth contour with water depths of ~18–30.5 m (Ref. 104). In 2013, AIMS and Woodside co-invested in a project to better understand the habitats and complexity of the submerged shoal ecosystems. Rankin Bank represents a diverse marine environment, predominantly composed of consolidated reef and algae habitat (~55% cover), followed by hard corals (~25% cover), unconsolidated sand/silt habitat (~16% cover), and benthic communities composed of macroalgae, soft corals, sponges and other invertebrates (~3% cover) (Ref. 104). Hard corals are a significant component of the benthic community of some parts of the bank, with abundance in the upper end of the range observed elsewhere on the submerged shoals and banks of north-west Australia (Ref. 105).



Figure 4-3: Seabed survey image showing typical seabed habitat at IAG-1 drill centre for the Wheatstone Project



Figure 4-4: Seabed survey image showing typical seabed habitat at WST-3 drill centre for the Wheatstone Project

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 EEA) specific to this EP are identified below.

The State-managed commercial fisheries with fishing effort recorded over a 20-year period (1999–2019) (Ref. 28) 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. None of these fisheries operated more than three vessels within the OA in 2018. The Mackerel Managed Fishery utilises near-surface trolling or jig fishing methods, with vessels primarily active during May to November (Ref. 29), and with the bulk of the catch typically taken north of the OA within Kimberley waters (Ref. 30). 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. 30). 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. 29).

The Commonwealth-managed commercial fisheries with fishing effort recorded over a five-year period (2015–2020) (Ref. 30) 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). 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. 30). 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		✓	✓
Pearl Oyster Managed Fishery			✓
Pilbara Crab Managed Fishery		✓	✓

Fishery	OA	EMBA	EEA
Pilbara Fish Trawl (Interim) Managed Fishery		✓	✓
Pilbara Line Fishery	✓	✓	✓
Pilbara Trap Managed Fishery	✓	✓	✓
West Australian Sea Cucumber (Beche-De-Mer) Fishery		✓	✓
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 Demersal Scalefish (Interim) Managed Fishery			✓
West Coast Rock Lobster Fishery			✓
Statewide			
Marine Aquarium Fish Managed Fishery		✓	✓
Specimen Shell Managed Fishery		✓	✓

Table 4-12: Presence of recent (2015-2020) 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			✓

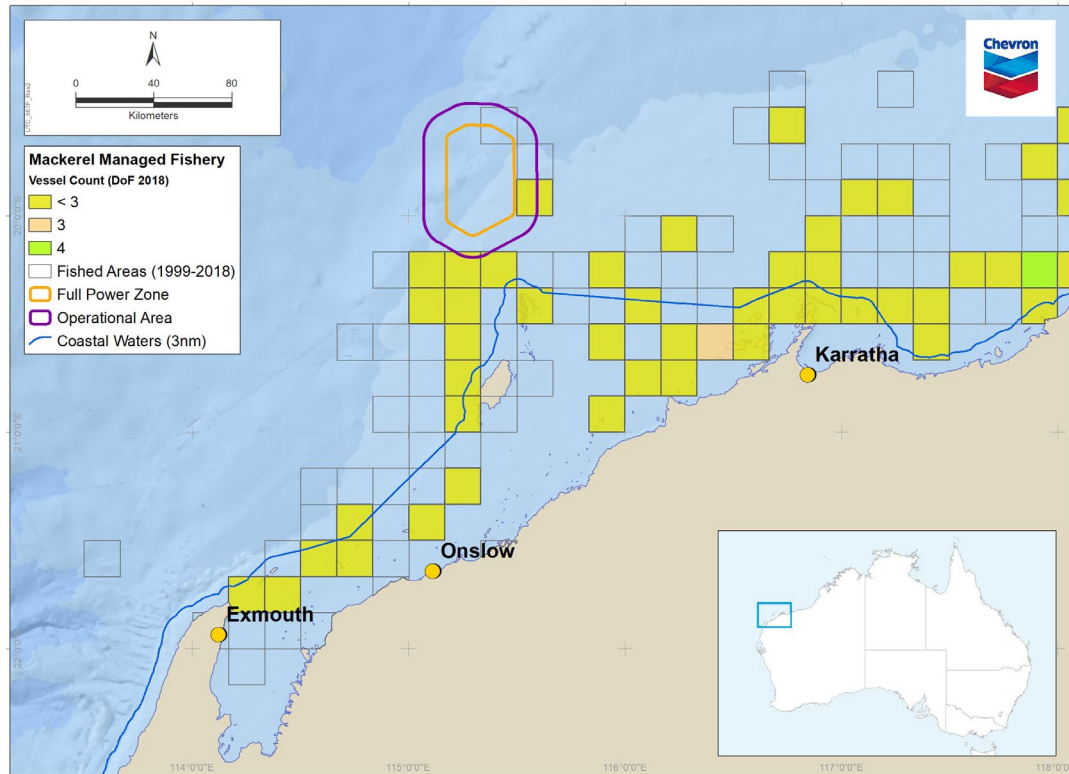


Figure 4-5: Recorded fishing effort (1999–2019), and active vessel counts for 2018, for the Mackerel Managed Fishery within the vicinity of the OA

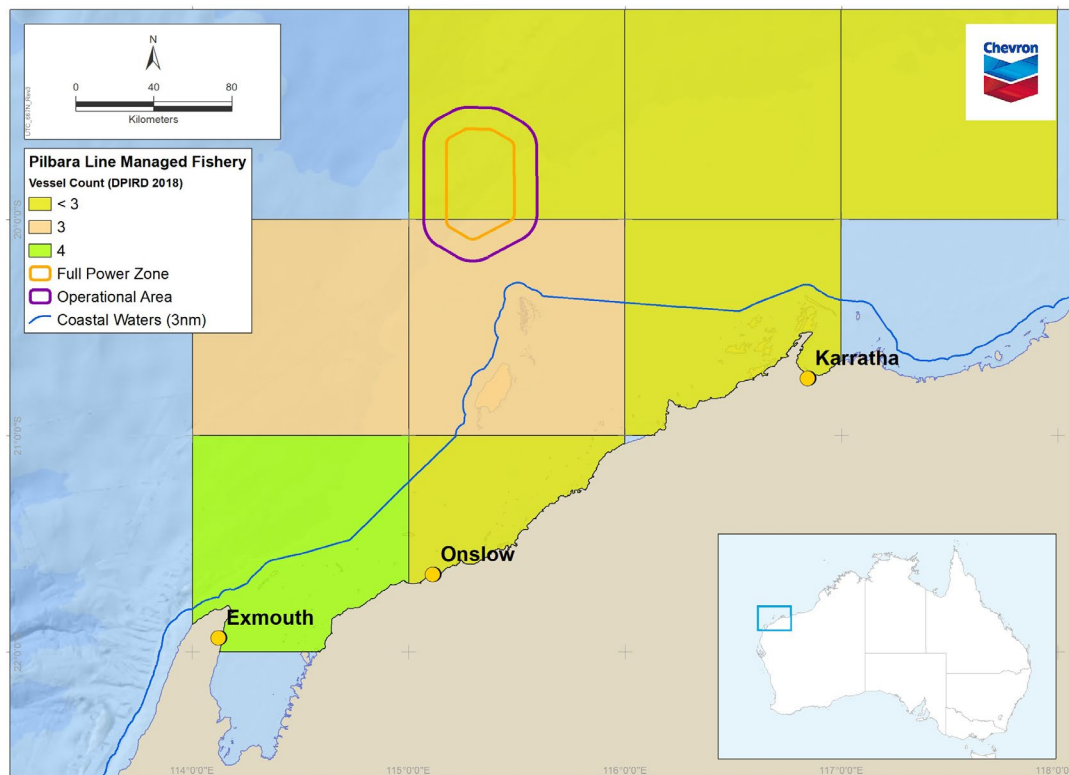


Figure 4-6: Recorded fishing effort (1999–2019), and active vessel counts for 2018, for the Pilbara Line Fishery within the vicinity of the OA

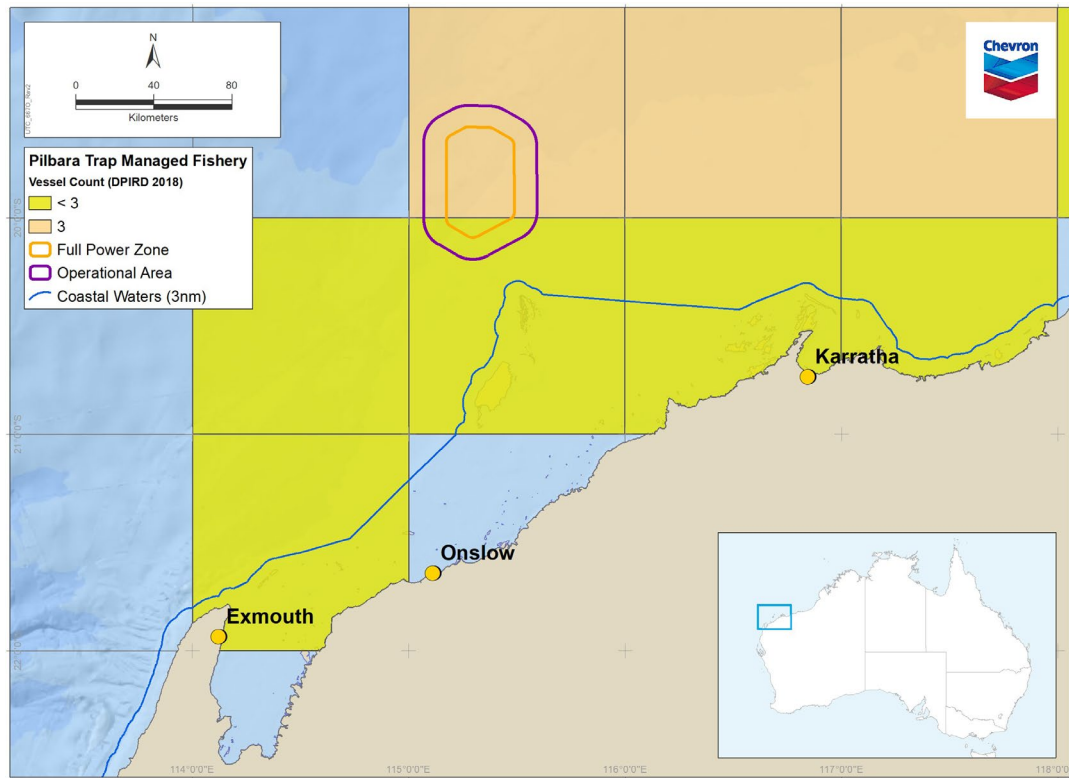
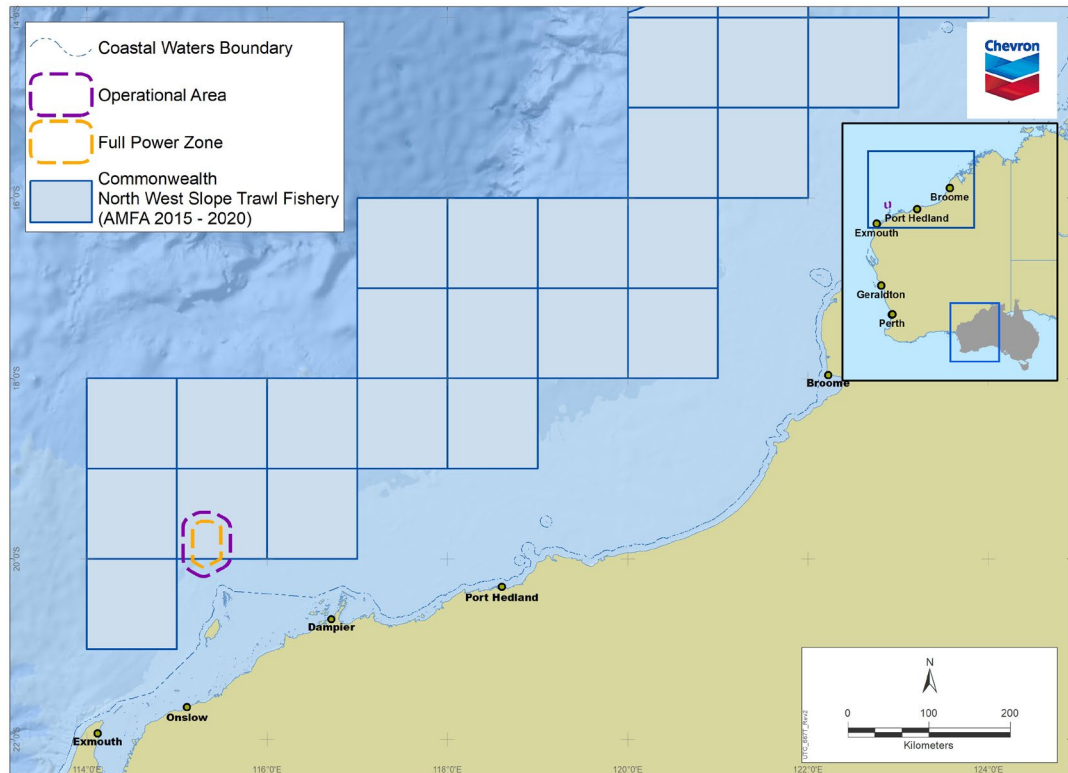


Figure 4-7: Recorded fishing effort (1999–2019), and active vessel counts for 2018, for the Pilbara Trap Managed Fishery within the vicinity of the OA



Source: Fisheries data were supplied by the ABARES from data collected by the AFMA. 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 (2015-2020) for the North West Slope Trawl Fishery within the vicinity of the OA

4.4.1.1 Commercially targeted fish stocks

The North-west marine region provides fishing grounds for several commercial fisheries which target a variety of demersal and pelagic fish species. Indicator species can be established based on the spawning and distribution of fish species that are used to provide an indication of fish stocks targeted by fisheries and are relevant to the management of commercial fish stocks. The fish indicator species that are of relevance to the OA are Goldband Snapper, Rankin Cod, Red Emperor, Blue-spotted Emperor, Giant Ruby Snapper and Spanish Mackerel.

All of these indicator fish species are summarised in Table 4-13.

Table 4-13: Key indicator fish species relevant to the 4D MSS

Species	Distribution and habitat	Biological stock range	Reproduction and recruitment	Spawning season	References
Goldband Snapper	Goldband Snapper occur around offshore reefs, shoals, and areas of hard flat bottom with occasional benthos or vertical relief in depths of 50-200 m. Juveniles typically occur on uniform sedimentary habitat with no relief. Goldband Snapper are widely distributed throughout northern Australia, from the Gascoyne region of WA to SE Queensland.	Australian populations of Goldband Snapper are likely to form a single biological stock and there is gene flow among Goldband Snapper from the Northern Territory (Timor Sea and Arafura Sea) and between the Western Australian management units (Kimberley, Pilbara and Gascoyne).	<p>Goldband Snapper are highly fecund, serial, broadcast spawners and they can produce several million eggs per season. Goldband Snapper can spawn approximately every three days / every week during the spawning period.</p> <p>Goldband Snapper spawn throughout their range rather than aggregate at specific locations.</p> <p>Juveniles remain in offshore waters with the adult spawning biomass but are found in association with different habitat.</p> <p>Fish are estimated to reach maturity after approximately 4.6 years</p> <p>Stock status: Sustainable</p>	October – May (extended peak spawning period)	<p>Ref. 205</p> <p>Ref. 218</p> <p>Ref. 208</p> <p>Ref. 209</p> <p>Ref. 203</p> <p>Ref. 220</p>
Rankin Cod	Rankin Cod are a demersal species distributed in continental shelf waters throughout tropical and sub-tropical northern Australia, from Shark Bay in WA to the NT in depths of 10-150 m. They are generally found in warm coastal waters in association with drop-offs and deep rocky reefs. Juveniles are generally found in inshore coral reefs.	There is low genetic variation and extensive connectivity among populations over large distances (at least 1,400 km). There is no evidence of discrete breeding populations of Rankin Cod in Western Australia, indicating that there is a single biological stock between Shark Bay and the Kimberley.	Rankin Cod are highly fecund, serial, broadcast spawners that release eggs over a protracted spawning period (8-10 months of the year) and appear to spawn across much of the continental shelf of the Pilbara region. Juveniles generally occur inshore from the adults in deeper waters, indicating there may be some movement of juveniles offshore with increasing age. Fish are	The species spawns for 8-10 months of the year in the Pilbara region. The main spawning season is June – December and in March (peaks August – October).	<p>Ref. 205</p> <p>Ref. 206</p> <p>Ref. 217</p> <p>Ref. 203</p> <p>Ref. 220</p>

Species	Distribution and habitat	Biological stock range	Reproduction and recruitment	Spawning season	References
			estimated to reach maturity after approximately 2 years. Stock status: Sustainable		
Red Emperor	Red Emperor occur from the central west coast of WA to southern Queensland. Red Emperor are widely distributed across the continental shelf and associated with reefs, lagoons, epibenthic communities, limestone sand flats and gravel patches in depths of 10-180 m.	The reproductive biology of Red Emperor results in a very broad distribution of eggs and larvae, which results in genetic connectivity over a wide geographic range. There is extensive connectivity and gene flow among populations across northern Australia (Queensland to Shark Bay in WA), indicating a single genetic stock. There is no evidence of discrete breeding populations between regions in WA.	Red Emperor are highly fecund, serial, broadcast spawners. Females release numerous batches of eggs over an extended spawning period. Juvenile fish are more common in nearshore waters and move offshore and recruit to the stock as they mature. Fish are estimated to reach maturity after approximately 4 – 6 years. Stock status: Sustainable	The species spawns for 10-12 months of the year on the north coast of WA. The main spawning season is September – June (with bimodal peaks September – November and January – March).	Ref. 207 Ref. 205 Ref. 218 Ref. 210 Ref. 203 Ref. 220
Blue-spotted Emperor	The Blue-spotted Emperor is distributed primarily from around Geraldton and the Abrolhos Islands in WA to Darwin in the NT. Greatest abundances are noted in the western Pilbara region. The species is often found in association with shallow reef, sand and mud areas at depths of 10-150 m.	There is extensive connectivity among populations of Blue-spotted Emperor over large distances, and there is considered to be a single biological stock in WA and potentially as far as the Northern Territory.	Blue-spotted Emperor are highly fecund, serial, broadcast spawners that release eggs over a protracted spawning period (11 months of the year). Fish are estimated to reach maturity after approximately 18 months. Stock status: Sustainable	The species spawns for 11 months of the year. The main spawning season is July – March (extended peak spawning period).	Ref. 218 Ref. 217 Ref. 205 Ref. 203 Ref. 220
Giant ruby Snapper	Ruby Snapper occurs across the Indo-West pacific region at depths of 150-480 m. In Australia, ruby snapper is recorded from Geraldton, WA to north-eastern Queensland.	The extent of the biological stock of Ruby Snapper is uncertain.	Like other snappers, Ruby Snapper are understood to be highly fecund, serial, broadcast spawners. Stock status: Sustainable	December-April (peak spawning period January-March).	Ref. 215 Ref.219 Ref. 205 Ref. 203

Species	Distribution and habitat	Biological stock range	Reproduction and recruitment	Spawning season	References
					Ref. 220
Spanish Mackerel	Spanish Mackerel are a pelagic species that are widely distributed throughout Indo-West Pacific waters. In Australia, Spanish Mackerel are found from approximately Geraldton in WA to Northern NSW. Adult movements in Australian waters occur over ranges of 100 – 300 km at depths from 1 m to at least 50 m.	Spanish Mackerel in northern Australia form three distinct genetic stocks: an east coast stock, a Torres Strait stock, and a single stock across the north and west coasts of Australia (Northern Territory and WA). Consequently, the whole of the WA Mackerel Managed Fishery (spanning the Kimberley, Pilbara and Gascoyne regions) is defined as a single stock.	Spanish Mackerel spawning occurs in coastal waters. They are serial spawners and alongshore dispersal of eggs maintains genetic homogeneity. Females are capable of producing a batch of hundreds of thousands of eggs every 1-3 days during the spawning season, though a spawning frequency of 1.9 to 5.9 days has also been reported. Larvae are commonly associated with reef lagoonal areas, before juveniles move to estuary and foreshore nursery and feeding grounds where they tend to remain for the first year of life. Fish are estimated to reach maturity after approximately 2 years. Stock status: Sustainable	September – December (peak spawning).	Ref. 211 Ref. 204 Ref. 212 Ref. 213 Ref. 214 Ref. 220

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 OA is located to the south-east and west of the nearest NWS shipping fairways (Figure 4-9). Commercial vessels transiting the NWS are expected to remain within the fairways and therefore will not typically coincide with the OA. Vessel traffic within and around the OA is most likely to comprise offshore support vessels for petroleum activities.

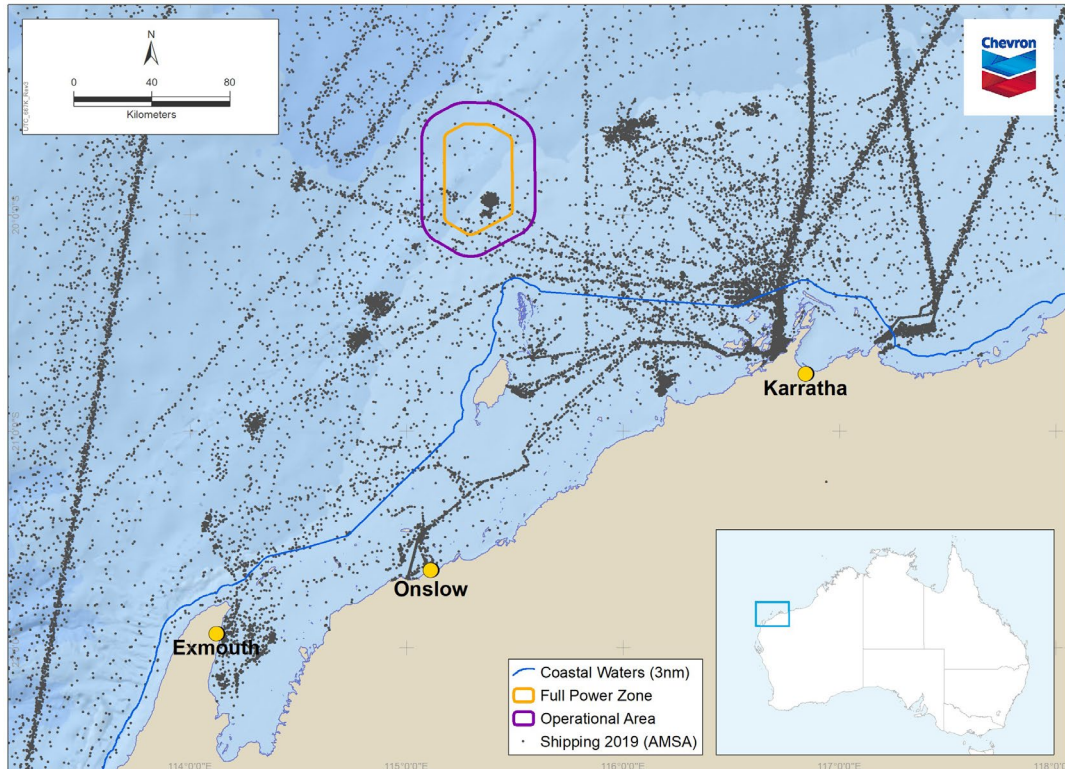


Figure 4-9: Vessel traffic within the vicinity of the OA

4.4.3 Other petroleum activities

The CAPL Wheatstone Platform and Woodside Energy Pluto-A Platform are located within the OA (Figure 3-2). Both platforms have gazetted petroleum safety zones (PSZs) of 500 m in place under the OPGGS Act.

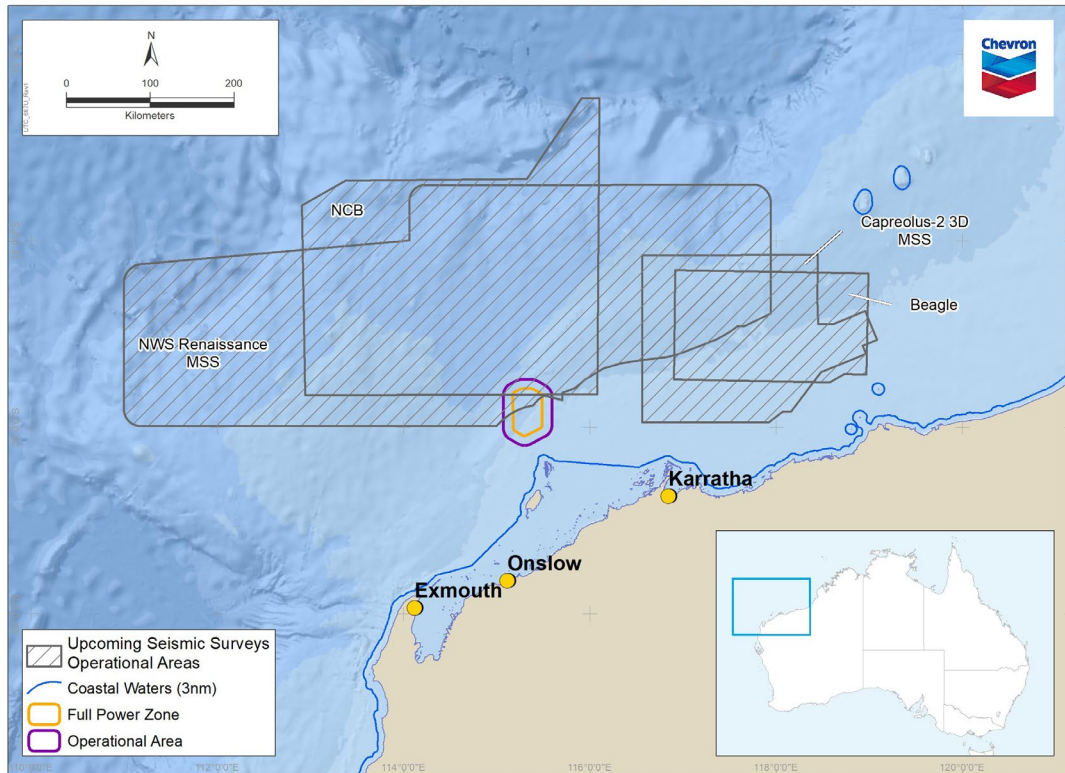
There are other operational platforms located outside the OA, the closest being:

- Santos operated John Brooks platform (~32 km from OA, and ~43 km from FPZ)
- Santos operated Wonnich platform (~36 km from OA, and ~47 km from FPZ)
- Woodside Energy operated Goodwyn Alpha platform (~32 km from OA, and ~43 km from FPZ).

In order to identify the potential for concurrent seismic surveys, surveys currently being assessed by NOPSEMA or approved (but not yet conducted) were identified

from the NOPSEMA website (Ref. 187). Those surveys that may occur concurrently within a ~100 km of the OA are described in Table 4-14, and approximate OAs shown in Figure 4-10.

Consultation with seismic operators for the surveys described in Table 4-14 during January 2022 indicate that no concurrent activities for the two surveys (Rollo Multiclient MSS or the NWS Renaissance North Multi Client MSS) with overlapping OAs with the Wheatstone 4D MSS are currently scheduled. The third survey (Capreolus-2 3D MSS) may occur at a similar time; however, this survey is located ~100 km east from the 4D MSS.



'NWS Renaissance MSS' refers to the North West Shelf Renaissance North Multi Client Marine Seismic Surveys described in Table 4-14. 'Beagle' and 'NCB' (Northern Carnarvon Basin) are part of the Rollo Multiclient Marine Seismic Surveys described in Table 4-14

Figure 4-10: Proposed seismic surveys within the vicinity of the OA

Table 4-14: Proposed seismic surveys within the vicinity of the OA

Activity	Organisation	Status	Description	Interaction with Wheatstone 4D MSS
Capreolus-2 3D Marine Seismic Survey 2020 – 2024	TGS-NOPEC Geophysical Company Pty Ltd	<ul style="list-style-type: none"> Approval: EP accepted by NOPSEMA on 10 November 2020. Activity: Not commenced Approval expiry: November 2025 	<ul style="list-style-type: none"> Up to 190 days to acquire 10,000 km² No activity within southern OA during October to June No activity within northern OA during April to August, and October to December 	<ul style="list-style-type: none"> Area: ~100 km west of the OA Timing: Potential to occur at same time
Rollo Multiclient Marine Seismic Surveys	PGS Australia Pty Ltd	<ul style="list-style-type: none"> Approval: EP accepted by NOPSEMA on 4 October 2018. Activity: Commenced Approval expiry: October 2023 	<ul style="list-style-type: none"> Two OAs: Northern Carnarvon Basin, Beagle 3D seismic surveys over specific petroleum titles and adjacent vacant acreage over a period of five years, Within the OAs a maximum of two surveys may be undertaken at the same time greater than 40 km apart. 	<ul style="list-style-type: none"> Area: survey OAs overlap Timing: Potential to occur at same time
North West Shelf Renaissance North Multi Client Marine Seismic Surveys	TGS-NOPEC Geophysical Company Pty Ltd	<ul style="list-style-type: none"> Approval: EP accepted by NOPSEMA on 13 June 2018. Activity: Not commenced Approval expiry: June 2023 	<ul style="list-style-type: none"> Proposed acquisition of up to 25,000 km² of 3D seismic data over a period of two years. 	<ul style="list-style-type: none"> Area: survey OAs overlap Timing: Potential to occur at same time

4.4.4 Tourism and recreation

Tourism and recreation activities are unlikely to occur within the OA, due to the distance offshore and the water depths (ranging from ~50–1,250 m). Recreational fishing in the Northwest Shelf Province is mainly concentrated around the coastal waters and islands (including Dampier Archipelago, Ningaloo Marine Park, North West Cape area, Montebello Islands and other islands and reefs in the region). Occasional recreational fishing occurs at Rankin Bank (located ~1 km east of the OA and ~12 km east of the FPZ). Rankin Bank has been shown to support a diverse fish assemblage that attracts recreational fishing to the area.

The Montebello Islands Marine Park (overlaps with the OA) is the next closest location for tourism to the OA, with some charter boat operators taking visitors to remote islands for diving and recreational fishing.

Recreational diving is typically restricted to shallow water depths (e.g., up to 30 m, based on the advanced open water diving certification prescribed depth limit). Thus, recreational diving is unlikely within the OA due to the water depths being greater than ~50 m. A review of charter boat websites did not identify diving activity at Rankin Bank.

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 4-15 and Table 4-16 respectively.

The OA overlaps ~1.0% of the ancient coastline at 125 m depth contour KEF, and ~1.5% of the continental slope demersal fish communities KEF.

Table 4-15: Presence of AMPs

Australian Marine Park	OA	EMBA	EEA
Abrolhos			✓
Argo-Rowley Terrace			✓
Carnarvon Canyon			✓
Gascoyne		✓	✓
Mermaid Reef			✓
Montebello	✓	✓	✓
Ningaloo		✓	✓
Shark Bay			✓

Table 4-16: 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			✓
Perth Canyon and adjacent shelf break, and other Western demersal slope and associated fish communities			✓
Wallaby Saddle			✓
Demersal slope and associated fish communities of the Central Western Province			✓

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 4-17, Table 4-18, and Table 4-19 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. 32) identified that four historic shipwrecks within the OA, and several occur within the spatial extent of the EMBA and EEA; and no historic sunken aircrafts were identified within the OA, EMBA, or EEA. The historic shipwrecks within the OA are *Curlew* (1911), *Marietta* (1905), *Wild Wave (China)* (1873), and *Vianen* (1628).

Table 4-17: World Heritage properties

World Heritage Properties	OA	EMBA	EEA
The Ningaloo Coast		✓	✓

Table 4-18: National Heritage places

National Heritage Properties	OA	EMBA	EEA
<i>HMAS Sydney II</i> and <i>HSK Kormoran</i> shipwreck sites			✓
The Ningaloo Coast		✓	✓

Table 4-19: Commonwealth Heritage places

Commonwealth Heritage Properties	OA	EMBA	EEA
<i>HMAS Sydney II</i> and <i>HSK Kormoran</i> shipwreck sites			✓
Learmonth Air Weapons Range Facility			✓

Commonwealth Heritage Properties	OA	EMBA	EEA
Mermaid Reef - Rowley Shoals			✓
Ningaloo Marine Area – Commonwealth Waters		✓	✓

4.7 Summary of seasonal sensitivities

Periods of the year coinciding with key environmental sensitivities, including EPBC Act listed Threatened and/or Migratory species, potentially occurring within the OA are presented in Table 4-20.

Table 4-20: Seasonal presence of environmental sensitivities within the vicinity of the OA

Species	January	February	March	April	May	June	July	August	September	October	November	December
Seismic acquisition												
Pygmy Blue Whale- northern migration (Montebello region)												
Pygmy Blue Whale- southern migration (Montebello region)												
Humpback Whale migration												
Flatback Turtle Interesting (nesting at Montebello Islands)												
Whale Shark- foraging/aggregation near Ningaloo												
Whale Shark - foraging BIA												
Wedge-tailed Shearwater (foraging)												
Australian Fairy Tern (foraging)												
Goldband Snapper spawning (extended peak spawning)												
Rankin Cod spawning												
Red Emperor spawning												
Blue-spotted Emperor (extended peak spawning)												
Giant Ruby Snapper spawning												
Spanish Mackerel spawning												
	Planned survey acquisition											
	Species may be present/display biologically important behaviour in the region											
	Peak period. Presence of animals reliable and predictable each year.											

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. 33) 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. 34) and the HB 203:2012 *Managing environment-related risk* (Ref. 35).

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 previous Wheatstone 3D MAZ seismic survey
- 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). 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., physical presence, planned discharges).

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
- air emissions
- light emissions
- underwater sound
- invasive marine pests
- planned discharges
- unplanned releases.

5.4 Identification of 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

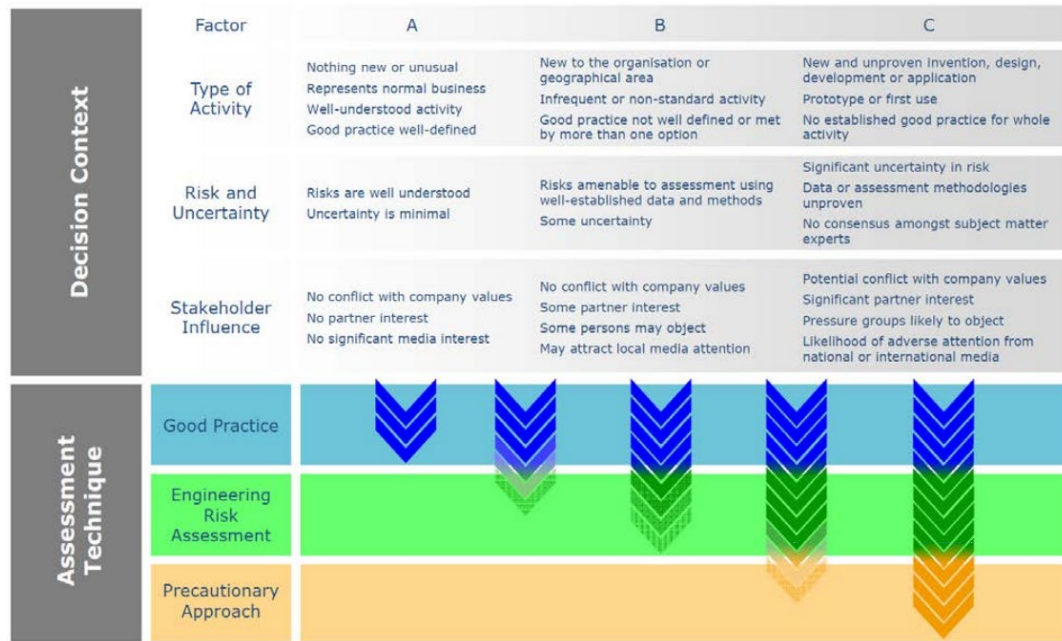
In alignment with NOPSEMA's ALARP guidance note (Ref. 36), CAPL has adapted the approach developed by Oil and Gas UK (OGUK) (Ref. 37) for use in an environmental context to determine the assessment technique required to demonstrate that impacts and risks are ALARP. Specifically, the framework considers 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. 36)

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 Section 6. The assessment techniques considered include:

- good practice
- engineering risk assessment
- precautionary approach.

5.5.2.2 Good practice

OGUK (Ref. 37) 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. 37), 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. 37) 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 acceptability criteria

NOPSEMA provides guidance on demonstrating that impacts and risks will be of an ‘acceptable level’ (Ref. 8). 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. 36), 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. 8) 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. 8), 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	4	9	A	Yes	Yes
0	Air emissions	6	–	–	–	A	Yes	Yes
6.4	Light emissions	6	6	5	10	A	Yes	Yes
6.5	Underwater sound—seismic acquisition	5	5	3	7	B	Yes	Yes
6.6	Underwater sound—field support operations	5	5	6	10	A	Yes	Yes
6.7	Invasive marine pests	–	2	6	7	A	Yes	Yes
6.8	Planned discharges—vessel operations	6	6	6	10	A	Yes	Yes
6.9	Unplanned release—waste	–	6	5	10	A	Yes	Yes
6.10	Unplanned release—loss of equipment	–	6	4	9	A	Yes	Yes
6.11	Unplanned release—loss of containment	–	5	5	9	A	Yes	Yes
6.12	Unplanned release—vessel collision event	–	5	5	9	A	Yes	Yes
6.13.4.1	Ground disturbance – shoreline spill response	–	5	5	9	A	Yes	Yes
6.13.4.2	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			
<p>Activities identified as having the potential to result in an interaction with other marine users are:</p> <ul style="list-style-type: none"> • presence of vessels within the OA during the seismic survey • presence of towed equipment from the seismic vessel. 			
Potential impacts and risks			
Impacts	C	Risks	C
N/A	–	<p>Unplanned interactions with other marine users may result in:</p> <ul style="list-style-type: none"> • disruption to commercial shipping and fishing vessels • disruption to other petroleum facilities or activities 	<p>6</p> <p>6</p>
Consequence evaluation			
<p>Disruption to commercial shipping and fishing vessels</p> <p>The seismic vessel and at least one of the support vessels will be present within the OA for the duration of the survey (~75 days during mid-December to mid-April; Section 3.1.3). The second support vessel will either be present within the OA or transiting to/from port during the survey period. There will be a 500 m SNA around the seismic vessel and towed array, which will be maintained at all times except by those vessels providing supply to the seismic vessel (e.g., refueling, resupply, etc.). The OA consists of an area of ~3,730 km².</p> <p>The use of vessels during the seismic survey (particularly the seismic vessel due its limited maneuverability) has the potential to result in a disruption to other marine users, including commercial shipping or fishing vessels.</p> <p>As identified in Section 4.4.1, there are four commercial fisheries (three State, one Commonwealth) that have recent fishing effort that overlaps with the OA.</p> <p>The State-managed Mackerel Managed Fishery has a management area that overlaps with the OA (specifically with Area 2 of the fishery). The extent to which the OA overlaps Area 2 of the fishery management area is <1%. Limited fishing effort was recorded within the 10 nm graticular blocks that overlap the OA (Ref. 30; Figure 4-5). Specifically, during 2018, fishing effort was recorded in blocks outside the FPZ with <3 fishing vessels present (Figure 4-5). The Mackerel Managed Fishery vessels are primarily active during May to November (Ref. 29), which is outside of the proposed timing of the seismic survey (Section 3.1.3).</p> <p>The State-managed Pilbara Line Fishery has a management area that overlaps with the OA. The extent to which the OA overlaps the fishery management area is <1%. The Pilbara Line Fishery operates on an exemption basis which restricts vessels to operating within a nominated 5-month block period each year. Recorded fishing effort during 2018 indicated that up to 3 vessels may have been operating within the OA (Figure 4-6).</p> <p>The State-managed Pilbara Trap Fishery has a management area that overlaps with the OA (specifically with the Schedule 1 [open waters] area of the fishery). The extent to which the OA overlaps Schedule 1 of the fishery management area is <1%. Recorded fishing effort during 2018 indicated that up to 3 vessels may have been operating within the OA (Figure 4-7).</p> <p>The Commonwealth-managed North West Slope Trawl Fishery has a management area that overlaps with the OA. The extent to which the OA overlaps this trawl fishery management area is <1%. Fishing activity within the Commonwealth trawl fisheries is restricted to waters >200 m water depth. Fishing effort was recorded within the 60 nm graticular block that overlaps the OA each year during the 2015–2020 period (Ref. 30; Figure 4-8). While fishing intensity data is not available for this fishery, vessel activity is expected to be relatively low given that 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])</p> <p>The OA is located outside the North West Shelf shipping fairways and commercial vessel traffic density within and around most of the OA is low, with the exception of around existing petroleum infrastructure (risk evaluated separately below) (Figure 4-9).</p> <p>Therefore, the presence of vessels within the OA during the seismic survey are not expected to significantly affect commercial shipping operators. Any deviation required by these vessels is not</p>			

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 vessels is not expected to cause significant impacts to other commercial shipping or fishing vessels, 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).

