wheatstone 4D marine seismic survey environment plan

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Document information

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Approved:	Birgit Cropp Wheatstone Reservoir Development Team Lead		

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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 Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Commonwealth [Cth]).

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
11(4)(a)(iii)	a description of the activity	Section 3
11(4)(a)(iv)	details of environmental impacts and risks	Section 7
11(4)(a)(v)	a summary of the control measures for the activity	Section 7
11(4)(a)(vi)	a summary of the arrangements for ongoing monitoring of the titleholder’s environmental performance	Section 8
11(4)(a)(vii)	a summary of the response arrangements in the oil pollution emergency plan	Section 7.13, Ref. 1
11(4)(a)(viii)	details of consultation already undertaken, and plans for ongoing consultation	Section 6
11(4)(a)(ix)	details of the titleholder’s nominated liaison person for the activity	Section 2.4

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 *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (Cth) (OPGGS Act) and Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth) (OPGGS(E)R) as administered, and is submitted to the National Offshore Petroleum Safety and Environment Management Authority (NOPSEMA) for regulatory acceptance.

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.

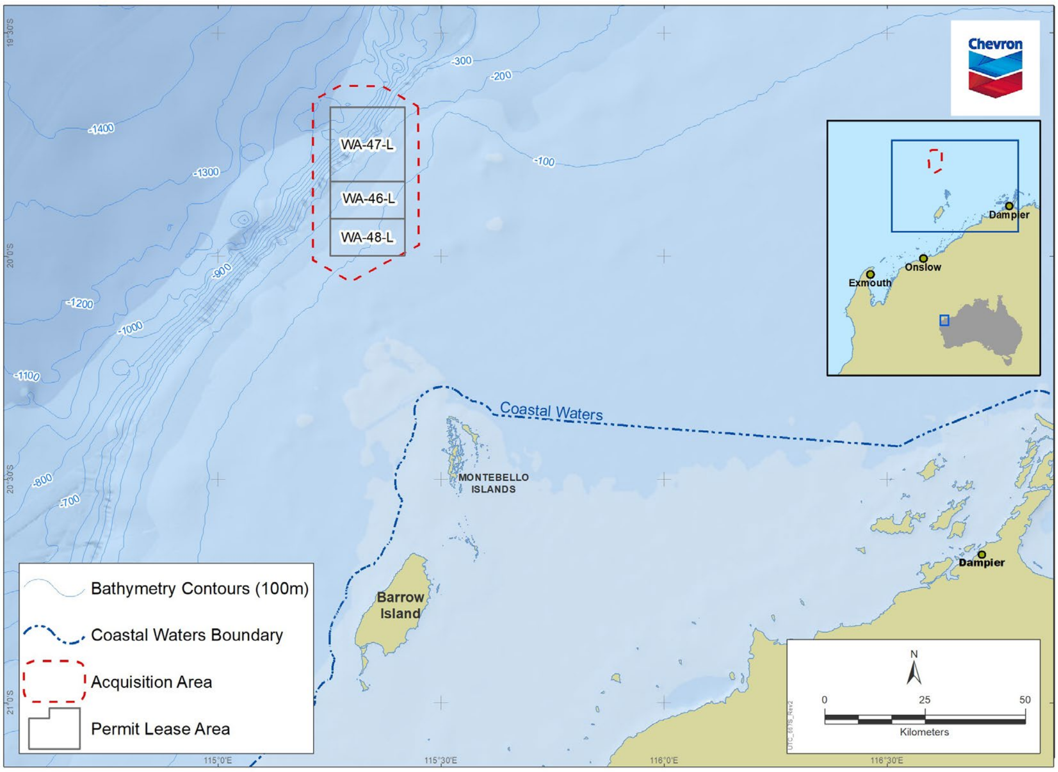


Figure 2-1: Wheatstone 4D MSS acquisition area

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

2.3 Scope

This EP addresses the following petroleum activity 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 *Navigation Act 2012* (Cth) and are not performing the petroleum activity
- activities associated with the start-up and operations for the Wheatstone Project which are covered under the NOPSEMA-accepted *Wheatstone Project: Start-up and Operations Environment Plan* (Ref. 3).

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.

Section 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

<table>
<tr><th>Title</th><th>Detail</th><th>Titleholders</th><th>Nominated titleholder</th><th>Address</th></tr>
<tr><td>WA-46-L</td><td>Production Licence</td><td rowspan="2">Chevron Australia Pty Ltd
Chevron (TAPL) Pty Ltd
PE Wheatstone Pty Ltd
Kyushu Electric Wheatstone Pty Ltd</td><td rowspan="3">Chevron Australia Pty Ltd
(ACN: 086 197 757)</td><td rowspan="3">1 The Esplanade Perth, WA, 6000</td></tr>
<tr><td>WA-47-L</td><td>Production Licence</td></tr>
<tr><td>WA-48-L</td><td>Production Licence</td><td>Chevron Australia Pty Ltd
Kufpec Australia (Wheatstone Iago) Pty Ltd
Chevron (TAPL) Pty Ltd
PE Wheatstone Pty Ltd
Kyushu Electric Wheatstone Pty Ltd</td></tr>
</table>

Table 2-2: Nominated liaison person

Position	HSE Team Lead – Regulatory Affairs
Company	Chevron Australia Pty Ltd
ACN	086 197 757
Business Address	1 The Esplanade, Perth WA 6000
Telephone	+61 8 9216 4000

Position	HSE Team Lead – Regulatory Affairs
Email	feedback@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 8.

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 requirements and other requirements that apply to the petroleum activity and are relevant to the environmental management of the activity are provided in Table 2-3 and Table 2-4.

Table 2-3: Commonwealth legislative requirements

Legislation	Description	Requirements relevant to the risks associated with the petroleum activity	Demonstration of how requirements are met
Australian Maritime Safety Authority Act 1990	Aims to promote maritime safety, protect the marine environment from pollution from ships or other environmental damage caused by shipping, and provide for a national search and rescue service	Requirements include the involvement of the Australian Maritime Safety Authority (AMSA) in response to relevant spill events	Roles and responsibilities are described in the Oil Pollution Emergency Plan (OPEP) (Ref. 1).
Biosecurity Act 2015 Biosecurity Regulations 2016	This Act is about managing diseases and pests that may cause harm to human, animal, or plant health or the environment. The Act provides for managing biosecurity risks in Australia and its external territories. It also provides for managing risks related to ballast water.	Pre-arrival reporting (PAR) before arrival in Australian territory Ballast water management plans and certificates, and reporting of ballast water discharges	Section 7.7
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	Provides for the protection and management of nationally and internationally important flora, fauna,	The EP must describe matters protected under Part 3 of the EPBC Act and assess any impacts and risks to these protected matters	Section 4, and Section 7

Legislation	Description	Requirements relevant to the risks associated with the petroleum activity	Demonstration of how requirements are met
EPBC Regulations 2000	ecological communities, and heritage places	EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans	Section 7.2, and Section 7.6
		EPBC Act Policy Statement 2.1 – Interaction between Offshore Seismic Exploration and Whales (Ref. 6).	Section 7.5
		Injury or fatality caused to EPBC-listed fauna shall be reported	Section 8.4.2
Navigation Act 2012	Provides for vessel and seafarer safety, and marine pollution prevention	Notice to Mariners	Section 7.1, and Section 7.12
Navigation Act 2012 *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* *Protection of the Sea (Harmful Anti-fouling Systems) Act 2006* Various marine orders	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 7.12
		Marine order 91—Marine pollution prevention—oil	Section 7.8, Section 7.11, and Section 7.12
		Marine order 95—Marine pollution prevention—garbage	Section 7.9
		Marine order 96—Marine pollution prevention—sewage	Section 7.8
		Marine order 97—Marine pollution prevention—air pollution	Section 7.3
		Marine order 98—Marine pollution prevention—anti-fouling systems	Section 7.7
OPGGS Act 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. 1) and Operational and Scientific Monitoring Plan (OSMP) (Ref. 2)

Legislation	Description	Requirements relevant to the risks associated with the petroleum activity	Demonstration of how requirements are met
Underwater Cultural Heritage Act 2018 (UCH Act)	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 7

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
Australian Ballast Water Management Requirements (Ref. 4)	Provides guidance on how vessel operators should manage ballast water when operating within Australian seas in order to comply with the *Biosecurity Act 2015* (Cth). They also align to the International Convention for the Control and Management of Ships' Ballast Water and Sediments 2004 (the Ballast Water Management Convention).	Ballast water management requirements for vessels, including having a ballast water management plan and certificate (unless an exemption applies).	Section 7.7
Australian Biofouling Management Requirements (Ref. 5)	Sets out vessel operator obligations for the management of biofouling when operating vessels under biosecurity control within Australian territorial seas.	Biofouling management for vessels, including PAR, and having biofouling management plans.	Section 7.7
Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species (Ref. 7)	International Maritime Organization (IMO) guidelines for global management of biofouling	Requires a biofouling management plan and record book to be available and maintained	Section 7.7
National Light Pollution Guidelines for Wildlife (Ref. 8)	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	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 7.4

Standard / guideline	Description	Requirements relevant to the risks associated with the petroleum activity	Demonstration of how requirements are met
	being affected by existing artificial light		

2.5.2.1 Protected areas

Australian Marine Parks (AMPs) occur within Commonwealth waters and are proclaimed as Commonwealth reserves under the EPBC Act. In alignment with the EPBC Act, each reserve is assigned an IUCN category (or multiple categories); and each category has a set of Australian IUCN reserve management principles associated with it (as defined in Schedule 8 of the EPBC Regulations 2000). The IUCN categories and management principles associated with AMPs within the OA (refer to Section 4.5) for this petroleum activity are described in Table 2-5.

The *North-west Marine Parks Network Management Plan* (Ref. 9) enables activities to be conducted in zones consistent with the zone objectives while enabling the impacts to be effectively managed. The zones, objectives, and allowable activities associated within AMPs relevant to the petroleum activity are described in Table 2-6.

Table 2-5: IUCN categories and Australian IUCN reserve management principles

IUCN category	Australian IUCN reserve management principles
Managed resource protected area (category VI)	7.01 The reserve or zone should be managed mainly for the sustainable use of natural ecosystems based on the following principles. 7.02 The biological diversity and other natural values of the reserve or zone should be protected and maintained in the long term. 7.03 Management practices should be applied to ensure ecologically sustainable use of the reserve or zone. 7.04 Management of the reserve or zone should contribute to regional and national development to the extent that this is consistent with these principles

Table 2-6: AMP zones, objectives, and activities

Zone	Objective	Rules for activities	Requirements relevant to the risks associated with the petroleum activity	Demonstration of how requirements are met
Multiple use zone (VI)	The objective of the Multiple Use Zone (VI) is to provide for ecologically sustainable use and the conservation of ecosystems, habitats and native species	Mining operations (including exploration)^ is an allowable activity within this zone, subject to assessment and authorisation	The class approval for mining operations within a multiple use zone requires a NOPSEMA-accepted EP to be in place before activities commence	This EP, including the OPEP (Ref. 1) and Operational and Scientific Monitoring Plan (OSMP) (Ref. 2)

^ Mining operations are defined in Section 355(2) of the EPBC Act, and include offshore petroleum activities, transportation of minerals by pipeline, and oil spill response.

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 licenses (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)*

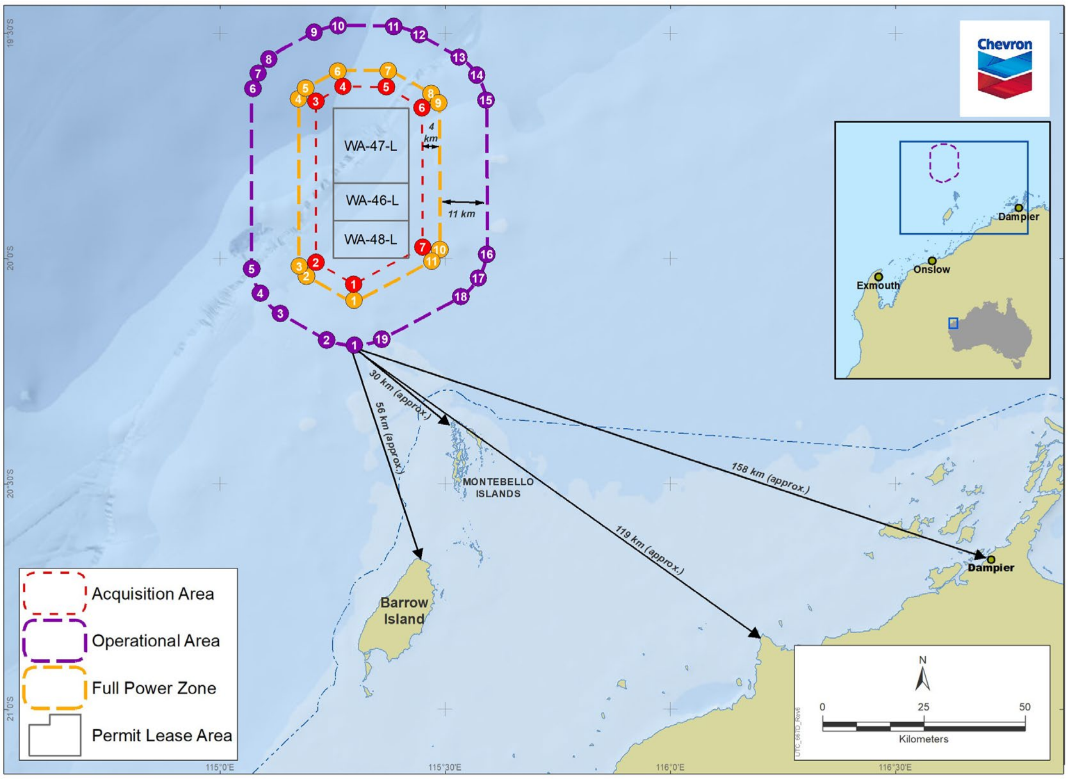


Figure 3-1: Acquisition area, full power zone, and operational area for the Wheatstone 4D MSS

3.1.3 Timing

The Wheatstone 4D MSS is scheduled to occur between mid-December 2023 and mid-April 2024, subject to vessel availability. While the seismic and support vessels may mobilise to the OA during December 2023, seismic acquisition will not commence before 1 January 2024 (i.e., the seismic source will only be discharged between January and mid-April 2024 [inclusive]).

The 4D 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 2023 to mid-April 2024) for the 4D MSS 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 (NWS), 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 aqusition area to increase the data density around the Wheatstone Platform and Pluto Platform), from the previous 2011–2012 (Ref. 10) 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.

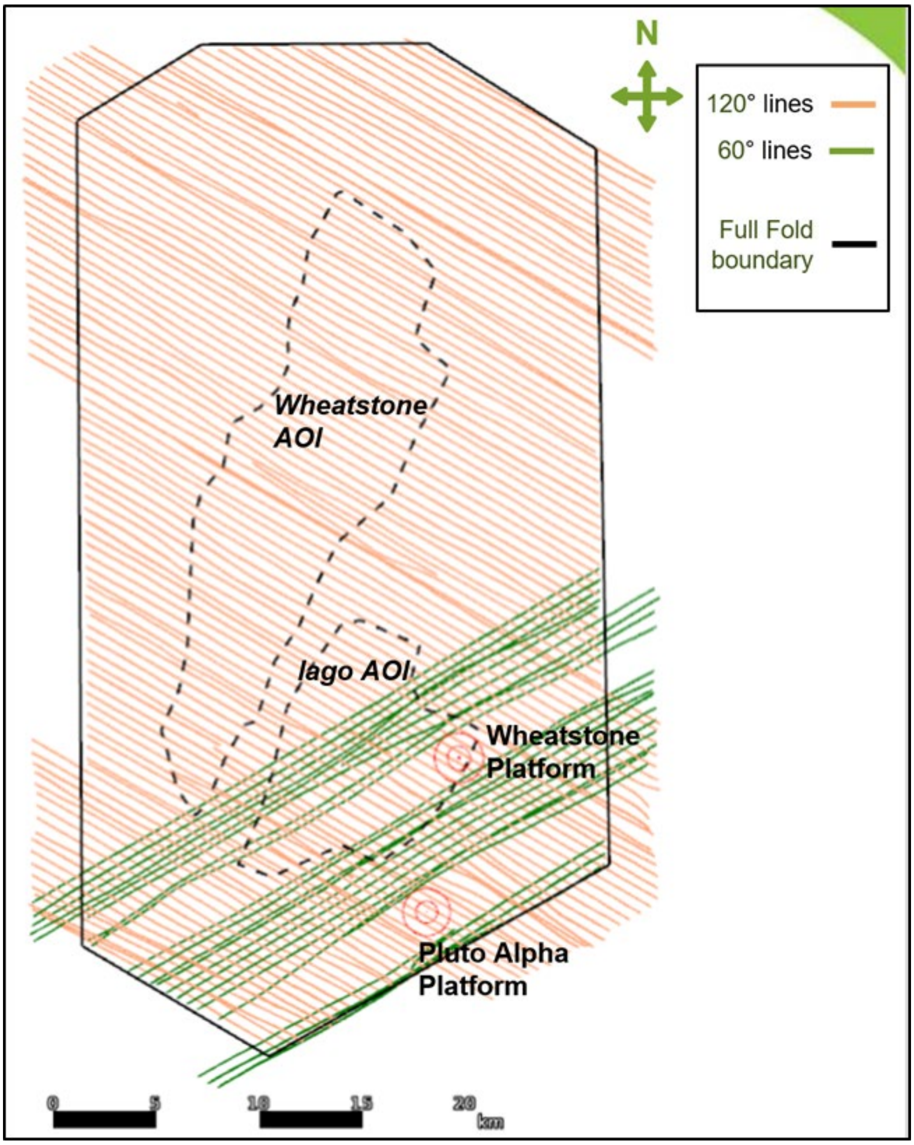


Figure 3-2: Schematic showing the proposed 120° and 60° azimuth acquisition lines for the 4D MSS

The 4D MSS acquisition parameters are provided in Table 3-3, and aim to replicate the acquisition parameters of the 3D MSS (Ref. 10) 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 km^2 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 (January to mid-April 2024; Section 3.1.3). The reason for the Wheatstone 4D MSS starting in January rather than during November or December is to limit the overlap with the predicted Pygmy Blue Whale peak southern migration period (Section 4.3.3.1.1; Section 4.3.3.5).