Disruption to other petroleum facilities or activities

There are two existing oil and gas production facilities within the OA: the CAPL-operated Wheatstone Platform and the Woodside-operated Pluto Platform; both of which have a 500 m radius Petroleum Safety Zone (PSZ) in place. The acquisition lines for the seismic survey have been designed such that the seismic vessel and towed array should avoid both platform PSZs. Vessels will adhere to entry prohibitions into designated PSZs, unless an application for entry and presence has been approved.

The potential for concurrent seismic activities within the vicinity of the OA is possible based on three existing approved seismic surveys (Section 4.4.3). Two of these approved survey scopes overlap the OA, while the third is ~100 km east (Figure 4-10). Consultation with seismic operators for the surveys described in Table 4-14 indicate that no concurrent activities for the two surveys (Rollo Multiclient MSS or the NWS Renaissance North Multi Client MSS) with overlapping OAs with the Wheatstone 4D MSS are currently scheduled. The third survey (Capreolus-2 3D MSS) described in Table 4-14 may occur at a similar time, however this survey is located ~100 km east from the 4D MSS. Should concurrent seismic surveys be scheduled within proximity to each other, these are typically managed via simultaneous operations plans (SIMOPS) and time-sharing arrangements.

The physical presence of vessels within the OA is not expected to cause significant impacts to other petroleum facilities or activities, 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).

ALARP decision context justification

Offshore commercial vessel operations 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 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	<p>Communicating the activity details, location, requested SNA, and presence of vessels to other marine users ensures they are informed and aware, thereby reducing the risk of unplanned interactions.</p> <p>In addition to consultation undertaken during the preparation of this EP (Section 2.6), relevant stakeholders will also be notified at least four weeks prior to the commencement of activities (Table 2-7).</p>
Maritime safety information	<p>Maritime safety information, such as AUSCOAST radio-navigation warnings, are issued by the Joint Rescue Coordination Centre (JRCC) Australia, part of AMSA.</p> <p>Under the <i>Navigation Act 2012</i>, 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.</p> <p>As per Table 2-7, maritime safety information (radio-navigation warnings and/or Notice to Mariners) will be issued; thus enabling other marine users to also safely plan their activities.</p>

Marine Safety Reliability and Efficiency (MSRE) process	<p>CAPL's <i>ABU MSRE Corporate OE Process</i> (Ref. 42) ensures that various legislative requirements are met. These include:</p> <ul style="list-style-type: none"> crew meet the minimum standards for safely operating a vessel, including watchkeeping requirements navigation, radar equipment, and lighting meets industry standards. <p>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 SNAs.</p>	
Managing Safe Work (MSW) process	<p>CAPL's <i>Managing Safe Work OE Process</i> (Ref.) 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.</p> <p>Where required under the MSW process, a SIMOPS Plan will be developed to identify and manage hazards arising from the 4D MSS activities and other planned petroleum activities when occurring within the same area.</p>	
Petroleum safety zones	<p>PSZs are specified areas surrounding petroleum wells, structures, or equipment which vessels or classes of vessel are prohibited from entering or being present in. In compliance with the OPGGS Act, vessel(s) will adhere to vessel entry prohibitions into designated PSZs, unless an application for entry and presence has been approved.</p>	
Adjustment protocol	<p>CAPL will consider an evidence-based adjustment protocol for the commercial fishing sector should fishers be verifiably impacted to a commercially material extent by the 4D MSS (Section 7.3.4.1). CAPL will assess claims from commercial fishing license holders for temporary loss of catch, displacement, or equipment loss/damage, occurring within the OA and during the 4D MSS.</p>	
Additional control measures and cost-benefit analysis		
Control measure	Benefit	Cost
N/A	N/A	N/A
Likelihood and risk level summary		
Likelihood	<p>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. As such, CAPL consider that the likelihood of the consequence occurring is Unlikely (4).</p>	
Risk level	Very low (9)	
Determination of acceptability		
Principles of ESD	<p>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.</p> <p>The consequence associated with this aspect is Incidental (6). Therefore, no further evaluation against the Principles of ESD is required</p>	
Relevant environmental legislation and other requirements	<p>Legislation and other requirements considered relevant for this aspect include:</p> <ul style="list-style-type: none"> Commonwealth <i>Navigation Act 2012</i>. 	
Internal context	<p>These CAPL environmental performance standards or procedures were deemed relevant for this aspect:</p> <ul style="list-style-type: none"> MSRE process (Ref. 42) MSW process (Ref. 41). 	

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 and expected completion dates of the activity and any relevant SNA information prior to commencing offshore activities	Stakeholder consultation records
	Maritime safety information Notify relevant agency of activities, vessel movements, and requested SNA, to enable them to generate radio-navigation warnings and/or Notice to Mariners prior to commencing offshore activities	Record of lodgment 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 Where required, CAPL will develop and implement SIMOPS Plan(s) to manage 4D MSS and other planned petroleum activities	Records indicate that where identified as relevant, a SIMOPS Plan has been developed and implemented
	Petroleum safety zones Vessels will adhere to entry prohibitions into designated PSZs, unless an application for entry and presence has been approved	Records demonstrate that vessel activity did not occur within designated petroleum safety zones, without an approved application for entry and presence, within the OA
Reduce the impact to commercial fishery licence holders within the OA from petroleum activities	Adjustment protocol CAPL will assess any evidence-based claims from commercial fishery licence holders for compensation in line with the adjustment protocol (Section 7.3.4.1)	Records show that any evidence-based claim from commercial fishery licence holders was assessed and decision finalised

6.2 Physical presence—marine fauna

Source			
<p>Activities identified as having the potential to result in an interaction with marine fauna are:</p> <ul style="list-style-type: none"> • presence of vessels within the OA during the seismic survey • presence of towed equipment from the seismic vessel. 			
Potential impacts and risks			
Impacts	C	Risks	C
N/A	–	<p>Unplanned interactions with marine fauna may result in:</p> <ul style="list-style-type: none"> • injury or death of marine fauna 	6
Consequence evaluation			
<p>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 and/or critical habitat also overlap with the OA, including:</p> <ul style="list-style-type: none"> • Pygmy Blue Whale (migration and distribution BIAs) • Flatback Turtle (internesting BIA, internesting critical habitat) • Whale Shark (foraging BIA). <p>The <i>Recovery Plan for Marine Turtles in Australia</i> (Ref. 62) identifies vessel disturbance as a key threat; however, it also notes that this is particularly an issue in shallow coastal foraging habitats, internesting areas with high numbers of recreational and commercial craft, or areas of marine development. The Recovery Plan defines the critical habitat for internesting as a distance seaward from nesting critical habitat of 60 km for Flatback Turtles (Ref. 62). However, recent studies (Ref. 69) 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. 62). Whittock et. al. (Ref. 69) 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. 69). This suggests that although the OA does overlap with some internesting critical habitat and internesting buffer BIA, due to the OA being located offshore (>25 km from the Montebello Islands) and with increasing water depths (up to ~1,250 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. The OA within this EP occurs in Commonwealth waters only, does not include shallow coastal habitats, and is not expected to be highly utilised during internesting periods. 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.</p> <p>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. 64], Fin Whale [Ref. 65], Sei Whale [Ref. 66], Humpback Whale [Ref. 67], and Blue Whale [Ref. 68]) indicates that either vessel disturbance or interaction (such as collisions) as a key threat to the recovery of the species.</p> <p>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 (included within reporting requirements in Section 7.4.2) and ensuring that the risk of vessel strike is assessed (see the following text below).</p> <p>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. 70). There have been recorded instances of cetacean deaths in Australian waters (e.g., a Bryde's Whale in Bass Strait in 1992) (Ref. 72), although the data indicates deaths are more likely to be associated with container ships and fast ferries. Mackay et al. (Ref. 73) report that four fatal and three non-fatal collisions with Southern Right Whales were</p>			

recorded in Australian waters between 1950 and 2006, with one fatal and one non-fatal collision reported between 2007 and 2014.

Both the *Conservation Management Plan for the Blue Whale 2015–2025* (Ref. 68) and *Conservation Advice Megaptera novaeangliae Humpback Whale* (Ref. 67) 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. 71) 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 slow moving whilst undertaking the activities within the scope of this EP (Section 3.2), any interaction with marine fauna would not be expected to cause severe injuries.

As described in Section 4.3.1.1, migrating Pygmy Blue Whales are likely to occur in the Exmouth to Montebello Islands region from April to August (northern migration) and from November to December (southern migration). As the 4D MSS is scheduled to occur between mid-December to mid-April there is the possibility that the seismic survey could overlap with the end of the southern migration period (December) and the start of the northern migration period (April). However, as discussed in Section 4.3.1.1, although the defined BIA for Pygmy Blue Whales overlaps the northern part of the OA and FPZ, it is expected based on recent satellite tracking and acoustic detection that Pygmy Blue Whales are likely to travel predominantly to the northwest of the OA in deeper waters, particularly on their southern migration.

The migration BIA for Humpback Whales is located ~5 km south of the OA, and Humpback Whales are typically present from June to October (Section 4.3.1.2). As such, the presence of Humpback Whales within the OA during the acquisition of the 4D MSS is not expected.

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 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. 74, Ref. 75) 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.

The seismic survey is scheduled to occur between mid-December to mid-April (Section 3.1.3), which is outside of when Whale Sharks are likely to be foraging within the BIA (July to November) (Ref. 76). As such, significant numbers of Whale Sharks are not expected to occur within the OA.

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 did occur 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).

Historically turtles have been recorded as becoming trapped in the streamer tail buoys. Tail buoys are now either of a design that does not represent an entrapment risk to turtles, or turtle guards are used as standard equipment (if the tail buoy is not of the newer design). Thus, there is no cause effect pathway for entrapment of turtles in streamer buoys, and this risk is not evaluated further.

In summary, the physical presence of vessels or towed equipment is not expected to cause significant impacts to marine fauna, and the risks are considered limited with potential consequences. Therefore, CAPL has ranked the potential consequence to marine fauna from physical presence as Incidental (6).

ALARP decision context justification

Offshore commercial vessel operations are commonplace and well-practised nationally and internationally. The control measures to manage the risks associated with unplanned interactions

<p>with marine fauna are well defined via legislative requirements that are considered standard industry practice. These are well understood and implemented by the petroleum industry and CAPL.</p> <p>During stakeholder consultation, no objections or claims were raised regarding interaction with marine fauna arising from the activity.</p> <p>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.</p>		
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.	
Turtle entanglement prevention	A tail buoy will be fitted to the end of each streamer. Tail buoys are brightly coloured and contain a radar reflector and navigation light to be visible to other marine users. If the tail buoys are of a design that represents an entrapment risk to turtles, they will be fitted with guards to prevent accidental entrapment of turtles.	
Acquisition timing	Seismic acquisition surveys will be scheduled to avoid regional peak migration periods for cetaceans and shark species to reduce the likelihood of high numbers of individuals transiting through the OA.	
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 or buoy entanglement with marine fauna is considered low. Based upon previous experience in the OA, 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 individual fauna injury or mortality, 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: <ul style="list-style-type: none"> • EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans • <i>Conservation Management Plan for the Blue Whale 2015–2025</i> (Ref. 68) • <i>Conservation Advice Megaptera novaeangliae Humpback Whale</i> (Ref. 67) • <i>Conservation Advice Balaenoptera borealis Sei Whale</i> (Ref. 66) • <i>Conservation Advice Balaenoptera physalus Fin Whale</i> (Ref. 65) • <i>Conservation Advice Rhincodon typus Whale Shark</i> (Ref. 64) 	

	<ul style="list-style-type: none"> • <i>Recovery Plan for Marine Turtles in Australia</i> (Ref. 62) • <i>Approved Conservation Advice for Dermochelys coriacea (Leatherback Turtle)</i> (Ref. 63). 	
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	<p>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.</p> <p>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.</p> <p>The Conservation Advices for Blue Whales, Humpback Whales, Sei Whales, and Fin Whales (Ref. 68; Ref. 67; Ref. 66; Ref. 65) all specify the following action:</p> <ul style="list-style-type: none"> • ensure all vessel strike incidents are reported in the National Ship Strike Database. <p>This action is incorporated into reporting requirements under this EP (Section 7.4.2).</p>	
Environmental performance outcome	Performance standard / Control measure	Measurement criteria
No injury or mortality to marine fauna within the OA from petroleum activities	<p>EPBC Regulations 2000 – Part 8 Division 8.1 – Interacting with cetaceans</p> <p>Seismic and support vessels will implement caution and no approach zones, where practicable:</p> <ul style="list-style-type: none"> • 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 <p>Exception: <i>does not apply to seismic vessel towing equipment and operating under constrained manoeuvrability; or to any vessel in the event of an emergency.</i></p>	Induction materials include relevant marine fauna caution and no approach zone requirements
		Training records confirm personnel involved in offshore vessel 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

	Turtle entanglement prevention If the tail buoys are of a design that represents an entrapment risk to turtles, they will be fitted with turtle guards prior to deployment	Inspection records verify turtle guards are installed on tail buoys where required (or buoys have been designed to not represent an entanglement risk to turtles)
	Acquisition timing Seismic acquisition scheduled to avoid regional peak migration periods for cetaceans and shark species	Records confirm that the seismic survey has been acquired during a period mid-December to mid-April

6.3 Air emissions

Source			
Activities identified as having the potential to result in air emissions are: <ul style="list-style-type: none"> • combustion of marine fuel from vessels within the OA during seismic survey • combustion of aviation fuel from helicopters within the OA during seismic survey. 			
Potential impacts and risks			
Impacts	C	Risks	C
Air emissions may result in:		N/A	–
<ul style="list-style-type: none"> • localised and temporary reduction in air quality 	6		
<ul style="list-style-type: none"> • contribution to the reduction of the global atmospheric carbon budget 	6		
Consequence evaluation			
<p>Localised and temporary reduction in air quality</p> <p>Modelling was undertaken for nitrogen dioxide (NO₂) emissions from a mobile offshore drilling unit MODU power generation for another offshore project (Ref. 77). NO₂ 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 NO₂ concentrations of 0.0005 ppm within 10 km of the emission source and an increase of <0.1 µg/m³ (0.00005 ppm) in ambient NO₂ concentrations >40 km away.</p> <p>The <i>National Environmental Protection (Ambient Air Quality) Measure</i> (NEPM) recommends that hourly exposure to NO₂ is <0.12 ppm with annual average exposure <0.03 ppm.</p> <p>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 the seismic and support vessels when compared to MODU operations, and as the highest hourly averages (0.00039 ppm or 0.74 µg/m³) were restricted to a distance of ~5 km from the MODU (Ref. 77), exposures from vessel activities covered under this EP would be well below NEPM standards and thus any impacts were considered to be Incidental (6).</p>			
<p>Contribution to the reduction of the atmospheric carbon budget</p> <p>Direct GHG emissions from activities within this EP are estimated to be ~0.002 Mtpa CO₂-e². These direct emissions represent ~0.0004% of national Australian emissions (when compared to 2021 inventory) (Ref. 78).</p> <p>According to the IPCC, Assessment Sixth Report for Working Group 1, “the total anthropogenic effective radiative forcing in 2019, relative to 1750, was 2.72 [1.96 to 3.48] Wm⁻² (<i>medium confidence</i>) and has likely been growing at an increasing rate since the 1970s, [and] . . . Over 1750–2019, CO₂ increased by 131.6 ± 2.9 ppm (47.3%).”³</p> <p>The IPCC defines the term “carbon budget” as “refer[ing] to the maximum amount of cumulative net global anthropogenic CO₂ 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 CO₂ emissions determine to a large degree warming to date, while future emissions cause future additional warming. The remaining carbon budget indicates how much CO₂ could still be emitted while keeping warming below a specific temperature level.”⁴</p> <p>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 CO₂, 850 Gt CO₂, and 1350 Gt CO₂.⁵</p>			

² Emissions calculation is based on 75 days of vessel activity, and 1 day of helicopter activity, using NGER energy content and emissions factors (Ref. 272).

³ IPCC, AR6, WG1, at TS-35 (Ref. 79).

⁴ IPCC, AR6, WG1, at SPM-48 footnote 43 (Ref. 80).

⁵ IPCC, AR6, WG1, at SPM-29 Table SPM.2 (Ref. 80).

<p>If the total direct GHG emissions from activities associated with this EP are ~0.002 Mtpa CO₂-e, then the activities under this EP may contribute ~1.5–4.0 x 10⁻⁷ percent to the reduction in the total remaining global carbon budget, which is a <i>de minimis</i> decrease.</p> <p>Due to the overall <i>de minimis</i> contribution to the reduction of the global carbon budget from the activities under this EP, the impact of contribution to the global carbon budget has been evaluated as having the potential to result in an Incidental (6) consequence.</p>		
ALARP decision context justification		
<p>Offshore commercial vessel operations and subsequent air 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.</p> <p>During stakeholder consultation, no objections or claims were raised regarding air emissions arising from the activity.</p> <p>The impacts arising from atmospheric emissions constitute lower-order impacts (Table 5-3). As such, CAPL applied ALARP Decision Context A for this aspect.</p>		
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	<p>Prior to commencement of activities, the MSRE process (Ref. 42) 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:</p> <ul style="list-style-type: none"> • Vessels will hold a valid International Air Pollution Prevention (IAPP) certificate and a valid 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. 	
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	<p>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.</p> <p>The impact associated with this aspect is a <i>de minimis</i> contribution to the reduction of the global carbon budget, which is not considered to have the potential to affect intergenerational equity. The control measures identified above are considered to reduce this impact to ALARP.</p> <p>The consequence associated with this aspect is Incidental (6). Therefore, no further evaluation against the Principles of ESD is required.</p>	
Relevant environmental	Legislation and other requirements considered relevant to this aspect include:	

legislation and other requirements	<ul style="list-style-type: none"> • Marine Order 97 • MARPOL 73/78. 	
Internal context	<p>These CAPL environmental performance standards or procedures were deemed relevant for this aspect:</p> <ul style="list-style-type: none"> • MSRE process (Ref. 42). 	
External context	<p>During stakeholder consultation, no objections or claims were raised regarding atmospheric emissions arising from the activity.</p>	
Defined acceptable level	<p>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.</p>	
Environmental performance outcome	Performance standard / Control measure	Measurement criteria
No impacts to air quality outside of the OA from petroleum activities	<p>Reduced sulfur content fuel</p> <p>Only low-sulfur (0.50 mass % concentration [m/m]) fuel oil will be used to minimise SO_x emissions when available</p>	Bunker receipts verify the use of low-sulfur fuel oil
	<p>Marine Order 97: Marine Pollution Prevention – Air Pollution</p> <p>Prior to commencement of activities, the following will be verified, as per the MSRE process:</p> <ul style="list-style-type: none"> • vessels will hold a valid International Air Pollution Prevention (IAPP) certificate and a valid 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. 	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

6.4 Light emissions

Source			
<p>Activities identified as having the potential to result in light emissions are:</p> <ul style="list-style-type: none"> navigation and operational lighting from vessels within the OA during seismic survey. 			
Potential impacts and risks			
Impacts	C	Risks	C
<p>Light emissions may result in:</p> <ul style="list-style-type: none"> localised and temporary change in ambient light. 	6	<p>A change in ambient light may result in:</p> <ul style="list-style-type: none"> attractant for light-sensitive species and in turn affect predator-prey dynamics 	6
Consequence evaluation			
<p>Localised and temporary change in ambient light</p> <p>As the seismic survey will be undertaken 24 hours a day, lighting is required at night for navigation and to ensure safe operations when working on the seismic vessel.</p> <p>Monitoring undertaken by Woodside (Ref. 81) 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.</p> <p>Based on Woodside (Ref. 81), 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 seismic or support vessels. Navigational lighting is expected to be the less on vessels in comparison to a MODU, therefore referencing this modelling is considered an overly conservative approach for this consequence evaluation.</p> <p>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).</p>			
<p>Acting as an attractant to light-sensitive species and in turn affecting predator-prey dynamics</p> <p>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. 82), so light is not considered to be a significant factor in cetacean behaviour or survival.</p> <p>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 and/or critical habitat also overlap with the OA, including:</p> <ul style="list-style-type: none"> Flatback Turtle (interesting buffer BIA, interesting critical habitat) Whale Shark (foraging BIA) Wedge-tailed Shearwater (breeding BIA). <p>The <i>National Light Pollution Guidelines</i> (Ref. 7) 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. 83; Ref. 84) and fledgling seabirds grounded in response to artificial light 15 km away (Ref. 85).</p> <p>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. 86) and that lighting can attract birds from large catchment areas (Ref. 87). 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. 88). At its closest, the OA is located ~25 km from the coast (Montebello Islands). As light emissions from 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.</p> <p>The <i>Recovery Plan for Marine Turtles in Australia</i> (Ref. 62) identifies light emissions as a key threat because it can disrupt critical behaviours, such as nesting, hatchling orientation, sea finding, and dispersal behaviour.</p>			

The *Recovery Plan for Marine Turtles in Australia* (Ref. 62) defines the critical habitat for nesting for each species at a stock level. The closest nesting critical habitats to the OA for Flatback Turtles include Barrow and Montebello islands (Ref. 62). At its closest, the OA is located ~25 km from the coast (Montebello Islands). As light emissions from 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. 62) defines the critical habitat for internesting as a distance seaward from nesting critical habitat of 60 km for Flatback Turtles. However, recent studies (Ref. 69) 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. 62). Whittock et. al. (Ref. 69) 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. 69). This suggests that although the OA does overlap with some internesting critical habitat, due to the OA being located offshore (>25 km from the Montebello Islands) and with increasing water depths (up to ~1,250 m) it would be very unlikely that turtles would be aggregating within the OA during their internesting period. Consequently, as the presence of Flatback Turtles within the OA during the 4D MSS is likely to be limited, 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. Vessels, and their associated light fields, are also not stationary during the survey; thus further reducing the risk of introducing a consistent and extended exposure to artificial light within critical habitat.

Anthropogenic disturbance and artificial lighting is identified as a threat within the *Wildlife Conservation Plan for Migratory Shorebirds* (Ref. 89). 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 <i>ABU MSRE Corporate OE Process</i> (Ref. 42) 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.
Light management	The scheduled 4D MSS (mid-December to mid-April) overlaps with the turtle nesting season (September to March). Recent studies of habitat suitability for internesting Flatback Turtles (Ref. 69) indicate that due to the water depths and distance from nesting beaches, the OA is unlikely to be used by Flatback Turtles during their internesting period. As a conservative management measure, seismic and support 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	<p>The risk 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.</p> <p>The impact associated with this aspect is Incidental (6).</p> <p>Therefore, no further evaluation against the Principles of ESD is required.</p>	
Relevant environmental legislation and other requirements	<p>Legislation and other requirements considered for this aspect include:</p> <ul style="list-style-type: none"> • Commonwealth <i>Navigation Act 2012</i> • <i>National Light Pollution Guidelines</i> (Ref. 7) • <i>Recovery Plan for Marine Turtles in Australia</i> (Ref. 62) • <i>Wildlife Conservation Plan for Migratory Shorebirds</i> (Ref. 89). 	
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 light emissions arising from the activity.	
Defined acceptable level	<p>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.</p> <p>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.</p> <p>The <i>Recovery Plan for Marine Turtles in Australia</i> (Ref. 62) specifies the following relevant action:</p> <ul style="list-style-type: none"> • 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. <p>No other specific relevant actions were identified within other documents implemented under the EPBC Act.</p> <p>The OA does intersect with critical habitat as identified within the Recovery Plan for Flatback Turtles (Table 4-4). However, recent studies indicate that the preferred internesting habitat for Flatback Turtles is closer to coasts (<27.8 km) and in shallow water depths (<44 m). These studies indicate that the presence of Flatback Turtles within the OA during the 4D MSS is likely to be limited; and further that the presence of Flatback Turtles within the outer extents of the defined critical habitat internesting buffer is unlikely.</p> <p>CAPL has defined an acceptable level of impact as no displacement of marine fauna from critical habitat.</p>	
Environmental performance outcome	Performance standard / Control measure	Measurement criteria
Avoid displacement of marine fauna from critical habitat	<p>MSRE process</p> <p>Vessels will meet the lighting requirements of the MSRE process</p>	Records indicate that vessels meet lighting requirements of the MSRE process

during nesting seasons from petroleum activities	Light management Seismic and support 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	Inspection records during night operations within critical habitat and during nesting season confirm only minimum lighting for safe operations is used
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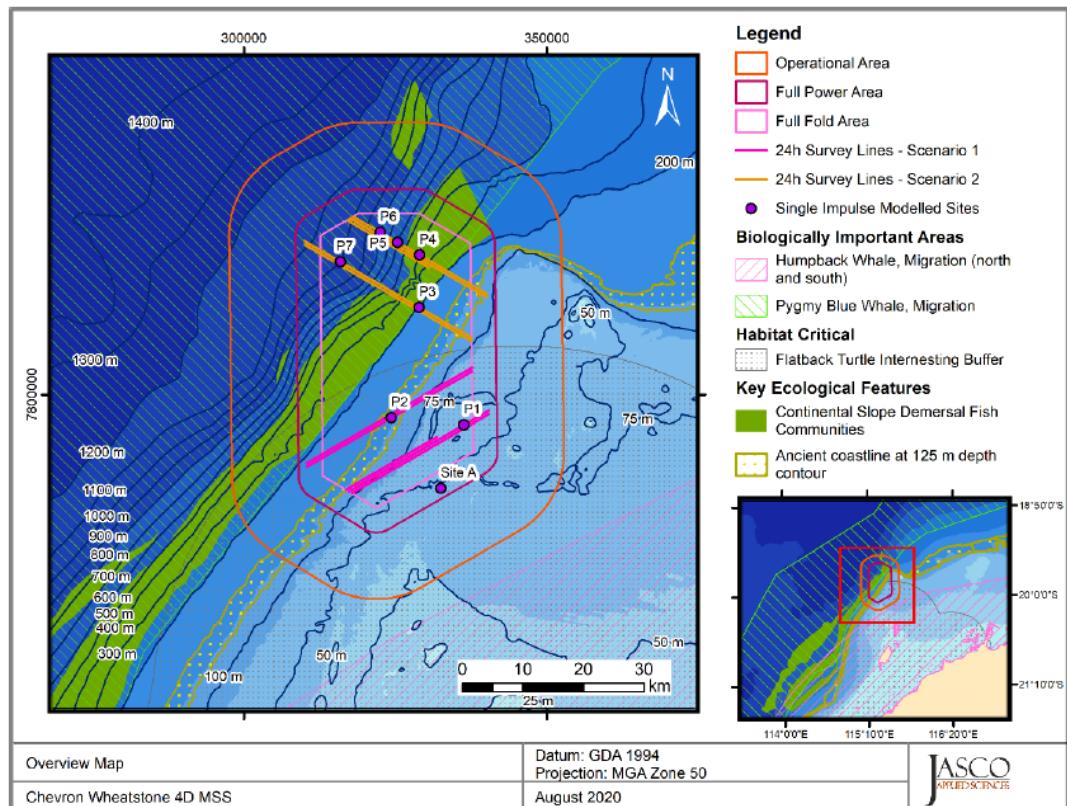
6.5 Underwater sound—seismic acquisition

6.5.1 Acoustic modelling

CAPL commissioned JASCO Applied Sciences to conduct acoustic modelling to inform the risk assessment associated with underwater sound exposure from seismic acquisition (Ref. 188). The modelling was undertaken to assist in understanding the potential acoustic impact on receptors including marine mammals, fish, turtles, benthic invertebrates, plankton, sponges, corals, and divers (Ref. 188).

JASCO’s specialised airgun array source model (AASM) was used to predict acoustic signatures and spectra for a 4,130 cu.in airgun array (Ref. 188). AASM accounts for individual airgun volumes, airgun bubble interactions, and array geometry to yield accurate source predictions (Ref. 188). Complementary underwater acoustic propagation models were used in conjunction with the array signature to estimate sound levels (Ref. 188). Estimated underwater acoustic levels are presented as sound pressure levels (SPL), zero-to-peak pressure levels (PK), peak-to-peak pressure levels (PK-PK), and either single-impulse (i.e., per-pulse) or accumulated sound exposure levels (SEL_{24h}) as appropriate for different noise effect criteria (Ref. 188).

JASCO designed the modelling study to take into consideration the location of key environmental and social receptors, and the range of water depths across the FPZ. Eight standalone single impulse sites and two scenarios for survey operations over 24 hours to assess accumulated SEL (SEL_{24h}) were modelled (Figure 6-1; Table 6-2).



Source: Ref. 188

Figure 6-1: Locations for acoustic modelling

Table 6-2: Acoustic modelling sites, water depths, and associated receptors

24 hr Scenario	Site	Tow direction	Approximate water depth	Relevant receptors
1	1	60°	82 m	Marine mammals (Humpback Whales), turtles, fish, fish egg and larvae, Wheatstone ridgeline
	2		126 m	Ancient Coastline at 125 m Depth Contour KEF, fish, invertebrates, sponges and corals, fish egg and larvae
	3		200 m	Continental Slope Demersal Fish Communities KEF, marine mammals (Blue Whales), fish, fish egg and larvae
2	4	120°	400 m	Continental Slope Demersal Fish Communities KEF, marine mammals (Blue Whales), fish, fish egg and larvae
	5		600 m	Marine mammals (Blue Whales), invertebrates, fish egg and larvae
	6		800 m	Marine mammals (Blue Whales), fish, fish egg and larvae
	7		1000 m	Marine mammals (Blue Whales), fish, fish egg and larvae
N/A	A	120°	64 m	Divers, turtles, Humpback Whales, fish, invertebrates, sponges and corals, fish egg and larvae

6.5.1.1 Exposure criteria

Different species groups perceive and respond to sound differently, and so a variety of exposure criteria for the different types of impacts and species groups are considered. JASCO (Ref. 188) have selected the following noise effect thresholds, based on current best available science, for use in the impact and risk assessment:

- peak pressure levels (PK) and frequency-weighted accumulated sound exposure levels (SEL_{24h}) from the US National Oceanic and Atmospheric Administration (NOAA) Technical Guidance (Ref. 179) for the onset of permanent threshold shift (PTS)⁶ and temporary threshold shift (TTS)⁷ in marine mammals (Table 6-3)
- marine mammal behavioural threshold based on the current NOAA (Ref. 190) criterion for marine mammals of 160 dB re 1 µPa (SPL) for impulsive sound sources (Table 6-3)
- peak pressure levels (PK) and frequency-weighted accumulated sound exposure levels (SEL_{24h}) from Finneran et al. (Ref. 181) for the onset of PTS and TTS in marine turtles (Table 6-3)
- marine turtle behavioural response threshold of 166 dB re 1 µPa (SPL) (Ref. 191), as applied by the US NMFS, along with a sound level associated with behavioural disturbance 175 dB re 1 µPa (SPL) (Ref. 178; Ref. 194) (Table 6-3)

⁶ PTS is a physical injury to an animals hearing organs.

⁷ TTS is a temporary reduction in an animals hearing sensitivity due to receptor hair cells in the cochlea becoming fatigued.

- sound exposure guidelines for fish, fish eggs and larvae (including plankton) (Ref.182) (Table 6-3)
- peak-peak pressure levels (PK-PK) at the seafloor to help assess effects of noise on crustaceans [no effect sound level of 202 dB re 1 μ Pa, and maximum sound level of 209–213 dB re 1 μ Pa] and bivalves [maximum sound level of 212–213 dB re 1 μ Pa] through comparing to results in Day et al. (Ref. 193), Day et al. (Ref. 195), Day et al. (Ref. 194), Day et al. (Ref. 196) and Payne et al. (Ref.197)
- for comparison to current literature, a no effect sound level for sponges and corals of 226 dB re 1 μ Pa (PK), is reported for comparing to Heyward et al. (Ref. 198).
- an SPL human health assessment threshold of 145 dB re 1 μ Pa (SPL) for sound exposure to people swimming and diving derived from Parvin (Ref.199) and considering Ainslie (Ref. 200).

Recent Commonwealth guidance has defined “injury to Blue Whales” as both PTS and TTS hearing impairment, as well as any other form of physical harm arising from anthropogenic sources of underwater noise (Ref. 202).

Table 6-3: Noise effect criteria for impulsive sound for different types of impacts and species groups

Receptor	Mortal or potential mortal injury	Recoverable injury	Permanent threshold shift	Temporary threshold shift	Masking	Behavioural
Low-frequency cetaceans	N/A	N/A	SEL _{24h} : 183 dB re 1 µPa ² s PK: 219 dB re 1 µPa	SEL _{24h} : 168 dB re 1 µPa ² s PK: 213 dB re 1 µPa	N/A	SPL: 160 dB re 1 µPa
Mid-frequency cetaceans	N/A	N/A	SEL _{24h} : 185 dB re 1 µPa ² s PK: 230 dB re 1 µPa	SEL _{24h} : 170 dB re 1 µPa ² s PK: 224 dB re 1 µPa	N/A	SPL: 160 dB re 1 µPa
High-frequency cetaceans	N/A	N/A	SEL _{24h} : 155 dB re 1 µPa ² s PK: 202 dB re 1 µPa	SEL _{24h} : 140 dB re 1 µPa ² s PK: 196 dB re 1 µPa	N/A	SPL: 160 dB re 1 µPa
Marine turtles	N/A	N/A	SEL _{24h} : 204 dB re 1 µPa ² s PK: 232 dB re 1 µPa	SEL _{24h} : 189 dB re 1 µPa ² s PK: 226 dB re 1 µPa	N/A	SPL: 166 dB re 1 µPa SPL: 175 dB re 1 µPa
Fish (no swim bladder) (relevant to sharks)	SEL _{24h} : >219 dB PK: >213 dB	SEL _{24h} : >216 dB PK: >213 dB	N/A	SEL _{24h} : >>186 dB	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low
Fish (swim bladder not involved in hearing)	SEL _{24h} : 210 dB PK: >207 dB	SEL _{24h} : 203 dB PK: >207 dB	N/A	SEL _{24h} : >>186 dB	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low
Fish (swim bladder involved in hearing)	SEL _{24h} : 207 dB PK: >207 dB	SEL _{24h} : 203 dB PK: >207 dB	N/A	SEL _{24h} : 186 dB	(N) Low (I) Low (F) Moderate	(N) High (I) High (F) Moderate
Fish eggs and fish larvae (relevant to plankton)	SEL _{24h} : >210 dB PK: >207 dB	(N) Moderate (I) Low (F) Low	N/A	(N) Moderate (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low

Relative risk (high, moderate, low) is given for fauna at three distances from the source (near [N], intermediate [I] and far [F]). Source: Ref. 188

6.5.1.2 Modelling outputs

The modelled sound contours were not symmetrical around the sound source (Ref. 188). The distances to the behavioural response criteria for both marine mammals and turtles were typically greater at the shallower sites, and those closer to the continental shelf (Ref. 188). The orientation of the sound source was also found to influence the directivity pattern, with greater distances to sound levels in the broadside (perpendicular to the tow) direction as compared to the endfire (along the tow) direction (Ref. 188).

Horizontal maximum distances (R_{\max}) from the sound source to the relevant noise effect criteria for marine mammals, turtles, fish, and plankton are shown in Table 6-4 (Ref. 188). Distances to noise effect criteria varied between the individually modelled sites and scenarios, the largest of these has been reported in Table 6-4.

The SEL_{24h} is a cumulative metric that reflects the dosimetric impact of noise levels within 24 hours based on the assumption that a receptor is consistently exposed to such noise levels at a fixed position (Ref. 188). Where the modelled SEL_{24h} exposure is larger than those for PK pressure criteria, they often represent an unlikely worst-case scenario (Ref. 188). Realistically, marine fauna are unlikely to remain stationary in the same location for a 24 hour period. Therefore, a modelled exposure area for the SEL_{24h} criteria does not mean that marine fauna travelling within this area will be impaired, but rather that they could be exposed to the sound level associated with impairment (either PTS or TTS) if they remained in that location for 24 hours.

At distances offshore from the continental shelf, the single impulse sound fields demonstrate that there is significantly less sound energy above 400 m as compared to greater depths. This distribution of sound over the water column means that it is likely that the maximum-over-depth SEL_{24h} results for TTS in low-frequency cetaceans at greater distances from continental shelf do not accurately represent the actual exposures that whales migrating at predominantly shallow depths will receive (Ref. 188).

The maximum horizontal distance for exposure to the PK-PK no effect sound level at the seafloor was for crustaceans was 0.431–0.913 km depending on the modelled site (Ref. 188). The maximum distance for exposure to the PK-PK maximum sound level at the seafloor for crustaceans was 0.101–0.366 km depending on the modelled site (Ref. 188). The maximum distance for exposure to the PK-PK maximum sound level at the seafloor for bivalves was 0.159–0.241 km depending on the modelled site (Ref. 188).

The PK noise effect criteria at the seafloor for sponges and corals was not reached (Ref. 188).

For human health, the maximum distance for exposure to the SPL noise effect criteria at Site A (~64 m water depth) was 51.07 km. The SPL human health assessment will not be exceeded in water depths (<25 m) relevant to recreational diving around the Montebello Islands (Ref. 188).