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

Parameter	Proposed specification
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

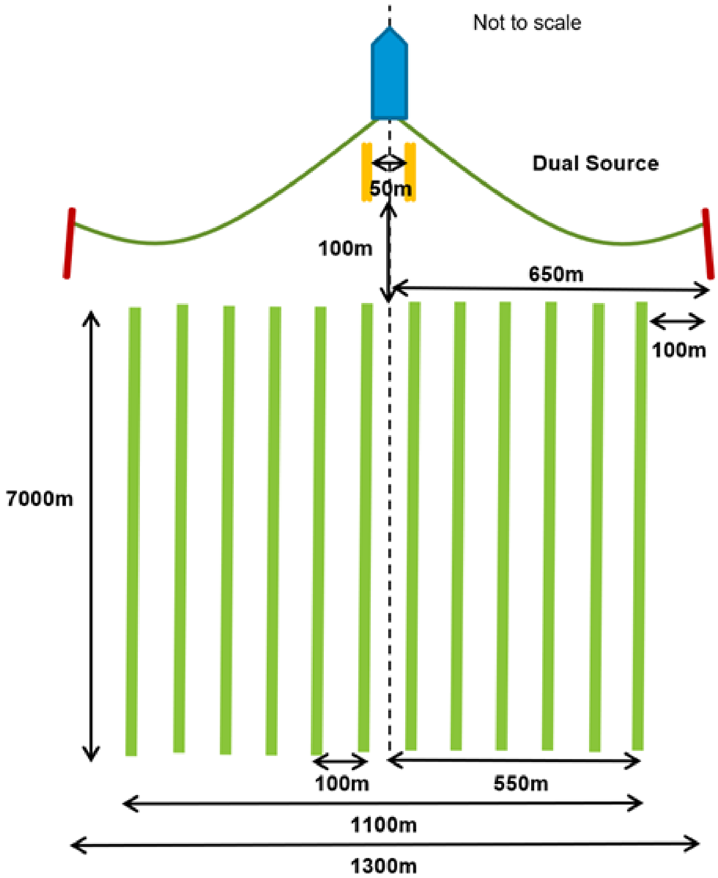


Figure 3-3: Schematic showing proposed acquisition configuration for the 4D MSS

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 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 Environment that may be affected

The environment that may be affected (EMBA) by the petroleum activity within scope of this EP has been defined as the area where a change to environmental receptors may potentially occur as a result of planned activities or unplanned events.

For the purposes of the EP, CAPL have also defined sub-areas of the EMBA that are used to support the subsequent impact and risk assessments (

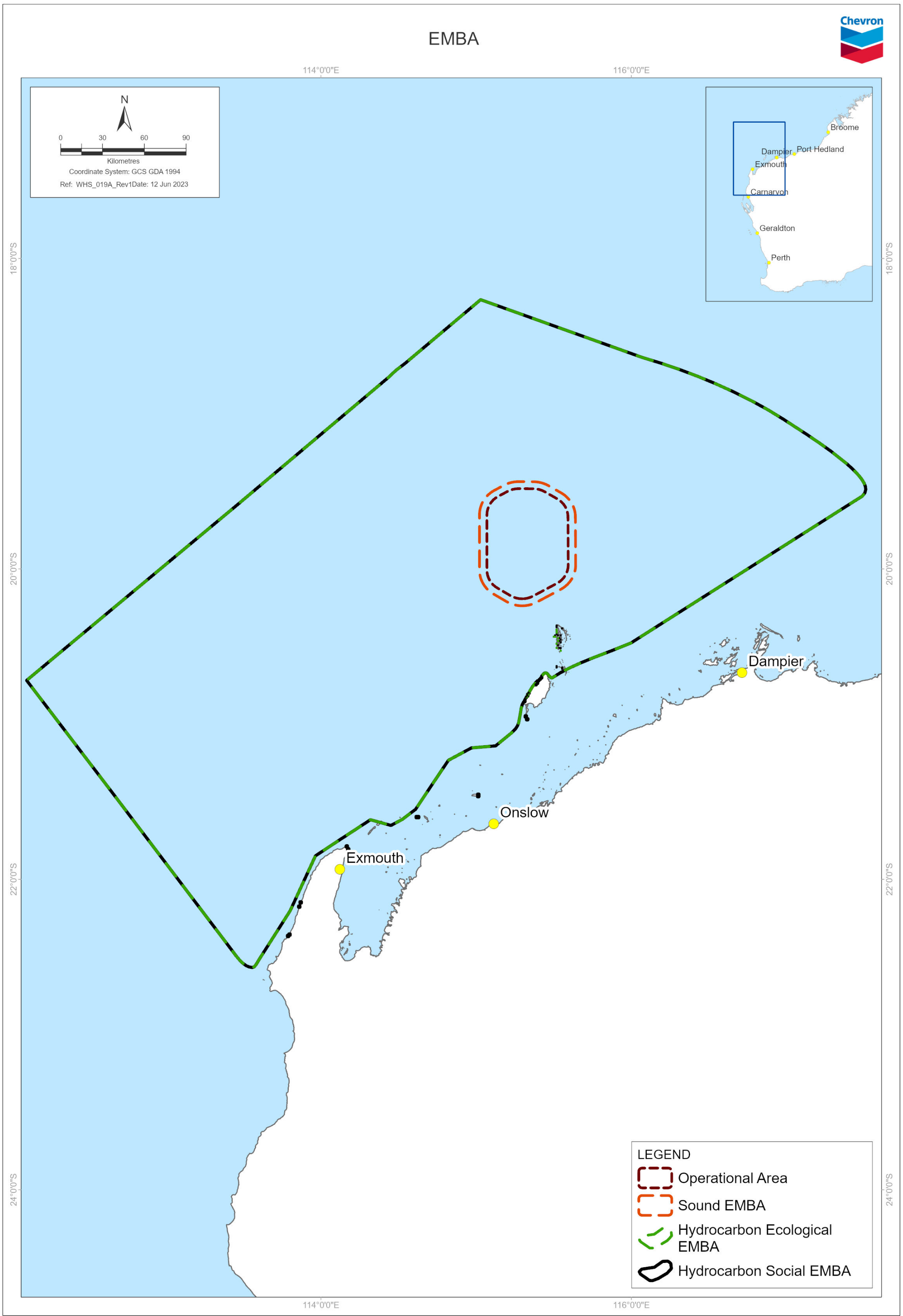
Table 4-1, Figure 4-1). Receptors present within the EMBA (and relevant to the purpose of each of the specific sub-areas) are described in the following sections.

For the following sections, the document refers to the EMBA when it is applicable to all the sub-areas identified in

Table 4-1.

Table 4-1: Description of EMBA sub-areas for Wheatstone 4D MSS

EMBA sub-area	Description and purpose
OA	The OA is defined as the area in which the petroleum activity will be undertaken (Section 3.1.2). The OA is relevant to the impact and risk assessments for all planned activities and unplanned events (except where specified by an aspect-specific EMBA), as the exposure area associated with these impacts and risks is considered to occur within the spatial extent of the OA.
Underwater Sound EMBA (Sound EMBA)	The Sound EMBA is relevant to the impact and risk assessments for planned underwater sound emissions (Sections 7.5 and 7.6), and determined by the predicted spatial extent of acoustic exposure at the relevant thresholds (Table 7-3 and Table 7-7).
Unplanned Hydrocarbon Release Ecological EMBA (Hydrocarbon Ecological EMBA)	The Hydrocarbon Ecological EMBA is relevant to the risk assessments for ecological receptors from unplanned hydrocarbon release events (Section 7.12), and determined by the predicted spatial extent of hydrocarbon exposure at the relevant thresholds for surface, entrained, dissolved, and shoreline components (Table 7-10).
Unplanned Hydrocarbon Release Social EMBA (Hydrocarbon Social EMBA)	The Hydrocarbon Social EMBA is relevant to the risk assessments for social, economic, and cultural receptors from unplanned hydrocarbon release events (Section 7.12), and determined by the predicted spatial extent of hydrocarbon exposure at the relevant thresholds for surface, entrained, dissolved, and shoreline components (Table 7-10). The Hydrocarbon Social EMBA incorporates lower thresholds for surface and shoreline hydrocarbon exposure that are associated with visible oil but are below concentrations at which ecological impacts are expected to occur.



Note: The Hydrocarbon EMBAs are shown as separate in-water (surface, entrained, dissolved) and shoreline components. Shorelines are only part of a Hydrocarbon EMBA where stochastic spill modelling predicts that shoreline loading above the relevant threshold occurs.

Figure 4-1: EMBA for the Wheatstone 4D MSS

4.2 Matters of national environmental significance

Matters of national environmental significance (MNES) are protected under the EPBC Act (Cth). The presence of MNES within the EMBA has been determined from the Australian Government's online Protected Matters Search Tool (PMST) (Ref. 11). Table 4-2 summarises the presence of relevant marine and/or coastal MNES within the EMBA; the full PMST reports[2] are included in appendix b.

It should be noted that the EPBC Act PMST is a general database that conservatively identifies areas in which protected species have the potential to occur.

Table 4-2: Presence of MNES within the EMBA

MNES	OA	Sound EMBA	Hydrocarbon Ecological and Social EMBA
World Heritage properties^	×	×	✓
National Heritage places^	×	×	✓
Wetlands of international importance (Ramsar wetlands)^	×	×	×
Nationally listed threatened species and communities^	✓ species × communities	✓ species × communities	✓ species × communities
Nationally listed migratory species^	✓	✓	✓
Commonwealth marine area^	✓	✓	✓
Great Barrier Reef Marine Park	×	×	×
Nuclear actions (including uranium mining)	—	—	—
Water resources (in relation to coal seam gas or large coal mining development)	—	—	—

^ These MNES are also identified as particular values and sensitivities under the OPGGS(E)R.

^ Where ✓ = present, × = not present, and — = not relevant to the petroleum activity.

4.3 Ecosystems and their constituent parts, including people and communities

4.3.1 Benthic communities and habitats

Benthic communities are biological communities that inhabit the seabed and are important for primary or secondary production. Benthic habitats are areas of seabed that do, or can, support these communities. Benthic communities play important roles in maintaining the integrity of marine ecosystems and the supply of ecological services. There is strong evidence that benthic communities are important for the maintenance of biological diversity by providing structurally complex and diverse habitat, refuge for vulnerable life stages, and a varied and increased food supply (Ref. 296).

[2] The PMST is a general database that includes all MNES, including species or features (such as terrestrial-based species or features) that are not expected to credibly occur within the EMBA.

The EMBA occurs within the North-west Marine Region (NWMR), which is typically characterised by shallow-water tropical marine ecosystems and high species richness (Ref. 85; Ref. 297). The high species richness is thought to be associated with the diversity of habitats available, such as limestone pavement, coral reefs, and pinnacles (Ref. 85). The broader benthic communities and habitats that may be present within the EMBA are summarised below, with additional data specific to the OA summarised in Section 4.3.1.1.

The geomorphology of Australia's continental margin is varied. Based on Geoscience Australia's geomorphic classification of seabed within Australia's exclusive economic zone (EEZ) (Ref. 298), the geomorphic features present within the EMBA are shown in Table 4-3. Two of the features identified within this dataset are Rankin Bank and Glomar Shoal, known bathymetric features of regional significance. Rankin Bank occurs within the Sound EMBA and Hydrocarbon EMBAs; and Glomar Shoal occurs just within the Hydrocarbon EMBAs (see Section 4.3.1.2 and 4.3.1.3 for descriptions of these features).

Table 4-3: Geomorphic features

Feature	OA	Sound EMBA	Hydrocarbon Ecological and Social EMBAs
Canyon			✓
Deep/hole/valley	✓	✓	✓
Pinnacle	✓	✓	✓
Plateau			✓
Shelf	✓	✓	✓
Slope	✓	✓	✓
Terrace	✓	✓	✓
Trench/trough		✓	✓

The composition, distribution, and movement of marine sediments is an important component of a marine ecosystem. These sediments can influence the primary biological production in the water column as well as the evolution and distribution of benthic habitats. The north-west WA comprises bio-clastic, calcareous, and organogenic sediments deposited from relatively slow and uniform sedimentation rates (Ref. 299). Sediments in the NWMR generally become finer with increasing water depth, ranging from sand and gravels on the continental shelf to mud on the continental slope and abyssal plain (Ref. 300).

Based on CSIRO's marine benthic substrate database (Ref. 301), the predominant seafloor sediment type within the OA and Sound EMBA is "calcareous gravel, sand and silt" and "calcareous ooze". Within the Hydrocarbon EMBAs several seafloor sediment types were identified: "biosiliceous marl and calcareous clay", "calcareous gravel, sand and silt", "calcareous ooze", and "mud and calcareous clay".

While not identified as a specific feature in either geomorphic or sediment type databases, the Wheatstone ridgeline, an area of hard substratum is known to occur within the OA, and is described further in Section 4.3.1.1.

The Integrated Marine and Coastal Regionalisation of Australia (IMCRA) is a biogeographic regionalisation of oceanic waters within Australia's EEZ (Ref. 302). The OA and Sound EMBA overlap with the Northwest Province, Northwest Shelf Province, and Northwest Transition provincial bioregion[3]. The Hydrocarbon EMBAs also overlap with the Central Western Shelf Transition, and the Central Western Transition provincial bioregions. The geomorphology characteristics and biological communities for each of these bioregions, as described in *The North-west Marine Bioregional Plan: Bioregional Profile* (Ref. 297), are summarised in Table 4-4.

Listed threatened ecological communities (TECs) are a MNES under the EPBC Act, and a particular value and sensitivity under the OPGGS(E)R. There are no known TECs within the EMBA.

Table 4-4: Features of provincial bioregions

IMCRA Provincial Bioregion^	OA	Sound EMBA	Hydrocarbon Ecological and Social EMBAs
Northwest Province	✓	✓	✓
Characteristics of the geomorphology and biological communities of the Northwest Province include: • bioregion occurs entirely on the continental slope and is comprised of muddy sediments • distinguished by a number of topographic features, such as the Exmouth Plateau, terraces and canyons (including the Swan and Cape Range canyons), as well as deep holes and valleys on the inner slope (including the Montebello Trough) • the benthic shelf and slope communities of this bioregion comprise both tropical and temperate species with a north-south gradient • the continental slope between North West Cape and the Montebello Trough has been identified as one of the most diverse slope habitats of Australia • the Exmouth Plateau is also likely to be an important area for biodiversity as it provides an extended area offshore for communities adapted to depths of ~1,000 m • information available on sediments in the bioregion indicates: – benthic communities are likely to include filter feeders and other epifauna – soft-bottom environments are likely to support patchy distributions of mobile epibenthos, such as sea cucumbers, ophiuroids, echinoderms, polychaetes and sea pens – biological communities within canyons in the bioregion are poorly understood. Features and areas of ecological importance within the Northwest Province have been identified as: • Exmouth Plateau • canyons on the slope, including the Cape Range Canyon • demersal fish communities associated with the slope. Of these features and areas within the Northwest Province, the demersal fish communities associated with the slope occurs within the OA, Sound EMBA, and Hydrocarbon EMBAs. The Exmouth Plateau, and canyons on the slope also occur within the Hydrocarbon EMBAs. Refer to Section 4.3.6.1 for further descriptions of these features.			

[3] Provincial bioregions were classified based on fish, benthic (seabed) habitat and oceanographic data at a scale that is useful for regional conservation planning and management (Ref. 318).