Table 6-4: Modelled maximum horizontal distances (R_{max}) from modelled sites or scenarios to reach noise effect criteria for impulsive sound

Receptor	Mortal or potential mortal injury	Recoverable injury	Permanent threshold shift	Temporary threshold shift	Masking	Behavioural
Low-frequency cetaceans	N/A	N/A	SEL _{24h} : 6.61 km PK: 0.04 km	SEL _{24h} : 95.4 km PK: 0.07 km	N/A	SPL: 13.45 km
Mid-frequency cetaceans	N/A	N/A	SEL _{24h} : – PK: –	SEL _{24h} : – PK: 0.02 km	N/A	SPL: 13.45 km
High-frequency cetaceans	N/A	N/A	SEL _{24h} : <0.02 km PK: 0.45 km	SEL _{24h} : 1.63 km PK: 1.00 km	N/A	SPL: 13.45 km
Marine turtles	N/A	N/A	SEL _{24h} : <0.02 km PK: –	SEL _{24h} : 3.84 km PK: 0.02 km	N/A	SPL: 7.11 km
Fish (no swim bladder) (relevant to sharks)	SEL _{24h} : <0.02 km PK: 0.096 km	SEL _{24h} : <0.02 km PK: 0.096 km	N/A	SEL _{24h} : 8.63 km	N/A	N/A
Fish (swim bladder not involved in hearing)	SEL _{24h} : <0.02 km PK: 0.27 km	SEL _{24h} : <0.02 km PK: 0.27 km	N/A	SEL _{24h} : 8.63 km	N/A	N/A
Fish (swim bladder involved in hearing)	SEL _{24h} : <0.02 km PK: 0.27 km	SEL _{24h} : <0.02 km PK: 0.27 km	N/A	SEL _{24h} : 8.63 km	N/A	N/A
Fish eggs and fish larvae (relevant to plankton)	SEL _{24h} : <0.02 km PK: 0.27 km	N/A	N/A	N/A	N/A	N/A

A dash indicates the threshold was not reached within the limits of the modelling resolution (20 m). Source: Ref. 188.

6.5.2 Pygmy Blue Whale exposure modelling

In addition to the acoustic modelling study, JASCO undertook an acoustic exposure analysis for migrating Pygmy Blue Whales (Ref. 189), which describes the modelled predictions of sound levels that individual Pygmy Blue Whales may receive during the 4D MSS.

Sound exposure distribution estimates are determined by moving large numbers of simulated animals ('animats') through a modelled time-evolving sound field, computed using specialised sound source and sound propagation models (Ref. 189). This approach provides the most realistic prediction of the maximum expected root-mean-square sound pressure level (SPL), peak pressure level (PK), and the temporal accumulation of sound exposure level (SEL_{24h}) that are now considered the most relevant sound metrics for the assessment of effects (Ref. 189). The resulting sound fields from the acoustic modelling study (Section 6.5.1; Ref. 188) were used to predict animat sound exposures.

The JASCO Animal Simulation Model Including Noise Exposure (JASMINE) was used to model the movement of Pygmy Blue Whales through the predicted sound field. Biologically meaningful movement rules were applied to each animat in the model to represent Pygmy Blue Whale behaviours. This included swim speeds, direction, diving and ascent rates, dive depths (for both migratory dives near the surface and deeper exploratory or feeding dives), and time spent at or near the surface before diving again. The animats, were set to simulate the real-world movements of migrating Pygmy Blue Whales within the migratory BIA.

The same noise effect criteria as defined for low-frequency cetaceans in Section 6.5.1.1 were used in this Pygmy Blue Whale exposure modelling.

The modelled 95th percentile exposure ranges (ER_{95%}) from the sound source to the relevant noise effect criteria for Pygmy Blue Whales are shown in Table 6-5 (Ref. 189). For comparison, the horizontal maximum distances (R_{max}) for low-frequency cetaceans from the acoustic modelling in Section 6.5.1 are repeated in Table 6-5.

The ER_{95%} to both the PTS and TTS SEL_{24h} noise effect criteria thresholds are substantially lower than distances predicted by acoustic modelling (Table 6-5; Ref. 189). Acoustic modelling is inherently more conservative as it does not incorporate the complex interactions of both a moving sound field and moving receivers (Ref. 189).

The ER_{95%} to the PTS and TTS PK thresholds, and to the behavioral response thresholds, was similar between the two modelling studies. This is as expected given these noise effect criteria are based off single loudest exposures by each of the animats during the model simulation (Ref. 189).

The probability of exposure within ER_{95%} range in all cases varied between 65–88%, indicating that most, but not all, animats within the ER_{95%} range were exposed above threshold (Ref. 189). This is due to the animats constantly changing their position in three-dimensions as they exhibit their modelled behaviour, and also changing their position in relation to the sound fields, thus potentially limiting the length of time they are within the exposure radius (Ref. 189).

Table 6-5: Modelled 95th percentile exposure ranges (ER_{95%}) and probability of exposure, compared to modelled maximum horizontal distances (R_{max}) for Pygmy Blue Whales

Modelling	Parameter	Permanent threshold shift	Temporary threshold shift	Behavioural
Acoustic modelling	R _{max}	SEL _{24h} : 6.61 km PK: 0.04 km	SEL _{24h} : 95.4 km PK: 0.07 km	SPL: 13.45 km
Exposure modelling	ER _{95%}	SEL _{24h} : 0.06 km PK: 0.03 km	SEL _{24h} : 12.5 km PK: 0.06 km	SPL: 12.43 km
	Probability of exposure	SEL _{24h} : 70% PK: 78%	SEL _{24h} : 65% PK: 88%	SPL: 68%

6.5.3 Risk assessment

Source			
<p>Activities identified as having the potential to result in underwater sound are:</p> <ul style="list-style-type: none"> seismic acquisition within the OA. <p>These activities result in the emission of the impulsive sound.</p>			
Potential impacts and risks			
Impacts	C	Risks	C
Underwater sound emissions may result in:		A change in ambient underwater sound may result in:	
<ul style="list-style-type: none"> localised and temporary change in ambient underwater sound. 	5	<ul style="list-style-type: none"> behavioural disturbance 	5
		<ul style="list-style-type: none"> auditory impairment, temporary threshold shift (TTS), permanent threshold shift (PTS), recoverable or non-recoverable injury to marine fauna 	5
		<ul style="list-style-type: none"> injury or auditory impairment to humans 	6
Consequence evaluation			
<p>Localised and temporary change in ambient underwater sound</p> <p>Anthropogenic underwater sound emitted during the 4D MSS activities will result in a change in ambient noise levels.</p> <p>Underwater broadband ambient sound spectrum levels range from 45–60 dB re 1 µPa in quiet regions (light shipping and calm seas) to 80–100 dB re 1 µPa for more typical conditions, and >120 dB re 1 µPa during periods of high winds, rain or 'biological choruses' (many individuals of the same species vocalise near simultaneously in reasonably close proximity to each other) (Ref. 222). Low-frequency ambient sound levels (20–500 Hz) are frequently dominated by distant shipping plus some great whale species. Light weather-related sounds will be in the 300–400 Hz range, with wave conditions and rainfall dominating the 500–50,000 Hz range (Ref. 222).</p> <p>The rate of sound attenuation from the seismic source is dependent on local sound propagation characteristics, including seawater temperature and salinity profiles, water depth, bathymetry and the geoacoustic properties of the seabed (Ref. 201). A seismic sound source is typically a short, discrete, non-continuous, low-frequency pulse.</p> <p>While the individual impulses are short and discrete, the 4D seismic survey is estimated to take ~75 days to complete, noting that the sound source is not stationary during this duration. Most acoustic energy from a seismic source is output at lower frequencies, in the tens to hundreds of hertz (Ref. 188). The modelled 4,130 cu.in array had a pronounced broadside directivity for 1/3-octave-bands between ~125–316 Hz, which caused a noticeable axial bulge in the modelled</p>			

acoustic footprints (Ref. 188). The overall broadband (10–25,000 Hz) unweighted per-pulse SEL source level of the 4,130 cu.in seismic source operating at 5 m depth was 229.6 dB $1 \mu\text{Pa}^2\text{m}^2\text{s}$ in the broadside direction and 229.2 dB $1 \mu\text{Pa}^2\text{m}^2\text{s}$ in the endfire direction. The peak SPL in the same directions was 250.1 dB re $1 \mu\text{Pa}$ m and 248.2 dB re $1 \mu\text{Pa}$ m, respectively (Ref. 188).

Given the details above, the consequence of seismic acquisition causing a change in ambient underwater sound has been assessed as Minor (5) as it will result in a localized and short-term environmental impact.

Marine mammals

Behavioural disturbance

Acoustic modelling indicated that the R_{max} from the source to SPL behavioural noise effect criteria for all cetaceans was 13.45 km (Table 6-3, Table 6-4).

As identified in Section 4.3.1, several marine mammal species listed as threatened and/or migratory under the EPBC Act have the potential to occur within the OA. In addition, a migration and distribution BIA for the Pygmy Blue Whale also overlaps with the OA and FPZ (Section 4.3.1.1). The Humpback Whale migration BIA is located ~5 km from the OA and ~16 km from the FPZ (Section 4.3.1.2), with migration occurring between June and October. Given there is no temporal overlap in the use of this migration BIA for Humpback Whales and the 4D MSS, no behavioural disturbance is predicted.

As the OA and FPZ overlaps a migration BIA for the Pygmy Blue Whale, there is the potential for Pygmy Blue Whales to be present during migration periods. However, given the acquisition timing (mid-December to mid-April) for the 4D MSS is predominantly outside the migration periods (April to August, and November to late-December), the OA is within an open-water environment (i.e., not a confined migratory pathway), and there will be a single seismic vessel operating, it is not expected that the 4D MSS would result in a significant change to migration behaviours or displace species outside of the BIA. In addition, it is expected that whales in the vicinity of a seismic source will avoid the immediate area due to an aversive response to the sound (Ref. 5). It is considered that any such temporary displacement during a seismic survey is unlikely to result in any real biological cost unless the interaction occurs during critical behaviours (e.g., breeding, feeding, and resting), or in important areas such as narrow migratory corridors (Ref. 5). The OA is not within a confined migratory corridor, and other critical behaviours are not expected.

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

Acoustic modelling indicated that the R_{max} from the source to TTS and PTS single pulse PK noise effect criteria for low-frequency cetaceans was 0.07 km and 0.04 km respectively; and for high-frequency cetaceans was 1.00 km and 0.45 km respectively (Table 6-3, Table 6-4).

Acoustic modelling also indicated that the R_{max} from the source to TTS and PTS $\text{SEL}_{24\text{h}}$ noise effect criteria for low-frequency cetaceans was 95.4 km and 6.61 km respectively; and for high-frequency cetaceans was 1.63 km and <0.02 km respectively (Table 6-3, Table 6-4). Note that the $\text{SEL}_{24\text{h}}$ is a cumulative metric that assumes a receptor is consistently exposed to the relevant noise effect criteria for a 24-hour period. In reality, given both a moving sound source (i.e., the seismic vessel) and moving marine fauna, these modelled outputs are likely to be an overly conservative and unlikely worst-case scenario.

While relatively high R_{max} values were estimated for the cumulative 24-hour exposures ($\text{SEL}_{24\text{h}}$) for low-frequency cetaceans, the additional exposure modelling for Pygmy Blue Whales, which takes into consideration both a moving sound source and a moving cetacean, substantially reduced these estimated exposure areas to 12.5 km for TTS (compared to 95.4 km) and 0.06 km for PTS (compared to 6.61 km) (Table 6-5). While this exposure modelling (Ref. 189) was undertaken specifically for Pygmy Blue Whales, it is considered an analogue for other low-frequency cetaceans in that the modelled R_{max} distances from the acoustic modelling (Ref. 188) for 24-hour exposure are likely substantially over conservative.

The $\text{SEL}_{24\text{h}}$ threshold for mid-frequency cetaceans was not reached within the limits of the modelling resolution (20 m) (Table 6-3, Table 6-4). The PK threshold for mid-frequency cetaceans was 0.02 km for TTS and was not reached for PTS (Table 6-3, Table 6-4). Dolphins typically have peak sensitivities in the higher frequency ranges and are less likely to be affected by lower frequency seismic sounds and as such, less vulnerable to acoustic trauma (Ref. 5). As such, no further evaluation of mid-frequency cetaceans (e.g., dolphins, Sperm Whale) has been undertaken.

High-frequency cetaceans are toothed whales specialised at hearing at high frequencies, such as the Pygmy Sperm Whale and Dwarf Sperm Whale. These species are not listed as threatened under the EPBC Act, but may occur within the OA (appendix c). All cetacean species are

expected to be transiting through the area; no areas of known aggregation within or around the OA have been identified.

Low-frequency cetaceans are baleen whales specialised at hearing at low frequencies. Within the OA, low-frequency cetaceans include the following threatened species: Blue, Bryde's, Fin, Humpback, and Sei Whales (Section 4.3.1). A migration and distribution BIA for the Pygmy Blue Whale also overlaps a small proportion of the OA and FPZ (Section 4.3.1.1). The Humpback Whale migration BIA is located ~5 km from the OA and ~16 km from the FPZ (Section 4.3.1.2), with migration occurring between June and October. Given there is no temporal overlap in the use of this migration BIA for Humpback Whales and the 4D MSS, no TTS or PTS impacts are predicted. As such the following consequence evaluation for low-frequency cetaceans focusses on Pygmy Blue Whales.

Pygmy Blue Whales

As detailed in Section 4.3.1.1, migrating Pygmy Blue Whales are likely to occur in the Exmouth – Montebello region from November through to late-December (southern migration) and from April through to August (with a peak in May and June) (northern migration). As the 4D MSS is planned between mid-December to mid-April there is the potential for some overlap with the end of the southern migration period (December) and the start of the northern migration period (April). However, as discussed in Section 4.3.1.1, although the defined BIA for Pygmy Blue Whales passes through the northern part of the OA, it is expected based on recent satellite tracking and acoustic detection studies that the Pygmy Blue Whales are more likely to travel predominantly to the northwest of the OA in deeper waters, particularly during their southern migration (November to December).

Based on the exposure modelling (Ref. 189) a Pygmy Blue Whale would need to be within 30 m of the seismic source to be exposed to noise level above the noise effect criteria for a single pulse PTS, and within 60 m of the seismic source to be exposed to noise level above the noise effect criteria for single pulse TTS or cumulative SEL_{24h} PTS (Table 6-5). Based on the implementation of industry standard controls such as soft starts, and the expected behavioural avoidance if exposed to noise, it would be highly unlikely for a Pygmy Blue Whale to be as close as 60 m to the seismic vessel, thus TTS and PTS from either single pulse and PTS sound exposure over 24 hr is not predicted, and no further evaluation has been undertaken for these types of effects.

The exposure modelling (Ref. 189) indicated that a Pygmy Blue Whale would need to be within 12.5 km of the seismic source over a 24-hour period to be exposed to noise level above the noise effect criteria for TTS SEL_{24h} (Table 6-5). However, it is noted that the exposure modelling (Ref. 189) conservatively assumes Pygmy Blue Whales do not exhibit avoidance behaviour from the seismic source; however, in reality, avoidance behaviour is expected to occur (Ref. 5). This expected avoidance behaviour is supported by other studies. For example, Moulten and Holst (Ref. 223) documented that Blue Whales were seen farther (~677 m) from the seismic vessel during periods when the source was active (1,904 m) vs. silent (1,227 m), based on analysing 9,180 hours of seismic survey observations in eastern Canada from 2003 to 2008. Additionally, Stone et al. (Ref. 224) undertook a comprehensive study of 181,000 hours of marine mammal observations during 1,196 seismic surveys from 1994-2010 in the UK and concluded as a combined group, on average, baleen whales were shown to stay 500 m further away from the seismic source when active compared to when off, suggesting the group exhibit natural avoidance. Given the distance to the behavioural response noise effect criteria is 12.43 km (Table 6-4) it would be highly unlikely Pygmy Blue Whales would be consistently exposed to sound levels over 24 hrs that would result in TTS. It is more likely that migrating Pygmy Blue Whales would exhibit natural avoidance.

The Conservation Management Plan for the Blue Whale (Ref. 68) includes a specific action that "Anthropogenic noise in biologically important areas will be managed such that any blue whale continues to utilise the area without injury and is not displaced from a foraging area". The OA does not intersect with a foraging BIA for the Pygmy Blue Whale (Table 4-2). The nearest foraging BIA occurs ~225 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. Double et al. (Ref. 225) acknowledged that: "While anthropogenic noise may alter blue whale behaviour, it is unlikely to pose a conservation risk unless it causes population level consequences such as changes in growth, reproduction and survival of individuals. Elevated ambient noise has been responsible for abandonment or avoidance of critical habitat by a number of cetacean species including gray whale, bowhead whales and killer whales. Critical habitat includes habitat used to meet essential lifecycle requirements such as foraging and breeding, both of which are activities likely to be impacted by elevated ambient noise for the Pygmy Blue Whales." It is expected that the natural avoidance behaviour exhibited by baleen whales will result in Blue Whales moving away, and therefore not being consistently exposed to sound levels above the TTS effect criteria

within ~12.5 km from the seismic vessel for a 24-hour period. In the unlikely event that this did occur, it would be at the individual scale, and not population level.

Based on the relatively small (e.g., up to two weeks) potential of temporal overlap with either the Pygmy Blue Whale southbound or northbound migration, the small spatial overlap (i.e., the FPZ overlaps ~720 km² (~0.23%) of the Pygmy Blue Whale migration BIA), the absence of critical behaviours (e.g., breeding, feeding, and resting), or important areas such as narrow migratory corridors, the predicted sound levels from seismic acquisition may affect individuals but are not considered likely to cause ecologically significant impacts at a population level for Pygmy Blue Whales.

In summary, the behavioral disturbance to individual Pygmy Blue Whales is expected to be temporary and short term and has been evaluated as Minor (5); and the potential for TTS injury to Pygmy Blue Whales is expected to be limited and has been evaluated as Incidental (6).

Turtles

Behavioural disturbance

Acoustic modelling indicated that the R_{max} from the source to SPL behavioural noise effect criteria for turtles was 7.11 km (Table 6-3, Table 6-4).

McCauley et al. (Ref. 192) found that turtles showed behavioural responses (i.e., increased swimming behaviour) to an approaching seismic source at received sound levels of approximately 166 dB SPL, and a stronger avoidance response at around 175 dB SPL. Similarly, Moein et al. (Ref. 227) monitored the behaviour of penned Loggerhead Turtles to seismic sources operating at 175–179 dB SPL. Avoidance of the seismic source was observed at first exposure, but the turtles habituated to the sound over time. Finneran et al. (Ref. 181) identified 175 dB SPL as the level at which marine turtles are expected to actively avoid seismic sound exposure.

As identified in Section 4.3.2, several marine reptile species listed as threatened and/or migratory under the EPBC Act have the potential to occur within the OA. In addition, an interesting BIA and critical habitat for Flatback Turtles also overlaps with the OA and FPZ (Section 4.3.1.1). The *Recovery Plan for Marine Turtles in Australia* (Ref. 62) details that Flatback Turtles nest at the Montebello Islands from October to March, with the peak between November and January, which overlaps the seismic survey timing. The *Recovery Plan for Marine Turtles in Australia* (Ref. 62) identifies an action for addressing key threats to the Pilbara Flatback Turtle stock of “manage anthropogenic activities to ensure marine turtles are not displaced from identified habitat critical to the survival”.

However, as discussed in Section 4.3.2.1, although the defined interesting BIA and critical habitat for Flatback Turtles overlaps the southern part of the OA, it is expected based on recent studies that Flatback Turtles are unlikely to occur within the OA during their interesting period due to the habitat suitable for interesting being in shallower and nearshore waters. There is no evidence to date to indicate Flatback Turtles swim out into deep offshore waters during the interesting period.

Given that the ensounded area for behavioural disturbance is not predicted to overlap with the habitat suitable for interesting, and that if marine turtles did occur further offshore within the OA, only localised short-term behavioural impacts to transient individuals have the potential to arise from these activities and have therefore been evaluated as Incidental (6).

TTS and PTS

Acoustic modelling indicated that the R_{max} from the source to TTS single pulse PK noise effect criteria for turtles was 0.02 km; the threshold for PTS was not reached (Table 6-3, Table 6-4). Based on the expected behavioural avoidance if exposed to noise, it would be highly unlikely for a marine turtle to be as close as 20 m to the seismic source thus TTS is not predicted, and no further evaluation has been undertaken for this type of effect.

Acoustic modelling also indicated that the R_{max} from the source to TTS and PTS SEL_{24h} noise effect criteria for turtles was 3.84 km and <0.02 km respectively (Table 6-3, Table 6-4). Note that the SEL_{24h} is a cumulative metric that assumes a receptor is consistently exposed to the relevant noise effect criteria for a 24-hour period. In reality, given both a moving sound source (i.e., the seismic vessel) and moving marine fauna, these modelled outputs are likely to be an overly conservative and unlikely worst-case scenario.

As described above, it is expected that marine turtles would exhibit avoidance behaviour from the seismic source. Given the distance to the behavioural response noise effect criteria is 7.11 km (Table 6-4) it would be highly unlikely that Flatback Turtles would be consistently exposed to sound levels over 24 hrs that would result in TTS (which requires them to remain within 3.84 km of the source). In addition, ensounding for TTS SEL_{24h} noise effect criteria is not expected to extend into the areas defined as suitable habitat for interesting Flatback Turtles in accordance with recent studies (Section 4.3.2.1).

Given that the ensonified area for SEL_{24h} TTS and PTS is not predicted to overlap with the habitat suitable for interesting, and that if marine turtles did occur further offshore within the OA, only localised short-term behavioural impacts to transient individuals have the potential to arise from these activities and have therefore been evaluated as Incidental (6).

Fish (with no swim bladder)

Cartilaginous fish, such as sharks and rays, or pelagic fish such as mackerel, do not have swim bladders. As identified in Section 4.3, several fish species (including shark and ray species) listed as threatened and/or migratory under the EPBC Act have the potential to occur within the OA. A foraging BIA for the Whale Shark also overlaps with the OA.

Based on the values and sensitivities within the OA, the following fish have been identified as relevant for this evaluation:

- Whale Sharks
- pelagic fish species including commercial fish species such as mackerel.

Behavioural disturbance

Impulsive sound sources have been identified as a high, moderate, and low risk of causing behavioural changes within the near (tens of metres), intermediate (hundreds of metres), and far (thousands of metres) distances from a sound source respectively; and a low risk of causing masking changes at all distances (Table 6-3).

Potential behavioural impacts to finfish from seismic sounds include temporary stunning, changes in position in the water, displacement from area and effects on breeding behaviours (Ref. 226). However, the transient nature of the seismic source and the highly mobile nature of pelagic fish species means that behavioural avoidance responses and effects on distribution will be incidental, localised and of short duration.

Mortal, potential mortal, and recoverable injury

Acoustic modelling indicated that the R_{max} from the source to mortal, potential mortal, or recoverable injury single pulse PK noise effect criteria for fish (with no swim bladder) was <0.02 km (Table 6-3, Table 6-4).

Acoustic modelling also indicated that the R_{max} from the source to mortal, potential mortal, or recoverable injury SEL_{24h} noise effect criteria for fish (with no swim bladder) was 0.096 km (Table 6-3, Table 6-4). Note that the SEL_{24h} is a cumulative metric that assumes a receptor is consistently exposed to the relevant noise effect criteria for a 24-hour period. In reality, given both a moving sound source (i.e., the seismic vessel) and moving marine fauna, these modelled outputs are likely to be an overly conservative and unlikely worst-case scenario.

These modelling results indicate that a fish (with no swim bladder) would have to be in very close proximity to the seismic vessel to be at risk of injury, for both a single pulse or cumulative 24-hour exposure.

TTS

Acoustic modelling indicated that the R_{max} from the source to TTS SEL_{24h} noise effect criteria for fish (with no swim bladder) was 8.63 km (Table 6-3, Table 6-4). Note that the SEL_{24h} is a cumulative metric that assumes a receptor is consistently exposed to the relevant noise effect criteria for a 24-hour period. In reality, given both a moving sound source (i.e., the seismic vessel) and moving marine fauna, these modelled outputs are likely to be an overly conservative and unlikely worst-case scenario.

Whale Sharks

Whale Shark migration along the WA coast occurs mainly between July and November (Section 4.3.3.1). Based on the 4D MSS timing of mid-December to mid-April, there is no temporal overlap with the Whale Shark migration period.

Whale Sharks' auditory sensitivity or susceptibility to sound-induced effects have not been tested. Like all elasmobranchs, they are lacking a swim bladder and have no air-filled chambers or accessory morphological structures to their hearing system that could serve as hearing specialisations. Like other shark species, they can be considered to have relatively insensitive hearing and less likely to be negatively affected by intense underwater sound.

It is expected that the potential effects to Whale Sharks associated with underwater sound will be the same as for other pelagic fish species, resulting in minor and temporary behavioural change such as avoidance. This aligns with the Popper et al. (Ref.182) guidelines, which detail that there is the potential for high risk of behavioural impacts in fish species near the seismic source (tens of metres) with the level of risk declining to low at thousands of metres from the seismic source.

As the timing of the 4D MSS does not overlap the period when Whale Sharks are likely to be in the area, potential impacts to Whale Sharks are assessed as a consequence level of Incidental (6) as impacts are unlikely to occur.

Pelagic fish species including commercial fish species such as mackerel

Key pelagic fish species that may occur in the OA include Spanish Mackerel and various other mackerels (e.g., Grey Mackerel), as well as various species of tuna and billfish. These species either do not possess a swim bladder or it is poorly developed and not directly connected to hearing (Ref.182), indicating that they are sensitive only to the particle motion component of sound at close range to a sound source.

Pelagic fishes such as mackerel travel distances of 100–300 km or more, while tunas and billfish may travel in the order of thousands of kilometres. Therefore, pelagic fishes can reasonably be expected to exhibit an avoidance response and swim away from the approaching seismic source before sound levels approach levels that may result in mortality, injury or TTS.

As detailed in Table 6-6 the principal depth range for Spanish Mackerel, which is targeted by the Mackerel Managed Fishery, is up to 50 m. As the OA is in water depths 50 m and deeper, the FPZ is in water depths >60 m and there has been no catch effort for the fishery within the FPZ in the last five years, significant impacts to this species and hence the fishery is not predicted.

In addition, a risk assessment facilitated by DPIRD was undertaken (Ref. 226), and this assessment determined that the risk of any impact type (i.e., including behaviour, hearing impairment, and injury) to pelagic finfish (e.g., Spanish Mackerel, Silver Trevally) from a >4,000 cu.in seismic array in waters >250 m depth was negligible.

The potential impacts to pelagic fish species, including commercial fish species, from underwater sound emissions from the seismic source are assessed as a consequence level of Incidental (6) as impacts are expected to be limited.

Fish (with swim bladder)

Fish with swim bladders include:

- demersal fish species such as tropical snappers and emperors (swim bladders not used for hearing)
- some reef fish and site-attached fish species (swim bladders used for hearing).

Most, if not all, demersal fish species expected to occur in the OA have relatively poor hearing compared to fishes with hearing specialisations and swim bladders directly involved in hearing.

Based on the values and sensitivities within the OA, the following fish have been identified as relevant for this evaluation:

- demersal fish species including commercial fish species such as tropical snappers and emperors
- demersal fish species associated with the Continental Slope Demersal Fish KEF
- site-attached fish species associated with the Ancient Coastline at 125 m Depth Contour KEF
- site-attached fish species associated with the Wheatstone ridgeline.

Fish communities at Rankin Bank have been excluded as it is located ~12 km from the FPZ and the furthest predicted distance to a fish sound exposure criterion is 8.63 km (Ref. 188), therefore impacts are not predicted.

Behavioural disturbance

Impulsive sound sources have been identified as a moderate/high risk of causing behavioural changes within the near (tens of metres) or intermediate distances (hundreds of metres) from a sound source respectively; and a low risk of causing masking changes (Table 6-3).

Potential behavioural impacts to finfish from seismic sounds include temporary stunning, changes in position in the water, displacement from area and effects on breeding behaviours (Ref. 226). However, the transient nature of the seismic source and the relatively deep waters of most of the OA and FPZ, suggests that behavioural responses on demersal or site-attached fish will be incidental, localised and of short duration.

Mortal, potential mortal, and recoverable injury

Acoustic modelling indicated that the R_{max} from the source to mortal, potential mortal, or recoverable injury single pulse PK noise effect criteria for fish (with swim bladders) was <0.27 km (Table 6-3, Table 6-4).

Acoustic modelling also indicated that the R_{max} from the source to mortal, potential mortal, or recoverable injury SEL_{24h} noise effect criteria for fish (with swim bladders) was <0.02 km (Table 6-3, Table 6-4). Note that the SEL_{24h} is a cumulative metric that assumes a receptor is consistently exposed to the relevant noise effect criteria for a 24-hour period. In reality, given both

a moving sound source (i.e., the seismic vessel) and moving marine fauna, these modelled outputs are likely to be an overly conservative and unlikely worst-case scenario.

These modelling results indicate that a fish (with swim bladders) would have to be in very close proximity to the seismic vessel to be at risk of injury, for both a single pulse or cumulative 24-hour exposure.

No studies to date have demonstrated direct mortality of adult fish in response to seismic acoustic emissions, even within 1–7 m of the source (Ref. 228; Ref. 229; Ref. 182; Ref. 230). Although some fish deaths have been reported during cage experiments, these were more likely caused by experimental artefacts of handling fish or confinement stress (Hassel et al. 2004, as cited in NSW DPI (Ref. 231)).

TTS

Acoustic modelling indicated that the R_{max} from the source to TTS SEL_{24h} noise effect criteria for fish (with swim bladders) was 8.63 km (Table 6-3, Table 6-4). Note that the SEL_{24h} is a cumulative metric that assumes a receptor is consistently exposed to the relevant noise effect criteria for a 24-hour period. In reality, given both a moving sound source (i.e., the seismic vessel) and moving marine fauna, these modelled outputs are likely to be an overly conservative and unlikely worst-case scenario.

Fish that showed TTS recovered to normal hearing levels within 18–24 hours. For the acoustic modelling TTS was modelled over the cumulative period of 24 hr based on Popper (Ref. 182) who states: *“The time over which energy should be accumulated in each individual fish in the survey area should be limited to the time over which fish receives the maximum exposure. Thus, 24 hours is likely far too long a period for calculating the accumulation of energy in determining potential harm (e.g., damage or TTS). There is no scientific basis for longer periods than 24 hours.”* Popper (Ref. 182) in his review of TTS for the Santos Bethany 3D MSS, which considered similar fish species as likely to be present in the OA, noted:

- it is highly unlikely that there would be physical damage to fishes as a result of the seismic survey, unless the animals are very close to the source (perhaps within a few metres)
- most fishes in the Bethany region (and given the similarity in fish species, this also applies for the NWS region), being species that do not have hearing specialisations, are not likely to have much (if any) TTS as a result of the Bethany 3D survey
- if TTS takes place, its level is likely to be sufficiently low that it will not be possible to easily differentiate it from normal variations in hearing sensitivity
- even if fishes do show some TTS, recovery will start as soon as the most intense sounds end, and recovery is likely to even occur, to a limited degree, between seismic pulses; based on very limited data, recovery within 24 hours (or less) is very likely
- nothing is known about the behavioural implications of TTS in fishes in the wild; however, since the TTS is likely very transitory, the likelihood of it having a significant impact on fish fitness is very low.

Demersal fish species (including commercial species)

Demersal fish species likely to be within the FPZ are various species of snapper, emperors, rock cods and groupers and typically have a swim bladder not used for hearing.

The majority of studies relevant to behavioural responses in demersal fish species (Ref. 236; Ref. 237; Ref. 192; Ref. 238; Ref. 239; Ref. 240; Ref. 241; Ref. 242), indicate that exposure to a mobile seismic source resulting in behavioural response such as startle, changes in swimming speed or direction and avoidance are likely to be limited to durations of minutes or hours and occur within hundreds of metres of the seismic source as it passes.

The modelled distances to the mortality and injury sound exposure guidelines range from <20 m to 270 m (Table 6-4). As discussed previously, the sound exposure guidelines for mortality and injury are considered highly conservative. While mortality or injury to fishes in the immediate proximity of the seismic source is theoretically possible, free swimming fishes such as the demersal species that are likely to be present within the FPZ are expected to be able to avoid the seismic source as it approaches. The demersal fish species likely to be present in the FPZ (predominantly snappers, emperors and rock cods), despite exhibiting particular habitat preferences and some fidelity to an area, can be found across a variety of habitats and are typically mobile with home ranges in the order of kilometres or tens of kilometres (Ref. 232; Ref. 231; Ref. 233; Ref. 234; Ref. 235). Therefore, demersal fishes can reasonably be expected to exhibit an avoidance response and swim away from the approaching seismic source before sound levels approach levels that may result in mortality, injury or TTS.

The modelled distance to the TTS SEL_{24h} cumulative sound exposure guideline is 8.63 km (Table 6-4). There is the potential for some fishes to experience TTS if they stayed within the exposure range for a period of 24 hours. However, as detailed by Popper (Ref. 182), recovery

would start as soon as the most intense sounds ended with recovery within 24 hours or less and therefore the likelihood of TTS having a significant impact on fish fitness (in terms of communication, detection of predators or prey, etc.) is low.

A recent field study by Meekan et al. (Ref. 270) found no short-term (days) or long-term (months) effects of exposure on the composition, abundance, size structure, behaviour or movement of demersal fish species targeted by commercial fisheries on the NWS of WA.

The FPZ overlaps the ~1.6% of the area of catch effort of Pilbara Trap Fishery (2014–2019 data) and ~1% of the area of catch effort of Pilbara Line Fishery (2014–2019 data). The main species landed by these fisheries in the Pilbara subregion are Blue Spotted Emperor, Red Emperor and Rankin Cod (Ref. 243). Table 6-6 details that the FPZ overlaps 0.9% of the Blue Spotted Emperor stock range, 0.3% of Red Emperor stock range and 0.9% of the Rankin Cod stock range.

Potential impacts to demersal fish species, including commercial fish species, from underwater sound emissions from the seismic source are assessed as a consequence level of Minor (5) as impacts will be localised and short term based on the following:

- there are no documented cases of mortality (both immediate and delayed) in free-swimming fish upon exposure to seismic source sound in experimental or field studies (Ref. 244)
- recent studies show no short-term (days) or long-term (months) effects of exposure on the composition, abundance, size structure, behaviour or movement of demersal fish species targeted by commercial fisheries (Ref. 270)
- the potential for fish to receive TTS is assessed as being acceptable based on hearing loss and any subsequent decrease in fitness would be temporary and recovery occurring in a relatively short timeframe (<24 hrs)
- any behavioural impacts are likely to be short-lived (minutes or hours) and occur within hundreds of metres of the seismic source as it passes
- the stock assessment for all key indicator commercial fish species (Table 6-6) indicates adequate stock status, breeding stock and fishery catch levels (Ref. 243)
- as recovery from TTS or behavioural effects is expected in hours to days, no population level effects are predicted to commercial fish species, thus lasting effects on their catchability, and consequently to commercial catch rates, are not predicted
- there are no predicted impacts to the ecosystems or habitats of the North Coast Fishing Bioregion, where the seismic survey is located within, therefore the seismic survey does not threaten the sustainability of the fisheries that cover smaller areas than the overall distribution of commercial fish species in the North Coast Fishing Bioregion
- commercial fish catches within the Pilbara Demersal Scalefish Fisheries (trawl, trap and line) have been within or exceeded the acceptable catch ranges since 2016, despite a history of seismic surveys across the fisheries.

Demersal fish species associated with the Continental Slope Demersal Fish KEF

The demersal fish species associated with the KEF occupy two distinct demersal community types (biomes) associated with the upper slope, in water depths of 225–500 m and the mid-slope, in water depths of 750–1,000 m (Ref. 27).

As detailed in Table 6-2, Site 3, Site 4 and Scenario 2 best represent sound modelling for the KEF. The modelled distances to the mortality and injury sound exposure guidelines range from <20 to 150 m (Ref. 188). The modelled distance to the TTS 24-hr cumulative sound exposure guideline is 7.56 km (Ref. 188). Thus, there is the potential for some fishes to experience TTS; but as detailed by Popper (Ref. 182) recovery would start as soon as the most intense sounds ended with recovery within 24 hours or less and therefore the likelihood of TTS having a significant impact on fish fitness (in terms of communication, detection of predators or prey, etc.) is low.

Thus, potential impacts to fish species associated with the KEF are not likely to be ecologically significant based on:

- the area of potential overlap with the FPZ is <1% of the total area of the KEF.
- there are no documented cases of mortality (both immediate and delayed) in free-swimming fish upon exposure to seismic source sound in experimental or field studies (Ref. 244)
- the potential for fish to receive TTS is assessed as being acceptable based on hearing loss and any subsequent decrease in fitness would be temporary and recovery occurring in a relatively short timeframe (<24 hrs)
- demersal fish species associated with the KEF are expected to be able to avoid the seismic source as it approaches

- The *Marine Bioregional Plan for the North-west Marine Region* (Ref. 76) rates the impact of underwater sound pollution to the KEF as “*not of concern*” which is based on the impacts are minimal or that the pressure is managed effectively through routine management measures.

The potential impacts to fish species associated with the Continental Slope Demersal Fish KEF from underwater sound emissions from the seismic source are assessed as a consequence level of Minor (5) as impacts will be localised and short term.

Fish species associated with the Ancient Coastline at 125 m Depth Contour KEF

There is little information in relation to fish species associated with the Ancient Coastline at 125 m Depth Contour KEF. DEWHA (Ref. 246) details enhanced productivity associated with the sessile communities and increased nutrient availability may attract larger marine life such as Whale Sharks and large pelagic fish. Preliminary data from the AIMS North West Shoals to Shore research program identified that the KEF is dominated by sandy habitats with some areas of hard substrate with filter feeder communities typical of the North West Shelf (Ref. 247). Thus, substantial benthic communities that would support site-attached fish species are not likely to be present. AIMS (Ref. 248) detailed that fish communities were characteristic of the region and were dominated by various shark species including hammerhead and tiger sharks.

Santos commissioned RPS to undertake a study to describe the fishes associated with the Ancient Coastline at the 125 m Depth Contour KEF. Nine sites at three separate geographic locations were surveyed in the KEF. Key findings from the study in relation to the Ancient Coastline at the 125 m Depth Contour KEF were:

- a total of 643 fish from 39 species and 17 families were recorded with Goldband Snapper (*Pristipomoides multidentis*) and Yellow Spotted Rock Cod (*Epinephelus areolatus*) being the only commercially important species observed at these locations on the KEF
- no escarpment, complex relief, emergent bedrock or complex epibiota assemblages were recorded on video or observed on the vessel sounder at the KEF survey sites
- limited variation in fish assemblages of the KEF were observed between the three KEF study locations
- although within-site variability was high, abundances of fish species were low in the area, comprising relatively mobile demersal fish species
- the four most ubiquitous species were Lunartail Pufferfish (72% deployments), Threadfin Bream (67% deployments), Longnose Trevally (59% deployments) and Giant Trevally (47% deployments).