<table>
<tr><th>IMCRA Provincial Bioregion^</th><th>OA</th><th>Sound EMBA</th><th>Hydrocarbon Ecological and Social EMBAs</th></tr>
<tr><td>Northwest Shelf Province</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td colspan="4">
Characteristics of the geomorphology and biological communities of the Northwest Shelf Province include:

bioregion occurs almost entirely on the continental shelf, except for a small area to the north of Cape Leveque that extends onto the continental slope
this bioregion includes more than 60% of the continental shelf in the NWMR
continental shelf gradually slopes from the coast to the shelf break, but displays a number of seafloor features such as banks/shoals and holes/valleys, including:

Glomar Shoal which occurs in ~26–70 m water depth and is distinguished by highly fractured molluscan debris, coralline rubble and coarse carbonate sand
Leveque Rise (large plateau), which is one of only two shelf plateaux within the NWMR
significant areas of tidal sandwaves or sandbanks (ranging in height ~5–10 m) occur on the inner-most reaches of Exmouth Gulf, and are one of only three major occurrences of this type of feature in the NWMR
shelf also contains several terraces and steps that extend into adjacent bioregions and reflect ancient coastlines from when the sea level in the NWMR was lower; the most prominent of these occurs at a water depth of ~125 m

sediment differentiation occurs on a north-south gradient:

south of Broome, sediment is relatively homogenous and dominated by sands with small proportion of gravel
north of Broome, sediment is highly variable with sand or gravel dominance in no discernable spatial pattern
mud increases slightly within ~100 km of the coast, and within ~100 km of the shelf break, but is mostly absent from areas in between

sandy substrates on the shelf withing this bioregion are thought to support low density benthic communities of bryozoans, molluscs, and echinoids
sponge communities are also sparsely distributed on the shelf, but are found only in areas of hard substrate.

Features and areas of ecological importance within the Northwest Shelf Province have been identified as:

Browse Island and surrounding waters
Lacepede Islands and surrounding waters
Quondong Point, north of Broome and surrounding waters
West coast of the Dampier Peninsula, including Beagle and Pender bays and surrounding waters
Pilbara coast (between Exmouth and Broome) and surrounding waters
Exmouth Gulf—Muiron Islands and surrounding waters
demersal fish communities associated with the slope
ancient coastline at 125 m depth contour
Glomar Shoal.

Of these features and areas within the Northwest Shelf Province, the ancient coastline at 125 m depth contour and demersal fish communities associated with the slope occur within the OA, Sound EMBA and Hydrocarbon EMBAs. Glomar Shoal also occurs within the Hydrocarbon EMBAs. Refer to Section 4.3.6.1 for further descriptions of these features.
</td></tr>
<tr><td>Northwest Transition</td><td>✓</td><td>✓</td><td>✓</td></tr>
<tr><td colspan="4">Characteristics of the geomorphology and biological communities of the Northwest Transition include:</td></tr>
</table>

<table>
<tr><th>IMCRA Provincial Bioregion^</th><th>OA</th><th>Sound EMBA</th><th>Hydrocarbon Ecological and Social EMBAs</th></tr>
<tr><td colspan="4">

around half (52%) of the bioregion occurs on the continental slope, with smaller areas in the north-west of the bioregion located on the Argo Abyssal Plain and continental rise
encompasses a range of water depths, from the shelf break (~200 m water depth) to ~5,980 m over the Argo Abyssal Plain
other topographic features within the bioregion include areas of rise, ridges, canyons and apron/fans
sediments of the slope are dominated by sands, whereas the sediments of the abyssal plain/deep ocean floor are dominated by muds
the bioregion also has reefs such as Mermaid, Clerke, and Imperieuse reefs, which are collectively known as the Rowley Shoals
the benthos of the deep ocean areas are likely to support meiofauna (e.g. nematodes), larger infauna (e.g. polychaete worms, isopods), and sparsely distributed epibenthic communities (e.g. sea pens)
mobile benthic species (e.g. deepwater sea cucumbers, crabs, polychaetes) are likely to be associated with the seafloor, and bioregion may support sparse populations of bentho-pelagic fish and cephalopods in low densities.

Features and areas of ecological importance within the Northwest Transition have been identified as:

Rowley Shoals—Mermaid Reef Marine National Nature Reserve, Clerke and Imperieuse reefs and surrounding waters
Fish communities associated with the slope

Of these features and areas within the Northwest Transition, the demersal fish communities associated with the slope occurs within the OA, Sound EMBA, and Hydrocarbon EMBAs. Refer to Section 4.3.6.1 for further descriptions of these features.
</td></tr>
<tr><td>Central Western Shelf Transition</td><td></td><td></td><td>✓</td></tr>
<tr><td colspan="4">
Characteristics of the geomorphology and biological communities of the Central Western Shelf Transition include:

bioregion is located entirely on the continental shelf and is comprised mainly of sandy sedimentsthis bioregion includes both State and Commonwealth waters between water depths of 0 m to ~80
Commonwealth waters in this bioregion represent <1% of the total area of the NWMR
the benthic ecological communities of the bioregion, include both tropical and temperate species transitioning along a north-south gradient
Ningaloo Reef[4] is the most significant geomorphic feature of this bioregion:

it extends along the Cape Range Peninsula for over 260 km, and is the only example in the world of an extensive fringing coral reef on the west coast of a continent
it is marked by a well-developed spur and groove system of fingers of coral formations penetrating into the ocean with coral sand channels in between
a lagoon on the inshore side separates Ningaloo reef from the mainland
the biological communities of the Ningaloo Reef differ from the hard coral reefs located elsewhere in the NWMR

a large proportion of this bioregion is covered by the State and Commonwealth Ningaloo Marine Parks, which are one of the most significant hotspots of biodiversity within the NWMR
the Ningaloo Marine Parks incorporate a diversity of habitats including the seabed of the continental slope and shelf that supports demersal and benthic plants and animals including

</td></tr>
</table>

[4] Ningaloo Reef also extends into the Northwest Province, Central Western Transition Province, and a small portion of the Northwest Shelf Province. The geomorphology and biological communities of Ningaloo Reef are discussed in this bioregion summary.

IMCRA Provincial Bioregion^	OA	Sound EMBA	Hydrocarbon Ecological and Social EMBAs
fish, molluscs, algae, sponges, soft corals and burrowing bivalves; as well as coral reefs and intertidal areas such as rocky shores and mangroves in State waters. Features and areas of ecological importance within the Central Western Shelf Transition have been identified as: • Ningaloo Marine Park – North West Cape. Of these features and areas within the Central Western Shelf Transition, the Ningaloo Marine Park – North West Cape occurs within the Hydrocarbon EMBAs. Refer to Section 4.5 for further descriptions of these features.			
Central Western Transition			✓
Characteristics of the geomorphology and biological communities of the Central Western Transition include: • the bioregion is characterised by large areas of continental slope, with sediments dominated by muds and sands that decrease in grain size with increasing depth • about 40% of the bioregion occurs in water depths greater than 4,000 m and the deepest areas of the bioregion occur within the Cuvier Abyssal Plain at ~5,330 m • the continental slope is incised by numerous topographic features such as terraces (e.g. Carnarvon Terrace), canyons (e.g. Cloates and Carnarvon canyons) and rises • a large part of the bioregion comprises the Cuvier Abyssal Plain • Wallaby Saddle is another important topographic feature within this bioregion and is the most extensive area of this type of topographic feature in the NWMR • the benthic slope communities of this bioregion comprise both tropical and temperate species along a north-south gradient • the biological communities of the Central Western Transition are thought to be distinctive owing to the proximity of deep ocean areas to the continental slope and shelf, resulting in close interaction between pelagic species of the Cuvier Abyssal Plain and those of the slope and shelf • the harder substrate of the slope in waters of 200–2,000 m deep is likely to support populations of epibenthos such as bryozoans, sponges and encrusting coralline algae; these support larger infauna and benthic animals such as crabs, cephalopods, echinoderms and other suspension-feeding epibenthic organisms • in the deeper waters of the abyss, the benthic communities are likely to be sparse and include meiofauna (e.g. nematodes). Features and areas of ecological importance within the Central Western Transition have been identified as: • Wallaby saddle • Cape Range Canyon and Cloates Canyon Of these features and areas within the Central Western Transition, the Cape Range Canyon and Cloates Canyon occur within the Hydrocarbon EMBAs.			

^ Source: Ref. *297*.

4.3.1.1 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. 83). 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 4-2, Figure 4-3) (Ref. 83).

The Wheatstone platform is on a ridgeline (~11 km long) located within the OA, 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. 84). 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. 85).

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. 83). The dominant sessile benthic invertebrates on the ridgeline were gorgonians and sponges (Ref. 83). A subsequent survey in 2016 found the dominant benthic organisms on the ridgeline included gorgonians, antipatharians (black coral) and hydrozoans (Ref. 86). Overall, the percentage cover and density of benthic organisms were low and spatially variable (Ref. 86) Findings reported in 2010 (Ref. 83) and 2016 (Ref. 86) 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. 87).

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. 88) 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. 89) listed 732 species from shelf waters (30–150 m) between Exmouth and the Gulf of Carpentaria. Allen and Swainston (Ref. 90) 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. 91).

Seagrasses and macroalgae, which are characteristic of sand habitats and reefs, are unlikely to occur within the Commonwealth waters of the OA (Ref. 92). 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. 83). There are no identified ecologically isolated or regionally significant marine habitats found around the Wheatstone platform or in the wider OA (Ref. 83; Ref. 93).

Figure 4-2: Seabed survey image showing typical seabed habitat at IAG-1 drill centre for the Wheatstone Project

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

4.3.1.2 Rankin Bank

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 key ecological feature (KEF), it is a large, complex bathymetrical feature on the outer western shelf of the Pilbara region and represents habitats that are likely to play an important role in the productivity of the Pilbara region (Ref. 94). Rankin Bank consists of three submerged shoals delineated by the 50 m depth contour with water depths of ~18–30.5 m (Ref. 94). 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. 94). The proportion of cover at Rankin Bank was highest for macroalgae and hard corals, particularly at depths less than 40 m, and decreased with increasing depth (Ref. 303). Encrusting corals (reaching cover of ~12.5%) at depths less than 40 m and solitary corals (~10% cover) primarily at depths between 40–60 m were also present (Ref. 303). Other benthic taxa including soft corals and sponges were present in lower proportions at all depths (Ref. 303). The high cover of macroalgae and hard corals in shallower water depths are presumably due to greater light penetration and lower sand cover Ref. 303).

4.3.1.3 Glomar Shoal

Glomar Shoal is a large (~215 km^2) and complex bathymetrical feature situated on the outer continental shelf off the Pilbara coast. Glomar Shoal is ~8.5 times wider than Rankin Bank at the 60 m contour. Glomar Shoal is a shallow sedimentary bank comprised of coarser biogenic material than the surrounding seabed. The shoal is ~26–70 m below the sea surface (Ref. 304). Glomar Shoal is located ~125 km east of the OA. Abdul Wahab et al. (Ref. 303) found a number of hard coral and sponge species in water depths less than 40 m. Together with Rankin Bank, these remote shallow water areas represent regionally unique habitats and are considered likely to play an important role in the productivity of the Pilbara region (Ref. 305).

Glomar Shoal has been identified as a KEF for its high productivity and aggregations of marine life (Ref. 304). This KEF encompasses a wider area than the shoal feature itself. See also Section 4.3.6.1 for a description of the Glomar Shoal KEF.

4.3.2 Coastal communities and habitats

Coastal communities are biological communities that inhabit the coastal zone. Coastal habitats are areas of shoreline types that do, or can, support these communities. Similarly to benthic communities (as described in Section 4.3.1), coastal communities are likely to play roles in maintaining the integrity and diversity of coastal ecosystems, and the supply of ecological services.

The OA and Sound EMBA occur offshore and do not interface with the coast. The Hydrocarbon EMBAs do interface with the coast (due to predicted shoreline loading associated with unplanned hydrocarbon release events;

Table 4-1). The Hydrocarbon Ecological EMBA includes the Montebello Islands; and the Hydrocarbon Social EMBA includes the Montebello, Lowendal, Barrow (west coast), Boodie, Thevenard, and Flat islands, and small areas on west and northern coast of the North West Cape peninsula (Figure 4-1). The coastal communities and habitats that may be present within the Hydrocarbon EMBAs are summarised below.

Based on Smartline (Ref. 307), a spatial database containing geomorphic classifications for Australia’s coasts, the types of shoreline present within the Hydrocarbon EMBAs were typically rocky coasts and sandy beaches. Within the

Hydrocarbon Social EMBA, an additional shoreline type was identified: sandy tidal flats (occurring on the western coast of the North West Cape peninsula).

The Seamap Australia spatial database collates and classifies marine and coastal habitats on the Australian continental shelf (Ref. 308). Based on this dataset, areas of saltmarsh may be present on southwestern Barrow Island, and parts of the North West Cape; and isolated areas of mangroves may be present on Montebello Islands. Mangroves grow within the intertidal zone and are typically located within sheltered areas. The mangrove communities within the Montebello Islands are considered globally significant as they occur in lagoons of offshore islands (Ref. 309). Coastal and marine baseline studies undertaken by CAPL (Ref. 343) identified that there are no mangrove stands on the west coast of Barrow Island, where the Hydrocarbon Social EMBA intersects with the coast. One species of mangrove, *Avicennia marina*, is known to occur in sparse stands on the north-east and southern coasts of Barrow Island (Ref. 343).

Listed TECs and wetlands of international importance (Ramsar wetlands) are MNES under the EPBC Act, and a particular value and sensitivity under the OPGGS(E)R. There are no known TECs or Ramsar wetlands within the Hydrocarbon EMBAs.

4.3.3 Marine fauna

Listed threatened or migratory species are MNES under the EPBC Act, and a particular value and sensitivity under the OPGGS(E)R. The following sections identify the presence of these species within the EMBA.

4.3.3.1 Marine mammals

Based on searches of the online PMST (Ref. 11; appendix b), the threatened and/or migratory mammal species shown in Table 4-5 may be present within the EMBA. The full list of marine species identified from the PMST is provided in appendix b. Biologically important areas[5] (BIAs) associated with regionally significant marine mammal species are listed in Table 4-6.

For the threatened and/or migratory species with BIAs within, or within close proximity to, the OA or Sound EMBA (i.e. EMBAs associated with planned activities), additional information has been provided in the following subsections.

The threatened and/or migratory cetaceans that may be present within the OA and Sound EMBA are predominantly low-frequency cetaceans[6] (Blue Whale, Bryde's Whale, Fin Whale, Humpback Whale, Sei Whale) and mid-frequency cetaceans[7] (Sperm Whale, Australian Humpback Dolphin, Killer Whale, Spotted Bottlenose Dolphin). High-frequency cetaceans[8] (e.g., Dwarf Sperm Whale, Pygmy Sperm Whale) were also identified within the PMST (Ref. 11; appendix b) as species or species habitat that may occur within the OA and Sound EMBA, these species are not listed as threatened and/or migratory under the EPBC Act. As shown in Table 4-6, except for Pygmy Blue Whales and Humpback Whales,

[5] Biologically important areas are spatially defined areas where aggregations of individuals of a species are known to display biologically important behaviour such as breeding, foraging, resting or migration.

[6] Low-frequency cetaceans are the functional cetacean hearing group that are specialised for hearing low frequencies (e.g., baleen whales).

[7] Mid-frequency cetaceans are the functional cetacean hearing group that are specialised for hearing mid frequencies (e.g., toothed whales, beaked whales, dolphins).

[8] High-frequency cetaceans are the functional cetacean hearing group that are specialised for hearing high frequencies (e.g., *Kogia* spp).

there are no known BIAs or aggregation areas for other cetacean species within or adjacent to the OA or Sound EMBA; as such it is expected that any presence of cetacean species within the OA and Sound EMBA would be of a transitory nature.

Table 4-5: Presence of threatened and/or migratory marine mammals

Common name (EPBC protected status)	OA	Sound EMBA	Hydrocarbon Ecological and Social EMBAs
Cetaceans (whales)			
Antarctic Minke Whale *(Migratory)*			✓
Blue Whale *(Endangered, Migratory)*	✓	✓	✓
Bryde's Whale *(Migratory)*	✓	✓	✓
Fin Whale *(Vulnerable, Migratory)*	✓	✓	✓
Humpback Whale *(Migratory)*	✓	✓	✓
Sei Whale *(Vulnerable, Migratory)*	✓	✓	✓
Southern Right Whale *(Endangered, Migratory)*			✓
Sperm Whale *(Migratory)*	✓	✓	✓
Cetaceans (dolphins)			
Australian Humpback Dolphin *(Migratory)*	✓	✓	✓
Australian Snubfin Dolphin *(Migratory)*	✓	✓	✓
Killer Whale *(Migratory)*	✓	✓	✓
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) *(Migratory)*	✓	✓	✓
Sirenians			
Dugong *(Migratory)*		✓	✓

Table 4-6: Presence of BIAs for marine mammals

Common name	BIA behaviour	Seasonal presence	OA	Sound EMBA	Hydrocarbon Ecological and Social EMBAs
Humpback Whale	Migration (north and south)	Northern migration, late July to September			✓
Pygmy Blue Whale	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	✓	✓	✓

Common name	BIA behaviour	Seasonal presence	OA	Sound EMBA	Hydrocarbon Ecological and Social EMBAs
		coastline from October to late December)			
Dugong	Breeding	Year round			✓
	Calving	Year round			✓
	Foraging (high density seagrass beds)	Year round			✓
	Nursing	Year round			✓

4.3.3.1.1 Pygmy Blue Whale

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. 12). Recent information collected from satellite tags shows 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. 13; Ref. 14; Ref. 15). These seas are considered the northern terminus of the migration and potentially the breeding and calving ground, but may also act as a feeding area (Ref. 211; Ref. 275).