As detailed in Table 6-2, Site 2 and Scenario 1 best represent sound modelling for the KEF. The modelled distances to the mortality and injury sound exposure guidelines range from <20 m to 192 m (Ref. 188). As discussed previously, the sound exposure guidelines for mortality and injury are considered highly conservative. While mortality or injury to fishes in the immediate proximity of the seismic source is theoretically possible, mobile demersal and pelagic fish species that are likely to be present within the KEF are expected to be able to avoid the seismic source as it approaches.

The modelled distance to the TTS SEL_{24h} cumulative sound exposure guideline is 8.63 km (Ref. 188). Thus, there is the potential for some fishes to experience TTS, but as detailed by Popper (Ref. 182) recovery would start as soon as the most intense sounds ended with recovery within 24 hours or less and therefore the likelihood of TTS having a significant impact on fish fitness (in terms of communication, detection of predators or prey, etc.) is low.

Thus, potential impacts to fish species associated with the KEF are not likely to be ecologically significant based on:

- the area of potential overlap with the FPZ is <1% of the total area of the KEF.
- there are no documented cases of mortality (both immediate and delayed) in free-swimming fish upon exposure to seismic source sound in experimental or field studies (Ref. 244)
- the potential for fish to receive TTS is assessed as being acceptable based on hearing loss and any subsequent decrease in fitness would be temporary and recovery occurring in a relatively short timeframe (<24 hrs)
- studies to date have identified predominately mobile demersal and pelagic fish species associated with the KEF and these species are expected to be able to avoid the seismic source as it approaches
- The *Marine Bioregional Plan for the North-west Marine Region* (Ref 76) rates the impact of underwater sound pollution to the KEF as “*of less concern*” which is based on the impacts are unlikely to be substantial or that current management measures in place are effective in minimising or mitigating the impact.

The potential impacts to fish species associated with the Ancient Coastline at 125 m Depth Contour KEF from underwater sound emissions from the seismic source are assessed as a consequence level of Minor (5) as impacts will be localised and short term.

Fish species associated with the Wheatstone ridgeline

There is no information in relation to fish species associated with the Wheatstone ridgeline so it is assumed that fish species would be similar to those associated with the hard substrate of the Ancient Coastline at the 125 m Depth Contour KEF. Thus, it is likely that fish species would consist of demersal and pelagic species characteristic of the region.

As detailed in Table 6-2, Site 1 and Scenario 1 best represent sound modelling for the Wheatstone ridgeline. The modelled distances to the mortality and injury sound exposure guidelines range from <20 to 270 m (Ref. 188). As discussed previously, the sound exposure guidelines for mortality and injury are considered highly conservative. While mortality or injury to fishes in the immediate proximity of the seismic source is theoretically possible, mobile demersal and pelagic fish species that are likely to be present within the Wheatstone ridgeline are expected to be able to avoid the seismic source as it approaches.

The modelled distance to the TTS SEL_{24h} cumulative sound exposure guideline is 8.63 km (Ref. 188). Thus, there is the potential for some fishes to experience TTS, but as detailed by Popper (Ref. 182) recovery would start as soon as the most intense sounds ended with recovery within 24 hours or less and therefore the likelihood of TTS having a significant impact on fish fitness (in terms of communication, detection of predators or prey, etc.) is low.

Thus, potential impacts to fish species at the Wheatstone ridgeline is not likely to be ecologically significant based on:

- there are no documented cases of mortality (both immediate and delayed) in free-swimming fish upon exposure to seismic source sound in experimental or field studies (Ref. 244)
- the potential for fish to receive TTS is assessed as being acceptable based on hearing loss and any subsequent decrease in fitness would be temporary and recovery occurring in a relatively short timeframe (<24 hrs)
- mobile demersal and pelagic fish species likely to be associated with the Wheatstone ridgeline are expected to be able to avoid the seismic source as it approaches.

The potential impacts to fish species associated with the Wheatstone ridgeline are assessed as a consequence level of Minor (5) as impacts will be localised and short term.

Plankton

Plankton is a collective term for all marine organisms that are unable to swim against a current. This group is diverse and includes phytoplankton (plants) and zooplankton (animals), as well as fish and invertebrate eggs and larvae. The noise effect criteria for fish eggs and fish larvae has been identified as relevant for plankton (Ref. 188; Section 6.5.1.1), and as such has been used for the following consequence evaluation.

Behavioural disturbance

Impulsive sound sources have been identified as moderate risk of causing behavioural changes to plankton in close proximity to the sound source; and there is low risk of causing behavioural change beyond this close proximity, and low risk of masking at all distances from the sound source (Table 6-3).

Any effects to plankton have to be assessed in the context of natural mortality rates, which are generally considered high and variable. Plankton also have a patchy distribution linked to localised and seasonal productivity that produces sporadic bursts in populations (Ref. 76). Sound emissions on sparse plankton populations are unlikely to cause a significant change in behaviour at a measurable level. Therefore, the potential behavioural impacts from sound emissions on plankton are not evaluated further.

Mortal or potential mortal injury

Acoustic modelling indicated that the R_{max} from the source to mortal, potential mortal, or recoverable injury single pulse PK noise effect criteria for fish eggs and fish larvae was <0.27 km (Table 6-3, Table 6-4).

Acoustic modelling also indicated that the R_{max} from the source to mortal, potential mortal, or recoverable injury SEL_{24h} noise effect criteria for fish eggs and fish larvae was <0.02 km (Table 6-3, Table 6-4). Note that the SEL_{24h} is a cumulative metric that assumes a receptor is consistently exposed to the relevant noise effect criteria for a 24-hour period. In reality, given both a moving sound source (i.e., the seismic vessel) and moving marine fauna, these modelled outputs are likely to be an overly conservative and unlikely worst-case scenario.

Any potential mortality or mortal injury effects to plankton have to be assessed in the context of natural mortality rates. Mortality or mortal injury impacts to plankton (including fish eggs and larvae) resulting from seismic acoustic emissions are likely to be inconsequential compared to natural mortality rates. These have been reported to be very high, exceeding 50% per day in some species and commonly exceeding 10% per day (Ref. 249). In a review of mortality estimates (Ref. 250) the mean mortality rate for marine fish larvae was 0.24, a rate equivalent to a loss of 21.3% per day. In the experiment undertaken by McCauley et al. (Ref. 251) zooplankton mortality rate background levels were 19%, thus predicted impacts to zooplankton from the seismic survey are likely to be within natural mortality rates. Sætre and Ona (Ref. 252) calculated that under the 'worst-case' scenario, the number of larvae killed during a typical seismic survey was 0.45% of the total population, and they concluded that mortality rates caused by exposure to underwater sound are so low compared to natural mortality that the impact from seismic surveys must be regarded as insignificant.

Richardson et al. (Ref. 253) modelled the results from McCauley et al. (Ref. 254) in the context of ocean ecosystem dynamic and zooplankton population dynamic. They determined that zooplankton abundance would not be adversely affected during the extensive movement of water masses carrying plankton through areas targeted by seismic acquisition, and the rapid reproductive cycle and high reproductive potential characteristics of planktonic organisms. The study showed that it would take approximately three days after the end of a typical 4,000 cu.in seismic survey for the zooplankton to recover to original levels. In addition, zooplankton communities may begin to recover during the seismic survey such that a continuous decline in zooplankton throughout the duration of the seismic survey is not anticipated and parts of the seismic survey area would be replenished as the seismic survey progressed (Ref. 253).

As identified in Section 4, the following values and sensitivities have been identified as relevant to this consequence evaluation:

- foraging BIA for Whale Sharks
- fish eggs and larvae for commercial fisheries.

Foraging BIA for Whale Sharks

As described in Section 4.3.3.1, the Whale Shark is a suction filter feeder, with a diet consisting of planktonic and nektonic prey. The foraging BIA for Whale Sharks overlaps with both the OA and FPZ, and is associated with the northward migration of Whale Sharks from the Ningaloo Reef area during July to November (Section 4.3.3.1). The acquisition timing (mid-December to mid-April) for the 4D MSS is outside of the migration period (July to November) and therefore use of the foraging BIA for Whale Sharks. Given that there is no temporal overlap between the use of the foraging BIA by Whale Sharks and the 4D MSS, and the naturally high plankton recovery rates as described above, no further evaluation of this sensitivity has been undertaken.

Fish eggs and larvae for commercial fisheries

DPIRD (Ref. 254) has defined the depth ranges and spawning periods for a range of key indicator species for the North Coast commercial fish species. For those key commercial fish species that have spawning periods overlapping the timing of the 4D MSS (Goldband Snapper, Rankin Cod, Red Emperor, Blue-spotted Emperor and Ruby Snapper), they spawn throughout their ranges rather than aggregating at a specific area (Ref. 254). Spanish Mackerel is the exception as they form spawning schools around inshore reefs (Ref. 254).

To evaluate the consequence to commercial fish spawning the assessment considers:

- spatial-temporal analysis to provide context on the proportion of the spawning biomass that may be exposed during the 4D MSS
- natural variability in fish distribution, spawning biomass and recruitment
- sustainability status of the fish stocks and fisheries.

Newman et al. (Ref. 255) note that the mixed or multispecies fisheries in WA are managed using an indicator species approach where one or more species in the suite are used to monitor the status of the fishery.

A spatial-temporal analysis was undertaken as detailed in Table 6-6 to determine the overlap between the 4D MSS and the principal spawning ranges and timings of key commercial indicator species. The analysis provides an indication of the proportion of the spawning area and the proportion of the spawning period for each species that may be exposed to underwater sound from the 4D MSS.

Spawning for Spanish Mackerel, the key indicator species for the Mackerel Managed Fishery, is not predicted to be impacted as the principal depth range for the species, and hence spawning, is <50 m (Ref. 254) and the depth of the OA and FPZ is >50 m and >60 m respectively.

The spatial-temporal analysis is not intended to provide an exact estimate of how much each species' spawning success rate will be impacted. Instead, it demonstrates that the proportion of eggs and larvae that may be affected is relatively small compared to the larger overall spawning biomass, spawning area and spawning periods of each stock, which is important context for this consequence evaluation. The analysis identified that the spatial overlap ranges from ~0.3% (Red Emperor) to ~3.8% (Ruby Snapper) and the temporal overlap ranges from ~25% (Red Emperor) to ~49% (Ruby Snapper) (Table 6-6).

Based on the spatial-temporal analysis the overlap of spawning timing and area with the OA and timing is small and conservative based on:

- The key commercial fish species have multiple, broadcast spawning behaviours which offset potentially high natural embryo and larval mortality as a result of predation or other environmental factors that may occur at a regional scale, and thereby spreads the risk or potential opportunity for larval settlement over large areas and long timeframes.
- Fish spawning will not be evenly distributed through their range or within the OA.
- Only a small area within the OA will be impacted at a time as the seismic vessel moves through the OA over the 75-day period.
- The sound source will not be operating for the entire 75-day period which includes down time, equipment set-up and maintenance and line turns.

Impacts to fish spawning are not predicted to lead to a reduction in spawning stock as impacts to fish eggs and larvae are likely to be inconsequential compared to natural mortality rates (Ref. 249, Ref. 250, Ref. 251, Ref. 252).

In addition, the spawning biomass and breeding stock for the key indicator species for assessment and stock status have been assessed as sustainable - adequate (Ref. 243) for the past 5 years, in which time there has been both ongoing commercial fishing and seismic surveys undertaken.

The potential impacts to fish eggs and larvae from underwater sound emissions from the seismic source is assessed as a consequence level of Minor (5) as impacts will be localised and short term.

Table 6-6: Commercial fish species spawning spatial and temporal overlap

Key indicator fish stock*	FPZ spatial overlap with stock range^	FPZ temporal overlap with spawning period^
Goldband Snapper		
Principal depth range: 50 – 200 m	1.3%	31%
Stock range (area within depth range): 124,441 km ² A single genetic stock is considered from Lynher Bank north of Broome to Shark Bay. For this assessment a smaller stock range extending to the North West Cape, which is the westerly limit of the Pilbara fisheries, has been used.	(1,644/124,441)	(75/243)
Spawning period: 243 days (Oct-May)		
Red Emperor*		
Principal depth range: 10 – 180 m	0.3%	25%
Stock range (area within depth range): 494,173 km ² A single genetic stock between Queensland and Shark Bay in WA. For this assessment a smaller stock range to the WA-NT border has been used.	(1,644/124,441)	(75/303)
Spawning period: 303 days (Sept-Jun)		
Rankin Cod*		
Principal depth range: 10 – 150 m	0.9%	31%
Stock range (area within depth range): 177,449 km ² A single biological stock from the Lacepede Islands to Abrolhos Islands.	(1,644/177,449)	(75/245)
Spawning period: 245 days (Jun-Dec, Mar)		
Blue-spotted Emperor*		
Principal depth range: 5 – 110 m	0.9%	27%
Stock range (area within depth range): 177,449 km ²	(1,644/177,449)	(75/274)

A single biological stock from the Lacepede Islands to Abrolhos Islands.		
Spawning period: 274 days (Jul-Mar)		
Ruby Snapper		
Principal depth range: 150 – 480 m	3.8%	49%
Stock range (area within depth range): 43,572 km ² The genetic stock is uncertain. For this assessment the Pilbara management unit has been used.	(1,644/43,572)	(75/152)
Spawning period: 152 days (Dec-Apr)		
Spanish Mackerel*		
Principal depth range: 0 – 50 m	No overlap (OA in >50 m water depth; FPZ in >60 m water depth)	N/A
Stock range (area within depth range): 186,753 km ² The north and west coasts of Australia (NT and WA). For this assessment a smaller stock from the NT border to Shark Bay has been used.		
Spawning period: 91 days (Sept-Dec)		

* indicator species monitored for the sustainability of the fishery

^ spatial and temporal overlaps calculated on assumption that entire FPZ area and entire duration of the seismic acquisition occur within stock range and spawning period.

Benthic invertebrates

Acoustic modelling indicated that the maximum horizontal distance from the source to the PK-PK no effect sound level at the seafloor for crustaceans was 0.913 km; and to the maximum sound level at the seafloor was 0.366 km (Section 6.5.1.2). Acoustic modelling indicated that the maximum distance from the source to the PK-PK maximum sound level for bivalves was 0.241 km (Section 6.5.1.2).

Research is ongoing into the relationship between sound and its effects on benthic invertebrates, including the relevant metrics for both effect and impact. Marine invertebrates lack a gas-filled bladder and are unable to detect the pressure component of sound waves (Ref. 256; Ref. 257) or “hear” sound in the way that mammals and fish can. Available literature suggests particle motion, rather than sound pressure, is a more important factor for crustacean and bivalve hearing. Water depth and seismic source size are related to the particle motion levels at the seafloor, with larger arrays and shallower water being related to higher particle motion levels, more likely relevant to effects on crustaceans and bivalves (Ref. 188).

There have been several recent reviews of seismic underwater sound impacts to invertebrates — Carroll et al. (Ref. 230), Edmonds et al. (Ref. 258), Ref. 259 and Webster et al. (Ref. 226). Several studies have been undertaken on decapods (crabs, lobsters, prawns) with a range of effects to no effects identified, though none have found any evidence of increased mortality due to acoustic impacts from seismic exposure. A range of physiological responses have been identified in some studies at sound levels typically received within a few hundred metres from the seismic source or from repeated exposure at the same sound levels. This repeated exposure is not realistic in an actual seismic survey as the vessel is transiting along sail lines with a swath width approximately 7.5–8 km apart, therefore a single receptor will not be exposed to repeated exposure at the same sound level.

From 2013 to 2015, a long-term study evaluated the acoustic impacts from seismic exposure on southern rock lobsters (*Jasus edwardsii*) (Ref. 260). The study found that sub-lethal effects, relating to impairment of reflexes, damage to the statocysts and reduction in numbers of haemocytes (possibly indicative of decreased immune response function), were observed after exposure to measured received sound levels of 209 to 212 dB PK-PK. Payne et al. (Ref. 261) in a study on seismic impacts to the American lobster (*Homarus americanus*) found no effects in righting time or haemolymph biochemistry but a possible reduction in calcium after exposure to received sound levels of 202 dB PK-PK.

At received sound levels of 209 dB PK-PK (Ref. 260) impacts to spiny lobster embryonic development were not observed with hatched larvae found to be unaffected in terms of egg development, the number of hatched larvae, larval dry mass and energy content and larval competency (i.e., survival in adverse conditions); thus, recruitment should be unaffected.

Recent Australian studies (Ref. 262; Ref. 263; Ref. 264; Ref. 265) have focussed on commercial scallops (*Pecten fumatus*). Przeslawski et al. (Ref. 262; Ref. 263) examined the short-term impacts on scallops and other marine invertebrates from a 2,530 cu.in seismic source and found no evidence of mortality or change in condition following exposure to a seismic survey. Day et al.

(Ref. 264; Ref. 265) exposed scallops to maximum received sound exposures of up to 213 dB PK-PK with exposure not resulting in any immediate mass mortality; however, repeated exposure was considered to possibly increase the risk of mortality. Though Day et al. (Ref. 264) recorded increased mortality with repeated exposure to a seismic source, it has not been established as to whether this was due to the seismic source exposure or other mechanism related to the study design (Ref. 262). Using a precautionary approach, if the increased mortality was due to the seismic source then the increased mortality identified translates to an annual increase of between 9.4% and 20%. These fall towards the low end of what might be expected when compared with natural mortality rates in wild scallop populations, which range from 11-51% with a six year mean of 38% (Ref. 264).

As identified in Section 4, the following values and sensitivities have been identified as relevant to this consequence evaluation:

- scampi (crustaceans) associated with the North West Slope Trawl Fishery
- invertebrate communities associated with the ancient coastline at 125 m depth contour KEF
- invertebrate communities associated with the Wheatstone ridgeline.

Scampi (crustaceans) associated with the North West Slope Trawl Fishery

As identified in Section 4.4, the North West Slope Trawl Fishery (NWSTF) has recorded fishing effort within the OA, with low vessel numbers, during the 2015-2020 period. The key target species of the NWSTF is Australian scampi (*Metanephrops australiensis*) with smaller quantities of velvet scampi (*M. velutinus*) and Boschma's scampi (*M. boschmai*) (Ref. 266). Scampi are a benthic species that inhabits the continental shelf, typically occurring at depths of 420-500 m, and preferring a comparatively firmer substrate (Ref. 267). In the event that scampi are present within the OA, some may experience sound levels that could result in some low-level, sub-lethal effects (e.g., impairment of reflexes, damage to statocysts and reduction in numbers of haemocytes). These sub-lethal effects could reduce fitness of some individual scampi but impacts at a population level due to reduced fitness would be unlikely as there would be sufficient unaffected individuals to maintain the population.

Invertebrate communities associated with the ancient coastline at 125 m depth contour KEF

The FPZ overlaps ~0.75% of the ancient coastline at 125 m depth contour KEF (122/16,242 km²). Preliminary data from the AIMS North West Shoals to Shore research program, which includes multibeam and towed video surveys of an area of the KEF that the OA and FPZ overlaps, identified that the KEF is dominated by sandy habitats with some areas of hard substrate with filter feeder communities typical of the North West Shelf (Ref. 248). Thus, substantial benthic invertebrate communities are not likely to be present. Some invertebrates within the KEF may experience sound levels that could result in some low-level, sub-lethal effects (e.g., impairment of reflexes, damage to statocysts and reduction in numbers of haemocytes). These sub-lethal effects could reduce fitness of some individuals within the small (<0.75%) area of overlap with the KEF but impacts at a population level would be unlikely as there would be sufficient unaffected individuals to maintain the population. The ecosystem functioning and integrity of the ancient coastline at 125 m depth Contour KEF are not predicted to be altered.

Invertebrate communities associated with the Wheatstone ridgeline

As detailed in Section 4.3.5, the Wheatstone ridgeline comprises hard rock with a sand veneer (Ref. 91). Benthic surveys identified that for sessile benthic organisms, gorgonians and sponges were dominant (Ref. 90); however, as per the consequence evaluation for marine habitats below, no effect to these is predicted to occur. The dominant infauna species were polychaetes and crustaceans. Some invertebrates within the ridgeline may experience sound levels that could result in low-level, sub-lethal effects (e.g., impairment of reflexes, damage to statocysts and reduction in numbers of haemocytes). These sub-lethal effects could reduce fitness of some individuals within the area of overlap but impacts at a population level would be unlikely as there would be sufficient unaffected individuals to maintain the population. The ecosystem functioning and integrity of the ridgeline are not predicted to be altered.

The potential impacts to benthic invertebrates within the OA from underwater sound emissions from the seismic source are assessed as a consequence level of Minor (5) as impacts will be localised and short term.

Marine habitat (corals, sponges)

Acoustic modelling indicated that the PK no effect sound level at the seafloor for sponges and corals was not reached (Section 6.5.1.2). As such, no further evaluation of coral and sponge habitats has been undertaken.

Humans (divers, swimmers)

Acoustic modelling indicated that the SPL human health assessment threshold at Site A (~64 m water depth) was 51.07 km.

Guidance note DMAC 12 issued by the UK Diving Medical Advisory Committee (DMAC) "Safe Diving Distance from Seismic Surveying Operations" recommends that where diving and seismic activities are scheduled to occur within a distance of 45 km of each other, it would be good practice for all parties to be made aware of the planned activity where practicable. Within 45 km of the OA the following were identified:

- Recreational diving and snorkeling at the Montebello Islands
- Commercial diving at the Pluto, Wheatstone, Goodwyn Alpha, John Brookes, or Wonnich oil and gas facilities
- Commercial diving at pearl leases within the Montebello Islands Marine Park Special Purpose Zone (Pearling).

From the acoustic modelling study (Ref. 188), the shallow waters (<25 m) around the Montebello Islands are not predicted to be ensonified above 140 dB SPL considering the closest potential location where the seismic source could be active (Site A). Therefore, the isopleth corresponding to the human health assessment threshold of 145 dB SPL will not be exceeded in water depths relevant to recreational diving at the Montebello Islands or commercial diving at pearl leases within the Montebello Islands Marine Park Special Purpose Zone (Pearling). The influence of the bathymetry on the sound fields and the orientation of the source are the reason the shallow waters around the Montebello Islands are not predicted to be ensonified above the human health assessment threshold (Ref. 188).

There is the potential for commercial diving to occur at the Wheatstone and Pluto oil and gas facilities within the OA and the John Brookes, Goodwyn Alpha and Wonnich facilities, which are located within 45 km of the OA. If diving activities are required to be undertaken at the time of the seismic survey, consultation and management of activities will be undertaken as per the Guidance DMAC 12: Safe Diving Distance from Seismic Surveying Operations (Ref. 268).

The potential impacts to recreational and commercial divers from underwater sound emissions from the seismic source is assessed as a consequence level of Incidental (6) as impacts are unlikely to occur.

Concurrent operations

Cumulative impacts from seismic surveys can potentially occur when the activities take place concurrently in close proximity to each other, or when the timing between surveys is less than the recovery rate of any potential impacts.

Concurrent Surveys

For seismic surveys that occur at the same time, the Bureau of Ocean Energy Management (Ref. 269) recommends a 40 km geographic separation distance (based on worst-case scenarios) between the sources of concurrent seismic surveys to minimise the impacts to marine life, by providing a 'corridor' between vessels. As detailed in Section 4.4.3, the following seismic surveys have OAs that overlap (and therefore occur within 40 km) of the Wheatstone 4D MSS:

- Rollo Multiclient MSS
- NWS Renaissance North Multi Client MSS.

Consultation with seismic operators for the surveys described in Table 4-14 during January 2022 indicate that no concurrent activities for the two surveys (Rollo Multiclient MSS or the NWS Renaissance North Multi Client MSS) with overlapping OAs with the Wheatstone 4D MSS are currently scheduled. The third survey (Capreolus-2 3D MSS) described in Table 4-14 may occur at a similar time, however this survey is located ~100 km east from the 4D MSS. As such, no further evaluation on the risks from concurrent seismic surveys has been undertaken.

Previous Surveys

A review of previous seismic surveys over or adjacent to the OA identified:

- Woodside Pluto and Harmony 4D seismic surveys undertaken from December 2019 through to February 2020.

Based on the acoustic modelling study and sound impact assessment conducted for the seismic survey the recovery periods for any impacts to receptors are predicted to be:

- Immediately after completing seismic acquisition for migratory or transient species that may avoid the area such as whales, Whale Sharks, turtles and pelagic fishes.
- Days or weeks after completing seismic acquisition for demersal fish species, including key indicator commercial fish species that may show avoidance or behavioural reactions.

- Days to months after completing seismic acquisition for plankton, based on the CSIRO modelling study (Ref. 253).
- Weeks to months after completing seismic acquisition for site-attached fish species and benthic invertebrates as only sub-lethal effects were identified that would not reduce reproductive potential or inhibit spawning.

Based on the fishing effort reported in the annual State of the Fisheries reports (2013 to 2019) for key indicator commercial fish species, there has been no decline in the total annual catch, despite seismic surveys having been conducted within this period and overlapping the area of catch and effort for these fisheries.

As the most recent survey to overlap the OA was conducted December 2019 to February 2020, there will be a gap of 34 months prior to the commencement of the Wheatstone 4D MSS, and thus cumulative impacts to receptors are not predicted. As such, no further evaluation on the risks from repeated seismic surveys has been undertaken.

ALARP decision context justification

Marine seismic surveys are commonplace and well-practised nationally and internationally. Impacts from sound emissions are relatively well understood though there is the potential for uncertainty in relation to the level of impact.

The application of control measures to manage impacts and risks arising from this aspect are well defined and understood by the industry and are considered standard industry practice.

During stakeholder consultation objections and claims were raised regarding underwater sound emissions impacts on commercial fish species which have been addressed.

As such, CAPL applied ALARP Decision Context B for this aspect, and consideration of additional controls was undertaken to ensure the potential impacts and risks associated with underwater sound are managed to ALARP.

Good practice control measures and source

Control measure	Source
EPBC Act Policy Statement 2.1 – Standard Management Procedures	<p>The requirements to manage interactions between offshore seismic vessels and whales are detailed in the <i>EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales</i>.</p> <p>This policy describes a framework to minimise the risk of biological consequences from seismic acoustic sources to whales within biologically important areas or during critical behaviours. The policy also provides practical standards to minimise the risk of acoustic injury to whales in the vicinity of seismic acquisition activities. The management procedures described in the policy should be applied whenever whales are, or might be, encountered (where “whales” includes baleen whales and larger toothed whales).</p> <p>By implementing these control measures and managing interactions with cetaceans near the seismic vessel, the potential risks from underwater sound are reduced.</p> <p>The Standard Management Procedures defined within Policy 2.1 should be followed by all vessels conducting seismic surveys in Australian waters, irrespective of location and time of year.</p> <p><u>Precaution zones</u></p> <p>As per the requirements of EPBC Act Policy Statement 2.1 and the results of acoustic modelling (Ref. 188), the following precaution zones will apply during the 4D MSS:</p> <ul style="list-style-type: none"> • Observation zone: 3+ km horizontal radius from the acoustic source • Low power zone: 2 km horizontal radius from the acoustic source • Shut-down zone: 500 m horizontal radius from the acoustic source. <p><u>Part A – Standard management procedures</u></p> <ul style="list-style-type: none"> • A.1 Pre-survey planning: • A.2 Trained crew:

	<ul style="list-style-type: none"> A.3 During surveys: A.4 Compliance and sighting reports <p>EPBC Policy 2.1 considers that the likelihood of encountering whales increases from low to moderate-high where a survey is spatially and/or temporally proximate to aggregation areas, migratory pathways and/or areas considered to provide biologically important habitat. As the 4D MSS is scheduled to occur between mid-December and mid-April, and therefore overlaps with Pygmy Blue Whale migration (southbound during December, and northbound during April), EPBC Policy 2.1 also requires consideration of Part B management procedures is required under the policy – refer to assessment under 'additional control measures' below.</p>
DMAC Guidance	Guidance note DMAC 12 issued by the UK Diving Medical Advisory Committee (DMAC) "Safe Diving Distance from Seismic Surveying Operations" (Ref. 268) recommends that where diving and seismic activities are scheduled to occur within a distance of 45 km of each other, it would be good practice for all parties to be made aware of the planned activity where practicable. If diving activities are required to be undertaken at the time of the seismic survey, consultation and management of activities will be undertaken as per the Guidance DMAC 12: Safe Diving Distance from Seismic Surveying Operations (Ref. 268).
BOEM Guidance	For seismic surveys that occur at the same time, the Bureau of Ocean Energy Management (BOEM) (Ref. 269) recommends a 40 km geographic separation distance between the sources of concurrent seismic surveys to minimise the impacts to marine life, by providing a 'corridor' between vessels.
Adjustment protocol	CAPL will consider an evidence-based adjustment protocol for the commercial fishing sector should fishers be verifiably impacted to a commercially material extent by the 4D MSS (Section 7.3.4.1). CAPL will assess claims from commercial fishing license holders for temporary loss of catch, displacement, or equipment loss/damage, occurring within the OA and during the 4D MSS.

Additional control measures and cost-benefit analysis

Control measure	Benefit	Cost
EPBC Act Policy Statement 2.1 – Additional Management Procedures – B.1 Marine Mammal Observers	The use of marine fauna observers (MFOs) can increase the visual detection of cetaceans present within proximity to the seismic vessel. Being able to better locate cetaceans and implement the precaution zones, will assist in reducing the risk of behavioural or hearing impairment impacts to cetaceans.	<p>Costs for engaging a MFO are expected to be in the order of ~\$800-1,000/day.</p> <p>The use of MFOs and detection of cetaceans may lead to increased survey duration and overall costs due to power downs and shut-downs of the activity.</p> <p>However, the cost of MFOs and the benefit of reducing impacts to cetaceans is considered to outweigh the financial costs from not implementing this control. Therefore, control measure <u>has</u> been adopted for use.</p>
EPBC Act Policy Statement 2.1 – Additional Management	Limiting seismic operations during night-time or poor-visibility conditions would reduce the probability of a cetacean	Reducing operational timing to daylight hours only would significantly

<p>Procedures – B.2 Night-time/Poor-visibility</p>	<p>occurring the low power or shut down zones and not being detected.</p>	<p>increase the duration and operational cost of the MSS. This increase in duration would require the survey to either be split over multiple years or extend beyond the mid-December to mid-April acquisition window; both of which would also introduce additional environmental risks.</p> <p>Given the small temporal overlap of the migratory period for Pygmy Blue Whales (southbound during December, and northbound during April) and the 4D MSS (mid-December to mid-April), the additional cost of limiting seismic operations during night-time or poor-visibility conditions is grossly disproportionate to the environmental benefit. Therefore, control measure <u>has not</u> been adopted for use.</p>
<p>EPBC Act Policy Statement 2.1 – Additional Management Procedures – B.3 Spotter Vessel(s) and Aircraft</p>	<p>Use of spotter vessels or aircraft may be used to assist in detecting the presence of individuals or groups of cetaceans, during daylight operations only.</p> <p>The policy recommends considering this management procedure when the likelihood of encountering whales is 'high'. This is not considered to be the case for the 4D MSS as it is occurring outside the period of Humpback Whale migration, and outside the peak Pygmy Blue Whale migration with a small temporal overlap with the end of the southbound migration period during December or the beginning of the northbound migration during April.</p>	<p>Cost of specialist aircraft with good downward visibility (or a spotter vessel) with additional MFOs required on board aircraft/vessel are estimated at approximately \$10–20,000 per day. Use of these spotter aircraft/vessels would also introduce additional environmental and safety risks.</p> <p>Given the small temporal overlap of the migratory period for Pygmy Blue Whales (southbound during December, and northbound during April) and the 4D MSS (mid-December to mid-April), the additional cost and risks of the use of spotter aircraft/vessels is grossly disproportionate to the environmental benefit. Therefore, control measure <u>has not</u> been adopted for use.</p>
<p>EPBC Act Policy Statement 2.1 – Additional Management Procedures – B.4</p>	<p>The policy recommends considering this management procedure when surveys are in or near important habitats, such as feeding, breeding or resting areas</p>	<p>N/A</p>

<p>Increased Precaution zones and Buffer zones</p>	<p>increased precaution zones or buffer zones. As the seismic survey is not within and does not impact on feeding, breeding or resting areas increased precaution or buffer zones are not required</p>	
<p>EPBC Act Policy Statement 2.1 – Additional Management Procedures – B.5 Passive Acoustic Monitoring</p>	<p>Potential to detect vocalizing cetaceans which might not otherwise be visible at the sea surface. Although PAM can be used to supplement visual observations made by the MFO, the method is dependent upon animals vocalising. Therefore, the method is only effective at detecting vocalizing cetaceans and is also dependent on environmental conditions.</p> <p>The approach is most effective for detecting odontocetes (toothed cetaceans, e.g., orcas, dolphins, Sperm Whales) that produce clicks and whistles that can be more readily differentiated from low frequency seismic impulses and vessel noise than low frequency calls by baleen whales (e.g., Humpback, Pygmy Blue, Fin, Sei, Bryde’s Whales).</p> <p>Verfuss et al. (Ref. 271) who undertook a review of low visibility monitoring techniques, concluded that PAM works best in low background sound fields as high levels of sound can mask the vocalisations produced by the target species when overlapping in frequency and time. PAM detections of baleen whales during active seismic surveys are extremely low or entirely absent, but the method can work well with many odontocete species. As such PAM is not considered to be appropriate for use in detecting baleen whales such as Pygmy Blue Whales.</p>	<p>Sophisticated PAM systems are required to effectively filter low frequency cetacean calls and such systems are not readily available on all seismic vessels.</p> <p>Costs for engaging a trained PAM operator are expected to be in the order of ~\$1,000/day (~\$75,000 for the survey).</p> <p>The significant additional cost of having a trained PAM operator on board for the duration of the survey when there may be few or no detections of the targeted low-frequency whale species (i.e., Pygmy Blue Whale) is considered grossly disproportionate to any limited additional benefit that PAM might provide. Therefore, control measure <u>has not</u> been adopted for use.</p>
<p>EPBC Act Policy Statement 2.1 – Additional Management Procedures – B.6 Adaptive Management</p>	<p>The policy recommends considering this management procedure when the survey is in an area that is spatially or temporally on the edge of areas considered to provide biologically important habitat.</p> <p>The 4D MSS may overlap either the end of the Pygmy Blue Whale southbound migration period during December or the beginning of the Pygmy Blue Whale northbound migration period during April (i.e., there is potential for up to an approximate two-week overlap period during either the start or end of the survey).</p> <p>In recognition of this temporal and spatial overlap with the ends of predicted migration periods, and acknowledging that the predicted SEL_{24h} TSS extends up to 12.5 km from a sound source, the use of an extended observation zone during December and</p>	<p>No additional personnel costs. However, the detection of cetaceans in an extended observation zone may lead to increased survey duration and overall costs due to power downs and shut-downs of the activity.</p> <p>However, the benefit of reducing impacts to cetaceans is considered to outweigh the financial costs from not implementing this control. Therefore, control measure <u>has</u> been adopted for use.</p>

	<p>April pre start-up procedures is proposed.</p> <p>Supplementary marine fauna observations from the bridge-watch crew on the support vessel/s (noting at least one will always be within the OA with the seismic vessel) will be used to during the pre start-up 30 minute visual observation period to extend the observation zone beyond the required 3 km from the seismic vessel (as per the Standard Management Procedures under Policy 2.1). These supplementary observations are not intended as a dedicated MFO role, as bridge-watch crew will also be required to fulfil their primary responsibilities onboard the support vessel. However, any supplementary observations from a support vessel will increase the visual observation distance from the seismic vessel; and will therefore assist in reducing the risk of hearing impairment impacts to cetaceans.</p>	
<p>Application of observation and shutdown procedures for marine turtles</p>	<p>Extending fauna observations to include marine turtles will minimise the potential for acoustic impacts to internesting turtles should there be a presence within the OA.</p> <p>The use of a 100 m shutdown zone is considered to be a practicable measure to implement. A 100 m shutdown zone is considered to be conservative given that PK TTS effects were predicted to be limited to <20 m from (and PK PTS was not predicted to be reached).</p> <p>The seismic source will be shut down, or start-up will be delayed for 15 minutes, if a turtle is observed within the shut-down zone. Operation of the seismic source using soft-start shall only resume when 15 minutes have lapsed since the turtle sighting or the turtle has been observed to move outside the shutdown zone.</p>	<p>There is the potential for increased operational costs due to additional and/or prolonged shutdowns due to marine turtle sightings.</p> <p>However, the cost of MFOs and the benefit of reducing impacts to cetaceans is considered to outweigh the financial costs from not implementing this control. Therefore, control measure <u>has</u> been adopted for use.</p>
<p>Survey timed to avoid spawning times for commercially targeted key indicator species</p>	<p>Combined spawning periods for the key indicator species cover all 12 months of the year. The spatial area of overlap is very small (up to 3.8% for species that have very large stock ranges covering significant proportions of the NW of Australia).</p> <p>Timing the seismic survey to avoid spawning times for commercially targeted key species would result in the seismic survey coinciding with peak migration periods of cetaceans known to migrate through the OA. These cetacean species are considered more susceptible to the potential impacts associated with the seismic survey, and therefore the seismic survey timeframes have been set to avoid those peak migration periods and rather than</p>	<p>If all spawning periods for commercially targeted key indicator species were avoided, the 4D MSS could not be acquired. Altering the proposed acquisition period would also introduce risks for other sensitive species. Therefore, control measure <u>has not</u> been adopted for use.</p>

	<p>spawning periods for fish species which have been shown to be less sensitive.</p> <p>It is not possible to time the seismic survey to avoid both periods of fish spawning and cetacean migration, as this would not allow for a sufficient window of time to acquire the seismic survey.</p>	
Likelihood and risk level summary		
Likelihood	<p>With the identified controls implemented it is unlikely (4) that impacts such as mortality, mortal injury, injury, PTS or TTS will occur to receptors. It is more likely that receptors would exhibit short term behavioural avoidance to the seismic source as it moves through the seismic survey area.</p> <p>Although localised and temporary behavioural disturbance may occur, it is unlikely that this would result in any impact to a sensitive life stage of the fauna identified. It is reasonable to expect that impacts such as these will not occur during this project with the identified controls in place. Therefore, the likelihood is considered Seldom (3).</p>	
Risk level	Low (7)	
Determination of acceptability		
Principles of ESD	<p>The impacts and risks associated with this aspect are assessed as localised and short-term. There is no threat of serious or irreversible environmental damage or significant impact to biological diversity or ecological integrity associated with underwater sound emissions from the seismic source during the seismic survey. The aspect and potential interactions are well understood and managed in accordance with applicable industry standards and industry good practice.</p> <p>The consequence associated with this aspect is Minor (5).</p> <p>Therefore, no further evaluation against the Principles of ESD is required.</p>	
Relevant environmental legislation and other requirements	<p>Legislation and other requirements considered applicable for this aspect include:</p> <ul style="list-style-type: none"> • EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans • <i>Conservation Management Plan for the Blue Whale 2015–2025</i> (Ref. 68) • <i>Conservation Advice Megaptera novaeangliae Humpback Whale</i> (Ref. 67) • <i>Conservation Advice Balaenoptera borealis Sei Whale</i> (Ref. 66) • <i>Conservation Advice Balaenoptera physalus Fin Whale</i> (Ref. 65) • <i>Conservation Advice Rhincodon typus Whale Shark</i> (Ref. 64) • <i>Recovery Plan for Marine Turtles in Australia</i> (Ref. 62) • <i>Approved Conservation Advice for Dermochelys coriacea (Leatherback Turtle)</i> (Ref. 63). 	
Internal context	No CAPL environmental performance standards / procedures were deemed relevant for this aspect.	
External context	<p>During stakeholder consultation concerns were raised by WAFIC and individual stakeholders (Section 2.6.4).</p> <p>All stakeholder concerns have been assessed, responded to and controls adopted for objections and claims which hold merit. Proposed controls have been developed based on the advice of WAFIC and individual licence holders.</p>	
Defined acceptable level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In	

	<p>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.</p> <p>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.</p> <p>The <i>Conservation Management Plan for the Blue Whale 2015–2025</i> (Ref. 68) specifies the following relevant action:</p> <ul style="list-style-type: none"> 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. <p>No other specific relevant actions were identified within other documents implemented under the EPBC Act.</p> <p>The OA does not intersect with a foraging BIA for the Pygmy Blue Whale (Table 4-2). The nearest foraging BIA occurs ~225 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.</p> <p>Therefore, CAPL has defined an acceptable level of impact as no injury to marine fauna.</p>	
Environmental performance outcome	Performance standard / Control measure	Measurement criteria
No injury to marine fauna from underwater sound emissions from petroleum activities	<p>EPBC Act Policy Statement 2.1 – Standard Management Procedures</p> <p>The following precaution zones for whales will be implemented during the 4D MSS:</p> <ul style="list-style-type: none"> Observation zone: 3+ km horizontal radius from the acoustic source Low power zone: 2 km horizontal radius from the acoustic source Shut-down zone: 500 m horizontal radius from the acoustic source. 	Records demonstrate that all personnel are aware of the required precaution zones as required under EPBC Policy 2.1
	<p>EPBC Act Policy Statement 2.1 – Standard Management Procedures</p> <p>The following standard procedures will be implemented during the 4D MSS:</p> <ul style="list-style-type: none"> Pre start-up visual observation Sort start Start-up delay Operations Stop work Night-time and low visibility. 	Records demonstrate that seismic operations were undertaken in accordance with the standard management procedures defined under EPBC Policy 2.1
	<p>EPBC Act Policy Statement 2.1 – Additional Management Procedures</p> <p>A minimum of one dedicated marine fauna observer (MFO) will be on-duty on the seismic vessel during all active operations during daylight hours for the 4D MSS. The on-duty MFO will be responsible for undertaking fauna observations.</p>	Daily MFO observation reports from seismic vessel
	<p>EPBC Act Policy Statement 2.1 – Additional Management Procedures</p> <p>Two trained MFOs will be available on the seismic vessel during the 4D MSS acquisition to allow for a second MFO to be</p>	Records show that two trained MFOs were always onboard the seismic vessel during the 4D MSS acquisition

	brought on-duty if required under the EPBC Policy 2.1 standard management procedures (e.g., start-up delay procedures)	
	<p>EPBC Act Policy Statement 2.1 – Additional Management Procedures</p> <p>Supplementary whale observations from the support vessel/s will be implemented during December and April:</p> <ul style="list-style-type: none"> at least one support vessel will be within the OA at all times where practicable (given primary crew duties), the bridge-watch from the support vessel/s will record observations for whales during the pre start-up visual observation period 	<p>Induction records show support vessels bridge-watch crew were provided with whale observations and reporting guidelines</p> <p>Whale observation reports from support vessels during December and April</p>
	<p>Observation shutdown procedures for marine turtles</p> <p>Marine fauna observations from the seismic vessel will include marine turtles during the 4D MSS, during the pre start-up visual observation period.</p>	Daily MFO observation reports from seismic vessel
	<p>Observation shutdown procedures for marine turtles</p> <p>A shut-down zone of 100 m horizontal radius from the acoustic source, for marine turtles, will be implemented for the 4D MSS.</p> <ul style="list-style-type: none"> The seismic source will be shut down, or start-up will be delayed for 15 minutes, if a turtle is observed within the shut-down zone. Operation of the seismic source using soft-start shall only resume when 15 minutes have lapsed since the turtle sighting or the turtle has been observed to move outside the shutdown zone. 	Records demonstrate that seismic operations were undertaken in accordance with the additional turtle shutdown procedures
No injury to divers from underwater sound emissions from petroleum activities	<p>DMAC Guidance</p> <p>If diving activities are scheduled to occur at the time of the 4D MSS, consultation and management of activities will be undertaken as per the Guidance DMAC 12: Safe Diving Distance from Seismic Surveying Operations</p>	If required, records demonstrate that DMAC guidance was implemented for concurrent seismic and diving operations
No cumulative underwater sound emissions from petroleum activities	<p>BOEM Guidance</p> <p>For concurrent seismic surveys, a separation distance of 40 km between seismic sources will be maintained</p>	If required, records demonstrate that a 40 km separation distance was maintained for concurrent seismic operations
Reduce the impact to commercial fishery licence holders within the OA from petroleum activities	<p>Adjustment protocol</p> <p>CAPL will assess any evidence-based claims from commercial fishery licence holders for compensation in line with the adjustment protocol (Section 7.3.4.1)</p>	Records show that any evidence-based claim from commercial fishery licence holders was assessed and decision finalised

6.6 Underwater sound—field support operations

6.6.1 Acoustic modelling

Acoustic modelling undertaken by Woodside for pipelay and support vessels (Ref. 183) is considered suitable to inform potential sound exposures from this activity as the vessels are expected to be similar (or smaller) in size to those modelled thus source sound levels are expected to be similar (or smaller), and the physical environment of the operational area is comparable. The modelling (Ref. 183) also provides an indication of cumulative sound exposures by considering sound emissions from multiple vessel sources at a single location. On the basis that multiple vessels (i.e., a seismic vessel and a support vessel) will be within the OA during the 4D MSS, CAPL considers the use of this analogue modelling appropriate to inform this risk assessment.