Acoustic monitoring conducted by McCauley and Jenner (Ref. 16) 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. 16) that between 700–1,500 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 ~40–50 km west of the OA, and in ~ 1300 m water depth. The detection of Pygmy Blue Whale song peaked from mid-April to the end July, and then again from beginning of November through to early-December (Ref. 17). These peaks correspond with previously identified northern and southern migration peak periods of Pygmy Blue Whales. Pygmy Blue Whale song was detected on more days than any other type of mysticete (baleen whale) sound (Ref. 17).

It is known the Pygmy Blue Whales tend to follow the WA continental shelf edge between their feeding grounds at 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. 71; Ref. 63). However, more recent studies (e.g., Ref. 13; Ref. 12) 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 coast (100±1.7 km) in water depths of 1,369.5±47.4 m, until reaching the North West Cape, after which they travelled further offshore (238±14 km) into progressively deeper water (2,617±143.5 m) (Ref. 13). Data from tagged Pygmy Blue Whales also indicates that during their northern migration, the width of the migration path increases north of Montebello Islands, from ~175 km to ~690 km at its widest point (Ref. 274). Gavrilov et al. (Ref. 12) 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. 12). Pygmy Blue Whales have demonstrated extensive use of continental slope habitat off Western Australia and only limited use of shelf waters (Ref. 274). This contrasts with southern Australia, where use of the shelf and shelf break by Pygmy Blue Whales is more common.

McCauley and Jenner (Ref. 16) 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. A difference in travel speed was also reported by Thums et al (Ref. 274), where median speed during northward migration was 2.4 km/h (<0.1–15.4 km/h, n=22), and southward migration was 4.0–5.0 km/h (n=2).

A recent study incorporating data collected from both passive acoustic monitoring and satellite telemetry data, was analysed and determined the 'most important areas' for migration[9] along the WA coast as an almost continuous stretch from southern WA to around the latitude of Rowley Shoals, and thereafter was more dispersed (Ref. 274). The OA (including the FPZ) and Sound EMBA intersect with the eastern extent of this most important area for migration (Figure 4-4).

Predictions from modelling based on passive acoustic data indicate greatest numbers of Pygmy Blue Whales during April and June/July (northern migration), and November and December (southern migration) (Ref. 274). Monthly spatial predictions indicated higher densities around the Montebello Island region during May and June (northern migration) and November and December (southern migration) (Ref. 274). These months of predicted higher densities of Pygmy Blue Whales are outside of the proposed acquisition window (January to mid-April) for the 4D MSS.

Pygmy Blue Whales aggregate in the Austral summer to feed at known locations on or adjacent to the continental shelf including the Perth Canyon, Great Southern Australian Coastal Upwelling System, and the sub-tropical convergence zone (Ref. 274). The areas around the Perth Canyon and Australian Coastal Upwelling System correspond to 'Foraging Areas' and 'Known Foraging Areas' within the *Conservation Management Plan for the Blue Whale* (Ref. 63). The *Conservation Management Plan for the Blue Whale* (Ref. 63) also identifies 'Possible Foraging

[9] Grid cells with overlap between two metrics: largest percentage of whales and high move persistence, were designated as the 'most important areas' for migration (Ref. 291).

Areas'[10], including two in WA, one off the Ningaloo coast, and another around Scott Reef. These 'Possible Foraging Areas' have been characterised as foraging BIAs and occur ~225 km southwest and ~810 km northeast of the OA respectively.

Thums et al (Ref. 274) determined that Pygmy Blue Whale movement off northwest WA was predominantly relatively fast, directed travel (high move persistence) interspersed with relatively short (median 28 h) periods of low move persistence (Ref. 274). This high move persistence is indicative of migration, while the low move persistence is generally indicative of foraging (Ref. 274). Data collected from both passive acoustic monitoring and satellite telemetry data, was analysed and determined the 'most important areas' for foraging[11] along the WA coast included the Perth Canyon and vicinity, the shelf edge off Geraldton, and discontinuous use of the shelf edge from Ningaloo Reef to Rowley Shoals (Ref. 274). Although foraging areas are described as static, they are likely to be dynamic given their dependence on presence of prey (Ref. 274; Ref. 276). The north-western edge of the OA and Sound EMBA intersect with a small extent of this most important area for foraging; the FPZ is outside of these areas (Figure 4-5).

The OA is located in water depths ranging from ~50–1,250 m. The defined migration BIA for Pygmy Blue Whales overlaps the northern part of the OA (including the FPZ) and Sound EMBA; 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 and Sound EMBA in deeper waters, particularly on their southern migration (November to December), but also during the northern migration (April to August). While foraging BIAs have not been identified along the NWS, recent analysis indicates that there may be short interspersed periods of foraging occurring along the shelf edge during migration (Ref. 274).

[10] "Evidence of feeding is based on limited direct observations or through indirect evidence, such as occurrence of krill in close proximity to whales, or satellite tagged whales showing circling tracks. Blue whales travel through on a seasonal basis, possibly as part of their migratory route" (Ref. 70).

[11] Grid cells with overlap between three metrics: greatest time spent, largest percentage of whales, and lowest move persistence, were designated as the 'most important areas' for foraging (and/or resting/breeding) (Ref. 291).

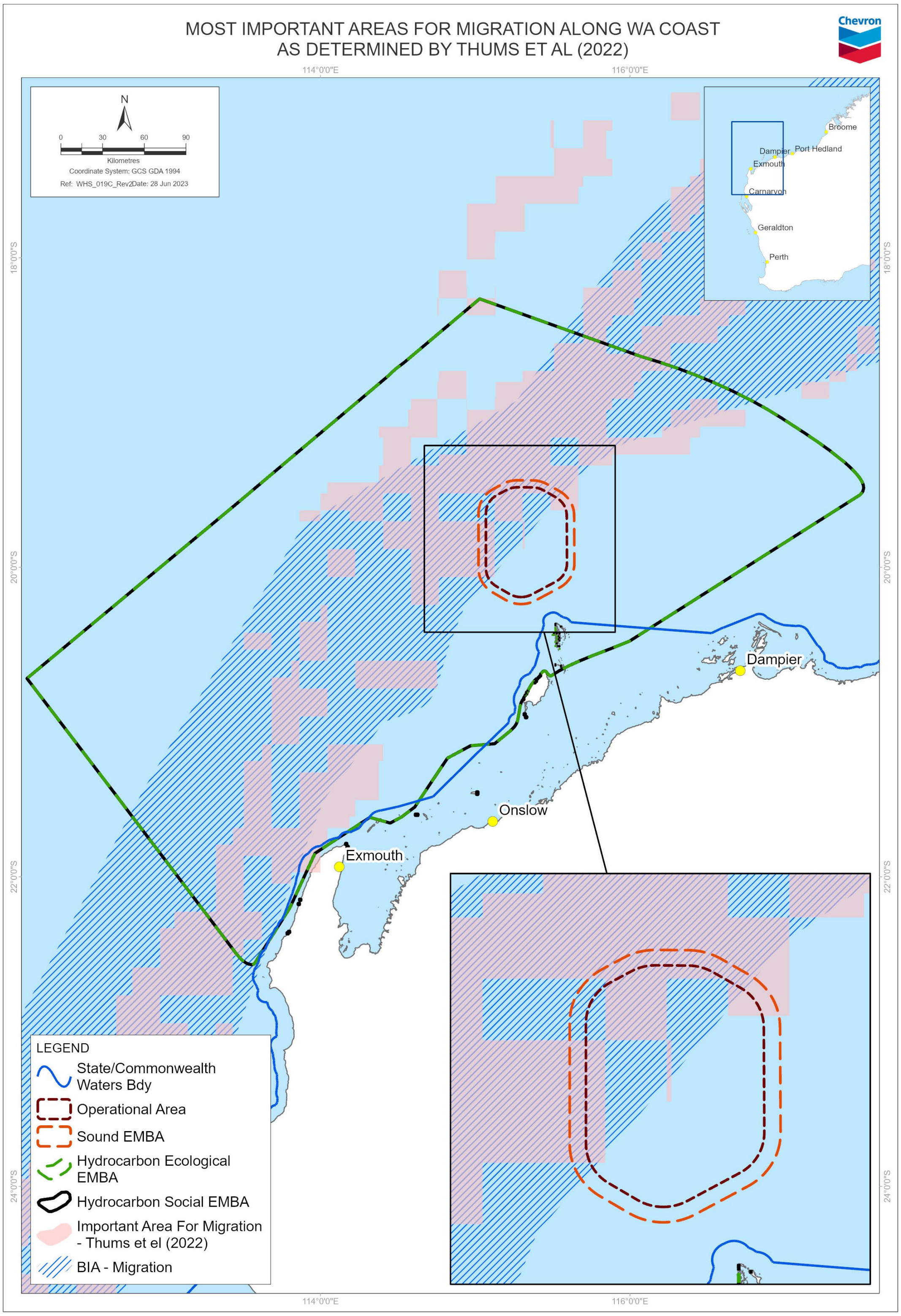


Figure 4-4: Most important areas (pink) for migration along WA coast as determined by Thums et al (Ref. 274); inset shows overlap of the OA and Sound EMBA for the Wheatstone 4D MSS

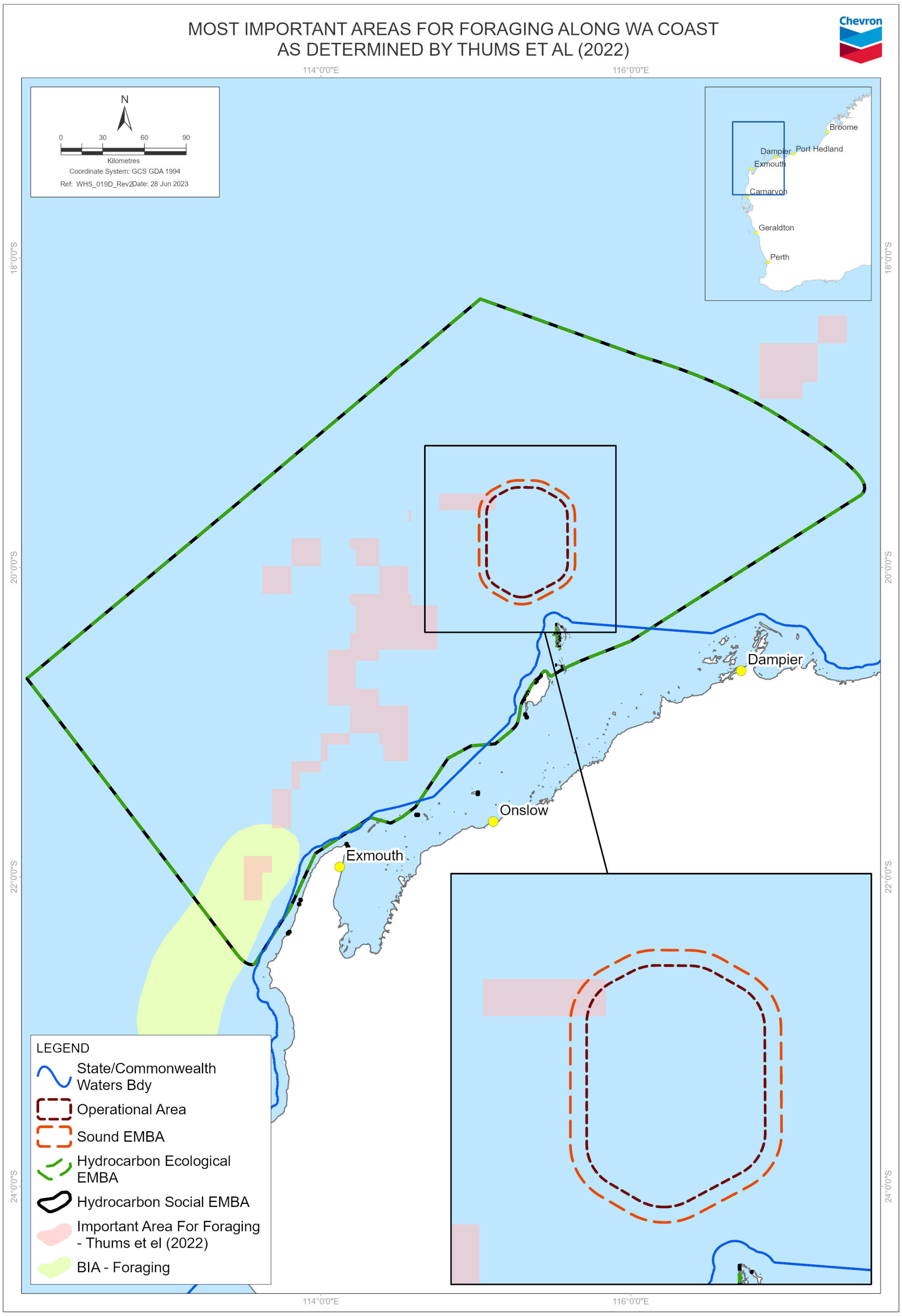


Figure 4-5: Most important areas (pink) for foraging along WA coast as determined by Thums et al (Ref. 274); inset shows overlap of the OA and Sound EMBA for the Wheatstone 4D MSS

4.3.3.1.2 Humpback Whale

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 Kimberley waters (Ref. 18). 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. 18). The migration (north and south) BIA corridor extends from the coast to out to ~100 km offshore in the Kimberley and Pilbara regions; reducing to ~50 km offshore south of North West Cape.

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. 18). Breeding and calving occurs in the region between mid-August and early-September (Ref. 18), 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. 18). 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. 18, Ref. 19). 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. 18; Ref. 17). Females and calves are known to stop and rest in Exmouth Gulf and Shark Bay (Ref. 18).

4.3.3.2 Reptiles

Based on searches of the protected matters database (Ref. 11; appendix b), the threatened and/or migratory reptile species shown in Table 4-7 may be present within the EMBA. The full list of marine species identified from the PMST is provided in appendix b. Habitat critical to survival of marine turtle species, or BIAs associated with regionally significant marine reptile species are listed in Table 4-8 and Table 4-9 respectively.

For the threatened and/or migratory species with habitat critical to the survival of a species, or BIAs within, or within close proximity to, the OA or Sound EMBA (i.e. EMBAs associated with planned activities), additional information has been provided in the following subsections.

Table 4-7: Presence of threatened and/or migratory reptiles

Common name (EPBC protected status)	OA	Sound EMBA	Hydrocarbon Ecological and Social EMBAs
Turtles			
Flatback Turtle (*Vulnerable, Migratory)*	✓	✓	✓
Green Turtle (*Vulnerable, Migratory)*	✓	✓	✓

Common name (EPBC protected status)	OA	Sound EMBA	Hydrocarbon Ecological and Social EMBAs
Hawksbill Turtle (*Vulnerable, Migratory)*	✓	✓	✓
Leatherback Turtle *(Endangered, Migratory)*	✓	✓	✓
Loggerhead Turtle (*Endangered, Migratory)*	✓	✓	✓
Seasnakes			
Leaf-scaled Seasnake (*Critically Endangered*)	✓	✓	✓
Short-nosed Seasnake (*Critically Endangered*)	✓	✓	✓

Table 4-8: Habitat critical to the survival of marine turtles

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

Table 4-9: Presence of BIAs for reptiles

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

4.3.3.2.1 Flatback Turtle

The Montebello Islands and Barrow Island support 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 internesting buffer around the Montebello Islands (Ref. 58). Both the internesting habitat critical to the survival of the species and the internesting buffer BIA overlap with the OA and Sound EMBA.

During internesting, turtles remain close to the nesting beach or rookery (Ref. 58). The 60 km internesting buffer defined within the *Recovery Plan for Marine Turtles in Australia* (Ref. 58) is based primarily on the movements of tagged internesting Flatback Turtles in WA (Ref. 20). The study tracked 56 turtles from four different rookeries, which demonstrated varying internesting 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. 20). There is no evidence to suggest that Flatback Turtles move to deep offshore waters during internesting periods.

A habitat suitability modelling study for internesting Flatback Turtles in the NWS region of WA (Ref. 64) was conducted to identify areas of suitable Flatback Turtle internesting 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 internesting Flatback Turtles from all rookeries remained within water depths of <44 m, with a mean depth of <10 m (Ref. 64). Results also showed internesting 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 internesting habitat as water depths of 0–16 m within 5–10 km of the coast. Unsuitable Flatback Turtle internesting habitat was defined as waters >25 m deep and >27 km from the coast (Ref. 64). The OA occurs in water depths of ~50–1,250 m, and is >25 km from nearest coast (northern Montebello Islands), and as such is unlikely to provide habitat suitable for internesting Flatback Turtles.

Consultation undertaken with the lead author of the aforementioned studies (Ref. 20; Ref. 64) as part of the Woodside North-west Australia 4D Marine Seismic Survey Environment Plan (Ref. 21) indicates that the Wheatstone 4D MSS OA would also not support suitable internesting habitat:

“…the location… [is] highly unlikely to host internesting Flatback Turtles from the Montebellos and do not represent important internesting habitat. Flatback turtles are known to spend their internesting 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. 22) 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.

Other previous studies (e.g., Ref. 258; Ref. 259; Ref. 260) have also presented findings that internesting behaviour was only observed in water depths of <40 m. One of these studies (Ref. 260) further indicates internesting Flatback Turtles have relatively shallow dives, with 85% of the time during spent in ≤20 m water depth, of which most was spent in 5–10 m (27±2.7%) and 10–15 m (22.3±3.5%) water depths.

The OA is located in water depths of greater than 50 m, and the OA is >25 km from the Montebello Islands, which is in deeper waters and further offshore than internesting behaviours were observed in any of the previous studies (Ref. 20; Ref. 64; Ref. 22; Ref. 258; Ref. 259; Ref. 260); therefore, it is considered highly unlikely that internesting Flatback Turtles will occur within the OA.

4.3.3.2.2 Green Turtle

The Montebello Islands and Barrow Island support Green Turtle nesting, occurring from November to March. The Montebello Islands are identified as nesting habitat critical to the survival of the species, as is the 20 km internesting buffer around the Montebello Islands (Ref. 58).

Green Turtles are the most common marine turtle breeding in the NWMR (Ref. 71). Locations of key nesting beaches for the include the Montebello Islands, west coast of Barrow Island, Muiron Islands, North West Cape, and Dampier Archipelago. The nesting period for the NWS stock is expected to begin in November, peak in January-February, and end in April (Ref. 58).

During internesting, turtles remain close to the nesting beach or rookery (Ref. 58). Analysis of satellite tracking data for Barrow Island Green Turtles suggests internesting habitat occurs throughout the rocky intertidal and subtidal platforms common on the west coast, around to the north-eastern beaches and waters (Ref. 267; Ref. 314). Satellite tracking data has shown that during nesting periods, female Green Turtles typically internest in shallow, nearshore waters between 0–10 m deep (Ref. 314) and remain <5 km from nesting beaches on Barrow Island, Varanus Island, and Rosemary Island (Ref. 314), and within 10 km of nesting beaches on the Lacepede Islands (Ref. 315). These conclusions for Green Turtles internesting are also supported by other studies that suggest internesting grounds are located close to nesting beaches, in 10–18 m of water (Ref. 316; Ref. 317; Ref. 318, Ref. 319).

Satellite tracking of post-nesting female Green Turtles has shown that Green Turtles nesting on Barrow Island and Sandy Island (Scott Reef, Western Australia) feed between 200 km and 1,000 km from their nesting beaches (Ref. 314). Following nesting at Barrow Island, Green Turtles that were tracked migrating to foraging grounds extending from Legendre Island in the Dampier Archipelago to waters in the southern Kimberley (Ref. 314).

The OA is located in water depths of greater than 50 m, and the OA is >25 km from the Montebello Islands, which is in deeper waters and further offshore than internesting behaviours were observed in any of the previous studies for Green Turtles; therefore, it is considered highly unlikely that internesting Green Turtles will occur within the OA.

4.3.3.2.3 Hawksbill Turtle

The Montebello Islands and Lowendal Islands are identified as nesting habitat critical to the survival of the species, as is the 20 km internesting buffer around the Islands (Ref. 58).

The Western Australia Hawksbill Turtle stock is one of the three stocks within Australia (Ref. 58). Most of the nesting for this stock is located in the Pilbara (Ref. 58). The most significant breeding areas of the species within the NWMR include Rosemary Island in the Dampier Archipelago, Varanus Island in the Lowendal Islands group, Barrow Island, and some islands in the Montebello group (Ref. 71). Hawksbill Turtles are expected to be present within these areas between October and February (Ref. 58). The estimated size of the reproductive population of WA stock is small (Ref. 362). For example, it has been estimated as an overall reproductive population at Barrow Island of 100, an additional 1,000 in the Lowendal Islands, and 13,00 in the Montebello Islands (Ref. 362).

Monitoring of Barrow Island Hawksbill Turtle nesting has found that nesting activity is more temporally and spatially diffuse than Flatback and Green turtles (Ref. 362). Whiting (Ref. 313) provided seasonality specific nesting data for Rosemary Island, and this study found that Hawksbill Turtles have a much earlier peak (October/November) compared to Flatback Turtles (December/January peak).

During internesting turtles remain close to the nesting beach or rookery (Ref. 58). Information on Hawksbill Turtles nesting on Varanus and Rosemary Islands suggests females remain within several (less than ten) kilometres of their nesting beaches on Varanus Island, and within 1 km of nesting beaches on Rosemary Island (Ref. 314).

The OA is located in water depths of greater than 50 m, and the OA is >25 km from the Montebello Islands, which is in deeper waters and further offshore than internesting behaviours were observed in any of the previous studies for Hawksbill Turtles; therefore, it is considered highly unlikely that internesting Hawksbill Turtles will occur within the OA.

4.3.3.3 Fishes, including sharks and rays

Based on searches of the online PMST (Ref. 11; appendix b), the threatened and/or migratory fish species shown in Table 4-10 may be present within the EMBA. The full list of marine species identified from the PMST is provided in appendix b. BIAs associated with regionally significant fish species are listed in Table 4-11.

For the threatened and/or migratory species with BIAs within, or within close proximity to, the OA and Sound EMBA (i.e. EMBAs associated with planned activities), additional information has been provided in the following subsections.

Table 4-10: Presence of threatened and/or migratory fishes, including sharks and rays

Common name (EPBC protected status)	OA	Sound EMBA	Hydrocarbon Ecological and Social EMBAs
Sawfish			
Dwarf Sawfish (*Vulnerable, Migratory)*	✓	✓	✓
Freshwater Sawfish (*Vulnerable, Migratory)*	✓	✓	✓
Green Sawfish (*Vulnerable, Migratory)*	✓	✓	✓
Narrow Sawfish (*Migratory*)	✓	✓	✓
Ray			
Giant Manta Ray (*Migratory*)	✓	✓	✓
Reef Manta Ray (*Migratory*)	✓	✓	✓
Shark			
Grey Nurse Shark (west coast population) (*Vulnerable*)	✓	✓	✓
Longfin Mako (*Migratory*)	✓	✓	✓
Oceanic Whitetip Shark (*Migratory*)	✓	✓	✓
Porbeagle (*Migratory*)			✓
Scalloped Hammerhead (*Conservation Dependent)*	✓	✓	✓
Shortfin Mako (*Migratory*)	✓	✓	✓
Whale Shark (*Vulnerable, Migratory*)	✓	✓	✓

Common name (EPBC protected status)	OA	Sound EMBA	Hydrocarbon Ecological and Social EMBAs
White Shark (*Vulnerable, Migratory*)	✓	✓	✓
Fish			
Southern Bluefin Tuna (*Conservation Dependent)*	✓	✓	✓

Table 4-11: Presence of BIAs for fishes, including sharks and rays

Common name	BIA behaviour	Seasonal presence	OA	Sound EMBA	Hydrocarbon Ecological and Social EMBAs
Whale Shark	Foraging	Spring	✓	✓	✓
	Foraging (high density prey)	April–June, Autumn			✓

4.3.3.3.1 Whale shark

The foraging BIA for Whale Sharks overlaps with both the OA and Sound EMBA. 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. 60).

Whale Sharks have a global distribution in tropical and warm temperate waters, including through Australian waters (mainly Northern Territory, Queensland and northern WA) (Ref. 23; Ref. 60). Within Australia, Whale Sharks form seasonal aggregations at Ningaloo Reef (March to July), Christmas Island (December to January), and in the Coral Sea (November to December) (Ref. 60). Ningaloo Reef is considered the main known seasonal aggregation area (Ref. 70). Whale Sharks aggregate off Ningaloo Reef between March and July each year to feed (Ref. 23; Ref. 24). Their presence off Ningaloo Reef has been linked to coral mass spawning timing (Ref. 23). 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. 23). 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. 25):

- north-west, into the Indian Ocean
- directly north, towards Sumatra and Java
- north-west, passing through the 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 Wheatstone 4D MSS (mid-December to mid-April).

4.3.3.3.2 Continental slope demersal fish communities

The OA and Sound EMBA overlap with small areas of the Continental Slope Demersal Fish Communities key ecological feature (KEF) (Section 4.3.6.1). The KEF supports two distinct fish communities, one associated with the upper slope (225–500 m depth), and the other with the mid-slope (750–1,000 m depth) (Ref. 26). The continental slope between North West Cape and the Montebello Trough display a high degree of endemism, supporting more than 500 fish species, of which up to 76 are endemic (Ref. 26). 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 (Ref. 26).

4.3.3.4 Seabirds and shorebirds

Based on searches of the online PMST (Ref. 11; appendix b), the threatened and/or migratory seabird and shorebird species shown in Table 4-12 may be present within the EMBA. The full list of marine species identified from the PMST is provided in appendix b. BIAs associated with regionally significant seabirds and shorebirds are listed in Table 4-13.

For the threatened and/or migratory species with BIAs within, or within close proximity to, the OA (i.e. EMBAs associated with planned activities), additional information has been provided in the following subsections.

Table 4-12: Presence of threatened and/or migratory seabirds and shorebirds

Common name (EPBC protected status)	OA	Hydrocarbon Ecological and Social EMBAs
Asian Dowitcher (*Migratory*)		✓
Australian Fairy Tern (*Vulnerable*)	✓	✓
Australian Painted Snipe (*Endangered*)		✓
Bar-tailed Godwit (*Migratory*)		✓
Bridled Tern (*Migratory*)		✓
Campbell Albatross (*Vulnerable, Migratory*)		✓
Caspian Tern (*Migratory*)		✓
Christmas Island White-tailed Tropicbird (*Endangered*)	✓	✓
Common Greenshank (*Migratory*)		✓
Common Noddy (*Migratory*)	✓	✓
Common Sandpiper (*Migratory*)		✓
Curlew Sandpiper (*Critically Endangered*, *Migratory*)	✓	✓

Common name (EPBC protected status)	OA	Hydrocarbon Ecological and Social EMBAs
Eastern Curlew (*Critically Endangered*, *Migratory*)	✓	✓
Flesh-footed Shearwater (*Migratory*)		✓
Fork-tailed Swift (*Migratory*)		✓
Great Frigatebird (*Migratory*)	✓	✓
Greater Crested Tern (*Migratory*)		✓
Greater Sand Plover (*Vulnerable, Migratory*)		✓
Grey Wagtail (*Migratory*)		✓
Indian Yellow-nosed Albatross (*Vulnerable, Migratory*)		✓
Lesser Frigatebird (*Migratory*)	✓	✓
Little Tern (*Migratory*)		✓
Northern Siberian Bar-tailed Godwit (*Critically Endangered*)		✓
Oriental Plover (*Migratory*)		✓
Oriental Pratincole (*Migratory*)		✓
Osprey (*Migratory*)		✓
Pectoral Sandpiper (*Migratory*)	✓	✓
Red Goshawk (*Vulnerable*)		✓
Red Knot (*Endangered*, *Migratory*)	✓	✓
Roseate Tern (*Migratory*)		✓
Sharp-tailed Sandpiper (*Migratory*)	✓	✓
Soft-plumaged Petrel (*Vulnerable*)		✓
Southern Giant-Petrel (*Endangered*, *Migratory*)	✓	✓
Streaked Shearwater (*Migratory*)	✓	✓
Wedge-tailed Shearwater (*Migratory*)		✓
White-tailed Tropicbird (*Migratory*)	✓	✓

Table 4-13: Presence of BIAs for seabirds and shorebirds

Common name	BIA Behaviour	Seasonal Presence	OA	Hydrocarbon Ecological and Social EMBAs
Fairy Tern	Breeding	July to late September		✓
Lesser Crested Tern	Breeding	March to June		✓
Roseate Tern	Breeding	Mid March to July		✓

Common name	BIA Behaviour	Seasonal Presence	OA	Hydrocarbon Ecological and Social EMBAs
Wedge-tailed Shearwater	Breeding	Mid August to April (Pilbara) or mid May (Shark Bay)	✓	✓

4.3.3.4.1 Wedge-tailed shearwater

Behaviours used to define biologically important areas for seabirds in Commonwealth marine areas include breeding with a foraging buffer, and roosting (Ref. 261). The Wedge-tailed Shearwater has a ‘breeding with a foraging buffer’ BIA that intersects with the OA (Table 4-13). The BIAs for this species are buffers around islands that this species is known to nest on. Bird species may forage in the waters surrounding the islands during nesting seasons. The Wedge-tailed Shearwater ‘foraging in high numbers BIA’ is much further south (>650 km from the OA), near Carnarvon.

Wedge-tailed Shearwaters are a pelagic, migratory visitor to WA; estimates indicate more than one million shearwaters migrate to the Pilbara islands each year (Ref. 262); out of an estimated global population of five million (Ref. 263). The Wedge-tailed Shearwaters typically begin arriving at their WA colonies around August each year and will excavate burrows on vegetated islands for nesting; peak egg laying typically occurs during November; and they will typically leave nests in early- April to early-May and travel north to the Indian Ocean (Ref. 264; Ref. 265). The departure (early-April to early-May) of Wedge-tailed Shearwaters from WA may overlap with the timing of the Wheatstone 4D MSS (mid-December to mid-April).

Known breeding locations in the North-west Marine Region include Forestier Island (Sable Island), Bedout Island, Dampier Archipelago, Passage Island, Lowendal Island, islands off Barrow Island (Mushroom, Double and Boodie islands), islands in the Onslow area (including Airlie, Bessieres, Serrurier, North and South Muiron and Locker islands), islands in Freycinet Estuary, and south Shark Bay (Slope, Friday, Lefebre, Charlie, Freycinet, Double and Baudin islands) (Ref. 263).

One of the closest colonies to the OA is Double Island (south of Barrow Island). Baseline monitoring (pre-construction of the Gorgon Gas Development) recorded ~20–50 Wedge-tailed Shearwater nesting burrows on North Double Island and ~300 on South Double Island (Ref. 266; Ref. 269). CAPL (Ref. 267; Ref. 269) provided an estimate of 500 burrows over a 2 ha portion of the north-eastern corner of South Double Island, supporting 5,000–10,000 pairs of Wedge-tailed Shearwaters.

This species forages relatively close to breeding islands and its diet consists of squid, fish, and crustaceans (Ref. 263). However, more recent studies have indicated bimodal foraging. A study on foraging behaviour of the Wedge-tailed Shearwaters during the 2018 nesting season on the Muiron Islands showed a bimodal foraging strategy that incorporated both short (<4 days) and long (>7 day) trips (Ref. 265). The foraging trips of the Wedge-tailed Shearwaters from the Muiron Islands were recorded over a large area, extending from the Cape Range Canyon to the Indonesian Archipelago; and a consistent pattern of foraging near seamounts was observed (Ref. 265). It is noted that this same area is part of the extent used by the Wedge-tailed Shearwaters from both Pelsaert and Houtman Abrolhos islands) (Ref. 268; Ref. 265). The use of a bimodal foraging strategy suggests that prey availability close to the colony (i.e., areas that would be utilised on short trips) are inadequate for the large numbers of breeding shearwaters (Ref. 265).

4.3.3.5 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 4-14.

Table 4-14: Seasonal presence of environmental sensitivities within the vicinity of the OA

Species	January	February	March	April	May	June	July	August	September	October	November	December
4D MSS vessel operations^												
4D MSS acquisition^												
Pygmy Blue Whale - northern migration (Montebello region)												
Pygmy Blue Whale - southern migration (Montebello region)												
Humpback Whale migration												
Flatback Turtle internesting (nesting at Montebello Islands)												
Whale Shark- foraging/aggregation near Ningaloo												
Whale Shark - foraging BIA												
Wedge-tailed Shearwater (foraging)												
Wedge-tailed Shearwater (migrating)												
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.

^ Survey schedule allows for vessel operations mid-December to mid-April; acquisition period January to mid-April (Section 3.1.3)

4.3.4 Marine environmental quality

The term ‘environmental quality’ refers to the level of contaminants, or changes to the physical or chemical properties relative to a natural state (Ref. 310).

4.3.4.1 Water quality

Marine water quality within the EMBA is expected to be representative of the typically high-water quality found in offshore waters.