The outcomes of this modelling (Ref. 183) are summarised throughout the subsequent risk and impact assessment (Section 6.6.2).

In the absence of modelling, the estimates of SPL from helicopter operations (149–162 dB re 1 μ Pa) (Ref. 176; Ref. 177) has been used for the purposes of behavioural thresholds for this consequence evaluation. 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 criteria is not relevant.

6.6.1.1 Exposure criteria

Different species groups perceive and respond to sound differently, and so a variety of exposure criteria for the different types of impacts and species groups are considered. The following noise effect thresholds, based on current best available science, have been used in the impact and risk assessment:

- frequency-weighted accumulated sound exposure levels (SEL_{24h}) from the NOAA Technical Guidance (Ref. 179) for the onset of PTS and TTS⁸ in marine mammals (Table 6-7)
- un-weighted SPL for behavioural threshold for marine mammals based on NOAA (Ref. 180) (Table 6-7)
- frequency-weighted accumulated sound exposure levels (SEL_{24h}) from Finneran et al. (Ref. 181) for the onset of PTS and TTS in marine turtles (Table 6-7)
- sound exposure guidelines for fish, fish eggs and larvae (including plankton) (Ref.182) (Table 6-7).

Recent Commonwealth guidance has defined “injury to Blue Whales” as both PTS and TTS hearing impairment, as well as any other form of physical harm arising from anthropogenic sources of underwater noise (Ref. 202).

⁸ TTS is a temporary reduction in an animals hearing sensitivity due to receptor hair cells in the cochlea becoming fatigued.

Table 6-7: Noise effect criteria for continuous sound for different types of impacts and species groups

Receptor	Mortal or potential mortal injury	Recoverable injury	Permanent threshold shift	Temporary threshold shift	Masking	Behavioural
Low-frequency cetaceans	N/A	N/A	SEL _{24h} : 199 dB re 1 µPa ² s	SEL _{24h} : 179 dB re 1 µPa ² s	N/A	SPL: 120 dB re 1 µPa
Mid-frequency cetaceans	N/A	N/A	SEL _{24h} : 198 dB re 1 µPa ² s	SEL _{24h} : 178 dB re 1 µPa ² s	N/A	SPL: 120 dB re 1 µPa
High-frequency cetaceans	N/A	N/A	SEL _{24h} : 173 dB re 1 µPa ² s	SEL _{24h} : 153 dB re 1 µPa ² s	N/A	SPL: 120 dB re 1 µPa
Marine turtles	N/A	N/A	SEL _{24h} : 220 dB re 1 µPa ² s	SEL _{24h} : 200 dB re 1 µPa ² s	N/A	N/A
Fish (no swim bladder) (relevant to sharks)	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	N/A	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low
Fish (swim bladder not involved in hearing)	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	N/A	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low
Fish (swim bladder involved in hearing)	(N) Low (I) Low (F) Low	SEL _{48h} : 170 dB	N/A	SEL _{12h} : 158 dB	(N) High (I) High (F) High	(N) High (I) Moderate (F) Low
Fish eggs and fish larvae (relevant to plankton)	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	N/A	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low	(N) High (I) Moderate (F) Low

Relative risk (high, moderate, low) is given for fauna at three distances from the source (near [N], intermediate [I] and far [F]).

6.6.2 Risk assessment

Source			
<p>Activities identified as having the potential to result in underwater sound are:</p> <ul style="list-style-type: none"> vessels or helicopter operations within the OA. <p>These activities result in the emission of continuous sound.</p>			
Potential impacts and risks			
Impacts	C	Risks	C
Underwater sound emissions may result in:		A change in ambient underwater sound may result in:	
<ul style="list-style-type: none"> localised and temporary change in ambient underwater sound. 	5	<ul style="list-style-type: none"> behavioural disturbance auditory impairment, temporary threshold shift (TTS), permanent threshold shift (PTS), recoverable or non-recoverable injury to marine fauna 	5 –
Consequence evaluation			
<p>Localised and temporary change in ambient underwater sound</p> <p>Anthropogenic underwater sound emitted during the 4D MSS activities will result in a change in ambient noise levels.</p> <p>Underwater broadband ambient sound spectrum levels range from 45–60 dB re 1 µPa in quiet regions (light shipping and calm seas) to 80–100 dB re 1 µPa for more typical conditions, and >120 dB re 1 µPa during periods of high winds, rain or 'biological choruses' (many individuals of the same species vocalise near simultaneously in reasonably close proximity to each other) (Ref. 222). Low-frequency ambient sound levels (20–500 Hz) are frequently dominated by distant shipping plus some great whale species. Light weather-related sounds will be in the 300–400 Hz range, with wave conditions and rainfall dominating the 500–50,000 Hz range (Ref. 222).</p> <p>Studies of underwater sound generated from propellers of offshore vessels when holding position indicate highest measured 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. 174). When underway at ~12 knots vessel sound of 120 dB re 1 µPa was recorded at 0.5–1 km (Ref. 174). Generally, during active seismic operations, the seismic vessel will be only going a speed of ~4–5 knots within the OA (similarly, the support vessel will transit at a similar speed during active seismic operations within the OA), producing lower underwater sound emissions than what were recorded by the study.</p> <p>Sound emitted from helicopter operations is typically below 500 Hz (Ref. 175). 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. 176; Ref. 177). Richardson et al. (Ref. 176) 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.</p> <p>Given the details above, the consequence of vessel or helicopter operations causing a change in ambient underwater sound has been assessed as Minor (5) as it will result in a localised and short-term environmental impact.</p>			
<p>Marine Mammals</p> <p><i>Behavioural disturbance</i></p> <p>Acoustic modelling for support vessels indicate that the maximum radial distance in any direction from the source to 120 dB re 1 µPa was 4.9 km (Ref. 183).</p> <p>As identified in Section 4.3.1, several marine mammal species listed as threatened and/or migratory under the EPBC Act have the potential to occur within the OA. In addition, a migration and distribution BIA for the Pygmy Blue Whale also overlaps with the OA and FPZ (Section 4.3.1.1). The Humpback Whale migration BIA is located ~5 km from the OA (Section 4.3.1.2), with migration occurring between June and October. Given there is no temporal or spatial overlap in the use of this migration BIA for Humpback Whales and the 4D MSS, no behavioural disturbance is predicted.</p>			

As the OA overlaps a migration BIA for the Pygmy Blue Whale, there is the potential for a larger number of cetaceans to be present during migration periods. However, given the activity timing (mid-December to mid-April) for the 4D MSS is predominantly outside the peak migration periods (April to August, and November to late-December), is within an open-water environment (i.e., not a confined migratory pathway), the close proximity (<5 km) to a vessel before behavioural response is likely to occur, it is not expected that the 4D MSS 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 μ Pa (Ref. 176; Ref. 177), which is above the noise exposure 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. 176). The helicopter operations covered under this EP (i.e., crew transfers for seismic vessel) 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

Acoustic modelling for support vessels indicate that the maximum radial distance in any direction from the source to a SEL_{48h} threshold of 170 dB re μ Pa².s was <0.010 km, and to a SEL_{12h} threshold of 158 dB re μ Pa².s was <0.097 km (Ref. 183). Given that the noise exposure criteria for marine mammals for TTS and PTS is based on a SEL_{24h} at similar or higher thresholds (Table 6-7), these distances (<10–100 m) are considered a conservative estimate.

Consequently, TTS and PTS for marine mammals from continuous sound sources is not expected to occur given that, exceedance of noise exposure criteria requires the mammals to remain in vicinity (<10–100 m) of the vessel over a 24-hour period.

Turtles

TTS and PTS

Acoustic modelling for support vessels indicate that the maximum radial distance in any direction from the source to a SEL_{48h} threshold of 170 dB re μ Pa².s was <0.010 km, and to a SEL_{12h} threshold of 158 dB re μ Pa².s was <0.097 km (Ref. 183). Given that the noise exposure criteria for marine turtles for TTS and PTS is based on a SEL_{24h} at higher thresholds (Table 6-7), these distances (<10–100 m) are considered a conservative estimate.

Consequently, TTS and PTS for marine turtles from continuous sound sources is not expected to occur given that, exceedance of noise exposure criteria requires turtles to remain in vicinity (<10–100 m) of the vessel over a 24-hour period.

Fish including sharks and rays

Behavioural disturbance

Continuous sound sources have been identified as a moderate risk of causing behavioural changes, a high risk of causing masking changes, within the near and intermediate vicinity of a sound source for all fish groups (Table 6-7). Continuous sound of any level that is detectable by fishes can mask signal detection, and thus may have a pervasive effect on fish behaviour. However, the consequences of this masking and any attendant behavioural changes for the survival of fishes are unknown (Ref. 182). It is expected that most fish (including sharks and rays) will exhibit avoidance behaviour from a sound source if it reaches levels that may cause behavioural or physiological effects.

As identified in Section 4.3, several fish species listed as threatened and/or migratory under the EPBC Act have the potential to occur within the OA. A foraging BIA for the Whale Shark also overlaps with the OA. Whale Shark migration along the WA coast occurs mainly between July and November (Section 4.3.3.1). Based on the 4D MSS timing of mid-December to mid-April, there is no temporal overlap with the Whale Shark migration period. It is expected that the potential effects to Whale Sharks associated with underwater sound will be the same as for other pelagic fish species.

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. 184). 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 within most of the OA, the sound levels at the seabed are expected to be below impact thresholds.

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 Recoverable injury

Continuous sound sources have been identified as low risk of causing injury or mortality to fish with no swim bladders, or those with bladders not involved in hearing (Table 6-7).

For fish species with a swim bladder involved in hearing, acoustic modelling for support vessels indicate that the maximum radial distance from the source to the recoverable injury criterion was <0.01 km, and to the TSS criterion was 0.097 km (Ref. 183).

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 within most of 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.

Plankton

Behavioural disturbance

Plankton is a collective term for all marine organisms that are unable to swim against a current. This group is diverse and includes phytoplankton (plants) and zooplankton (animals), as well as fish and invertebrate eggs and larvae.

Continuous sound sources have been identified as high risk of causing masking or behavioural changes to plankton in close proximity to the sound source; this risk decreases with increasing distance from the source (Table 6-7).

Any effects to plankton have to be assessed in the context of natural mortality rates, which are generally considered high and variable. Plankton also have a patchy distribution linked to localised and seasonal productivity that produces sporadic bursts in populations (Ref. 76). Sound emissions on sparse plankton populations are unlikely to cause a significant change in behaviour at a measurable level. Therefore, the potential behavioural impacts from sound emissions on plankton are not evaluated further.

TTS and Recoverable injury

Continuous sound sources have been identified as low risk of causing injury or mortality to plankton (Table 6-7), and as such are not discussed further.

ALARP decision context justification

Offshore commercial vessel operations 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.

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 whales are not harmed during offshore interactions with people. By implementing these control measures and managing interactions with cetaceans near the vessels, the potential impacts from underwater sound are limited.

Additional control measures and cost-benefit analysis		
Control Measure	Benefit	Cost
N/A	N/A	N/A
Likelihood and risk level summary		
Likelihood	<p>Baleen whales may exhibit behavioural avoidance when sound levels are at or above 160 dB re 1 µPa (Ref. 180). 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. 185), particularly during migration.</p> <p>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. 184; Ref. 186).</p> <p>Although localised and temporary behavioural 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 Rare (6).</p>	
Risk level	Very low (10)	
Determination of acceptability		
Principles of ESD	<p>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 (such as migration), CAPL would not expect these activities to affect migration, interesting, 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.</p> <p>The consequence associated with this aspect is Minor (5).</p> <p>Therefore, no further evaluation against the Principles of ESD is required.</p>	
Relevant environmental legislation and other requirements	<p>Legislation and other requirements considered applicable for this aspect include:</p> <ul style="list-style-type: none"> • EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans • <i>Conservation Management Plan for the Blue Whale 2015–2025</i> (Ref. 68) • <i>Conservation Advice Megaptera novaeangliae Humpback Whale</i> (Ref. 67) • <i>Conservation Advice Balaenoptera borealis Sei Whale</i> (Ref. 66) • <i>Conservation Advice Balaenoptera physalus Fin Whale</i> (Ref. 65) • <i>Conservation Advice Rhincodon typus Whale Shark</i> (Ref. 64) • <i>Recovery Plan for Marine Turtles in Australia</i> (Ref. 62) • <i>Approved Conservation Advice for Dermochelys coriacea (Leatherback Turtle)</i> (Ref. 63). 	
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 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.	

	<p>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.</p> <p>The <i>Conservation Management Plan for the Blue Whale 2015–2025</i> (Ref. 68) specifies the following relevant action:</p> <ul style="list-style-type: none"> 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. <p>No other specific relevant actions were identified within other documents implemented under the EPBC Act.</p> <p>The OA does not intersect with a foraging BIA for the Pygmy Blue Whale (Table 4-2). The nearest foraging BIA occurs ~225 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.</p> <p>Therefore, CAPL has defined an acceptable level of impact as no injury to marine fauna.</p>	
Environmental performance outcome	Performance standard / Control measure	Measurement Criteria
<p>No injury to marine fauna from underwater sound emissions from petroleum activities</p>	<p>EPBC Regulations 2000 – Part 8 Division 8.1 – Interacting with cetaceans</p> <p>Seismic and support vessels will implement caution and no approach zones, where practicable:</p> <ul style="list-style-type: none"> caution Zone (300 m either side of whales and 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 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 or an animal or pod, or follow directly behind. <p>Exception: <i>does not apply to seismic vessel towing equipment - operating under constrained manoeuvrability, or in an emergency.</i></p>	<p>Induction materials include relevant marine fauna caution and no approach zone requirements</p> <p>Training records confirm personnel involved in offshore vessel activities have completed the induction</p> <p>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</p>

6.7 Invasive marine pests

Source			
<p>Activities identified as having the potential to result in the introduction of an invasive marine pest (IMP) are:</p> <ul style="list-style-type: none"> planned discharged of ballast water or the presence of biofouling on vessels undertaking seismic survey activities within the OA. 			
Potential impacts and risks			
Impacts	C	Risks	C
N/A	–	<p>An introduction of an IMP may result in:</p> <ul style="list-style-type: none"> displacement of, or compete with, native species. 	2
Consequence evaluation			
<p>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. 106).</p> <p>IMPs primarily occur in shallow waters with high levels of slow-moving or stationary shipping traffic (such as ports). The probability of successful IMP settlement and recruitment decreases in well-mixed, deep ocean waters away from coastal habitats. IMP colonisation also requires a suitable habitat in which to establish itself, such as rocky and hard substrates or subsea infrastructure. The Australian Government Bureau of Resource Sciences (BRS) established that the relative risk of an IMP becoming established around Australia decreases with distance from the coast. Modelling conducted by BRS (Ref. 221) estimates: 33% chance of colonisation at 3 nm, 8% chance at 12 nm, and 2% chance at 24 nm</p> <p>The OA for the 4D MSS is in deeper waters ranging ~50–1,250 m, and as such low light levels are expected at the seabed. The OA is also located >25 km offshore from the closest island (Montebello Islands), and >100 km (>54 nm) from the mainland coast and large ports.</p> <p>The particular values and sensitivities within the OA with the potential to be impacted by the introduction of an IMP within the OA include:</p> <ul style="list-style-type: none"> continental slope demersal fish communities (KEF) ancient coastline at 125 m depth contour (KEF) ridgeline habitat and associated communities. <p>The benthic habitat within the OA predominantly comprises soft substrates (Section 4.3.5.1). Although the KEFs and ridgeline habitat may have a mixture of soft and hard substrates, these habitats are located in deep, well-mixed offshore waters, which is unlikely to facilitate the introduction and establishment of IMPs.</p> <p>Once established, some IMPs can be difficult to eradicate (Ref. 107) 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. 108; Ref. 109; Ref. 110; Ref. 111). Although marine pests are identified as being of concern to marine reptile species under the <i>North-west Marine Bioregional Plan</i> (Ref. 76), the risk is associated with terrestrial based IMPs thus is not relevant to the activities covered under this EP.</p> <p>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.</p>			
ALARP decision context justification			
<p>Offshore commercial vessel operations, and subsequent planned discharges, are commonplace and well-practiced locally, nationally, and internationally.</p> <p>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</p>			

<p>for over 10 years, thus has a demonstrated understanding of industry requirements and their operational implementation in these areas.</p> <p>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.</p>		
Good practice control measures and source		
Control measure	Source	
Quarantine procedure	<p>CAPL's <i>Quarantine Procedure Marine Vessels</i> (Ref. 47) 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:</p> <ul style="list-style-type: none"> undertaking biofouling risk assessments in line with the with the <i>National Biofouling Management Guidance for the Petroleum Production and Exploration Industry</i> (Ref. 112) and Vessel Check system requirements for biofouling management plans and/or biofouling record books, in accordance with the <i>Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species (Biofouling Guidelines)</i> MPEC.207(62) 2011 (Ref. 6) <p>The quarantine procedure requires that all relevant biofouling information is provided to enable suitable risk assessments to be completed.</p>	
Ballast water management	<p>The <i>Australian Ballast Water Management Requirements</i> (Ref. 4) describes the management requirements for ballast water exchange, including:</p> <ul style="list-style-type: none"> 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	<p>The Commonwealth <i>Protection of the Sea (Harmful Anti-fouling Systems) Act 2006</i> enacts Marine Order 98 (Marine pollution – anti-fouling systems). This marine order describes the conditions for when an antifouling certificate is required.</p>	
Maritime Arrivals Reporting System (MARS)	<p>Under the Commonwealth <i>Biosecurity Act 2015</i>, pre-arrival information must be reported through MARS before a vessel arrives in Australian waters.</p>	
Additional control measures and cost-benefit analysis		
Control Measure	Benefit	Cost
N/A	N/A	N/A
Likelihood and risk level summary		
Likelihood	<p>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 benthic habitats within or in close proximity to the OA.</p>	
Risk level	<p>Low (7)</p>	
Determination of acceptability		
Principles of ESD	<p>The potential risks associated with this aspect is a widespread long-term impact to benthic communities. The introduction of an IMP to these communities has the potential to affect biological diversity and ecological integrity.</p> <p>The consequence associated with this aspect is Severe (2).</p> <p>Therefore, further evaluation against the remaining Principles of ESD is required.</p> <p>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</p>	

	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.	
Relevant environmental legislation and other requirements	Legislation and other requirements considered relevant for this aspect include: <ul style="list-style-type: none"> • Commonwealth <i>Biosecurity Act 2015</i> • Commonwealth <i>Protection of the Sea (Harmful Anti-fouling Systems) Act 2006</i> (enacted by Marine Order 98 [Marine pollution – anti-fouling systems]) • <i>Australian Ballast Water Management Requirements</i> (Ref. 4) • <i>Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species (Biofouling Guidelines)</i> MPEC.207(62) 2011 (Ref. 6) • <i>National Biofouling Management Guidance for the Petroleum Production and Exploration Industry</i> (Ref. 112). 	
Internal context	This CAPL environmental performance standard / procedure was deemed relevant for this aspect: <ul style="list-style-type: none"> • <i>Quarantine Procedure Marine Vessels</i> (Ref. 47) 	
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 <i>Quarantine Procedure Marine Vessels</i> , including that where required: <ul style="list-style-type: none"> • biofouling risk assessments are completed • biofouling management plans and/or biofouling record books are available. 	Records confirm that relevant vessels meet requirements of the <i>Quarantine Procedure Marine Vessels</i>
	Ballast water management International marine vessels will be required to comply with the key <i>Australian Ballast Water Management Requirements</i> , which are: <ul style="list-style-type: none"> • 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

	<p>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 <i>Protection of the Sea (Harmful Anti-fouling Systems) Act 2006</i> and/or the International Convention on the Control of Harmful Anti-fouling Systems on Ships</p>	<p>Inspection reports confirm that international antifouling coating certifications are up-to-date</p>
	<p>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 <i>Biosecurity Act 2015</i></p>	<p>Records confirm that international vessels completed pre-arrival reporting (or can demonstrate meeting conditions for an exception)</p>

6.8 Planned discharges—vessel operations

Source			
<p>Activities identified as having the potential to result in planned discharges are:</p> <ul style="list-style-type: none"> vessels operations (during the seismic survey) within the OA. <p>The types of planned vessel discharges include deck wash-water, fire-fighting foam, sewage, greywater, food wastes, cooling water, and oily bilge water.</p>			
Potential impacts and risks			
Impacts	C	Risks	C
<p>Planned discharges from vessels may result in:</p> <ul style="list-style-type: none"> localised and temporary reduction in water quality. 	6	<p>A change in ambient water quality may result in:</p> <ul style="list-style-type: none"> changes to predator-prey dynamics. 	6
Consequence evaluation			
<p>Localised and temporary reduction to water quality</p> <p>The routine vessel discharges will be of low volume during the seismic survey and of an intermittent and transient nature as the vessels move through the OA.</p> <p>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. 113). 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. 113). This outcome was verified by sewage discharge monitoring for another offshore project (Ref. 114), which determined that a 10 m³ 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 vessel operations for the 4D MSS. Therefore, the extent of impacts are expected to be localised to the discharge location.</p> <p>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. 114).</p> <p>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.</p> <p>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. 115; Ref. 116). 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. 117; Ref. 118) and further dilution of the foam mixtures in dispersive aquatic environments may then occur before there is any substantial demand for dissolved oxygen (Ref. 119).</p> <p>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).</p>			
<p>Changes to predator / prey dynamics</p> <p>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.</p>			

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. The values and sensitivities within the OA with the potential to be affected by changes in predator–prey dynamics include:

- Whale Shark (foraging BIA)
- 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. 113).

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. 120) 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. 121; Ref. 122; Ref. 123).

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	Cost	Benefit
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
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	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.	
Relevant environmental legislation and other requirements	Legislation and other requirements considered relevant to this aspect include: <ul style="list-style-type: none"> • Marine Order 91 • Marine Order 95 • Marine Order 96 • MARPOL 73/78 Annex I, IV and V 	
Internal context	These CAPL environmental performance standards or procedures were deemed relevant for this aspect: <ul style="list-style-type: none"> • MSRE process (Ref. 42). 	
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 Outcomes	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: <ul style="list-style-type: none"> • 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:	Records show food waste is discharged in accordance with MARPOL 73/78 Annex V

	<ul style="list-style-type: none">• 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.	
	<p>MARPOL 73/78 oily bilge water discharge</p> <p>Oily bilge water will be discharged to marine environment only when the concentration is <15 ppm in accordance with MARPOL 73/78, Annex I:</p> <ul style="list-style-type: none">• through an IMO approved on board oil-water separator; and• when the marine vessel is en route.	<p>Records show oily bilge water is discharged in accordance with MARPOL 73/78 Annex I, including current International Oil Pollution Prevention (IOPP) Certificate</p>

6.9 Unplanned release—waste

Source			
<p>Activities identified as having the potential to result in the unplanned release of waste are:</p> <ul style="list-style-type: none"> vessel operations during seismic survey within the OA. <p>Because waste is generated on board vessels, inappropriate management and storage has the potential to result in a release to the environment.</p>			
Potential impacts and risks			
Impacts	C	Risks	C
N/A	–	<p>Unplanned release of waste to the environment may result in:</p> <ul style="list-style-type: none"> marine pollution resulting in entanglement or injury of marine fauna 	6
Consequence evaluation			
<p>If hazardous or non-hazardous waste is lost overboard, the extent of exposure to the environment is limited.</p> <p>Marine fauna most at risk from marine pollution include marine reptiles and seabirds, through ingestion or entanglement (Ref. 62; Ref. 64). Ingestion or entanglement has the potential to limit feeding or foraging behaviours and thus can result in marine fauna injury or death. In 2003, “[i]njury and fatality to vertebrate marine life caused by ingestion of, or entanglement in, harmful marine debris” was listed as a key threatening process under the EPBC Act (Ref. 124). However, the national Threat Abatement Plan (Ref. 124) identifies that harmful marine debris includes “land-sourced garbage, fishing gear from recreational and commercial fishing abandoned or lost to the sea, and vessel-sourced, solid, non-biodegradable floating materials disposed of or lost 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).</p>			
ALARP decision context justification			
<p>Offshore commercial vessel operations, and the subsequent management of waste, are commonplace and well-practiced activities within the industry.</p> <p>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.</p> <p>During stakeholder consultation, no objections or claims were raised regarding waste management arising from the activity.</p> <p>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.</p>			
Good practice control measures and source			
Control measure	Source		
Marine Order 95 (Marine pollution prevention – garbage)	<p>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.</p> <p>Marine Order 95 (Marine pollution prevention – garbage) gives effect to MARPOL 73/78 Annex V.</p>		

Additional control measures and cost-benefit analysis		
Control measure	Benefit	Cost
N/A	N/A	N/A
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 risk 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: <ul style="list-style-type: none"> • Marine Order 95 • MARPOL 73/78 • <i>Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (2018)</i> (Ref. 124) • <i>Conservation Advice Rhincodon typus Whale Shark</i> (Ref. 64) • <i>Recovery Plan for Marine Turtles in Australia</i> (Ref. 62) • <i>Conservation Management Plan for the Blue Whale 2015–2025</i> (Ref. 68) • <i>National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011–2016</i> (Ref. 125). 	
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)

	<p>Marine Order 95 (Marine pollution prevention – garbage) For waste that is incinerated on board a marine vessel, the incinerator is to be IMO-approved and the waste incinerated is to be recorded in accordance with MARPOL 73/78 Annex V</p>	<p>Current International Air Pollution Prevention (IAPP) Certificate (for marine vessels >400 T or certified to carry >15 persons)</p> <p>Current and completed Garbage Record Book (for marine vessels >400 T or certified to carry >15 persons).</p>
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6.10 Unplanned release—loss of equipment

Source			
<p>Activities identified as having the potential to result in the unplanned loss of equipment are:</p> <ul style="list-style-type: none"> • use and handling of seismic equipment during deployment and/or retrieval • mechanical failure/damage to equipment. 			
Potential impacts and risks			
Impacts	C	Risks	C
N/A	–	<p>Unplanned release of hazardous material to the environment may result in:</p> <ul style="list-style-type: none"> • disruption to other marine users from temporary navigation hazards • alternation of marine habitats arising from seabed disturbance 	<p>6</p> <p>6</p>
Consequence Evaluation			
<p>Disruption to other marine users from temporary navigation hazards</p> <p>The loss of seismic equipment (seismic source and/or streamers) may pose a navigation hazard to other users that may be present within the OA at the time of equipment loss. Other vessels would be required to avoid the area until equipment can be recovered (if possible). If the equipment is not recovered, with time it may sink to the seabed. This disruption to other users is considered to be short term and localised to the immediate vicinity of the lost equipment, therefore is expected to involve individual vessel interactions. Thus, CAPL ranked this consequence as Incidental (6).</p>			
<p>Alternation of marine habitats arising from seabed disturbance</p> <p>In the event of damage or loss of seismic streamers, tail buoy, and/or acoustic source equipment, potential environmental impacts would be limited to physical disturbance to benthic communities in the OA arising from the associated equipment potentially sinking and settling on the seabed. As such, any impact to the seabed as a result of a loss of seismic equipment are likely to be a highly localised disturbance.</p> <p>The particular values and sensitivities within the OA with the potential to be impacted by unplanned seabed disturbance within the OA include:</p> <ul style="list-style-type: none"> • continental slope demersal fish communities (KEF) • ancient coastline at 125 m depth contour (KEF) • ridgeline habitat and associated communities. <p>The KEFs and ridgeline habitat may have a mixture of soft and hard substrates, with hard substratum considered likely to support higher amounts of benthic fauna. However, studies of the ridgeline habitat have shown that the coverage of marine habitat is low (e.g., 2–10%) (Section 4.3.5.1).</p> <p>The potential impacts to benthic habitats as a result of loss of seismic equipment are considered unlikely, limited to individual occurrences and highly localised (i.e., area of impact limited to the size of equipment) thus will not have an impact on the values of the sensitive benthic habitats within the OA. Thus, CAPL ranked this consequence as Incidental (6).</p>			
ALARP decision context justification			
<p>Offshore seismic and vessel operations are commonplace and well-practiced industry activities. The control measures to manage the risk associated with loss of equipment scenarios from these activities are well defined via good practice measures that are considered standard industry practice in seismic data acquisition operations. These control measures are well understood and implemented by the petroleum industry and CAPL</p> <p>During stakeholder consultation, no objections or claims were raised regarding waste management arising from the activity.</p> <p>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.</p>			

Good practice control measures and source		
Control measure	Source	
Operating procedures	<p>Operating procedures for seismic equipment will be implemented to ensure:</p> <ul style="list-style-type: none"> • streamers are fitted with appropriate equipment to allow for safe deployment, operation and recovery (if required), including: <ul style="list-style-type: none"> – steerable fins – streamer recovery devices (SRDs) – surface marker buoys – real-time monitoring equipment – tail buoys • equipment is routinely checked and maintained to ensure integrity • streamer deployment will not occur in water closer than 12 nm to shore, or in waters <50 m deep • seismic equipment will only be deployed in suitable sea state in accordance with seismic operators matrix of permitted operations. 	
Stakeholder engagement	In the event of a loss of equipment that results in a navigational hazard, other marine users within the vicinity will be notified via VHF.	
Marine incident report	Reporting marine incidents is an important part of ensuring the safety of people and vessels. In the event of a loss of equipment meeting the requirements of a marine incident, an incident alert report must be issued to AMSA within 4 hours of the incident.	
Additional control measures and cost benefit analysis		
Control measure	Benefit	Cost
N/A	N/A	N/A
Likelihood and risk level summary		
Likelihood	Loss of equipment has occurred previously in the industry but is not considered likely 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 loss of equipment is considered Unlikely (4).	
Risk level	Very low (9)	
Determination of acceptability		
Principles of ESD	<p>The potential risk associated with this aspect is highly localised and limited to individual occurrences and is therefore not expected to affect biological diversity and ecological integrity.</p> <p>The consequence associated with this aspect is Incidental (6). Therefore, no additional evaluation against the Principles of ESD is required.</p>	
Relevant environmental legislation and other requirements	No environmental legislation or other requirements were deemed relevant for this aspect.	
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 loss of equipment 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 loss of seismic equipment within the OA during petroleum activities	Operating procedures Streamers are fitted with SRDs prior to deployment to bring the equipment to the surface in the event of loss.	Records confirm that all streamers have been fitted with SRD.
	Operating procedures Equipment is routinely checked and maintained to ensure integrity	Records show that all equipment is routinely checked
	Operating procedures Deployment, operation, and retrieval of streamers as per operational procedures, including: <ul style="list-style-type: none"> streamer deployment will not occur in water <12 nm to shore, or in waters <50 m deep streamers will only be deployed in suitable sea state in accordance with matrix of permitted operations (MOPO). 	Records show that seismic vessel holds procedures for streamer deployment, operations, and retrieval
		Records show that streamers were not deployed <12 nm from shore and water depths <50m
		Daily reports demonstrate that streamers were deployed in accordance with seismic vessel's MOPO
	Stakeholder engagement In the event of a loss of equipment that results in a navigational hazard, other marine users within the vicinity will be notified via VHF	Vessel records confirms notification to other marine users
Marine incident report In the event of a loss of equipment meeting the requirements of a marine incident, an incident alert report must be issued to AMSA within 4 hours of the incident	Records confirm incident alert issued to AMSA within 4 hours of a marine incident occurring	

6.11 Unplanned release—loss of containment

Source			
<p>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:</p> <ul style="list-style-type: none"> • using, handling, and transferring hazardous materials and chemicals on board (<1 m³)¹ • transferring hazardous materials between vessels (50 m³)². <p>¹ A range of hydrocarbons and other hazardous chemicals / materials are likely to be present onboard vessels; however, the maximum credible volume associated with a single-point failure was estimated to be ~1 m³ based on the loss of an entire intermediate bulk container due to rupture while handling.</p> <p>² AMSA (Ref. 126) 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 m³/h transfer rate (based on previous operations), this equates to an instantaneous spill volume of ~50 m³.</p>			
Potential impacts and risks			
Impacts	C	Risks	C
N/A	–	<p>Unplanned release of hazardous material to the environment may result in:</p> <ul style="list-style-type: none"> • indirect impacts to fauna arising from chemical toxicity 	5
Consequence Evaluation			
<p>Indirect impacts to fauna arising from chemical toxicity</p> <p>Upon release, a loss of 50 m³ of a hazardous material (such as MDO) would be expected to result in a localised and short-term change to water quality in surface waters. Given the surface release, and the known weathering and fate behaviour of MDO (Section 6.12.2.1), the small 50 m³ volume is expected to form a film on the surface and rapidly evaporate and disperse following release. The environmental impacts associated with a surface release of 50 m³ of MDO are much less than those associated with a loss of MDO from a vessel collision (Section 6.12), and thus are not evaluated in detail here.</p> <p>The values and sensitivities within the OA with the potential to be exposed to decreased water quality within surface waters from an unplanned LOC include:</p> <ul style="list-style-type: none"> • Pygmy Blue Whale (migration and distribution BIAs) • Flatback Turtle (interesting buffer BIA, interesting critical habitat) • Whale Shark (foraging BIA). • continental slope demersal fish communities (KEF) • commercial fisheries. <p>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.</p> <p>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.</p> <p>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).</p>			
ALARP decision context justification			
<p>Offshore commercial 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.</p> <p>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</p>			

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	<p>The MSRE process (Ref. 42) ensures that various legislative requirements and CAPL standards are met. Specifically, pre-mobilisation inspections may include:</p> <ul style="list-style-type: none"> • 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	<p>MARPOL 73/78 Annex I and Marine Order 91 (Marine pollution prevention – oil) requires that each vessel has an approved SOPEP in place.</p> <p>To prepare for a spill event, the SOPEP details:</p> <ul style="list-style-type: none"> • 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. <p>In the event of a spill, the SOPEP details:</p> <ul style="list-style-type: none"> • 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	<p>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 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.</p>	
Risk level	Very low (9)	
Determination of acceptability		
Principles of ESD	<p>The potential risk associated with this aspect would be short term, apply to some individuals, and consequently is not expected to affect biological diversity and ecological integrity.</p> <p>The consequence associated with this aspect is Minor (5).</p> <p>Therefore, no additional evaluation against the Principles of ESD is required.</p>	
Relevant environmental legislation and other requirements	<p>Legislation and other requirements considered relevant for this aspect include:</p> <ul style="list-style-type: none"> • Marine Order 91, Marine pollution prevention – oil • MARPOL 73/78. 	
Internal context	<p>These CAPL environmental performance standards or procedures were deemed relevant for this aspect:</p> <ul style="list-style-type: none"> • MSRE process (Ref. 42). 	