The NWS is characterised by a relatively clear water column; however, these waters sometimes have naturally higher levels of turbidity as a result of local current, tidal, or wave induced resuspension of fine sediments or seasonal fluvial inputs (Ref. 311 Ref. 344). In the waters off the east coast of Barrow Island, turbidity and concentrations of suspended sediments were generally low (<5 mg/L) and indicative of clear water environments (Ref. 344).

The nearshore waters on the east coast of Barrow Island are generally oligotrophic, with temporal fluctuations in nutrients (Ref. 344; Ref. 345). Nutrient concentrations were generally below the ANZG default trigger values (nutrient enrichment) for tropical Australia, with occasional fluctuations of ammonia, nitrite+nitrate, and orthophosphate well above guideline values (Ref. 344; Ref. 345).

Previous water quality data indicated that the coastal waters of the NWS (based on sampling from around the Dampier Archipelago) generally have very low levels of anthropogenic contamination (Ref. 312) The Wenziker et al (Ref. 312) study found no detectable levels of the sampled organic chemicals, and metals were below ANZG guidelines in the waters of the Dampier Archipelago. However, natural oil seeps are known to occur on the NWS (Ref. 311). Pre-construction water quality sampling off the east coast of Barrow Island showed that concentrations of metals were typically consistently below the ANZG guideline trigger values for 99% species protection (Ref. 344).

It is expected that these low levels of contamination would continue throughout the EMBA (unless within the immediate vicinity of an offshore point source).

4.3.4.2 Sediment quality

Marine sediment quality within the EMBA is expected to be representative of the typically high-sediment quality found in offshore waters.

Previous sediment quality data for Pilbara coastal waters (Ref. 312) indicated no detectable hydrocarbons, and with metal concentrations typically below the relevant ISQG-low guidelines.

Sediment quality sampling during 2014 and 2015 off the east coast of Barrow Island showed that except for nickel in one reference site sample, total metal concentrations of all sediment samples were below respective laboratory limits of reporting (LoR) and/or Interim Sediment Quality Guideline (ISQG)-Low trigger values (Ref. 344). Sediment tributyltin (TBT) concentrations were all below the laboratory LoR and the ISQG-Low trigger value, except for one sample in each of the 2014 and 2015 surveys (Ref. 344). Total petroleum hydrocarbons (TPH) and Total polycylic aromatic hydrocarbon (PAH) concentrations were all below the LoR in 2014 and at very low concentrations in 2015 samples (with a much lower LoR). Once normalised for (very low) organic carbon (OC) content, six samples from 2015 were above ISQG-Low concentrations for benzo(a)pyrene, but well below the ISQG-High concentrations (Ref. 344).

It is expected that these low levels of contamination would continue throughout the EMBA (unless within the immediate vicinity of an offshore point source).

4.3.4.3 Air quality

Air quality within the EMBA is expected to be representative of typically high quality found in offshore areas, away from industrialisation of point sources.

As part of the Ambient Air Quality Monitoring Program on Barrow Island, there were no recorded exceedances for nitrogen dioxide (NO_2), ozone (O_3), sulfur dioxide (SO_2), carbon monoxide (CO), hydrogen sulfide (H_2S), or aromatic hydrocarbons (benzene, toluene, ethylbenzene and xylene) against the relevant National Environmental Protection Measure (NEPM) standards (Ref. 346). There have been elevations of PM_{10} levels around facilities on Barrow Island, however these are likely associated with vehicle traffic and regional weather events (Ref. 346).

It is expected that these low levels of contamination would continue throughout the EMBA (unless within the immediate vicinity of an offshore point source).

4.3.5 People and communities

People and communities, and specifically their social, economic, and cultural features, are included within the definition of environment within the OPGGS(E)R. People and communities have been identified and described to the extent that they are directly affected, or are affected by, the existing physical and biological environments.

The NWMR supports a range of economic, social, and cultural activities. At present, industries within the NWMR include petroleum exploration and production, commercial and recreational fishing, tourism, ports, and shipping (Ref. 85). These uses of the NWMR make an important economic and social contribution to settlements along the coast (Ref. 85). Industry activities present with the EMBA are identified and described in Section 4.4.

4.3.5.1 Land use

The OA and Sound EMBA occur offshore and do not have any interface with the coast. The Hydrocarbon Ecological EMBA includes the Montebello Islands; and the Hydrocarbon Social EMBA includes the Montebello, Lowendal, Barrow (west coast), Boodie, Thevenard, and Flat islands, and small areas on west and northern coast of the North West Cape peninsula (Figure 4-1). Noting that the Hydrocarbon EMBAs typically only extend landward to the high-water mark (HWM).

The land uses that may be present within the Hydrocarbon EMBAs are summarised below.

The Montebello Islands are designated as a State Conservation Park (IUCN II) (Section 4.5.3), and are surrounded by the State Montebello Islands Marine Park (IUCN II) and Commonwealth Montebello Marine Park (IUCN VI) (Sections 4.5.1 and 4.5.2). The Conservation Park is gazetted to the HWM. Given the natural values of the islands and surrounding waters, recreational activities may occur. Shore-based fishing, beach walks, picnics and wildlife viewing are types of activities that may occur (Ref. 320). Camping is permitted on some of the islands (with some restrictions during turtle nesting season) (Ref. 320; Ref. 321).

Barrow and Boodie islands are designated State Nature Reserves (IUCN Ia) (Section 4.5.3), and are surrounded by the Barrow Island Marine Park (IUCN Ia) and Barrow Island Marine Management Area (IUCN VI) (Section 4.5.2). The Nature Reserves are gazetted to the low water mark (LWM). Access to Barrow, Double, Middle, and Boodie Islands is not encouraged due to numerous natural and man-made hazards, including the operation of an oilfield and the Gorgon Gas Project (Ref. 320). Camping is not permitted on any of these islands (Ref. 320).

The Pilbara inshore islands are a group of over 170 islands, islets, rocks and cays that lie between the bottom of Exmouth Gulf and the Regnard Islands near Cape Preston (Ref. 363). Lowendal, Thevenard, and Flat islands (i.e. part of the Hydrocarbon Social EMBA) are included in the Pilbara inshore islands. Lowendal Islands and Thevenard Island are both existing Nature Reserves (gazette to HWM) (Section 4.5.3). The Pilbara Inshore Islands Nature Reserves are known as important breeding and resting places for migratory and resident shorebirds, seabirds and marine turtles (Ref. 363). Fishing, beach walks and wildlife viewing are types of activities that may occur in the Pilbara inshore islands (Ref. 364). Camping is typically not permitted on Pilbara inshore islands[12]. Thevenard Island is shared tenure, there are two leases in addition to the nature reserve: a mining lease for the purpose of oil extraction with access restricted to authorised personnel only; and a resort comprising self-contained cabins (Ref. 322).

Cape Range National Park is located on the North West Cape, and is designated a State National Park (IUCN II) (Section 4.5.3); this area is also part of the Ningaloo Coast World Heritage Area (Section 4.6.1). The National Park is gazetted to the HWM. Given the natural and heritage values of Parks and surrounding waters, recreational activities may occur. Walk trails, wildlife viewing, camping, beachcombing, swimming, snorkelling, beach fishing are types of activities that may occur (Ref. 323).

A Native Title determination (WCD2019/016) extends over the Ningaloo area (Section 4.6.2). The determination area contains places of special significance, such as mythological and ceremonial sites and natural resources (Ref. 324).

There are no settlements located within the Hydrocarbon EMBAs.

4.3.5.2 Heritage

Heritage includes places, values, traditions, events, and experiences that capture where we have come from, where we are now, and gives context to where we are headed as a community (Ref. 325).

Where known heritage sites and/or artefacts are formally protected under specific heritage legislations, these are described within Section 4.6. The following sections summarise other known heritage values identified within the EMBA.

4.3.5.2.1 First Nations cultural activities, connections, and obligations

The land adjacent to the NWMR has been inhabited by First Nations people for at least 50,000 years, and they continue to use the NWMR and adjacent coastal resources with an ongoing connection to these areas (Ref. 85).

The term ‘country’ refers to more than just a geographical area, and includes values, places, resources, stories, and cultural obligations associated with that geographical area (Ref. 326). For First Nations peoples, the term ‘country’

[12] Camping is permitted on South Muiron Island from April to October and requires a permit (Ref. 389); this island is outside the EMBA for this EP.

includes both land and sea and the coastal areas that are connected with the traditional country of a group or clan. There are several coastal language groups or clans in northwest WA, including Thalanyji (associated with the Ashburton coastal plain, Exmouth Gulf, and surrounding areas). Based on engagement with First Nations groups, CAPL understands that Thalanyji (represented by the Buurabalayji Thalanyji Aboriginal Corporation RNTBC for native title rights and interests) and Mardudhunera and Yaburara people (represented by the Wirrawandi Aboriginal Corporation RNTBC for native title rights and interests) have connections to Barrow and/or Montebello Islands.

First Nations people in northwest WA continue to rely on coastal and marine environments and resources of the region for their cultural identity, health and wellbeing, and their domestic and commercial economies (Ref. 326). Their commitment to their sea country is demonstrated through their native title claims and their many initiatives to regain their role as managers of the cultural and natural values of northwest WA (Ref. 326).

First Nations peoples of northwest WA engage in a diverse range of marine resource use activities, including hunting, egg collecting, fishing and gathering shellfish. Activities also continue on lands and waters where they have ceremonial and spiritual connections (Ref. 326).

Consultation with First Nations groups in the Pilbara has identified that it is believed that the Dreamtime serpent which created the rivers and inland springs is now in its resting place off the Pilbara coast; and as such, if the sea is protected, then the serpent is also being protected. The Thalanyji people have also identified a cultural obligation to protect Ashburton Island (located ~30 km outside the Hydrocarbon Ecological EMBA, and ~16 km from closest shoreline extent of the Hydrocarbon Social EMBA).

4.3.5.2.2 European heritage

Early European exploration of the NWMR and adjacent coast occurred in the 1600s; however it was concluded at the time that resources and conditions were not appropriate for settlement (Ref. 85). British colonisation did not begin in the Pilbara until 1860s, with pastoralism as the first major industry, followed by small ports and service centers (Ref. 85). The pearling industry began in the late-1800s, and remains a significant contributor to the economy of northwest WA (Ref. 85). Similarly, small fishing fleets were common from the 1860s onwards, and the commercial fishing industry also remains a significant economic input for northwest WA, particularly from prawn and demersal finfish fisheries (Ref. 85). Petroleum discovery and development commenced from the 1950s, with both onshore and offshore discoveries (Ref. 85).

The marine and coastal industries that still exist and operate within the NWMR are further described in Section 4.4.

4.3.6 Commonwealth marine area

The Commonwealth marine area is a MNES under the EPBC Act, and a particular value and sensitivity under the OPGGS(E)R. The EMBA for this activity intersects with Commonwealth waters that are part of the NWMR.

The NWMR comprises the Commonwealth waters and seabed from the WA—Northern Territory border south to Kalbarri (Ref. 85). The NWMR is characterised by shallow-water tropical marine ecosystems with high species richness. Most of the region's species are tropical and are also found in other parts of the Indian and western Pacific oceans (Ref. 85). The region is a tropical carbonate margin that comprises an extensive area of shelf, slope, and abyssal plain/deep ocean floor, as well as complex areas of bathymetry such as plateau, terraces and major canyons (Ref. 298). The region experiences a tropical monsoonal climate towards the northern extent of the region, transitioning to tropical arid and subtropical arid within the central and southern areas of the region (Ref. 85).

Conservation values of the Commonwealth marine area include:

- protected species and/or their habitat (Section 4.3.3)
- protected places including Australian Marine Parks (Section 4.5.1) and heritage places (Section 4.6)
- KEFs (Section 4.3.6.1).

4.3.6.1 Key ecological features

KEFs are elements of the Commonwealth marine environment that are considered to be of regional importance for a region's biodiversity or its ecosystem function and integrity. KEFs are not MNES and have no legal status in their own right; however, they may be considered as components of the Commonwealth marine area.

KEFs meet one or more of these criteria (Ref. 327):

- a species, group of species, or a community with a regionally important ecological role (e.g. a predator, or prey that affects a large biomass or number of other marine species)
- a species, group of species, or a community that is nationally or regionally important for biodiversity
- an area or habitat that is nationally or regionally important for:
  - enhanced or high productivity (such as predictable upwellings—an upwelling occurs when cold nutrient-rich waters from the bottom of the ocean rise to the surface)
  - aggregations of marine life (such as feeding, resting, breeding or nursery areas)
  - biodiversity and endemism (species that only occur in a specific area)
- a unique sea floor feature, with known or presumed ecological properties of regional significance.

KEFs have been identified by the Australian Government on the basis of advice from scientists about the ecological processes and characteristics of the area (Ref. 327).

The presence of KEFs within the EMBA, and a description of the KEFs values, are shown in Table 4-15 and Figure 4-6. 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 KEFs

Key ecological feature	OA	Sound EMBA	Hydrocarbon Ecological and Social EMBAs
Ancient coastline at 125 m depth contour	✓	✓	✓
Parts of the ancient coastline, particularly where it exists as a rocky escarpment, are thought to provide biologically important habitats in areas otherwise dominated by soft sediments. The topographic complexity of these escarpments may also facilitate vertical mixing of the water column, providing relatively nutrient-rich local environments (Ref. 85). The ancient submerged coastline provides areas of hard substrate and therefore may provide sites for higher diversity and enhanced species richness relative to surrounding areas of predominantly soft sediment. Little is known about fauna associated with the hard substrate of the escarpment but it is likely to include sponges, corals, crinoids, molluscs, echinoderms and other benthic invertebrates representative of hard substrate fauna in the North West Shelf bioregion (Ref. 85). **Value:** Unique sea floor feature with ecological properties of regional significance.			
Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula			✓
The canyons are associated with upwelling as they channel deep water from the Cuvier Abyssal Plain up onto the slope. This nutrient-rich water interacts with the Leeuwin Current at the canyon heads. Aggregations of whale sharks, manta rays, sea snakes, sharks, large predatory fish and seabirds are known to occur in this area (Ref. 85). The canyons on the slope of the Cuvier Abyssal Plain and Cape Range Peninsula are connected to the Commonwealth waters adjacent to Ningaloo Reef and may also have connections to Exmouth Plateau. The narrow shelf width (about 10 km) near the canyons facilitates nutrient upwelling. Thus the canyons probably play a part in the enhanced productivity of the Ningaloo Reef system (Ref. 85). The canyons are also repositories for organic and inorganic particulate matter from the shelf and serve as conduits for its transfer from the surface and shelf to greater depths. The hard substrates of canyons provide habitat for deepwater snapper and other species (Ref. 300) **Value:** Unique sea floor features with ecological properties of regional significance.			
Commonwealth waters adjacent to Ningaloo Reef			✓
The Commonwealth waters adjacent to Ningaloo Reef are recognised for their biodiversity (aggregations of marine life) values, which apply to both the benthic and pelagic habitats within the feature. The Commonwealth waters adjacent to Ningaloo reef include Ningaloo Marine Park (Commonwealth waters) and encompass an area of 2,435 km^2. This feature lies adjacent to the Ningaloo Reef state water margin at the 3 nm limit. Ningaloo Reef is globally significant as the only extensive coral reef in the world that fringes the west coast of a continent. Upwellings associated with canyons on the adjacent slope and interactions between the Ningaloo and Leeuwin currents are thought to support the rich aggregations of large marine species present at Ningaloo Reef. Shelf waters and nutrient-rich upwellings on the seaward side support aggregations and migration pathways of whale sharks, manta rays, humpback whales, sea snakes, sharks, large predatory fish and seabirds (Ref. 328; Ref. 329; Ref. 330). Detrital input from phytoplankton production in surface waters and from higher-trophic consumers cycles back to the deeper waters of the shelf and slope (Ref. 300). Deepwater biodiversity includes fish, molluscs, sponges, soft corals and gorgonians. Some of these sponge and filter-feeding communities appear to be significantly different to those of the Dampier Archipelago and Abrolhos Islands, indicating that the Commonwealth waters of Ningaloo Marine Park have some particular areas of potentially high and unique sponge biodiversity (Ref. 331).			