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	<p>MSRE process</p> <p>Prior to commencement of activities, the following will be undertaken during a pre-mobilisation vessel inspection, as per the MSRE process:</p> <ul style="list-style-type: none"> 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
	<p>MSRE process</p> <p>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.</p>	Records confirm that refuelling is undertaken in accordance with CAPL-approved refuelling / bunkering procedure
Reduce the risk of impacts to the environment from the unplanned release of hydrocarbons / hazardous materials during petroleum activities	<p>SOPEP</p> <p>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</p>	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
	<p>SOPEP</p> <p>In the event of a vessel-based spill event, emergency response activities will be implemented in accordance with the vessel SOPEP (or equivalent)</p>	Records confirm that emergency response activities were implemented in accordance with the vessel SOPEP in the event of a vessel-based spill.

6.12 Unplanned release—vessel collision event

6.12.1 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 seismic surveys, 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. 126) as being a surface release of ~1,000 m³ of MDO.

6.12.1.1 Spill Modelling

6.12.2 Spill modelling

CAPL commissioned RPS to conduct spill modelling to inform the risk assessment associated with a vessel collision event (Ref. 127). While a vessel collision event has the potential to occur anywhere within the OA, the spill modelling was completed for a release location that represented the point closest to the nearest shoreline at the Montebello Islands (Table 6-8).

A three-dimensional oil spill model (SIMAP) was used to simulate the drift, spread, weathering and fate of the spilled oil (Ref. 127). 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 6-8 summarises the model settings; Table 6-9 summarises the hydrocarbon properties for MDO; and Table 6-10 and Table 6-11 describe the modelled environmental exposure and impact thresholds respectively.

Table 6-8: Vessel collision spill scenario model settings

Parameter	Details
Release location	Southern boundary of the OA, at closest point to the Montebello Islands (and within the Commonwealth Montebello Marine Park)
Latitude	20°09'22" S
Longitude	115°24'11" E
Water depth	~50–60 m
Oil type	MDO
Simulation spill type	Surface
Simulation spill volume	1,063 m ³ (based on the largest single tank)
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) Transitional (March, October, November) Winter (April to September)

Table 6-9: Physical properties and boiling point ranges for MDO

Characteristic	Value			
Density	829.1 kg/m ³ (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 6-10: Hydrocarbon environmental exposure thresholds

Environmental exposure threshold [^]	Justification
Surface ≥1 g/m ² (low)	In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 128), 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. 128).
In-water (dissolved) ≥10 ppb (low)	In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 128), 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. 128).
In-water (entrained) ≥10 ppb (low)	In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 128), 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. 128).
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. 128).

[^] 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 6-11: Hydrocarbon environmental impact thresholds

Environmental impact threshold	Justification
Surface ≥1 g/m ² (low)	In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 128), 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. 129) 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. 128), 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 thickness of ~10 µm. The Bonn Agreement Oil Appearance Code (Ref. 129) 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. 128). This

Environmental impact threshold	Justification
	<p>threshold is consistent with observations ranging from physical oiling to toxicity effects for marine fauna within literature, including French et al. (Ref. 130), French-McCay (Ref. 131), Engelhardt (Ref. 132), Clark (Ref. 133), Geraci and St. Aubin (Ref. 134) and Jenssen (Ref. 135).</p>
<p>In-water (dissolved) ≥50 ppb (moderate)</p>	<p>Laboratory studies have shown that dissolved oil exert most of the toxic effects of oil on aquatic biota (e.g., Carls et al. [Ref. 136], Nordtug et al. [Ref. 137], Redman [Ref. 138]). 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. 128), CAPL has set the in-water (dissolved) impact threshold for sublethal ecological effects at ≥50 ppb.</p> <p>This threshold is considered by NOPSEMA to approximate potential toxic effects, particularly sublethal effects to sensitive species (Ref. 128). 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.</p>
<p>In-water (dissolved) ≥4,800 ppb.hrs (moderate)</p>	<p>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.</p> <p>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.</p> <p>French-McCay (Ref. 139) 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.</p>
<p>In-water (entrained) ≥100 ppb (high)</p>	<p>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.</p> <p>In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 128), CAPL has set the in-water (entrained) impact threshold for sublethal ecological effects at ≥100 ppb.</p> <p>This threshold is considered by NOPSEMA as appropriate for informing risk evaluation (Ref. 128). 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.</p> <p>French-McCay (Ref. 140) 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.</p>
<p>In-water (entrained) ≥9,600 ppb.hrs (high)</p>	<p>CAPL has set the in-water (entrained) impact threshold for lethal ecological effects at ≥9,600 ppb.hrs.</p> <p>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.</p> <p>It is however noted that entrained oil, especially when in weathered state, is typically not considered toxic.</p>
<p>Shoreline ≥10 g/m² (low)</p>	<p>In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 128), CAPL has set the shoreline impact threshold for socio-economic effects at ≥10 g/m². This threshold is equivalent to ~10 mL/m² or ~2 teaspoons/m².</p>

Environmental impact threshold	Justification
	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)	<p>In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 128), CAPL has set the shoreline impact threshold for ecological effects at ≥100 g/m². This threshold is equivalent to ~100 mL/m² or 20 teaspoons/m².</p> <p>French et al. (Ref. 130) and French-McCay (Ref. 131) define shoreline oil accumulation at ≥100 g/m² as potentially harmful to wildlife (including invertebrates, birds, furbearing aquatic mammals and marine reptiles), based on studies for sub-lethal and lethal impacts.</p> <p>Impacts on vegetated habitats (such as saltmarsh and mangroves) have been observed at higher concentrations of shoreline oil. Observations by Lin and Mendelssohn (Ref. 141) demonstrated that loadings of >1,000 g/m² 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. 142], Suprayogi and Murray [Ref. 143]).</p>

[^] 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.

6.12.2.1 Weathering and fate

MDO is a light-persistent fuel oil used in the maritime industry. It has a density of 829.1 kg/m³, an API of 37.6, and a low pour point (-14 °C) (Table 6-9). 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.

While MDO will typically remain on the water surface (where it is subject to evaporation), it is noted that some of the heavy components have a strong tendency to physically entrain into the upper water column in the presence of moderate winds (i.e. >12 knots) and breaking waves but can re-float to the surface if these energies abate (Ref. 127).

6.12.2.2 Modelling outputs

Stochastic modelling outputs from RPS (Ref. 127) are summarised in Table 6-12 having regard to the particular values and sensitivities identified in Section 4.

For the 1,063 m³ MDO release at the southern boundary of the OA, at the closest point to Montebello Islands:

- The maximum distance from the release location to the ≥1 g/m² visible impact threshold was ~64 km south-southwest (transitional), and ~38 km south-southwest (summer) for the ≥10 g/m² impact threshold.
- The probability of contact to any shoreline at ≥10 g/m² was 7% in summer, 1% in winter, and no contact predicted in transitional months. The minimum time before shoreline contact was ~3 days and the maximum volume of oil ashore

was 24.4 m³. The maximum length of shoreline exposed at ≥ 10 g/m² was ~27 km, and at ≥ 100 g/m² was ~10 km.

- No dissolved oil at ≥ 50 ppb impact thresholds was predicted to occur during any season.
- Entrained oil at ≥ 100 ppb 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 6-12: Vessel collision spill modelling EMBA receptor exposure summary

Sensitivity	Name	Surface [^]		In-water (dissolved) [^]	In-water (entrained) [^]	Shoreline [^]	
		≥1 g/m ²	≥10 g/m ²	≥50 ppb	≥100 ppb	≥10 g/m ²	≥100 g/m ²
		(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	—	—	—	1–4%	—	—
	Montebello	100%, ~1 hour	100%, ~1 hour	—	89–97%	—	—
	Ningaloo	—	—	—	0–1%	—	—
KEF	Ancient coastline at 125 m depth contour	0–6%, ~0.75 days	—	—	19–30%	—	—
	Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula	—	—	—	1–4%	—	—
	Commonwealth waters adjacent to Ningaloo Reef	—	—	—	0–1%	—	—
	Continental slope demersal fish communities	0–1%, ~2.7 days	—	—	9–27%	—	—
	Exmouth Plateau	—	—	—	0–2%	—	—
	Glomar Shoals	—	—	—	0–2%	—	—
World Heritage Properties / National Heritage Places	The Ningaloo Coast <i>(inferred from Cape Range IBRA, and Exmouth shoreline)</i>	—	—	—	0–2%	0–2%, ~14.4 days, ~3 km	—
Commonwealth Heritage Properties	Ningaloo Marine Area – Commonwealth Waters <i>(inferred from Ningaloo IMCRA)</i>	—	—	—	1–2%	—	—

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

6.12.3 Risk assessment

Source			
<p>Activities identified as having the potential to result in a vessel collision event are:</p> <ul style="list-style-type: none"> vessels operations within the OA. <p>A vessel collision event may occur as a result of a loss of DP, navigational error or floundering due to weather.</p>			
Potential impacts and risks			
Impacts	C	Risks	C
N/A	–	<p>The potential environmental impacts associated with hydrocarbon exposures from a vessel collision event are:</p> <ul style="list-style-type: none"> marine pollution resulting in sublethal or lethal effects to marine fauna smothering of subtidal and intertidal habitats indirect impacts to commercial fisheries reduction in amenity resulting in impacts to tourism and recreation. 	<p>5</p> <p>5</p> <p>5</p> <p>5</p>
Consequence evaluation			
<p>Marine pollution resulting in sublethal or lethal effects to marine fauna</p> <p><u>Marine mammals</u></p> <p>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. 144; Ref. 145).</p> <p>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. 146). 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. 146). French-McCay (Ref. 147) identifies that a ≥ 10 g/m² 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.</p> <p>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.</p> <p>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. 146; Ref. 148).</p> <p>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. 146).</p> <p>Stochastic modelling was used to identify BIAs for marine mammals that may be exposed to hydrocarbon concentrations greater than impact thresholds within the EMBA. These were:</p> <ul style="list-style-type: none"> Humpback Whale (migration, resting) 			

- Pygmy Blue Whale (distribution, migration, foraging)
- Dugongs (breeding, calving, foraging, nursing).

As these species are considered most sensitive to surface exposures, deterministic analyses were utilised to understand the potential extent and duration of exposure.

The deterministic model for the worst-case trajectory for the Montebello Islands indicates that surface hydrocarbons concentrations $\geq 1 \text{ g/m}^2$ (i.e., visible threshold) are present for <5 days following the spill event, with a maximum area of coverage of $\sim 99 \text{ km}^2$ occurring 18 hours after the spill commenced. This deterministic scenario is considered most relevant for offshore waters, and subsequent impacts to offshore BIA's in those regions. 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.

The deterministic model for the worst-case trajectory for Ningaloo World Heritage area indicates that surface hydrocarbons concentrations $\geq 1 \text{ g/m}^2$ (i.e., visible threshold) are present for <2 days following the spill event, with a maximum area of coverage of $\sim 32 \text{ km}^2$ occurring 18 hours after the spill commenced. This deterministic scenario is considered most relevant for nearshore waters around Ningaloo and Exmouth Gulf, and subsequent impacts to nearshore BIA's in those regions. 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, it is acknowledged that behaviours in nearshore waters are likely to result in increased sensitivity to hydrocarbon exposures as species are less likely to be transient.

Based on an assessment of the predicted magnitude and duration of surface oil, and 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. 149).

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. 150). 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. 149).

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 Montebello Islands was the only area predicted to be exposed to shoreline hydrocarbons accumulation of $\geq 100 \text{ g/m}^2$. These islands are identified as habitat critical to the survival of Flatback, Green and Hawksbill turtles (Table 4-4). As such nesting adult turtles and hatchlings may be exposed as they traverse the intertidal area, resulting in potential smothering and acute impacts to some hatchlings during that nesting season.

The deterministic model for the worst-case trajectory for the Montebello Islands indicates that surface hydrocarbons concentrations $\geq 1 \text{ g/m}^2$ (i.e., visible threshold) are present for <5 days following the spill event, with a maximum area of coverage of $\sim 99 \text{ km}^2$ occurring 18 hours after the spill commenced. This deterministic run also predicted the largest volume of oil ashore as $\sim 24 \text{ m}^3$, and the maximum length of shoreline exposed to $\geq 100 \text{ g/m}^2$ was $\sim 10 \text{ km}$ occurring ~ 4 days after the spill commenced. Using the Flatback Turtle internesting and nesting BIAs around Montebello Islands as an example, modelling indicates that the extent of surface and shoreline exposures was predicted to be limited to <1% of the entire BIA, or <1% of the coastline. 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 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. 151). 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. 152; Ref. 153; Ref. 154).

Demersal fish are not expected to be impacted given the presence of entrained oil ≥ 100 ppb 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. 155). 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. 156). 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. 157). 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 considered most sensitive to surface exposures, deterministic analyses were utilised to understand the potential extent and duration of exposure.

The deterministic model for the worst-case trajectory for Montebello Islands indicates that surface hydrocarbons concentrations ≥ 1 g/m² (i.e., visible threshold) are present for <5 days following the spill event, with a maximum area of coverage of ~99 km² occurring 18 hours after the spill commenced. This deterministic scenario is considered most relevant for offshore waters, and subsequent impacts to offshore BIA's in those regions. Using 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 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. 158; Ref. 150). Damage to external tissues, including skin and eyes, can occur, along with internal tissue irritation in lungs and stomachs (Ref. 159). Acute and chronic toxic effects may result where the product is ingested as the bird attempts to preen its feathers (Ref. 159).

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 Montebello Islands was the only area predicted to be exposed to shoreline hydrocarbons accumulation of ≥ 100 g/m².

The deterministic model for the worst-case trajectory for the Montebello Islands indicates that surface hydrocarbons concentrations ≥ 1 g/m² (i.e., visible threshold) are present for <5 days following the spill event, with a maximum area of coverage of ~99 km² occurring 18 hours after the spill commenced. This deterministic run also predicted the largest volume of oil ashore as ~24 m³, and the maximum length of shoreline exposed to ≥ 100 g/m² was ~10 km occurring ~4 days after the spill commenced. Using the Wedge-tailed Shearwater breeding BIA around the Montebello Islands as an example, modelling indicates that the extent of surface and shoreline exposures was predicted to be limited to <1% of the entire BIA, or <1% of the coastline. This information indicates that if a vessel spill event occurred during breeding 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, seagrass and macroalgae

The effects of physical contact on subtidal habitats are similar, and studies have shown that it can cause sublethal stress and reduced growth rates in seagrass (Ref. 160; Ref. 161), act as a barrier to diffusion of CO₂ across cell walls in macroalgae (Ref. 162), and a decline in metabolic rate and partial mortality in corals (Ref. 163; Ref. 164) and impair respiration and photosynthesis by symbiotic zooxanthellae (Ref. 165; Ref. 166). The recovery of benthic habitats can be slow, with studies following the Deepwater Horizon incident showing long-term non-acute effects of the spill on coral colonies seven years after the event (Ref. 167).

Stochastic modelling predicted coral reefs associated with the following key values or sensitivities within the EMBA (Table 4-10) have the potential to be exposed to hydrocarbon concentrations above impact thresholds:

- Ningaloo Coast (World Heritage Property, National Heritage Place).

Coral, seagrass, and macroalgae habitats are also known to occur around the Barrow and Montebello islands, and to a smaller extent around some of the other Pilbara inshore islands.

Stochastic modelling showed that in-water (entrained) hydrocarbons were predicted to remain within the surface layers only. Therefore, exposure to coral reefs in deeper waters are not predicted to occur. However, smothering of benthic habitat communities may occur if a surface slick occurs in the intertidal area.

The deterministic model for the worst-case trajectory for the Montebello Islands indicates that surface hydrocarbons concentrations $\geq 1 \text{ g/m}^2$ (i.e., visible threshold) are present for <5 days following the spill event, with a maximum area of coverage of $\sim 99 \text{ km}^2$ occurring 18 hours after the spill commenced. This deterministic run also predicted the largest volume of oil ashore as $\sim 24 \text{ m}^3$, and the maximum length of shoreline exposed to $\geq 100 \text{ g/m}^2$ was $\sim 10 \text{ km}$ occurring ~ 4 days after the spill commenced.

The deterministic model for the worst-case trajectory for the Ningaloo World Heritage area indicates that surface hydrocarbons concentrations $\geq 1 \text{ g/m}^2$ (i.e., visible threshold) are present for <2 days following the spill event, with a maximum area of coverage of $\sim 32 \text{ km}^2$ occurring 18 hours after the spill commenced.

These deterministic scenarios are considered most relevant for nearshore waters and subsequent impacts to nearshore corals. 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. 168). 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. 168).

Stochastic modelling predicted shoreline accumulation above the $\geq 100 \text{ g/m}^2$ impact threshold may occur at the Montebello Islands during summer; but no accumulation $\geq 1,000 \text{ g/m}^2$ was predicted to occur. This higher threshold is typically associated with impacts to coastal vegetation communities (Table 6-11), and 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) was predicted to occur during any season. Entrained oil above impact thresholds (≥ 100 ppb) was predicted to occur; however, was predicted to remain in the surface layers, with no exposure at depths > 10 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 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. 169). Regardless of the small potential for tainting, customer perception that tainting has occurred may cause a larger impact than 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/m² (visible impact threshold) from a vessel spill event during summer has the potential to occur predominantly along the Montebello and Barrow Islands, with smaller/patchier occurrences along some of the other Pilbara inshore islands and North West Cape coast, depending on the environmental conditions at the time of the event. Only a small area of the Montebello Islands was predicted to be exposed during winter, and no shoreline contact was predicted to occur during transitional seasons.

The deterministic model for the worst-case trajectory for the Montebello Islands indicates that the maximum length of shoreline oil above the visible impact threshold (≥ 10 g/m²) at any given time was ~ 23 km, and the maximum volume of oil ashore was ~ 24 m³.

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).

ALARP decision context justification

Seismic and 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.

Good practice control measures and source	
Control measure	Source
Marine Safety Reliability and Efficiency (MSRE) process	<p>CAPL's <i>ABU MSRE Corporate OE Process</i> (Ref. 42) ensures that various legislative requirements are met. These include:</p> <ul style="list-style-type: none"> crew meet the minimum standards for safely operating a vessel, including watchkeeping requirements navigation, radar equipment, and lighting meets industry standards. <p>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 SNAs.</p>
Maritime safety information	<p>Maritime safety information, such as AUSCOAST navigational warnings, are issued by the Joint Rescue Coordination Centre (JRCC) Australia, part of AMSA.</p> <p>Under the <i>Navigation Act 2012</i>, 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.</p> <p>Where required, AUSCOAST and/or Notice to Mariners will be issued; thus enabling other marine users to also safely plan their activities.</p>
Managing Safe Work (MSW) process	<p>CAPL's <i>Managing Safe Work OE Process</i> (Ref. 41) 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.</p> <p>Where required under the MSW process, a SIMOPS Plan will be developed to identify and manage hazards arising from the 4D MSS activities and other planned petroleum activities when occurring within the same area.</p>
SOPEP / Shipboard Marine Pollution Emergency Plan	<p>MARPOL 73/78 Annex I and Marine Order 91 (Marine pollution prevention – oil) requires that each vessel has an approved SOPEP in place.</p> <p>To prepare for a spill event, the SOPEP details:</p> <ul style="list-style-type: none"> 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. <p>In the event of a spill, the SOPEP details:</p> <ul style="list-style-type: none"> reporting requirements and a list of authorities to be contacted activities to be undertaken to control the discharge of oil <p>procedures for coordinating with local officials.</p>
Oil Pollution Emergency Plan (OPEP)	<p>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.</p> <p>CAPL has developed a NOPSEMA-accepted OPEP (Ref. 2) to support all spill response activities across all its assets.</p>
Operational and Scientific Monitoring Plan (OSMP)	<p>The OSMP details the arrangements and capability in place for operational and scientific monitoring.</p> <p>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).</p> <p>CAPL has developed a NOPSEMA-accepted OSMP (Ref. 3) to support all spill monitoring activities across all its assets.</p>

Additional control measures and cost benefit analysis		
Control measure	Benefit	Cost
N/A	N/A	N/A
Likelihood and risk level summary		
Likelihood	<p>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.</p> <p>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.</p> <p>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)</p>	
Risk level	Very Low (9)	
Acceptability summary		
Principles of ESD	<p>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.</p> <p>The consequence associated with this aspect is Minor (5).</p> <p>Therefore, no additional evaluation against the Principles of ESD is required.</p>	
Relevant environmental legislation and other requirements	<p>Legislation and other requirements relevant for this aspect include:</p> <ul style="list-style-type: none"> • Commonwealth <i>Navigation Act 2012</i> • Marine Order 91, Marine Pollution Prevention – oil • Marine Order 30, Prevention of collisions • <i>Conservation Management Plan for the Blue Whale 2015–2025</i> (Ref. 68) • <i>Conservation Advice Megaptera novaeangliae Humpback Whale</i> (Ref. 67) • <i>Conservation Advice Balaenoptera borealis Sei Whale</i> (Ref. 66) • <i>Conservation Advice Balaenoptera physalus Fin Whale</i> (Ref. 65) • <i>Conservation Advice Rhincodon typus Whale Shark</i> (Ref. 64) • <i>Recovery Plan for Marine Turtles in Australia</i> (Ref. 62) • North-west Marine Parks Network Management Plan (Ref. 76). 	
Internal context	<p>These CAPL environmental performance standards or procedures were deemed relevant for this aspect:</p> <ul style="list-style-type: none"> • MSRE process (Ref. 42) • MSW process (Ref. 41) • OPEP (Ref. 2) • OSMP (Ref. 3). 	
External context	<p>During stakeholder consultation, no objections or claims were raised regarding a vessel collision event arising from the activity.</p>	
Defined acceptable level	<p>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.</p> <p>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</p>	

	<p>an acceptable level of impact such that it is not inconsistent with these documents.</p> <p>The <i>Recovery Plan for Marine Turtles in Australia</i> (Ref. 62) specifies the following relevant action areas and action:</p> <ul style="list-style-type: none"> • 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. <p>No other specific relevant actions were identified within other documents implemented under the EPBC Act.</p> <p>CAPL addresses spill response and monitoring within their OPEP (Ref. 2) and OSMP (Ref. 3).</p> <p>Therefore, CAPL has defined an acceptable level of impact as minimising the risk of impacts to the environment from spills from vessel operations.</p>	
Environmental performance outcome	Performance standard / Control measure	Measurement criteria
No leak or spill of hydrocarbons / hazardous materials to the environment during petroleum activities	<p>MSRE process</p> <p>Vessels will meet the crew competency, navigation equipment, and radar requirements of the MSRE process</p>	Records indicate that vessels meet the crew competency, navigation equipment, and radar requirements of the MSRE process
	<p>Maritime safety information</p> <p>Notify relevant agency of activities, vessel movements, and requested SNA, to enable them to generate radio-navigation warnings and/or Notice to Mariners prior to commencing offshore activities</p>	Record of lodgment of notification to relevant agency
	<p>MSW process</p> <p>Where required, CAPL will develop and implement SIMOPS Plan(s) to manage the 4D MSS and other planned petroleum activities</p>	Records indicate that MSW process has been applied, and where identified as relevant, a SIMOPS Plan has been developed and implemented
Reduce the risk of impacts to the environment from the unplanned release of hydrocarbons / hazardous materials during petroleum activities	<p>SOPEP</p> <p>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</p>	<p>OVIS report / ABU Marine OE Inspection Checklist confirms an approved SOPEP is on board marine vessels >400 T</p> <p>Inspection records (or similar) show drills conducted in accordance with SOPEP</p>
	<p>SOPEP</p> <p>In the event of a vessel-based spill event, emergency response activities will be implemented in accordance with the vessel SOPEP (or equivalent).</p>	Records confirm that emergency response activities were implemented in accordance with the vessel SOPEP in the event of a vessel-based spill.
	<p>OPEP</p> <p>In the event of a spill occurring, the OPEP will be implemented</p>	Records confirm the OPEP has been implemented
	<p>OSMP</p> <p>In the event of a spill occurring, the OSMP will be implemented</p>	Records confirm the OSMP has been implemented

6.13 Spill response

6.13.1 Response option selection

6.13.1.1 Strategic NEBA

CAPL has developed a series of Strategic Net Environmental Benefit Analysis (NEBAs) (Ref. 170) 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. 171). 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.

6.13.1.2 Protection prioritisation process

CAPL has developed a Protection Prioritisation Process (PPP) (Ref. 172) 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. 172) 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. 172) aligns with WA Department of Transport (DoT) PPP (Ref. 173) 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. 172]) 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. 172), 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 is 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 6-13 for the vessel collision event. 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 6-13: Priority planning areas for vessel collision event spill scenario

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

6.13.2 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 2 – 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 6-13, 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.

6.13.3 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).

6.13.3.1 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. 170) 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.

6.13.3.2 CAPL planned response vessel collision

In accordance with the Strategic NEBA (Ref. 170), the response strategies proposed to be used for this spill scenario and response package calculations are described below. Offshore containment and recovery (CAR) would not be effective because of the hydrocarbon properties (Group 2).

Implement MES response

A MES response will commence for a vessel collision 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 SPD response

Deterministic analysis for the largest volume of oil ashore indicates that ~24.4 m³ may wash ashore within ~3 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 m³ of hydrocarbon per day. On the assumption that 24.4 m³ washes ashore on the third 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 6-14.

Implement 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 may be on SHC operations if time restricts the ability to conduct SPD activities.

Deterministic analysis for the largest volume of oil ashore indicates that 24.4 m³ may wash ashore within ~3 days after release; and the maximum length of actionable shoreline oil was predicted to be ~10 km within ~4 days. This scenario predicted exposure to the western coastlines of the Montebello Islands.

The Montebello Islands consists of a series of relatively flat limestone islands and sandy beaches and lagoons, easily accessed by boat (dependent on weather and sea conditions). On this basis, response planning indicates it would be feasible to conduct SHC activities.

Based on Appendix C of the OPEP (Ref. 2), each SHC team is expected to recover 1.6 m³ of hydrocarbon per day. If 5 clean-up teams are mobilised on day 3 and used each day, all hydrocarbons can be recovered 5 days from the start of the spill (3 days of SHC response). If required, these efforts could be ramped up as directed and informed by MES activities.

Table 6-14: Vessel collision 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	5	5	5	0	0	0	0	0	0	0	
Does CAPL have the required capability?			Y	Y	Y								

6.13.4 Spill response environmental risk assessment

6.13.4.1 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 (vessel collision event releasing MDO), 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			
<p>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.</p> <p>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.</p> <p>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.</p> <p>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).</p>			
ALARP decision context justification			
<p>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.</p> <p>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.</p> <p>During stakeholder consultation, no objections or claims were raised regarding spill response activities.</p> <p>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.</p>			

Good practice control measures and source		
Control measure	Source	
OSMP	<p>The OSMP details the arrangements and capability in place for operational and scientific monitoring.</p> <p>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).</p> <p>CAPL has developed an NOPSEMA-accepted OSMP (Ref. 3) to support all spill monitoring activities across all its assets.</p> <p>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.</p>	
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	<p>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.</p> <p>The consequence associated with this aspect is Minor (5).</p> <p>Therefore, no additional evaluation against the Principles of ESD is required.</p>	
Relevant environmental legislation and other requirements	No legislation and other requirements relevant to this aspect were identified.	
Internal context	<p>This CAPL environmental performance standard / procedure was considered relevant for this aspect:</p> <ul style="list-style-type: none"> 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 outcome	Performance standard / Control measure	Measurement criteria
Reduce the risk of impacts to the environment during event response	<p>OSMP</p> <p>In the event of a spill occurring, the OSMP will be implemented</p>	Records confirm the OSMP has been implemented

6.13.4.2 Physical presence—oiled wildlife response

Oiled wildlife response (OWR) activities are aimed at treating fauna that have encountered, or are likely to encounter, spilled 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 (vessel collision event releasing MDO), 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			
<p>Particular environmental values that may be affected by OWR activities include marine fauna such as turtles and birds.</p> <p>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.</p> <p>Spill modelling indicates that areas along the coast frequented by fauna, such as the 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).</p>			
ALARP decision context justification			
<p>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.</p> <p>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.</p> <p>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.</p> <p>During stakeholder consultation, no objections or claims were raised regarding OWR activities.</p> <p>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.</p>			
Good practice control measures and source			
Control measure	Source		
OSMP	<p>The OSMP details the arrangements and capability in place for operational and scientific monitoring.</p> <p>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</p>		

	<p>attributable to the spill or the associated response activities and informs requirements for remediation (if required).</p> <p>CAPL has developed a NOPSEMA-accepted OSMP (Ref. 3) to support all spill monitoring activities across all its assets.</p> <p>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.</p>	
Likelihood and risk level summary		
Likelihood	<p>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).</p>	
Risk level	Very low (9)	
Acceptability summary		
Principles of ESD	<p>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.</p> <p>The consequence associated with this aspect is Minor (5).</p> <p>Therefore, no additional evaluation against the Principles of ESD is required.</p>	
Relevant environmental legislation and other requirements	<p>No legislation and other requirements considered relevant to this aspect were identified.</p>	
Internal context	<p>The CAPL environmental performance standard / procedure considered relevant for this aspect is:</p> <ul style="list-style-type: none"> OSMP (Ref. 3). 	
External context	<p>During stakeholder consultation, no objections or claims were raised regarding spill response activities.</p>	
Defined acceptable level	<p>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.</p>	
Environmental performance outcome	Performance standard / Control measure	Measurement criteria
Reduce the risk of impacts to the environment during event response	<p>OSMP</p> <p>In the event of a spill occurring, the OSMP will be implemented</p>	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. 40) 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.

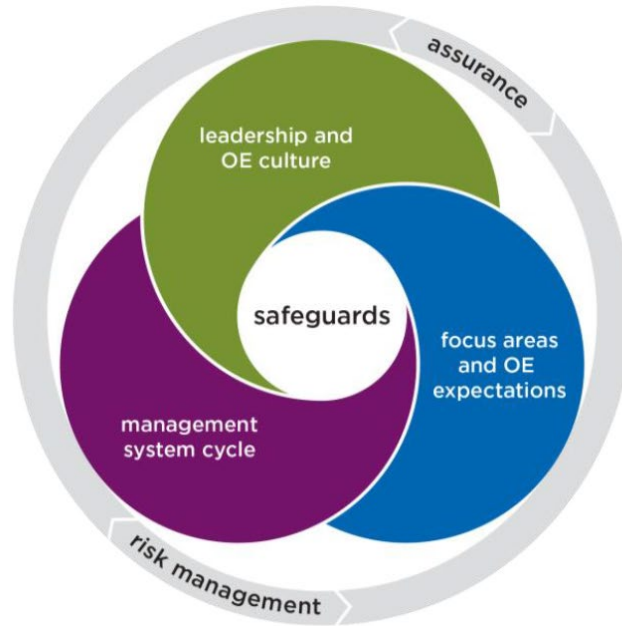


Figure 7-1: Overview of Chevron Corporation's OEMS

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.

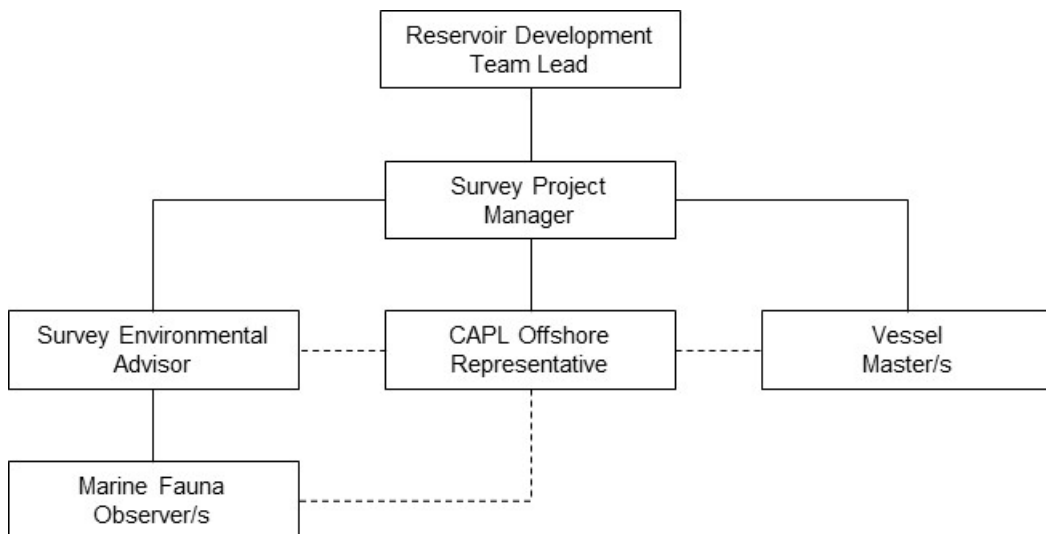


Figure 7-2: Chain of command—petroleum activities

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

Role	Responsibilities
Survey Project Manager	<ul style="list-style-type: none"> Overall responsibility for implementing, managing, and reviewing this EP <p>Ensure that:</p> <ul style="list-style-type: none"> all third-party vessels or contractors are aware of any requirements within this EP ongoing consultation is conducted in accordance with Section 2.6.5
CAPL Offshore Representative	<p>Ensure that:</p> <ul style="list-style-type: none"> 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 Section 6 all incidents are reported to Survey Project Manager
Survey Environmental Advisor	<p>Ensure that:</p> <ul style="list-style-type: none"> 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 Section 6 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.
Vessel Master/s	<p>Ensure that:</p> <ul style="list-style-type: none"> impacts and risks are continually reduced to ALARP by implementing this EP in accordance with Section 6 all necessary vessel-related documentation (e.g., SOPEPs, certificates, etc.) is available in accordance with Section 6 all marine safety information notifications are issued in accordance with Table 2-7 and Section 6 all incidents are reported to CAPL Offshore Representative all emissions and discharges are monitored and recorded in accordance with Section 6.
Marine Fauna Observer/s	<ul style="list-style-type: none"> Undertake visual observations for marine fauna in accordance with Section 6 Record and report all sightings of marine fauna to the Survey Environmental Advisor Provide advice to the CAPL Offshore Representative and Vessel Master (or delegate) regarding delay or shut down seismic source, if required, in accordance with Section 6.5 of this EP Assist Survey Environmental Advisor with compliance verification as required.

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) will be 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	<p>Before commencing activities, 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.</p> <p>The induction includes:</p> <ul style="list-style-type: none"> • 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 • whale interaction requirements under EPBC Act Policy 2.1 • 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.

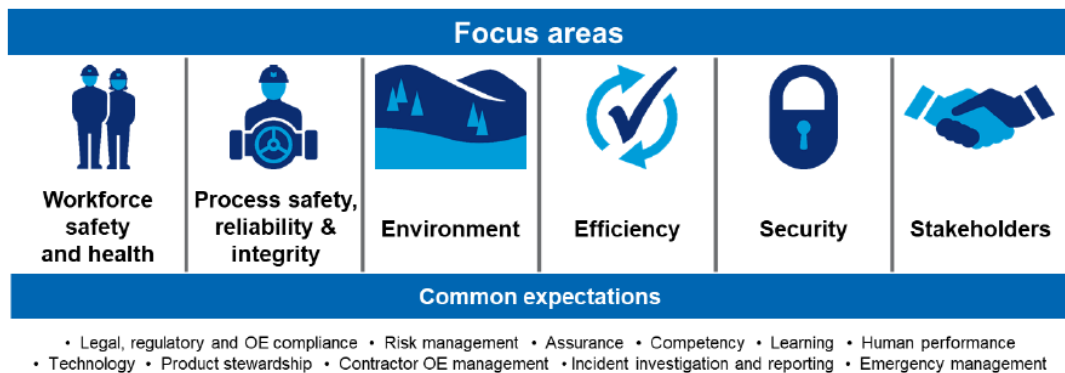


Figure 7-3: Focus areas and common expectations

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	<ul style="list-style-type: none"> • <i>Managing Safe Work (MSW): ABU Standardised OE Process (Ref. 41)</i> • <i>Marine Safety Reliability and Efficiency: ABU Standardised OE Process (Ref. 42)</i> • <i>ABU Hazardous Materials Management Procedure: ABU Standardised OE Procedure (Ref. 43)</i>
Process safety, reliability and integrity	<ul style="list-style-type: none"> • <i>OE Information Management: ABU Standardised OE Process (Ref. 44)</i> • <i>Management of Change for Facilities and Operations: ABU Standardised OE Process (Ref. 45)</i>
Environment	<ul style="list-style-type: none"> • <i>Environmental Stewardship: ABU Standardised OE Process (Ref. 46)</i> • <i>Quarantine Procedure Marine Vessels. ABU Standardised OE Process (Ref. 47)</i>
Stakeholders	<ul style="list-style-type: none"> • <i>Stakeholder Engagement and Issues Management: ABU Standardised OE Process (Ref. 48)</i>
Common expectation	
Risk management	<ul style="list-style-type: none"> • <i>ABU OE Risk Management Process (Ref. 33)</i>
Assurance	<ul style="list-style-type: none"> • <i>OE Assurance Corporate Process (Ref. 49)</i> • <i>OE Corporate Standard Incident Investigation (Ref. 52)</i> • <i>OE Data Reporting Standard (Ref. 53)</i>
Incident investigation and reporting	<ul style="list-style-type: none"> • <i>Incident Investigation and Reporting (II&R) Execution Manual (Ref. 54)</i>
Emergency management	<ul style="list-style-type: none"> • <i>Emergency Management OE Process (Ref. 55)</i> • <i>OPEP (Ref. 2)</i> • <i>Operational and Scientific Monitoring Plan (OSMP) (Ref. 3)</i>

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. 41) 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. 42) 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. 56), 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. 43) 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. 57).
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.

Assessment criteria	Selection rationale
	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. 44) 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. 45) 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.

7.3.3 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. 46) 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. 47) 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. 48) 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.

7.3.4.1 Adjustment Protocol

CAPL is committed to reducing impacts to commercial fisheries within its area of operations to ALARP. CAPL will consider an evidence-based adjustment protocol for the commercial fishing sector should fishers be verifiably impacted to a commercially material extent by the 4D MSS (Table 7-5). CAPL will provide reasonable monetary adjustment to a commercial fishing licence holder for temporary loss of catch, displacement, or equipment loss/damage, occurring within the OA and during the 4D MSS. The onus will be on the commercial fishing license holder to provide evidence to CAPL where impacts are identified with verifiable catch-data to support the claim.

All evidence-based claims made by commercial fishery licence holders will be assessed for merit by CAPL. CAPL will not accept claims under this EP if the claim covers the same time, area, fishing activity, or equipment made in another claim for a different seismic survey. If a claim cannot be resolved between CAPL and the fisher, an independent expert will be engaged to assess the claim.

Table 7-5: Commercial fisheries adjustment protocol

Claim type	Considerations
Temporary loss of catch	<ul style="list-style-type: none"> Loss of catch by the commercial fishing licence holder is based on an assessment of what the commercial fishing licence holder would have caught during that month within the OA “but for” the 4D MSS A loss of catch will be concluded if there is a reduction in the catch per unit of effort for each species calculated over a month, compared to the average historical catch per unit of effort for the same species and corresponding month If a loss of catch is substantiated, payments will be calculated based on the reduced kilograms per species caught, multiplied by the market price per kilogram at the time the catch would have been sold Loss of catch claims will be assessed for the months during the 4D MSS and for up to 3 months from the completion date Where a commercial fishing licence holder wants to receive a loss of catch payment, they will need to provide CAPL with monthly catch disposal records and multiple years (preferably 10 years, but will be decided on a case by case basis) of historical data to allow average monthly catch rates per species to be determined The commercial fishing licence holder must provide evidence that their vessel(s) continued to fish over the claim period Where a commercial fishing licence holder intends to make a temporary loss of catch claim, they will need to notify CAPL as soon as practicable, and they will need to have submitted the claim and supporting evidence within 6 months of the completion of the 4D MSS.
Displacement	<ul style="list-style-type: none"> Where a commercial fishing licence holder is displaced from the OA such that it is required to relocate their operations to another area during the 4D MSS, CAPL will consider a once-off payment to reimburse operational expenses which are in addition to those the commercial fishing licence holder would have borne “but for” the 4D MSS Where a commercial fishing licence holder intends to make an operational expense claim for relocation, they will need to notify CAPL as soon as practicable and prior to relocating, and state why the seismic survey has caused them to relocate Where a commercial fishing licence holder wants to be reimbursed for any relocation operational expenses, they will need to provide CAPL with evidence of the operating costs of bait, fuel, wages and any other

Claim type	Considerations
	<p>costs that are additional to the costs that would have been incurred to catch the fish “but for” the relocation</p> <ul style="list-style-type: none"> Where a commercial fishing licence holder intends to make a displacement expenses claim, they will need to notify CAPL within 14 days of the displacement occurring, and have submitted the claim and supporting evidence within 1 month of the completion of the 4D MSS.
Equipment loss or damage	<ul style="list-style-type: none"> Where a commercial fishing licence holder intends to make an equipment damage or loss expenses claim, they will need to evidence that CAPL was made aware of the specific equipment location and deployment dates Where a commercial fishing licence holder intends to make an equipment damage or loss expenses claim, they will need to notify CAPL within 14 days of the loss/damage occurring, and have submitted the claim and supporting evidence within 1 month of the completion of the 4D MSS.

7.3.5 Risk management

The risk management process (Ref. 33) 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. 39) and ISO 31000:2018 *Risk management – Principles and guidelines* (Ref. 38).

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. 33) and the *Management of Change for Facilities and Operations* process (Ref. 45) 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. 49) 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. 50) 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).

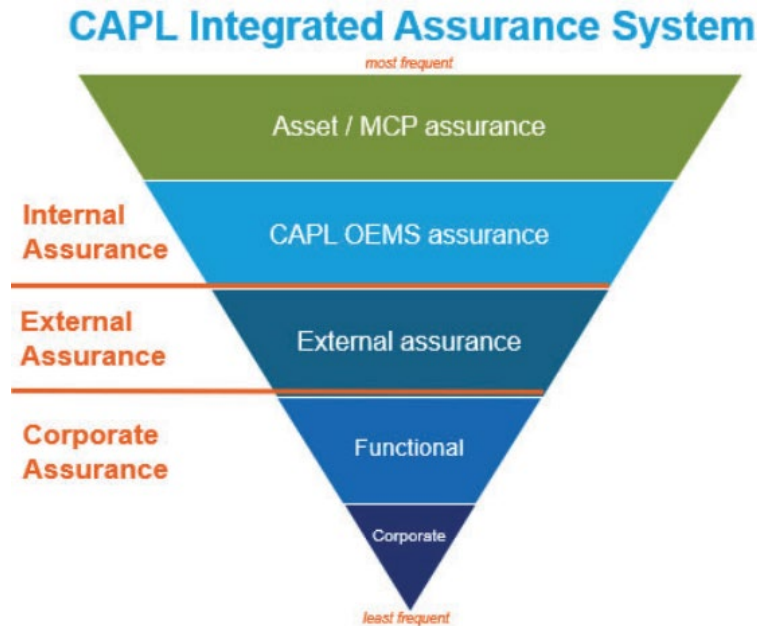


Figure 7-4: ABU integrated assurance system

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.

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 outcomes 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.

Environmental performance standards in the EP will undergo a compliance review and evidence will be gathered for each environmental performance standard to support the end of activity environmental report. Assurance related to the Wheatstone 4D MSS activities described in this EP will be summarised in the end of activity 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. 52) and *OE Data Reporting Standard* (Ref. 53). These processes apply to instances where the requirements of this EP have not been met. These processes are 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. 54) 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

CAPL's emergency management implementation strategy is described in the following sub-sections.

In addition to CAPL's overarching emergency management strategies, and with specific reference to vessel-based activities, an approved SOPEP will also be in place (in accordance with vessel class requirements) as required by MARPOL 73/78 Annex I and Marine Order 91 (Marine pollution prevention – oil). In the event of a vessel-based spill event the SOPEP will be implemented by the Vessel Master. Control measures and environmental performance standards relating to SOPEPs are described in Sections 6.11 and 6.12, and requirements have not been duplicated here.

7.3.8.1 Emergency management arrangements

The emergency management arrangements outline a systematic approach for preventing, preparing for, 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. 58) and is consistent with the core aspects presented in the International Maritime Organisation (IMO) equivalent courses.

The ERO comprises the groups listed in Table 7-6; 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. 59).

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 7-6: CAPL emergency management teams

Team	Description
Tier 1 (CAPL)	
On-site Response Teams (ORTs)	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.
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. 55) 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. 55) 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. 60).

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.

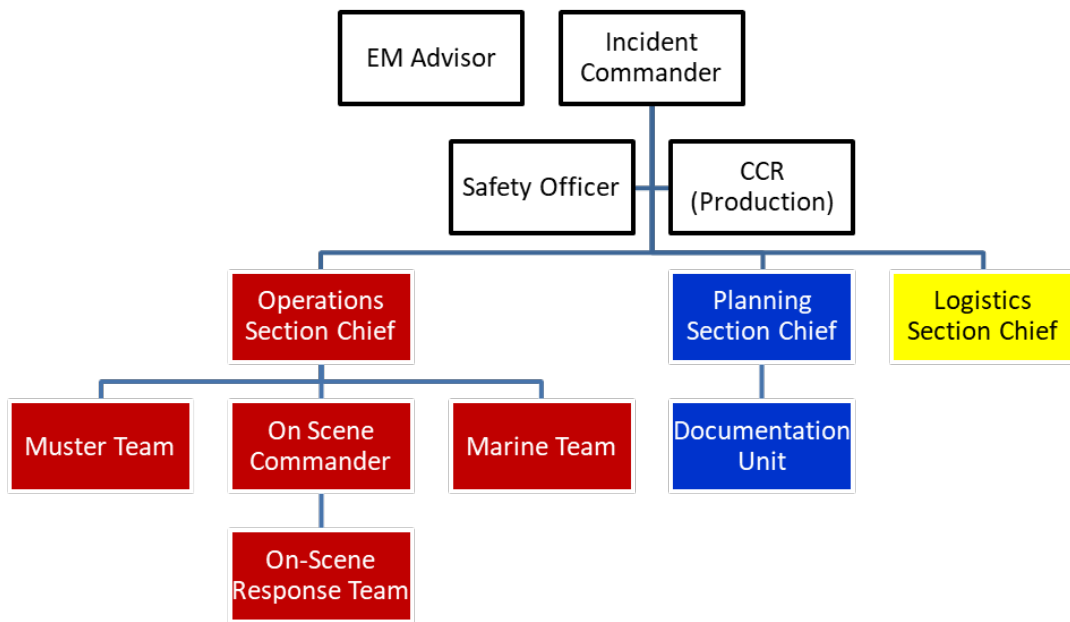


Figure 7-5: Basic installation EMT organisation chart

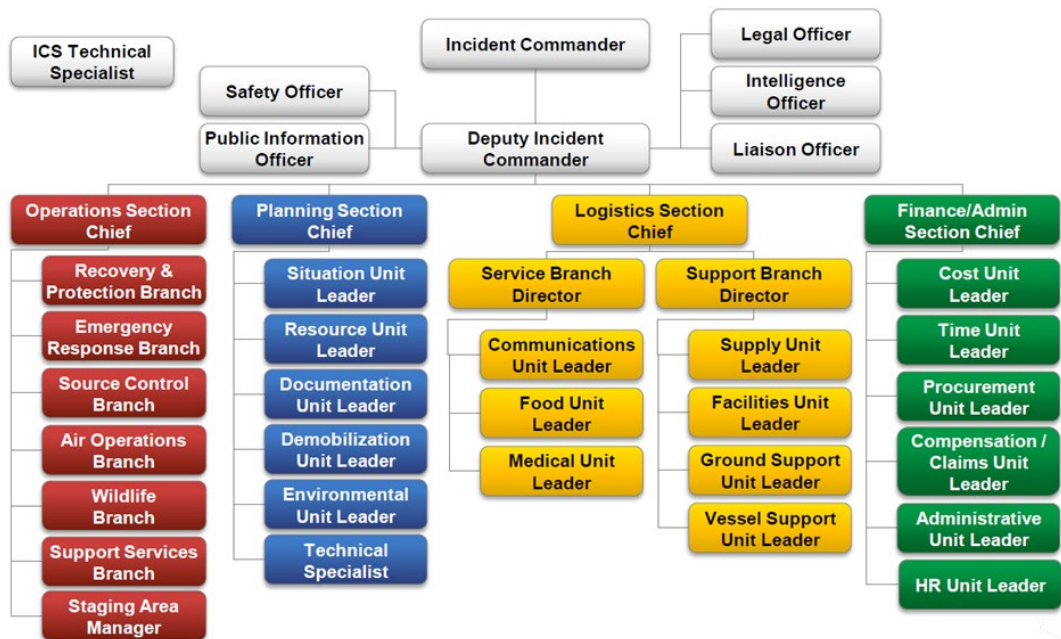


Figure 7-6: Expanded EMT organisation chart

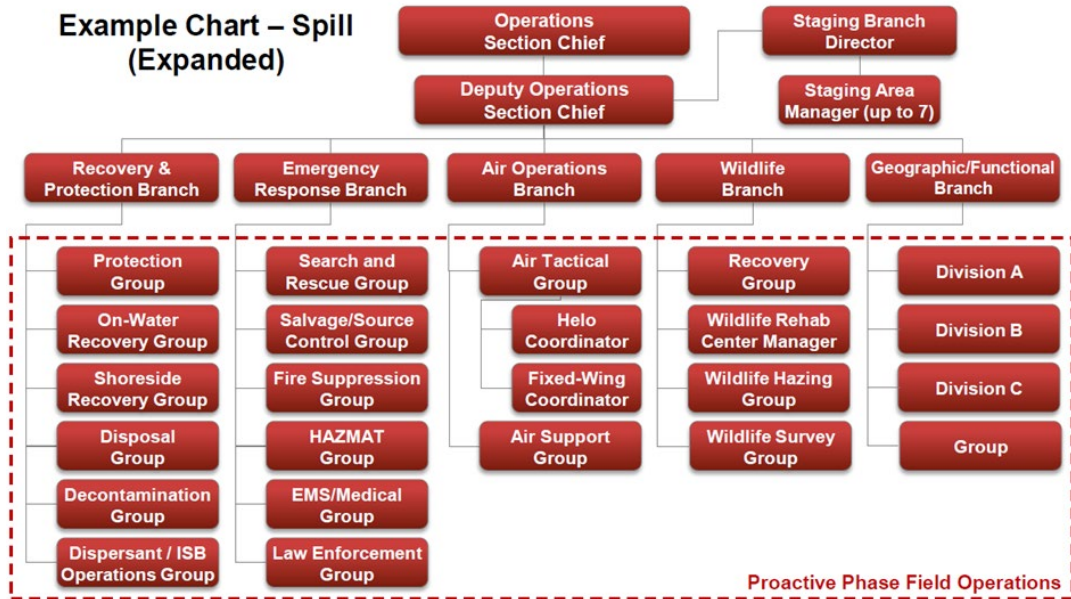


Figure 7-7: Example expanded operations section organisation chart

7.3.8.4 Roles and responsibilities (emergency response)

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

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

Role	Responsibilities
On-Site Response Team	
On-Scene Commander (OC) (Vessel Master)	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Ensures that appropriate actions are taken to protect the safety and health of ORT response personnel
Task Leader	<ul style="list-style-type: none"> Safely carries out their assignment consistent with directions received from the OC, branch director, division, or group supervisor
Emergency Management Team	
Incident Commander (IC)	<ul style="list-style-type: none"> 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)	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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

Role	Responsibilities
	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> 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 7-8. Competency and training records for personnel, including contractors and subcontractors, are maintained.

Table 7-8: Competency and training requirements—emergency response

Role	Summary	Training Standard
<i>Note: Personnel with no specialist emergency response duties should undergo training in line with their responsibilities as indicated below for 'All personnel'.</i>		
All personnel	<ul style="list-style-type: none"> 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) Frequency: every 3 years if not involved in response or drills/exercises 	
<i>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.</i>		
Emergency Management Teams (EMTs)		
PEMT Incident Commander	<ul style="list-style-type: none"> 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) 	<ul style="list-style-type: none"> 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	<ul style="list-style-type: none"> Selected Perth based personnel, typically a manager, or personnel with skills and knowledge appropriate to the function Competencies: provides strategic direction, internal 	<ul style="list-style-type: none"> ICS-100 Introduction to the Incident Command System ICS-200 Basic Incident Command System training ICS-220 Initial Response Team

Role	Summary	Training Standard
	<p>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</p> <ul style="list-style-type: none"> Frequency: once a year (maintenance of competencies may be through response or training/drills/exercises) 	<ul style="list-style-type: none"> 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. 61) 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. 61) outlines the proposed testing arrangements to be completed, including the exercise types (Table 7-9) and proposed level of response to be tested (Table 7-10) that may be used to meet the defined objectives. A minimum of one test for each level will be conducted each year.

Table 7-9: Exercise types

Type	Details
Notification exercise	<ul style="list-style-type: none"> Tests the procedures to notify and activate the EMTs, support organisations, and regulators
Tabletop exercise	<ul style="list-style-type: none"> Normally involves interactive discussions of a simulated scenario amongst members of an EMT; personnel or equipment are not mobilised
Drill	<ul style="list-style-type: none"> Conducts field activities such as equipment deployment, shoreline assessment, monitoring etc.
Functional exercise	<ul style="list-style-type: none"> 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 7-10: Exercise levels

Level	Details
Level 1 – ORT	<ul style="list-style-type: none"> • 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 ERO or a Level 2 EMT
Level 2 – EMT	<ul style="list-style-type: none"> • 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	<ul style="list-style-type: none"> • 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 6.12 and Section 6.13.4. 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 7-11.

Table 7-11: Incident reporting

Recordable Incident reporting – Regulation 26B	
<p>Legislative definition of ‘recordable incident’: <i>‘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’</i></p> <p>Recordable incidents are breaches of the environmental performance outcomes and standards described in Section 5.7.</p>	
Reporting requirements	Report to / Timing
<p>Written notification to NOPSEMA by the 15th of each month</p> <p>As a minimum, the written incident report must describe:</p> <ul style="list-style-type: none"> 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. <p>If no recordable incidents occur during the reporting month, a ‘nil report’ will be submitted.</p>	<p>Submit written report to NOPSEMA by the 15th of each month</p>
Reportable Incident reporting – Regulations 26, 26A, and 26AA	
<p>Legislative definition of ‘reportable incident’: <i>‘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.’</i></p> <p>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:</p> <ul style="list-style-type: none"> introduction of an IMP (Section 6.7). 	
Reporting requirements	Report to
<p>Verbal or written notification must be undertaken within two hours of the incident or as soon as practicable. This information is required:</p> <ul style="list-style-type: none"> the incident and all material facts and circumstances known at the time any actions taken to avoid or mitigate any adverse environmental impacts. 	<p>Report verbally to NOPSEMA within two hours or as soon as practicable and provide written record of notification by email.</p> <p>Phone: (08) 6461 7090</p> <p>Email: submissions@nopsema.gov.au</p>

<p>Verbal notifications must be followed by a written report as soon as practicable, and not later than three days following the incident.</p> <p>At a minimum, the written incident report will include:</p> <ul style="list-style-type: none"> 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. <p>If the initial notification of the reportable incident was verbal, this information must be included in the written report.</p>	<p>Written report to be provided to:</p> <ul style="list-style-type: none"> NOPSEMA: submissions@nopsema.gov.au National Offshore Petroleum Titles Authority: info@nopta.gov.au
Additional Reporting Requirements	
Reporting requirements	Report to
<p>An oil/gas pollution incident that occurs within a marine park or is likely to impact on a marine park.</p> <p>The notification should include:</p> <ul style="list-style-type: none"> 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. 	<p>Report verbally to the DNP (24-hour) Marine Duty Officer as soon as practicable, and also provide a follow-up email.</p> <p>Phone: 0419 293 465</p> <p>Email: marine.compliance@environment.gov.au</p>
<p>Death or injury to individual(s) from an EPBC Act Listed Species as a result of the petroleum activities</p>	<p>Report injury to or mortality of EPBC Act Listed Threatened or Migratory species within seven business days of observation to DAWE or equivalent:</p> <ul style="list-style-type: none"> Phone: +61 2 6274 1111 Email: EPBC.Permits@environment.gov.au
<p>Vessel collision with marine mammals (whales)</p>	<p>Reported as soon as practicable.</p> <p>https://data.marinemammals.gov.au/report/shipstrike</p>
<p>Presence of any suspected IMP or disease within 24 hours</p>	<p>DPIRD:</p> <ul style="list-style-type: none"> 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 7-12. Routine notifications required by Regulations 29 and 30 of the OPGGS(E)R and also included in Table 7-12.

Table 7-12: Routine external reporting requirements

Reporting requirement	Description	Reporting to	Timing
Environmental performance reporting	A report detailing environmental performance of the activity detailed in this EP	NOPSEMA submissions@nopsema.gov.au Phone: +61 8 6461 7090	Within three months of completion 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
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 post activity completion

7.5 Environment Plan review

If required, any 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 abbreviations and definitions

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

Table 8-1: Abbreviations and Definitions

Acronym/ Abbreviation	Definition
AASM	Airgun array source model
ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
ABU	Australian Business Unit
ACN	Australian Company Number
AFMA	Australian Fisheries Management Authority
AHO	Australian Hydrographic Office
AIIMS	Australasian Inter-service Incident Management System
AIMS	Australian Institute of Marine Science
AIS	Automated identification system
ALARP	As low as reasonably practicable
AMP	Australian Marine Park
AMSA	Australian Maritime Safety Authority
API	American petroleum index
APPEA	Australian Petroleum Production and Exploration Association
ASOG	Activity-specific operational guideline
AUSCOAST	A type of navigational warning
BIA	Biologically important areas
BTAC	Buurabalayji Thalanyji Aboriginal Corporation
CAPL	Chevron Australia Pty Ltd
CAR	Containment and recovery
CEFAS	(United Kingdom) Centre for Environment, Fisheries and Aquaculture Science
CHARM	Chemical Hazard Assessment and Risk Management
CMT	Crisis Management Team
DAWE	(Commonwealth) Department of Agriculture, Water and the Environment
DBCA	(Western Australia) Department of Biodiversity, Conservation and Attractions
DEWHA	(Commonwealth) Department of the Environment, Water, Heritage and the Arts
DMIRS	(Western Australia) Department of Mines, Industry Regulation and Safety
DNP	(Commonwealth) Director of National Parks
DoT	(Western Australia) Department of Transport
DP	Dynamic positioning
DPIRD	(Western Australia) Department of Primary Industries and Regional Development
EEA	Environmental exposure area

Acronym/ Abbreviation	Definition
EIS	Environmental impact statement
EMBA	Environment that may be affected
EMT	Emergency Management Team
EP	Environment Plan
EPBC Act	Commonwealth <i>Environment Protection and Biodiversity Conservation Act 1999</i>
ERO	Emergency Response Organisation
ESD	Ecologically sustainable development
FE	Facilities engineering
FPZ	Full power zone
GDA	Geocentric datum of Australia
GHG	Greenhouse gas
HB	Handbook
HFO	Heavy fuel oil
HIRA	Hazard Identification and Risk Assessment
HSE	Health, safety, and environment
IAPP	International Air Pollution Prevention
IBRA	Interim Biogeographic Regionalisation for Australia
IC	Incident Commander
IEE	International energy efficiency
IEMT	Installation Emergency Management Team
IFO	Intermediate fuel oil
IIR	Incident investigation and reporting
IMCRA	Integrated Marine and Coastal Regionalisation of Australia
IMO	International Maritime Organisation
IMP	Invasive marine pest
IMS	Incident management system
IOPP	International Oil Pollution Prevention
IPCC	Intergovernmental Panel on Climate Change
ISO	International Organization for Standardisation
ISPP	International Sewage Pollution Prevention
ITOPF	International Tanker Owners Pollution Federation Limited
JASMINE	JASCO Animal Simulation Model Including Noise Exposure model
JRCC	Joint Resource Coordination Centre
KEF	Key ecological feature
km	Kilometre
LC ₅₀	Lethal concentration with the potential to result in a 50% mortality of a sample population

Acronym/ Abbreviation	Definition
LNG	Liquefied natural gas
LOC	Loss of containment
m	Metre
MarCHES	Marine Contractor HES
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
MAZ	Multi-azimuth
MBES	Multibeam echo sounder
MDO	Marine diesel oil
MES	Monitoring, evaluation, and surveillance
MFO	Marine fauna observer
MGO	Marine gas oil
MoC	Management of change
MODU	Mobile offshore drilling unit
MOPO	Matrix of permitted operations
MSC	Management system cycle
MSRE	Marine safety reliability and efficiency
MSS	Marine seismic survey
MSW	Managing safe work
N/A	Not applicable
NEBA	Net environmental benefit analysis
NEPA	National Environmental Protection Measure
NMFS	National Marine Fisheries Service
NOAA	(United States) National Oceanic and Atmospheric Administration
NOPSEMA	National Offshore Petroleum Safety and Environment Management Authority
NOPTA	National Offshore Petroleum Titles Administrator
NSW	New South Wales
NT	Northern Territory
NWS	North West Shelf (of Western Australia)
NWSTF	North West Slope Trawl Fishery
OA	Operational area
OC	On-scene Commander
OCNS	Offshore Chemical Notification Scheme
OE	Operational Excellence
OEMS	Operational Excellence Management System
OGUK	Oil and Gas UK

Acronym/ Abbreviation	Definition
OPEP	Oil Pollution Emergency Plan
OPGGGS Act	Commonwealth <i>Offshore Petroleum and Greenhouse Gas Storage Act 2006</i>
OPGGGS(E)R	Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009
ORT	On-site Response Team
OSC	Operations Section Chief
OSMP	Operational and Scientific Monitoring Plan
OVIS	Offshore Vessel Information System
OWR	Oiled wildlife response
PAH	Polycyclic aromatic hydrocarbon
PAM	Passive acoustic monitoring
PCB	Prescribed Body Corporate
PEMT	Perth Emergency Management Team
PGPA	Policy, Government, and Public Affairs
PMST	Protected matters search tool
PPP	Protection Prioritisation Process
PSZ	Petroleum safety zone
PTS	Permanent threshold shift
PTW	Permit to Work
ROV	Remotely operated underwater vehicle
SEEMP	Ship Energy Efficiency Management Plan
SEL	Sound exposure level
SHC	Shoreline clean-up
SIMAP	Spill Impact Mapping and Analysis Program
SIMOPS	Simultaneous operations
SMPEP	Shipboard Marine Pollution Emergency Plan
SNA	Safe navigation area
SOPEP	Ship Oil Pollution Emergency Plan
SPD	Shoreline protection and deflection
SPL	Sound pressure level
SRD	Streamer recovery device
TEC	Threatened ecological community
TTS	Temporary threshold shift
UK	United Kingdom
VHF	Very high frequency radio
WA	Western Australia
WAFIC	Western Australian Fisheries Industry Council

Acronym/ Abbreviation	Definition
YACMAC	Yaburara and Coastal Mardudhunera Aboriginal Corporation

9 references

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

Table 9-1: References

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Ref. No.	Document	Document ID
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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.



Mark Hatfield
Managing Director, Australasia Business Unit

appendix b stakeholder engagement—fact sheet

wheatstone 4D seismic program

environment plan commercial fishing consultation

June 2021



overview

Chevron Australia is planning to conduct a 4D seismic survey over the Wheatstone and Iago gas fields as part of its standard reservoir management practice.

The proposed survey will be conducted using conventional seismic survey equipment and methodology. It will serve as a “timelapse” measurement and will be compared to data acquired in 2011/2012 to assist Chevron understand how the Wheatstone reservoir is performing.

location and water depths

The survey will be conducted within WA-46-L, WA-47-L, WA-48-L and surrounding permits located approximately 150 kilometers north-west of Dampier with water depths ranging from 80 to 1,140m depths.

At its closest point the full power zone will also be about 36km from the Montebello Islands.

See location map on page 5.

schedule and duration

Expected start is late 2022 or early 2023, subject to approvals and vessel availability. The project will run approximately 60-80 days depending on weather conditions.

activity summary

The proposed survey will be conducted by a purpose-built seismic vessel that will traverse a series of “sail lines” within the operational area at a speed of around 7-9kph. The vessel will follow as closely as possible the sail lines from the 2011/2012 survey.

The vessel will use compressed air to create “bubbles” that collapse and send directionally focused low-frequency sound waves towards the sea floor. A series of hydrophones (located in a series of streamers trailed behind the vessel) then capture the returning sound waves and record the data that is later interpreted by geoscientists.

The seismic vessel contracted for the Wheatstone 4D survey will tow the following equipment:

- Up to 14 streamers at a length of up to 7 kms and a depth of up to 25m.
- Two source arrays of approximately 4,130 cu.in. volume at a depth of 5-8m.

For best 4D seismic data results, the 2022/23 source size must match that of the 2011/12 survey.

A small number of support and chase vessels (likely two) will be used to assist with re-supply, re-fueling and other standby functions.

seismic surveys (3D and 4D)

Seismic surveys produce detailed images of the geology beneath the earth's surface. This information can assist identify location and size of oil and gas reservoirs and how, over time, a reservoir is performing.

A 4D seismic survey is simply a time-lapse version of 3D and allows for comparison with previous surveys to provide a better understanding of what is occurring in reservoirs over time.

survey area

The Wheatstone 4D full power zone is about 1,644 km² while the operational area associated with the survey will be about 3,700km². See location map for more details.

approvals process

Petroleum activities in Commonwealth waters, which includes seismic surveys, are regulated by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA).

Before a seismic survey can take place, Chevron Australia must develop a plan for managing the environment (the Environment Plan or EP) which will be assessed by NOPSEMA in accordance with the requirements of the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations (2009)*.

The EP will describe the environment in which the survey will take place, an assessment of the impacts and risks arising from the survey, and the identification of control measures to manage the potential impacts and risks to levels that are acceptable and as low as reasonably practicable (ALARP).

The EP is also required to outline how relevant stakeholders whose interests, functions and activities may be affected by the survey have been identified, engaged and consulted. The EP must include how feedback has been assessed and responded to.

Seismic survey environment plans must be submitted to NOPSEMA and published on its website for a 30-day public comment period.

Chevron Australia is currently aiming for the EP associated with this activity to be made available for broader public comment in late Q3 or early Q4 2021.

Chevron Australia is seeking comments on the proposed activities from relevant and interested stakeholders during the development of the EP and ahead of the formal public consultation period.

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 program. Chevron Australia is committed to engaging early and working proactively with the commercial fishing sector and specific information tailored for the sector will be developed and distributed to relevant stakeholders using advice from the Western Australia Fishing Industry Council (WAFIC). On-the-water communications and cooperation is a Chevron Australia priority.

diving

It is highly unlikely seismic noise would be detectable to the human ear but as the survey will be conducted about 36km from the Montebello Islands relevant commercial charters, tour operators and the WA Charter Boat Owners and Operators Association will be informed and consulted.

broader stakeholders

As well as consulting commercial fishing and other relevant stakeholders, Chevron Australia will keep informed any stakeholders who identify an interest in our planned activities.

environmental impact

Seismic surveying is an established science with strict requirements and operational procedures in place to minimise potential impact to the marine environment.

As part of the environmental approval process associated with an Environment Plan, we will outline the general marine environment and control measures to manage the potential impacts and risks. Proposed control measures are outlined on page 4 and any additional control measures identified during stakeholder engagement and the public comment period will be considered for inclusion in the Environment Plan. All relevant and available scientific information relating to potential environment impacts and risks, including to target fish species, will be considered in developing the Environment Plan.

communications with mariners

Seismic vessels will operate within the Operational Area and marine notices will be issued prior to the start of work to alert other mariners that access to these areas may be limited. This will include a temporary 500m 'safe navigation area' around the primary vessel and streamers during seismic operations.

Updates will be provided on vessel movements and activities to meet relevant stakeholder needs. Chevron Australia will ensure open radio access between other ocean users and the primary seismic vessel to enhance on-the-water communications. Radio information will be communicated to relevant potentially affected parties as part of the start-up notification process prior to survey commencement.

implications for stakeholders

Chevron is assessing potential impacts and risks to the marine environment and relevant stakeholders from the planned seismic activities and is considering timing, duration, location and potential impacts. These, and proposed control measures are summarised on page 4.

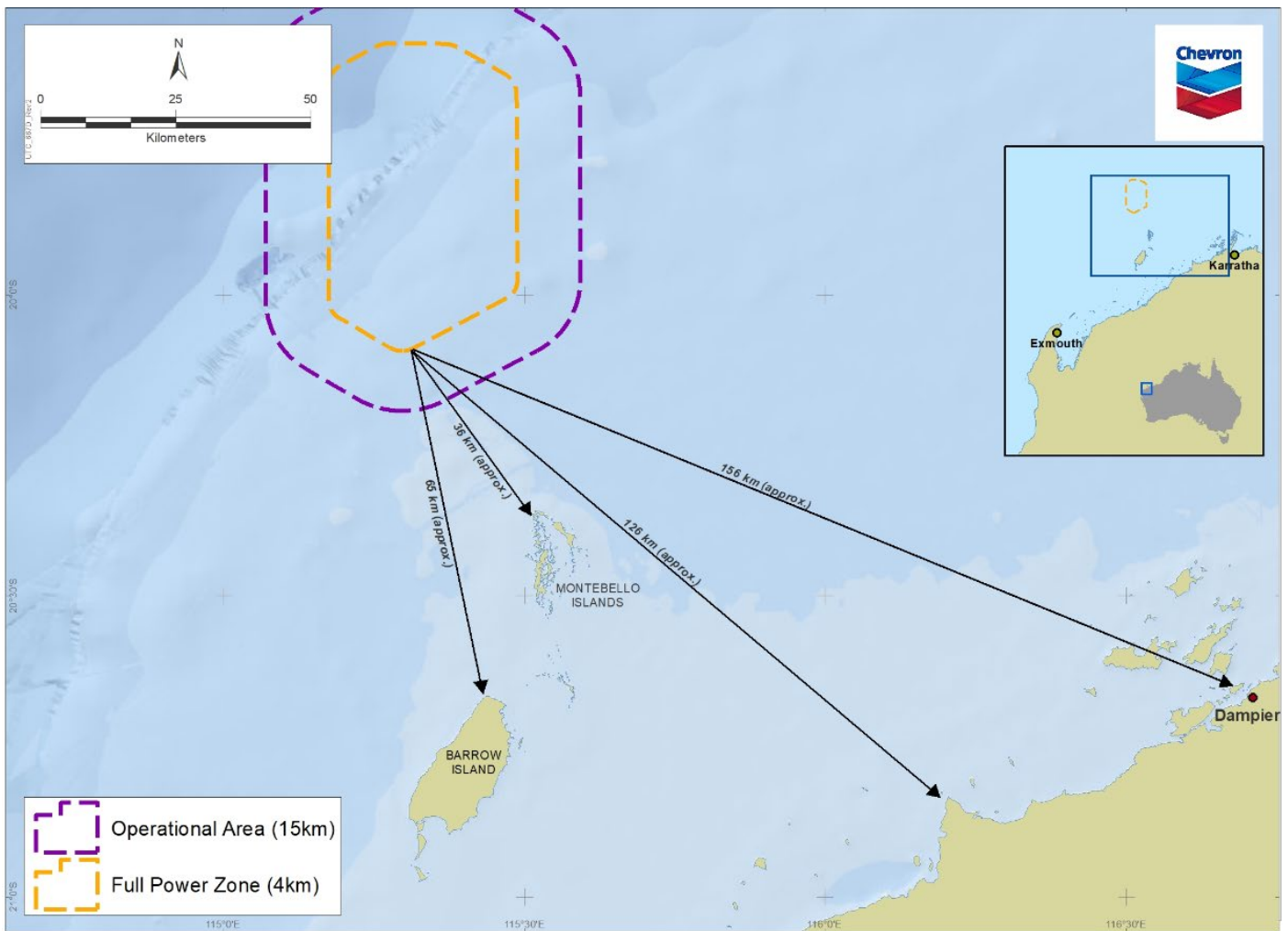
Further details will be provided in the Environment Plan and will incorporate feedback generated during the consultation process.

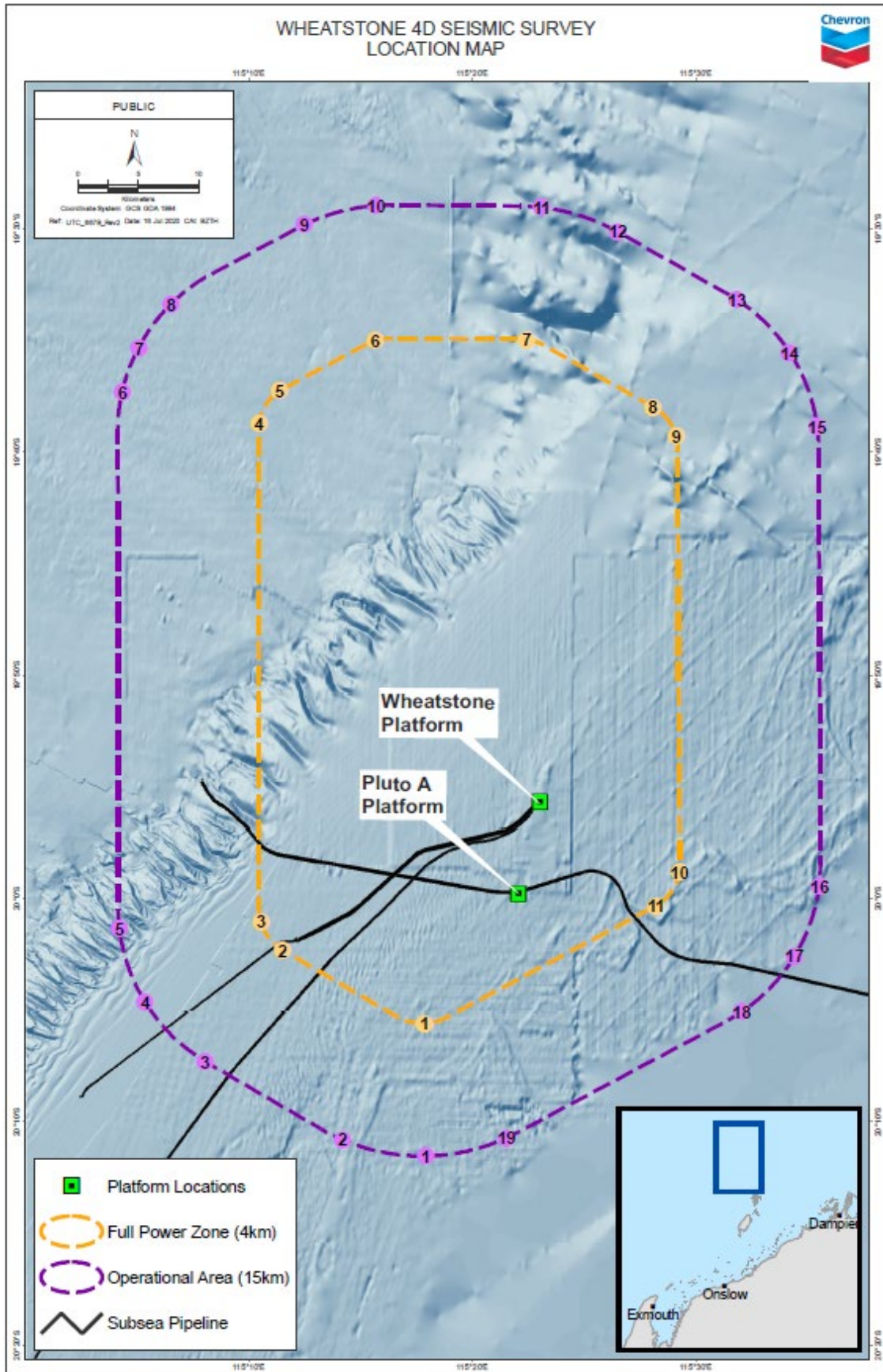
Summary of key impacts/risks and proposed controls

Potential Impact or Risk	Proposed Control
Planned Activities	
Interests of relevant stakeholders: <ul style="list-style-type: none"> Defence activities Petroleum operations and exploration Shipping Diving 	<ul style="list-style-type: none"> Consultation with petroleum titleholders, commercial fishers and their representative organisations and government departments to inform decision-making for the activity and development of the EP. Notification to relevant stakeholders a minimum of four weeks prior to the commencement of activities. Ongoing consultation via updates on vessel movements during the survey at a frequency to meet relevant stakeholder needs.
Commercial fishing	<ul style="list-style-type: none"> Working with Department of Primary Industries and Regional Development (Fisheries) to have a comprehensive understanding of peak fish spawning activities of the key indicator commercial species and, where reasonable, to avoid peak spawning periods. Consultation with commercial fishers and their representative organisations, and government departments (i.e. DPIRD, Australian Fisheries Management Authority) to inform decision making for the activity and development of the EP. Notification to relevant stakeholders a minimum of four weeks prior to the commencement of activities. Ongoing consultation by way of updates on vessel movements during the survey at a frequency to meet relevant stakeholder needs, encouraging ease of radio access between the seismic vessel and commercial fishing operators. Chevron will consider an evidence-based adjustment protocol for the commercial fishing sector should fisher(s) be verifiably impacted to a commercially material extent by the seismic program. This will be explored with WAFIC during the development of the EP.
Marine fauna interactions	<ul style="list-style-type: none"> Two dedicated marine fauna observers on survey vessel throughout the survey. Marine fauna sightings recorded and reported to Commonwealth Department of Agriculture, Water and the Environment.
Underwater noise	<ul style="list-style-type: none"> Implementation of Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act) Policy Statement 2.1. Noise modelling to inform potential impacts and input to mitigation and management measures.
Marine discharges	<ul style="list-style-type: none"> Marine discharges managed as per legislative requirements.
Vessel interaction	<ul style="list-style-type: none"> Relevant marine users and Government maritime safety agencies notified of survey start and end dates, vessel details and any exclusion zones prior to commencement of the survey. A 500 m radius safe navigation area will be in place around the seismic vessel and streamers during the survey. Seismic vessel will display appropriate day shapes and lights to indicate the vessel is towing and is therefore restricted in its ability to manoeuvre. Streamers fitted with surface tail buoys with radar reflectors. Visual and radar watch always maintained on vessels. Vessels will have automatic identification system. Support vessel on standby to direct marine users away from the seismic vessel and its towed equipment.