Key ecological feature	OA	Sound EMBA	Hydrocarbon Ecological and Social EMBAs
Value: High productivity and aggregations of marine life.			
Continental slope demersal fish communities	✓	✓	✓
The diversity of demersal fish assemblages on the continental slope in the Timor Province, the Northwest Transition and the Northwest Province is high compared to elsewhere along the continental slope. The continental slope between North West Cape and the Montebello Trough has more than 500 fish species, 76 of which are endemic, which makes it the most diverse slope bioregion in Australia (Ref. 88). The demersal fish species occupy two distinct demersal community types associated with the upper slope (water depth of 225–500 m) and the mid slope (750–1,000 m). Bacteria and fauna present on the continental slope are the basis of the food web for demersal fish and higher-order consumers in this system (Ref. 85). **Value:** High levels of endemism.			
Exmouth Plateau			✓
The Exmouth Plateau is a regionally and nationally unique deep-sea plateau (water depths of 800-4,000 m) in tropical waters. The plateau is a very large topographic obstacle that may modify the flow of deep waters, generating internal tides and may contribute to upwelling of deeper water nutrients closer to the surface, thus serving an important ecological role (Ref. 85). The topography of the plateau (with valleys and channels), in addition to potentially constituting a range of benthic environments, may provide conduits for the movement of sediment and other material from the plateau surface through the deeper slope to the abyss. The Exmouth Plateau is generally an area of low habitat heterogeneity; however, it is likely to be an important area of biodiversity as it provides an extended area offshore for communities adapted to depths of around 1,000 m. Sediments on the plateau suggest that biological communities include scavengers, benthic filter feeders and epifauna (Ref. 85). Fauna in the pelagic waters above the plateau are likely to include small pelagic species and nekton (Ref. 300). **Value:** Unique sea floor feature with ecological properties of regional significance.			
Glomar Shoal			✓
Glomar Shoal is recognised because of their ecological functioning and integrity values (high productivity) and biodiversity values (aggregations of marine life), which apply to both its benthic and pelagic habitats. The Glomar Shoals are a submerged littoral feature located approximately 150 km north of Dampier on the Rowley shelf at depths of 33–77 metres (Ref. 304). The shoals consist of a high percentage of marine-derived sediments with high carbonate content and gravels of weathered coralline algae and shells (Ref. 332). The area’s higher concentrations of coarse material in comparison to surrounding areas are indicative of a high-energy environment subject to strong sea-floor currents (Ref. 304). Cyclones are also frequent in this area of the north-west and stimulate periodic bursts of productivity as a result of increased vertical mixing. While much of the biodiversity associated with the Glomar Shoals has not been studied, it is known to be an important area for a number of commercial and recreational fish species such as rankin cod, brown-striped snapper, red emperor, crimson snapper, bream and yellow-spotted triggerfish (Ref. 306). These species have recorded high catch rates associated with the Glomar Shoals, indicating that the shoals are likely to be an area of high productivity. **Value:** High productivity and aggregations of marine life.			

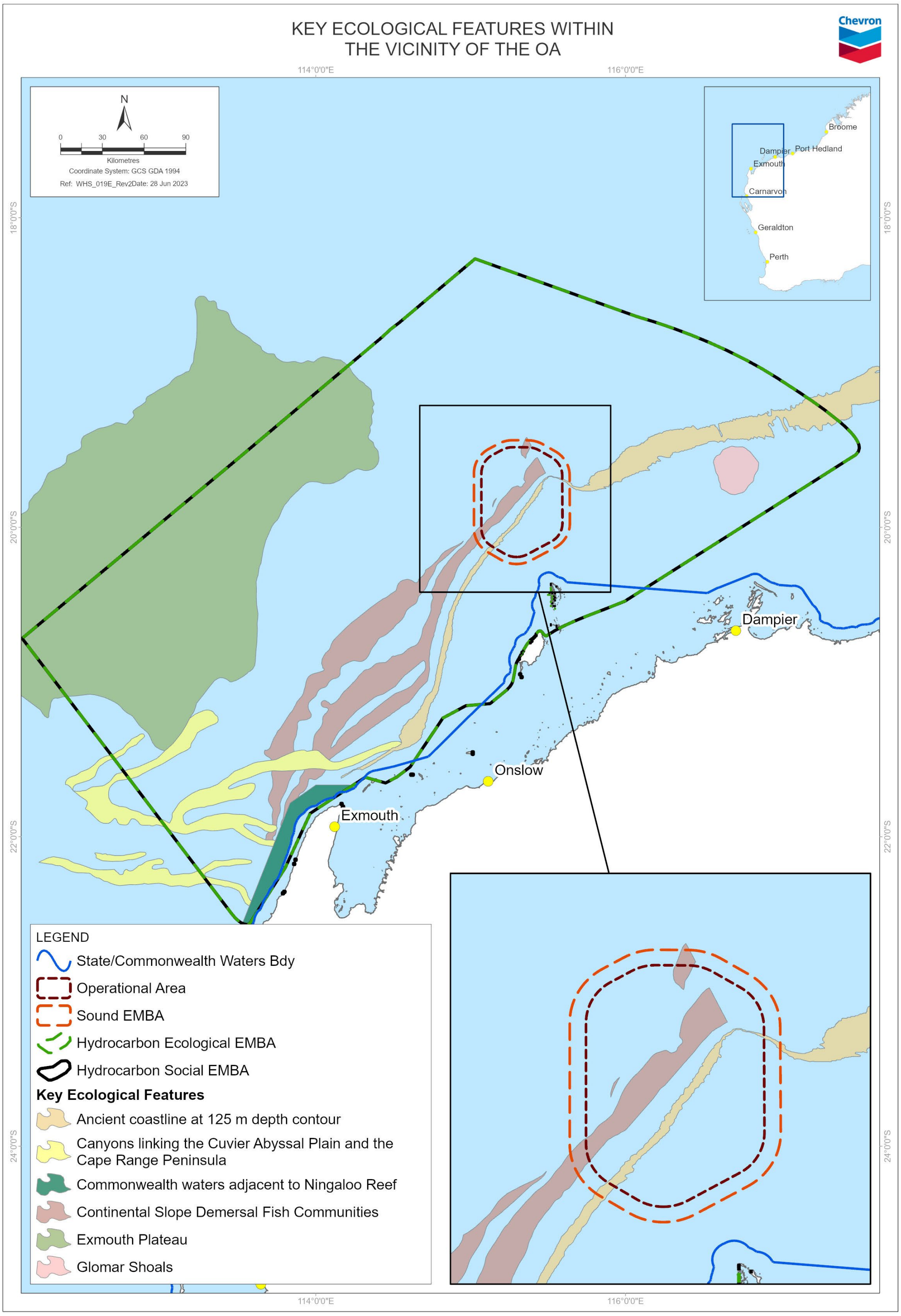


Figure 4-6: Key ecological features within the vicinity of the EMBA

4.3.7 Commonwealth land area

Commonwealth land[13] is a particular value and sensitivity under the OPGGS(E)R. Based on spatial review and searches of the online PMST (Ref. 11; appendix b) there is no Commonwealth land within the EMBA. However, there are designated training areas over marine waters associated with Department of Defence facilities (that occur on Commonwealth land) that extend into the Hydrocarbon EMBAs.

4.4 Natural and physical resources

Natural and physical resources are described as substances occurring in nature that can be exploited for economic gain, and may include such resources as fishing stocks, petroleum reservoirs, or values of the Commonwealth marine area. Marine and coastal industries have been developed based on natural and physical resources, and where these industries may interest with the EMBA they have been identified and described in the following sections.

4.4.1 Commercial fisheries

4.4.1.1 Commonwealth-managed fisheries

The Commonwealth-managed commercial fisheries with fishery management areas that intersect the EMBA, and that have fishing effort recorded during2015–2020 (Ref. 29) are listed in Table 4-16.

For the fisheries with fishing effort recorded within the OA or Sound EMBA (i.e. EMBAs associated with planned activities), additional information has been provided below.

Table 4-16: Presence of recent (2015-2020) fishing effort recorded within Commonwealth-managed commercial fisheries

Fishery	OA	Sound EMBA	Hydrocarbon Ecological and Social EMBAs
North West Slope Trawl Fishery	✓	✓	✓
Western Deepwater Trawl			✓

The only fishery with fishing effort recorded within the OA and Sound EMBA was the North West Slope Trawl Fishery (NWSTF) (Table 4-16, Figure 4-7). Relative fishing intensity data is not available for this fishery due to low vessel numbers and confidentiality.

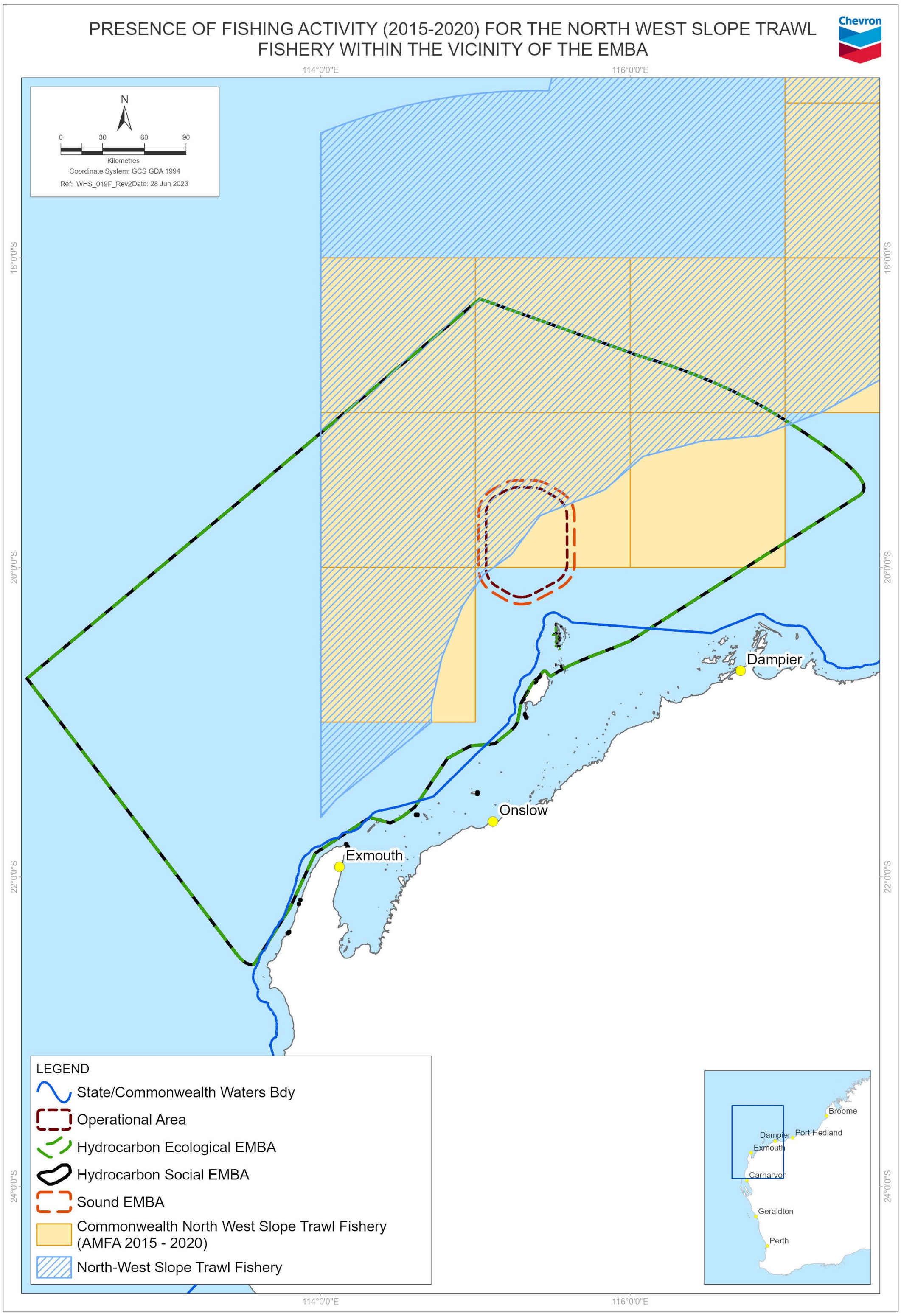
The NWSTF uses bottom (or demersal) trawl methods to target deep-water prawn and scampi that live on or near the seafloor, typically in depths of 350–600 m. The primary species landed in the NWSTF is the Australian scampi (*Metanephrops australiensis*), with smaller quantities of velvet scampi *(M. velutinus)* and Boschma's scampi (*M. boschmai*). A quantity of prawns is also harvested each

[13] Commonwealth land includes land owned or leased by the Commonwealth or a Commonwealth agency, land in the Jervis Bay Territory, land in the Christmas Island, Ashmore and Cartier Islands, Coral Sea Islands, Cocos (Keeling) Islands, Australian Antarctic territory and Heard and McDonald Islands external territories, and any other area of land that is included in a Commonwealth reserve.

season, and squids are becoming an increasingly significant component of the catch. Mixed snappers (*Lutjanidae*) and redspot emperor (*Lethrinus lentjan*) have historically been an important component of the NWSTF catch. Fishing for scampi occurs over soft, muddy sediments or sandy habitats, using demersal trawl gear on the continental slope.

Fishing efforts decreased from 306 days, 5,903 trawl-hours and seven fishing permits in the 2019–20 fishing season to 233 days, 4,420 trawl-hours and six fishing permits in 2020–21 season. Four vessels operated in the 2020–21 season. Scampi stock are classified as not overfished and not subject to overfishing.

The Southern Bluefin Tuna Fishery is active within waters in the Great Australian Bight and south-eastern Australia (i.e. not within the EMBA); however, the spawning grounds for Southern Bluefin Tuna are located in the north-east Indian Ocean (Ref. 29). This indicative spawning area extends into the EMBA (including 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 4-7: North West Slope Trawl Fishery—fishery management area, and records of fishing activity (based on 60 nm graticular reporting blocks) for 2015-2020, within the vicinity of the EMBA

4.4.1.2 State-managed fisheries

The State-managed commercial fisheries with fishery management areas that intersect the EMBA, and that have fishing effort recorded over a 10-year period (2012–2021) (Ref. 27) are listed in Table 4-17.

For the fisheries with fishing effort recorded within the OA or Sound EMBA (i.e. EMBAs associated with planned activities), additional information has been provided below.

Table 4-17: Presence of fishing effort recorded during 2012–2021 within State-managed commercial fisheries

Fishery	OA	Sound EMBA	Hydrocarbon Ecological and Social EMBAs
North Coast Bioregion			
Mackerel Managed Fishery	✓	✓	✓
Nickol Bay Prawn Managed Fishery			✓
Pilbara Crab Managed Fishery			✓
Pilbara Fish Trawl (Interim) Managed Fishery			✓
Pilbara Line Fishery	✓	✓	✓
Pilbara Trap Managed Fishery	✓	✓	✓
West Australian Sea Cucumber (Beche-De-Mer) Fishery			✓
Gascoyne Bioregion			
West Coast Deep Sea Crustacean Fishery			✓
Statewide			
Marine Aquarium Fish Managed Fishery			✓
Specimen Shell Managed Fishery	✓	✓	✓

Four fisheries were identified with activity within the vicinity of the OA; these are shown in Figure 4-8 to Figure 4-11. None of these fisheries operated more than three vessels within the OA.

The Mackerel Managed Fishery utilises near-surface trolling or jig fishing methods, with vessels primarily active during May to November (Ref. 28), and with the bulk of the catch typically taken north of the OA within Kimberley waters (Ref. 29). The fishery targets are Spanish Mackerel (*Scomberomorus commerson*), Grey Mackerel (*S. semifasciatus*) and other species from the genus *Scomberomorus*. The fishery extends from the West Coast Bioregion to the WA/NT border. There are three managed fishing areas and during the 2020 season only 16 boats operated in these areas. The Pilbara catch is often below the tolerance range, and the Gascoyne Coast / West Coast Bioregions catch have been below the tolerance range for almost all years since 2006 (Ref. 333). The total catch of the Fishery in 2020/2021 was 246–430 t

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 (typically May- September). The Pilbara Line Managed Fishery catch is made up around 45-50 different fish species. The main species targeted by the fisheries are Bluespotted Emperor (*Lethrinus punctulatus*), Red Emperor (*Lutjanus sebae*) and Rankin Cod (*Epinephelus multinotatus)*, as well as some deeper offshore species such as Ruby Snapper and Eightbar Grouper. The total catch of the fishery in 2020/2021 was 167 t, increasing by ~6% of the total catch during the last year (Ref. 333).

The Pilbara Trap Fishery (trap methods) is managed through area closures and effort allocations (Ref. 29). The main species targeted by the Pilbara Trap Managed Fishery are Bluespotted Emperor, Red Emperor, and Rankin Cod. The total catch of the fishery in 2020/2021 was 584 t, increasing by ~20% of the total catch by the Pilbara Demersal Scale Fishery (Ref. 333).

For the 2021 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 (20%) and line (6%) sectors (Ref. 333).

The Specimen Shell Managed Fishery encompasses the entire WA coastline, but effort is concentrated in areas adjacent to the population centres such as Broome, Exmouth, and Shark Bay. There are several closed areas where the fishery is not permitted to operate; these include various marine parks and aquatic reserves, such as Ningaloo Marine Park. The Specimen Shell Managed Fishery focuses on mollusc families that are most popular with shell collectors, such as cowries, cones, murexes, and volutes. The main methods are via hand collection by small groups of divers operating from small boats in shallow coastal waters (less than 30 m), by wading along coastal beaches below the HWM[14]. Total number of specimen shells collected in 2020 was 4,258 shells, across 206 species with a catch rate of ~11 shells per day (Ref. 333). Given the OA occurs in water depths of ~50–1,250 m, and is >25 km from the coast, the use of this area by this fishery is expected to be limited. This is supported by the records for fishing effort, which show that within the ten-year period (2012–2021), only two months (October 2014 and June 2016) recorded any presence within the graticular reporting blocks that intersect with the OA (Figure 4-11).