Waste	<ul style="list-style-type: none"> • Waste managed in accordance with legislative requirements and vessel Waste Management Plan. • Wastes managed and disposed of in a manner that prevents accidental loss to the environment. • Wastes transported onshore to recycling or disposal facilities by a licensed waste contractor.
Unplanned Activities	
Hydrocarbon release	<ul style="list-style-type: none"> • Spill response plans, equipment and materials available and maintained. • Refuelling procedures and equipment used to prevent spills to the marine environment.
Introduction of marine pests	<ul style="list-style-type: none"> • Vessels assessed and managed as appropriate to prevent the introduction of marine pests. • Compliance with Australian ballast water and biosecurity requirements and guidance.
Other	<ul style="list-style-type: none"> • Recreational fishing is not permitted on the seismic vessel or supporting vessels.

Location maps





NOTE: See next page for coordinates and depths of locations indicated in map above

fact sheet

ID	Area	Lat_GDA94	Long_GDA94	Depth (metres)
1	Full Power	115° 17' 51.534" E	20° 5' 35.039" S	75
2	Full Power	115° 11' 30.116" E	20° 2' 18.035" S	144
3	Full Power	115° 10' 32.601" E	20° 1' 2.108" S	165
4	Full Power	115° 10' 28.451" E	19° 38' 44.169" S	1123
5	Full Power	115° 11' 21.863" E	19° 37' 18.533" S	1129
6	Full Power	115° 15' 39.447" E	19° 35' 2.490" S	1108
7	Full Power	115° 22' 26.020" E	19° 34' 59.779" S	898
8	Full Power	115° 28' 5.379" E	19° 38' 0.235" S	229
9	Full Power	115° 29' 7.427" E	19° 39' 17.727" S	214
10	Full Power	115° 29' 15.824" E	19° 58' 48.241" S	67
11	Full Power	115° 28' 12.890" E	20° 0' 20.190" S	61
1	Operational Area	115° 17' 54.778" E	20° 11' 32.765" S	61
2	Operational Area	115° 14' 12.388" E	20° 10' 48.802" S	77
3	Operational Area	115° 8' 3.562" E	20° 7' 17.795" S	132
4	Operational Area	115° 5' 22.014" E	20° 4' 38.606" S	186
5	Operational Area	115° 4' 13.147" E	20° 1' 21.844" S	312
6	Operational Area	115° 4' 21.336" E	19° 37' 21.517" S	1231
7	Operational Area	115° 5' 5.828" E	19° 35' 21.247" S	1235
8	Operational Area	115° 6' 31.508" E	19° 33' 26.240" S	1245
9	Operational Area	115° 12' 30.495" E	19° 29' 50.591" S	1238
10	Operational Area	115° 15' 42.839" E	19° 28' 59.662" S	1208
11	Operational Area	115° 23' 5.654" E	19° 29' 3.955" S	969
12	Operational Area	115° 26' 31.029" E	19° 30' 9.944" S	662
13	Operational Area	115° 31' 50.574" E	19° 33' 12.565" S	358
14	Operational Area	115° 34' 12.080" E	19° 35' 33.923" S	219
15	Operational Area	115° 35' 25.662" E	19° 38' 53.083" S	186
16	Operational Area	115° 35' 32.245" E	19° 59' 25.552" S	80
17	Operational Area	115° 34' 25.504" E	20° 2' 35.692" S	75
18	Operational Area	115° 32' 3.472" E	20° 5' 4.420" S	67
19	Operational Area	115° 21' 31.685" E	20° 10' 44.133" S	49

providing feedback

Feedback from the commercial fishing sector and other interested and relevant stakeholders on potential or perceived impacts associated with Chevron Australia’s proposed Wheatstone seismic survey will be carefully considered and assessed.

Please note that stakeholder feedback and Chevron Australia’s response will be included in the EP.

NOTE: If feedback is identified as sensitive by a stakeholder, Chevron Australia will make this known to NOPSEMA in order for the information to remain confidential.

Feedback can be directed to:

Micha Stoker
 Partnerships Advisor
abuenvplaninfo@chevron.com
 (08) 9216 4000

appendix c protected matters search reports

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: 10/11/21 11:16:57

[Summary](#)

[Details](#)

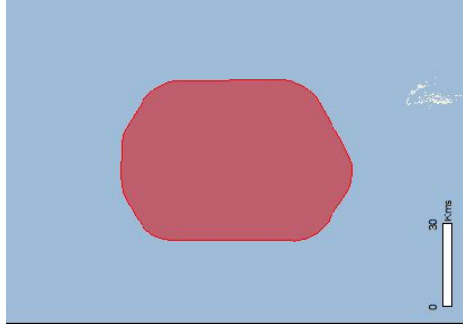
[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



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:	None
National Heritage Places:	None
Wetlands of International Importance:	None
Great Barrier Reef Marine Parks:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	21
Listed Migratory Species:	36

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	68
Whales and Other Cetaceans:	27
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	1

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Invasive Species:	None
Nationally Important Wetlands:	None
Key Ecological Features (Marine)	2

Details

Matters of National Environmental Significance

Commonwealth Marine Area

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

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

Name	Status	Type of Presence
Birds		
Calidris canutus	Endangered	Species or species habitat may occur within area
Red Knot, Knot [855]		
Calidris ferruginea	Critically Endangered	Species or species habitat may occur within area
Curlew Sandpiper [856]		
Macronectes giganteus	Endangered	Species or species habitat may occur within area
Southern Giant-Petrel, Southern Giant Petrel [1060]		
Numenius madagascariensis	Critically Endangered	Species or species habitat may occur within area
Eastern Curlew, Far Eastern Curlew [847]		
Phaethon lepturus fulvus	Endangered	Species or species habitat may occur within area
Christmas Island White-tailed Tropicbird, Golden Bousunbird [26021]		
Sternula nereis nereis	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Australian Fairy Tern [82950]		
Mammals		
Balaenoptera borealis	Vulnerable	Species or species habitat likely to occur within area
Sei Whale [34]		
Balaenoptera musculus	Endangered	Migration route known to occur within area
Blue Whale [36]		
Balaenoptera physalus	Vulnerable	Species or species habitat likely to occur
Fin Whale [37]		

Name	Status	Type of Presence
Megaptera novaeangliae	Vulnerable	Breeding known to occur within area
Humpback Whale [38]		
Reptiles		
Aipysurus apraefrontalis	Critically Endangered	Species or species habitat may occur within area
Short-nosed Seasnake [1115]		
Caretta caretta	Endangered	Species or species habitat known to occur within area
Loggerhead Turtle [1763]		
Chelonia mydas	Vulnerable	Species or species habitat known to occur within area
Green Turtle [1765]		
Dermochelys coriacea	Endangered	Species or species habitat likely to occur within area
Leatherback Turtle, Leathery Turtle, Luth [1768]		
Eretmochelys imbricata	Vulnerable	Species or species habitat known to occur within area
Hawksbill Turtle [1766]		
Natator depressus	Vulnerable	Congregation or aggregation known to occur within area
Flatback Turtle [59257]		
Sharks		
Carcharias taurus (west coast population) [68752]	Vulnerable	Species or species habitat likely to occur within area
Grey Nurse Shark (west coast population) [68752]		
Carcharodon carcharias	Vulnerable	Species or species habitat may occur within area
White Shark, Great White Shark [64470]		
Pristis clavata	Vulnerable	Species or species habitat known to occur within area
Dwarf Sawfish, Queensland Sawfish [68447]		
Pristis zijsron	Vulnerable	Species or species habitat known to occur within area
Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]		
Rhincodon typus	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Whale Shark [66680]		
Listed Migratory Species		
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	Vulnerable	Species or species habitat may occur within area
Common Noddy [825]		
Calonectris leucomelas	Vulnerable	Species or species habitat likely to occur within area
Streaked Shearwater [1077]		
Fregata ariel	Vulnerable	Species or species habitat likely to occur within area
Lesser Frigatebird, Least Frigatebird [1012]		
Fregata minor	Vulnerable	Species or species habitat likely to occur within area
Great Frigatebird, Greater Frigatebird [1013]		

Name	Threatened	Type of Presence
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	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
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	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat likely to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species

Name	Threatened	Type of Presence
Physeter macrocephalus Sperm Whale [69]		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		
Acetia 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		
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Birds	Threatened	Type of Presence
Acetia hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Anous stolidus Common Noddy [825]		Species or species

Name	Threatened	Type of Presence
Calidris acuminata Sharp-tailed Sandpiper [874]		habitat may occur within area 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
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pandion haliaetus Osprey [952]		Species or species habitat may occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bousbird [26021]	Endangered	Species or species habitat may occur within area
Fish		
Acentronura larsonae Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
Bulbonotus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choerichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choerichthys latispinosus Muiron Island Pipefish [66196]		Species or species habitat may occur within area
Choerichthys sullus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corvichoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish,		Species or species

Name	Threatened	Type of Presence
Network Pipefish [66200]		habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Dorvhamphus dactylophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Dorvhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Dorvhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Dorvhamphus multiannulatus Many-banded Pipefish [66717]		Species or species habitat may occur within area
Dorvhamphus 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
Haliscampus brocki Brook's Pipefish [66219]		Species or species habitat may occur within area
Haliscampus gravi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Haliscampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Haliscampus 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 penicillius Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
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
Trachyrhynchus bicarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhynchus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat may occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Aipysurus tenuis Brown-lined Seasnake [1121]		Species or species habitat may occur within area
Astrotia stokesi Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur

Name	Threatened	Type of Presence
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
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 grevi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Hydrophis czebulakovi 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 ornatius 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
[Resource Information]		
Name	Status	Type of Presence
Mammals		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area

Name	Status	Type of Presence
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
Globocephala 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, Pan-tropical 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		Species or species

Name	Status	Type of Presence
Bottlenose Dolphin [68418]		habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Tursiops truncatus s.str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area
Australian Marine Parks		[Resource Information]
Name	Label	
Montebello	Multiple Use Zone (IUCN VI)	
Extra Information		
Key Ecological Features (Marine)		
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	

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 of 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
 - 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.

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

Coordinates

-20.093585 115.52071, -20.166083 115.384178, -20.1797 115.357313, -20.187796 115.338177, -20.192212 115.316096, -20.192948 115.290336, -20.190004 115.265311, -20.185588 115.249302, -20.178964 115.232926, -20.123409 115.137319, -20.122889 115.136436, -20.118242 115.128227, -20.111966 115.119763, -20.100761 115.107618, -20.088065 115.096394, -20.077577 115.08885, -20.067272 115.083513, -20.056968 115.078913, -20.046688 115.075785, -20.040223 115.073393, -20.031943 115.071369, -20.024215 115.070449, -20.016655 115.069161, -20.008234 115.069382, -19.63762 115.069529, -19.614067 115.073945, -19.593458 115.082041, -19.574322 115.093393 115.10633, -19.557393 115.10633, -19.529425 115.144603, -19.498304 115.209379, -19.488207 115.229246, -19.483791 115.251326, -19.482319 115.276351, -19.483791 115.385282, -19.489679 115.416195, -19.510288 115.457412, -19.554449 115.534327, -19.582418 115.564504, -19.582418 115.579224, -19.627315 115.58732, -19.650132 115.592472, -19.981342 115.593944, -19.99827 115.592104, -20.014463 115.58732, -20.030287 115.581064, -20.04464 115.573336, -20.058256 115.584504, -20.0704 115.552727, -20.083649 115.537639, -20.093585 115.52071

Acknowledgements

This database has been compiled from a range of data sources. The department acknowledges the following custodians who have contributed valuable data and advice:

- Office of Environment and Heritage, New South Wales
- Department of Environment and Primary Industries, Victoria
- Department of Primary Industries, Parks, Water and Environment, Tasmania
- Department of Environment, Water and Natural Resources, South Australia
- Department of Land and Resource Management, Northern Territory
- Department of Environmental and Heritage Protection, Queensland
- Department of Parks and Wildlife, Western Australia
- Environment and Planning Directorate, ACT
- Birdlife Australia
- Australian Bird and Bat Banding Scheme
- Australian National Wildlife Collection
- Natural history museums of Australia
- Museum Victoria
- Australian Museum
- South Australian Museum
- Queensland Museum
- Online Zoological Collections of Australian Museums
- Queensland Herbarium
- National Herbarium of NSW
- Royal Botanic Gardens and National Herbarium of Victoria
- Tasmanian Herbarium
- State Herbarium of South Australia
- Northern Territory Herbarium
- Western Australian Herbarium
- Australian National Herbarium, Canberra
- University of New England
- Ocean Biogeographic Information System
- Australian Government, Department of Defence Forestry Corporation, NSW
- Geoscience Australia
- CSIRO
- Australian Tropical Herbarium, Cairns
- eBird Australia
- Australian Government – Australian Antarctic Data Centre
- Museum and Art Gallery of the Northern Territory
- Australian Government National Environmental Science Program
- Australian Institute of Marine Science
- Reef Life Survey Australia
- American Museum of Natural History
- Queen Victoria Museum and Art Gallery, Inveresk, Tasmania
- Tasmanian Museum and Art Gallery, Hobart, Tasmania
- Other groups and individuals

The Department is extremely grateful to the many organisations and individuals who provided expert advice and information on numerous draft distributions.

Please feel free to provide feedback via the [Contact Us](#) page.

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EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

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

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 10/11/21 11:13:27

[Summary](#)

[Details](#)

[Matters of NES](#)

[Other Matters Protected by the EPBC Act](#)

[Extra Information](#)

[Caveat](#)

[Acknowledgements](#)



This map may contain data which are
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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 Parks:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	41
Listed Migratory Species:	56

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:	2
Commonwealth Heritage Places:	1
Listed Marine Species:	98
Whales and Other Cetaceans:	29
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	3

Extra Information

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

State and Territory Reserves:	9
Regional Forest Agreements:	None
Invasive Species:	11
Nationally Important Wetlands:	1
Key Ecological Features (Marine)	6

Name	Status	Type of Presence
[89262]		habitat likely to occur within area
Petrogale lateralis lateralis	Endangered	Species or species habitat known to occur within area
Black-flanked Rock-wallaby, Moororong, Black-footed Rock Wallaby [66647]		
Rhinonicteris aurantia (Pilbara form)	Vulnerable	Species or species habitat may occur within area
Pilbara Leaf-nosed Bat [82790]		
Reptiles		
Alpysurus apraefrontalis	Critically Endangered	Species or species habitat known to occur within area
Short-nosed Seasnake [1115]		
Alpysurus foliosquama	Critically Endangered	Species or species habitat known to occur within area
Leaf-scated Seasnake [1118]		
Caretta caretta	Endangered	Breeding known to occur within area
Loggerhead Turtle [1763]		
Chelonia mydas	Vulnerable	Breeding known to occur within area
Green Turtle [1765]		
Ctenopus zasticus	Vulnerable	Species or species habitat likely to occur within area
Hamelin Ctenopus [25570]		
Dermodochelys coriacea	Endangered	Foraging, feeding or related behaviour known to occur within area
Leatherback Turtle, Leathery Turtle, Luth [1768]		
Eretmochelys imbricata	Vulnerable	Breeding known to occur within area
Hawksbill Turtle [1766]		
Natator depressus	Vulnerable	Breeding known to occur within area
Flatback Turtle [59257]		
Sharks		
Carcharias taurus (west coast population)	Vulnerable	Species or species habitat known to occur within area
Grey Nurse Shark (west coast population) [68752]		
Carcharodon carcharias	Vulnerable	Species or species habitat known to occur within area
White Shark, Great White Shark [64470]		
Pristis clavata	Vulnerable	Species or species habitat known to occur within area
Dwarf Sawfish, Queensland Sawfish [68447]		
Pristis zijsron	Vulnerable	Species or species habitat known to occur within area
Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]		
Rhincodon typus	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Whale Shark [66680]		
Listed Migratory Species		
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
Anous stolidus	Threatened	Species or species habitat likely to occur within area
Migratory Marine Birds		
Common Noddy [825]		
Apus pacificus	Vulnerable	Species or species habitat likely to occur
Fork-tailed Swift [678]		

Name	Threatened	Type of Presence
Ardenna carneipes		within area
Flesh-footed Shearwater, Fleshly-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		Species or species habitat likely to occur within area
Streaked Shearwater [1077]		
Fregata ariel		Species or species habitat likely to occur within area
Lesser Frigatebird, Least Frigatebird [1012]		
Fregata minor		Species or species habitat may occur within area
Great Frigatebird, Greater Frigatebird [1013]		
Hydroprogne caspia		Breeding known to occur within area
Caspian Tern [808]		
Macronectes giganteus		Species or species habitat may occur within area
Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	
Onychoprion anaethetus		Breeding known to occur within area
Bridled Tern [82845]		
Sterna dougalli		Breeding known to occur within area
Roseate Tern [817]		
Thalassarche impavida		Species or species habitat may occur within area
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	
Migratory Marine Species		
Aroxypristis cuspidata		Species or species habitat known to occur within area
Narrow Sawfish, Knifetooth Sawfish [68448]		
Balaena glacialis australis	Endangered*	Species or species habitat likely to occur within area
Southern Right Whale [75529]		
Balaenoptera bonaerensis		Species or species habitat likely to occur within area
Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		
Balaenoptera borealis	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Sei Whale [34]		
Balaenoptera edeni		Species or species habitat likely to occur within area
Bryde's Whale [35]		
Balaenoptera musculus	Endangered	Migration route known to occur within area
Blue Whale [36]		
Balaenoptera physalus	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Fin Whale [37]		
Carcharhinus longimanus		Species or species habitat likely to occur within area
Oceanic Whitetip Shark [84108]		
Carcharodon carcharias	Vulnerable	Species or species habitat known to occur within area
White Shark, Great White Shark [64470]		

Name	Threatened	Type of Presence
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Dugong dugong 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 likely to occur within area
Manta alfredi Reef Manta Ray, Coastal Manta Ray, Inshore Manta Ray, Prince Alfred's Ray, Resident Manta Ray [84994]		Species or species habitat known to occur within area
Manta birostris Giant Manta Ray, Chevron Manta Ray, Pacific Manta Ray, Pelagic Manta Ray, Oceanic Manta Ray [84995]		Species or species habitat known to occur within area
Megaptera novaeangliae Humpback Whale [38]	Vulnerable	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperrn 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
Hirundo rustica Barn Swallow [662]		Species or species

Name	Threatened	Type of Presence
Motacilla cinerea Grey Wagtail [642]		habitat may occur within area Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetland 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
Glaucala maldivaram Oriental Pratincole [840]		Species or species habitat may occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		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

Name	Threatened	Type of Presence
Sterna caspia Caspian Tern [59467]		within area Breeding known to occur within area
Sterna dougalli Roseate Tern [817]		Breeding known to occur within area
Sterna fuscata Sooty Tern [794]		Breeding known to occur within area
Sterna nereis Fairy Tern [796]		Breeding known to occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area
Fish		
Acentronura larsonae Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
Bulbonotus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within area
Campichthys tricornatus 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 sullius Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corvicoichthys flavofasciatus Reiculate 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 dactylophorus 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 jantssi 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

Name	Threatened	Type of Presence
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 pemicillus 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
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 leitensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Solierostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammals		
Dugong dugon Dugong [28]		Breeding known to occur within area
Reptiles		
Acalytophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Alpsurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Alpsurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Alpsurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Alpsurus foliosquama Leaf-scaled Seasnake [1118]		Species or species habitat known to occur within area
Alpsurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Alpsurus tenuis Brown-lined Seasnake [1121]		Species or species habitat may occur within area
Astrolia 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

Name	Threatened	Type of Presence
Ephalophis grevi North-western Mangrove Seasnake [1127]		habitat may occur within area Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area Species or species habitat may occur within area
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis czebelukovi 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 ornatius 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 Species or species habitat may occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area
Whales and other Cetaceans		
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
Eresea altenuata Pygmy Killer Whale [61]		Species or species

Name	Status	Type of Presence
Globocephala macrohynchus Short-finned Pilot Whale [62]		habitat may occur within area 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 novaengliae 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
Orca 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 (Aratura/Timor Sea populations) Spotted Bottlenose Dolphin (Aratura/Timor Sea populations) [78900]		Species or species habitat known to occur within area

Name	Status	Type of Presence
Tursiops truncatus s.str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area
Australian Marine Parks		
Name	Label	
Gascoyne	Multiple Use Zone (IUCN VI)	
Montebello	Multiple Use Zone (IUCN VI)	
Ningitoo	Recreational Use Zone (IUCN IV)	
Extra Information		
State and Territory Reserves		
Name	State	
Barrow Island	WA	
Bundegi Coastal Park	WA	
Cape Range	WA	
Jurabi Coastal Park	WA	
Lowendal Islands	WA	
Montebello Islands	WA	
Muiron Islands	WA	
Unnamed WA40828	WA	
Unnamed WA41080	WA	
Invasive Species		
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 Resources Audit, 2001.		
Birds		
Name	Status	Type of Presence
Columba livia		
Rock Pigeon, Rock Dove, Domestic Pigeon [803]		Species or species habitat likely to occur within area
Mammals		
Canis lupus familiaris		
Domestic Dog [82654]		Species or species habitat likely to occur within area
Capra hircus		
Goat [2]		Species or species habitat likely to occur within area
Equus caballus		
Horse [5]		Species or species habitat likely to occur within area
Felis catus		
Cat, House Cat, Domestic Cat [19]		Species or species habitat likely to occur within area
Mus musculus		
House Mouse [120]		Species or species habitat likely to occur within area
Oryctolagus cuniculus		
Rabbit, European Rabbit [128]		Species or species

Name	Status	Type of Presence
Rattus raitus Black Rat, Ship Rat [84]		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
Reptiles Hemidactylus frenatus Asian House Gecko [1708]		Species or species habitat likely to occur within area
Nationally Important Wetlands Name Cape Range Subterranean Waterways		[Resource Information] State WA
Key Ecological Features (Marine) 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.		[Resource Information] State WA

Name	Region
Ancient coastline at 125 m depth contour	North-west
Canyons linking the Cuvier Abyssal Plain and the Commonwealth waters adjacent to Ningaloo Reef	North-west
Continental Slope Demersal Fish Communities	North-west
Exmouth Plateau	North-west
Glomar Shoals	North-west

Caveat

The information presented in this report has been provided by a range of data sources as acknowledged at the end of the report.

This report is designed to assist in identifying the locations of places which may be relevant in determining obligations under the Environment Protection and Biodiversity Conservation Act 1999. It holds mapped locations of World and National Heritage properties, Wetlands of International and National Importance, Commonwealth and State/Territory reserves, listed threatened, migratory and marine species and listed threatened ecological communities. Mapping of Commonwealth land is not complete at this stage. Maps have been collated from a range of sources at various resolutions.

Not all species listed under the EPBC Act have been mapped (see below) and therefore a report is a general guide only. Where available data supports mapping, the type of presence that can be determined from the data is indicated in general terms. People using this information in making a referral may need to consider the qualifications below and may need to seek and consider other information sources.

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans. State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.

Threatened, migratory and marine species distributions have been derived through a variety of methods. Where distributions are well known and if time permits, maps are derived using either thematic spatial data (i.e. vegetation, soils, geology, elevation, aspect, terrain, etc.) together with point locations and described habitat, or environmental modelling (MAXENT or BIOCLIM habitat modelling) using point locations and environmental data layers.

Where very little information is available for species or large number of maps are required in a short time-frame, maps are derived either from 0.04 or 0.02 decimal degree cells by an automated process using polygon capture techniques (static two kilometre grid cells, alpha-hull and convex hull) or captured manually or by using topographic features (national park boundaries, islands, etc). In the early stages of the distribution mapping process (1999-early 2000s) distributions were defined by degree blocks, 100K or 250K map sheets to rapidly create distribution maps. More reliable distribution mapping methods are used to update these distributions as time permits.

Only selected species covered by the following provisions of the EPBC Act have been mapped:

- migratory and
 - marine
 - 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.

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

Coordinates

-22.05834 114.109 -21.95807 114.138 -21.86566 114.149 -21.81345 114.191 -21.78511 114.164 -21.81553 114.08 -21.87437 113.966 -21.9751 113.933 -22.31392 113.818 -22.32869 113.807 -22.47903 113.638 -22.59207 113.55 -22.54086 113.491 -20.7182 112.104 -19.5849 113.484 -19.17163 113.954 -18.87707 114.303 -18.72201 114.481 -18.26542 115.029 -18.63755 116.07 -18.63864 116.074 -18.63972 116.077 -18.64081 116.081 -18.64191 116.085 -18.75403 116.432 -18.89829 116.745 -19.11615 117.119 -19.27807 117.347 -19.42528 117.506 -19.51654 117.524 -20.5352 115.949 -20.57568 115.858 -20.62058 115.687 -20.65443 115.571 -20.70595 115.489 -20.67063 115.447 -20.73466 115.381 -20.77661 115.354 -20.8826 115.292 -21.0293 115.269 -22.05834 114.109

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.

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EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected.

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

Information is available about [Environment Assessments](#) and the EPBC Act including significance guidelines, forms and application process details.

Report created: 09/11/21 16:43:42

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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:	2
Wetlands of International Importance:	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	2
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	54
Listed Migratory Species:	68

Other Matters Protected by the EPBC Act

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

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

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

Commonwealth Land:	4
Commonwealth Heritage Places:	4
Listed Marine Species:	126
Whales and Other Cetaceans:	33
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	15

Extra Information

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

State and Territory Reserves:	28
Regional Forest Agreements:	None
Invasive Species:	15
Nationally Important Wetlands:	3
Key Ecological Features (Marine):	10

Details

Matters of National Environmental Significance

World Heritage Properties	[Resource Information]
Name	Status
The Ningaloo Coast	Declared property

National Heritage Properties	[Resource Information]
Name	Status
Natural	Listed place
The Ningaloo Coast	WA
Historic	Listed place
HMAS Sydney II and HSK Kormoran Shipwreck Sites	EXT

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
Birds	Type of Presence
Anous tenuirostris melanops	Vulnerable
Australian Lesser Noddy [26000]	

Calidris canutus	Foraging, feeding or related behaviour likely to occur within area
Red Knot, Knot [855]	Species or species habitat known to occur within area
Calidris ferruginea	Species or species habitat known to occur within area
Curllew Sandpiper [856]	Species or species habitat known to occur within area

Charadrius leschenaultii	Critically Endangered
Greater Sand Plover, Large Sand Plover [877]	Species or species habitat known to occur within area
Diomedea amsterdamensis	Vulnerable
Amsterdam Albatross [64405]	Species or species habitat likely to occur within area

Diomedea epomophora	Endangered
Southern Royal Albatross [89221]	Species or species habitat may occur within area
	Vulnerable

Name	Status	Type of Presence
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 menzibieri 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
Malarus 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
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bousunbird [26021]	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		

Name	Status	Type of Presence
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
Dasypus hallucatus Northern Quoll, Digu (Gogo-Yimidir), Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Isodon 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
Macroderma gigas Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [88]	Vulnerable	Breeding known to occur within area
Oosphranter 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
Rhinonictis aurantia (Pilbara form) Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat known to occur within area
Reptiles		
Albysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area

Name	Status	Type of Presence
Alpysurus loliosquama 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
Ctenopus zasticus Hamelin Ctenopus [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 <i>(west coast population)</i> [68752] 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 * Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Migratory Marine Birds	Threatened	Type of Presence
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

Name	Threatened	Type of Presence
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
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
Phaethon rubricauda Red-tailed Tropicbird [994]		Breeding known to occur within area
Sterna dougallii Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons Little Tern [82849]		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 Aroxypristis 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

Name	Threatened	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
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 dugong 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]	Vulnerable	Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackeral 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

Name	Threatened	Type of Presence
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sousa chinensis Indo-Pacific Humpback Dolphin [50]		Species or species habitat known to occur within area
Tursiops aduncus (Aratura/Timor/Sea populations) Spotted Bottlenose Dolphin (Aratura/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 [656]	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 leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
Glaucola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Species or species habitat known to occur

Name	Threatened	Type of Presence
Limosa lapponica Bar-tailed Godwit [844]		within area 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	State	Status
Commonwealth Land -		
Defence - EXMOUTH ADMIN & HF TRANSMITTING		
Defence - EXMOUTH VLF TRANSMITTER STATION		
Defence - LEARMONTH - RAAF BASE		
Commonwealth Heritage Places		
Name	State	Status
Natural		
Learmonth Air Weapons Range Facility	WA	Listed place
Mermaid Reef - Rowley Shoals	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		
* Species is listed under a different scientific name on the EPBC Act - Threatened Species list.		
Name	Threatened	Type of Presence
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	Foraging, feeding or related behaviour 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

Name	Threatened	Type of Presence
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat 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 leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Species or species habitat may occur within area
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
Glaucala maldivatum 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
Limnodromus semipalmatus Asian Dowitcher [843]		Species or species habitat known to occur

Name	Threatened	Type of Presence
Limosa lapponica Bar-tailed Godwit [844]		within area 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
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
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Phaethon rubricauda Red-tailed Tropicbird [994]		Breeding known to occur within area
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 known to occur within area
Puffinus carneipes Flesh-footed Shearwater, Fleishy-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

Name	Threatened	Type of Presence
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 dougalii 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
Thalassarache catterii Indian Yellow-nosed Albatross [64464]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Thalassarache cauta Shy Albatross [89224]	Endangered	Species or species habitat may occur within area
Thalassarache impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
Thalassarache melanophris Black-browed Albatross [66472]	Vulnerable	Species or species habitat may occur within area
Thalassarache 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
Bulbonotus 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
Choerichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choerichthys latispinosus Muiron Island Pipefish [66196]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Choerichthys sulillus Pig-snouted Pipefish [66198]		area 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 schulzi 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 dacyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus exoelus 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
Hallicampus brocki Brook's Pipefish [66219]		Species or species habitat may occur within area
Hallicampus dunckeri Red-hair Pipefish, Duncker's Pipefish [66220]		Species or species habitat may occur within area
Hallicampus oravi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Hallicampus nitidus Glistening Pipefish [66224]		Species or species habitat may occur within area
Hallicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area

Name	Threatened	Type of Presence
Hallichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys penicillius 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
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

Name	Threatened	Type of Presence
Trachyrhynchus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Slick Pipefish [66281]		Species or species habitat may occur within area
Mammals		
Dugong dugong Dugong [28]		Breeding known to occur within area
Reptiles		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Alpsurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Alpsurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Alpsurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Alpsurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
Alpsurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Alpsurus pooleorum Shark Bay Seasnake [66061]		Species or species habitat may occur within area
Alpsurus tenuis Brown-lined Seasnake [1121]		Species or species habitat may occur within area
Astrolia 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

Name	Threatened	Type of Presence
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis czebelukovi 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 mcdoowellii 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		
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

Name	Status	Type of Presence
Gibbiceps alba 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 densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon ginkgodens Ginkgo-toothed Beaked Whale, Ginkgo-toothed Whale, Ginkgo Beaked Whale [59564]		Species or species habitat may occur within area
Mesoplodon gravi Gray's Beaked Whale, Scamperdown Whale [75]		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

Name	Status	Type of Presence
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		habitat may occur within area Species or species habitat likely to occur within area
Tursiops aduncus (Aratutura/Timor Sea populations) Spotted Bottlenose Dolphin (Aratutura/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]		
Name	Label	
Abrolhos	Habitat Protection Zone (IUCN IV)	
Abrolhos	Multiple Use Zone (IUCN VI)	
Abrolhos	National Park Zone (IUCN II)	
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)	
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)	
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)	
Shark Bay	Multiple Use Zone (IUCN VI)	
[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	
Ciralia	WA	
Gnandaroo Island	WA	
Jurabi Coastal Park	WA	
Little Rocky Island	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	
Extra Information		
[State and Territory Reserves]		
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	
Ciralia	WA	
Gnandaroo Island	WA	
Jurabi Coastal Park	WA	
Little Rocky Island	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	

Name	State	Type of Presence
Unamed 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 Resources Audit, 2001.		
Name	Status	Type of Presence
Birds		
Columba livia		Species or species habitat likely to occur within area
Rock Pigeon, Rock Dove, Domestic Pigeon [803]		
Mammals		
Canis lupus familiaris		Species or species habitat likely to occur within area
Domestic Dog [82654]		
Capra hircus		Species or species habitat likely to occur within area
Goat [2]		
Equus asinus		Species or species habitat likely to occur within area
Donkey, Ass [4]		
Equus caballus		Species or species habitat likely to occur within area
Horse [5]		
Felis catus		Species or species habitat likely to occur within area
Cat, House Cat, Domestic Cat [19]		
Mus musculus		Species or species habitat likely to occur within area
House Mouse [120]		
Oryctolagus cuniculus		Species or species habitat likely to occur within area
Rabbit, European Rabbit [128]		
Rattus rattus		Species or species habitat likely to occur within area
Black Rat, Ship Rat [84]		
Vulpes vulpes		Species or species habitat likely to occur within area
Red Fox, Fox [18]		
Plants		
Cenchrus ciliaris		Species or species habitat likely to occur within area
Buffel-grass, Black Buffel-grass [20213]		
Parkinsonia aculeata		Species or species habitat likely to occur within area
Parkinsonia, Jerusalem Thorn, Jelly Bean Tree, Horse Bean [12301]		
Prosopis spp.		Species or species habitat likely to occur within area
Mesquite, Algaroba [68407]		
Reptiles		

Name	Status	Type of Presence
Hemidactylus frenatus		Species or species habitat likely to occur within area
Asian House Gecko [17708]		
Ramphotyphlops braminus		Species or species habitat likely to occur within area
Flowerpot Blind Snake, Brahmminy Blind Snake, Cacing Besi [1258]		
Nationally Important Wetlands [Resource Information]		
Name	State	
Cape Range Subterranean Waterways	WA	
Exmouth Gulf East	WA	
Mermaid Reef	EXT	
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	Type of Presence
Ancient coastline at 125 m depth contour	North-west	
Canyons linking the Cuvier Abyssal Plain and the 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	
Wallaby Saddle	North-west	
Perth Canyon and adjacent shelf break, and other Western demersal slope and associated fish	South-west	
	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, ecology, 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
 - 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.

The following species and ecological communities have not been mapped and do not appear in reports produced from this database:

Coordinates

-15.87446 118.60978 -16.56863 120.0194 -17.5519 119.45585 -19.85389 118.03874 -20.30256 116.78609 -20.3787 116.61001 -20.45009 116.50056 -21.23055 115.66299 -21.57687 115.2415 -21.64177 115.14517 -21.63357 115.10544 -21.68647 115.05622 -21.67427 114.99233 -21.67066 114.97343 -21.68898 114.91726 -21.79193 114.77567 -21.79942 114.72089 -21.8447 114.64925 -21.91429 114.64578 -21.94562 114.61666 114.57476 -22.00252 114.57006 -22.01615 114.57988 -22.02687 114.55349 -22.06017 114.54796 -22.06056 114.54779 -22.06318 114.54746 -22.06278 114.51665 -22.08448 114.52987 -22.12217 114.52237 -22.12932 114.50096 -22.17014 114.50577 -22.1555 114.48102 -22.15982 114.45588 -22.21188 114.49445 -22.20879 114.45256 -22.23402 114.45147 -22.24165 114.45951 -22.23818 114.45093 -22.24668 114.45979 -22.24266 114.44299 -22.27166 114.45811 -22.27403 114.42944 -22.29313 114.45592 -22.30043 114.42372 -22.33137 114.40801 -22.34659 114.4245 -22.34299 114.44366 -22.35177 114.43058 -22.35718 114.4402 -22.35122 114.40625 -22.38411 114.39655 -22.39354 114.41577 -22.39044 114.39317 -22.42691 114.39736 -22.4328 114.38471 -22.43937 114.3946 -22.44233 114.37979 -22.45932 114.39165 -22.50103 114.35519 -22.47935 114.32471 -22.4873 114.31928 -22.43469 114.30684 -22.45731 114.22561 -22.49733 114.21866 -22.52391 114.1808 -22.52494 114.15509 -22.47412 114.12167 -22.41337 114.12234 -22.40995 114.14035 -22.3976 114.14643 -22.39777 114.13111 -22.35666 114.17696 -22.30571 114.17797 -22.30175 114.15007 -22.32967 114.11493 -22.26223 114.13282 -22.19249 114.08476 -22.15499 114.08029 -21.95807 114.13795 -22.40765 114.14882 -21.81345 114.19122 -21.7851 114.16477 -21.81553 114.07988 -21.87437 113.99633 -21.9751 113.933 -22.91392 113.81775 -22.40755 113.75021 -22.47147 113.7384 -22.49666 113.72333 -22.49663 113.70772 -22.51774 113.71379 -22.55041 113.69462 -22.57886 113.65392 -22.59865 113.67325 -22.62802 113.6661 -22.66471 113.66632 -22.71745 113.6706 -22.71559 113.71037 -22.75233 113.75949 -22.95335 113.82615 -23.03511 113.82923 -23.06288 113.81319 -23.1214 113.76101 -23.20687 113.25355 112.64579 -28.51819 112.19609 -28.55897 111.83997 -28.43375 111.58691 -28.12416 111.21679 -27.12392 110.30977 -20.91039 -18.59727 168.79291 109.16689 109.5309 95.4343 63.97763 110.5276 65.569 107.4425 107.4425 12.90689 14.38668 13.13763 14.00287 11.410289 13.23486 11.475649 13.49376 13.73521 11.525729 13.88082 11.534105 12.98841 11.540101 14.33634 11.556292 14.75066 11.549219 11.53154 11.6.03357 -15.46448 11.6.19047 -15.44288 11.6.20835 -14.93316 11.6.72436 -14.8651 11.6.81156 -14.7708 11.6.94283 -8.37446 11.8.60878

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 d sensitive information report