[14] In 2021, an exemption for the trial of remotely operated underwater vehicles (limited to one per licence) was also in place.

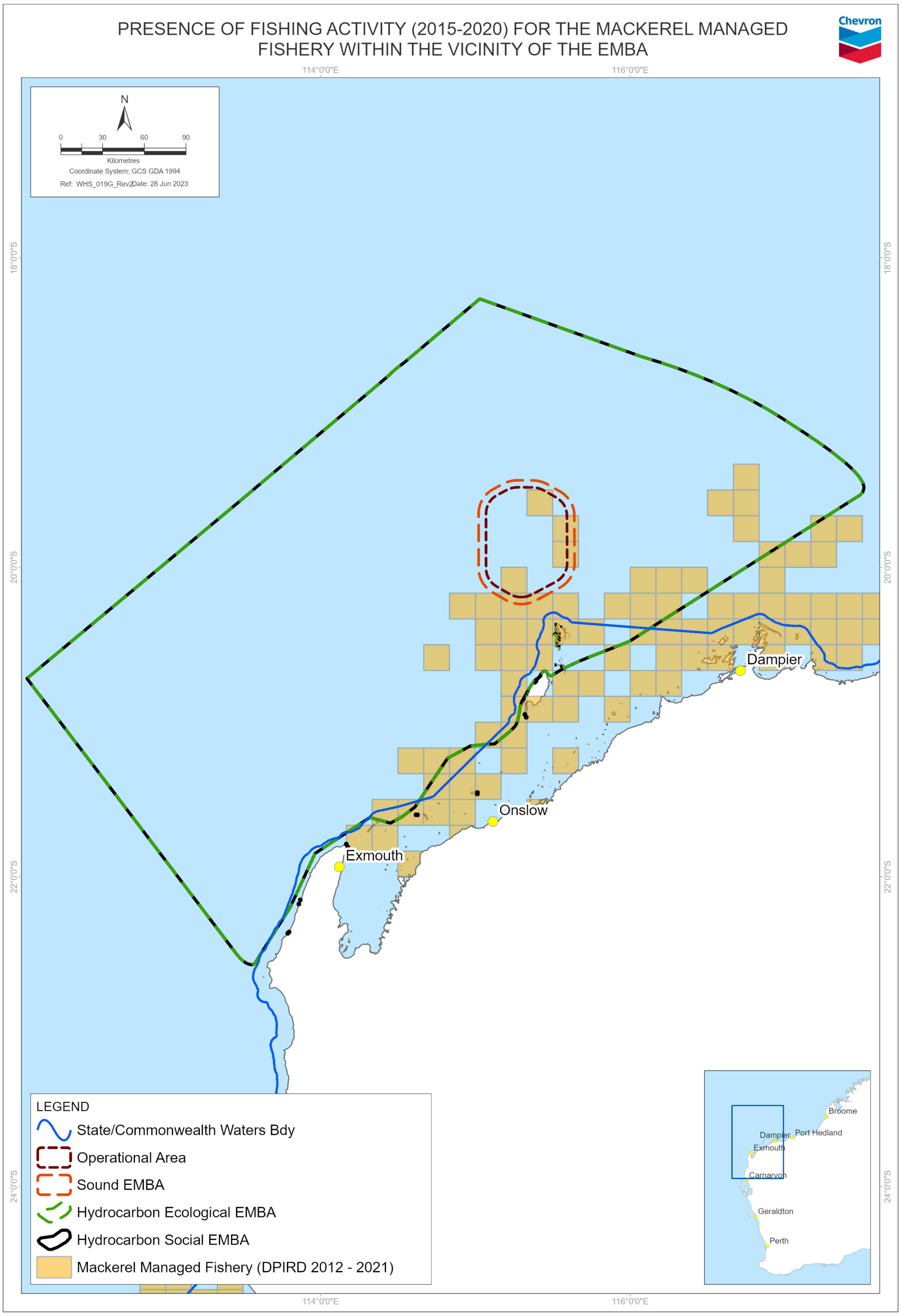


Figure 4-8: Mackerel Managed Fishery—recorded fishing effort (based on 10 nm graticular reporting blocks) for 2012–2021, within the vicinity of the EMBA

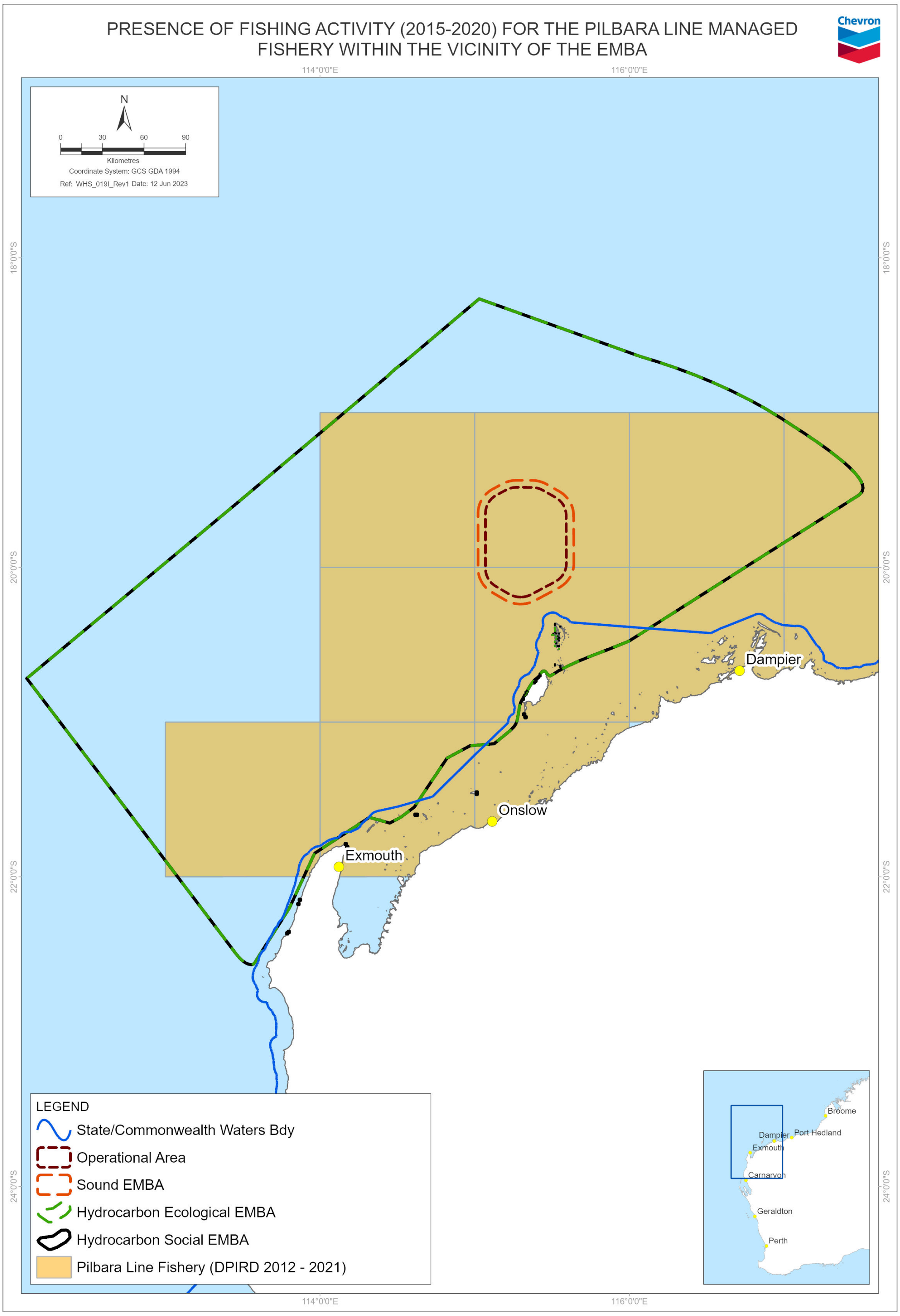


Figure 4-9: Pilbara Line Fishery—recorded fishing effort (based on 60 nm graiticular reporting blocks) for 2012–2021, within the vicinity of the EMBA

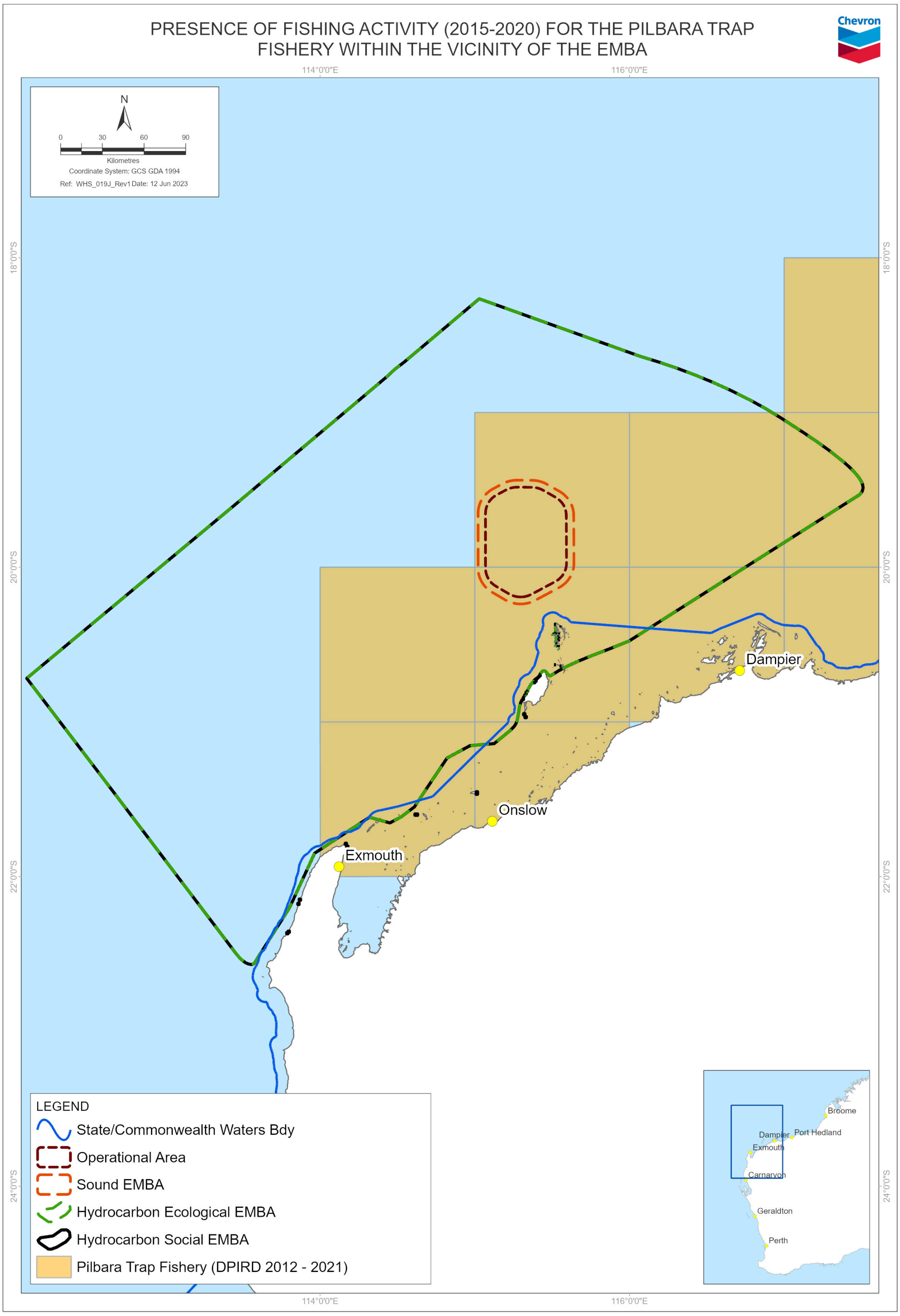


Figure 4-10: Pilbara Trap Managed Fishery—recorded fishing effort (based on 60 nm graiticular reporting blocks) for 2012–2021, within the vicinity of the EMBA

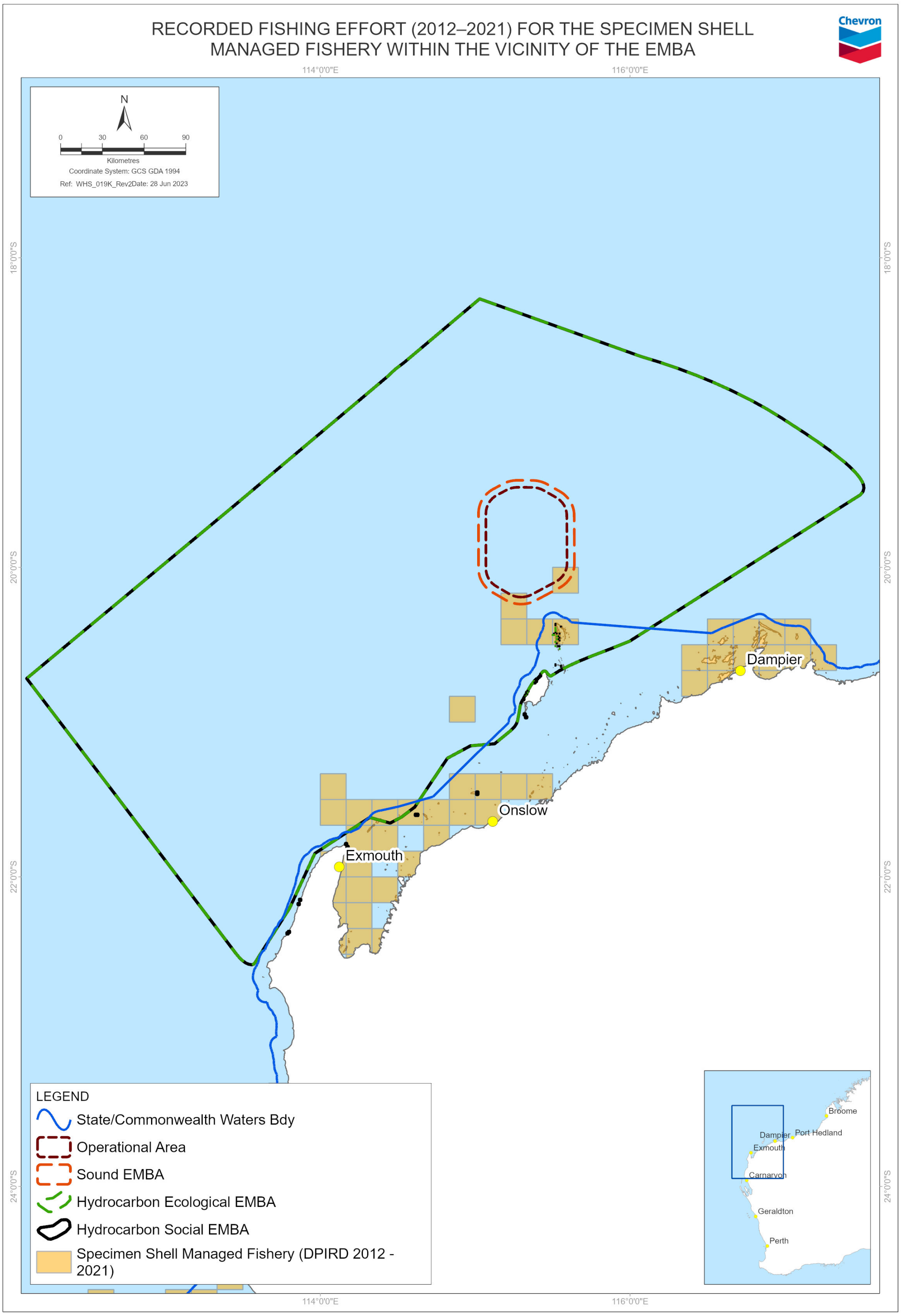


Figure 4-11: Specimen Shell Managed Fishery—recorded fishing effort (based on 10 nm graiticular reporting blocks) for 2012–2021, within the vicinity of the EMBA

4.4.1.3 Commercially targeted fish stocks

The NWMR 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 4-18.

Table 4-18: 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).	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. Goldband Snapper spawn throughout their range rather than aggregate at specific locations. Juveniles remain in offshore waters with the adult spawning biomass but are found in association with different habitat. Fish are estimated to reach maturity after approximately 4.6 years Stock status: Sustainable	October – May (extended peak spawning period)	Ref. 192 Ref. 204 Ref. 195 Ref. 196 Ref. 190 Ref. 206
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).	Ref. 192 Ref. 193 Ref. 203 Ref. 190 Ref. 206

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. 194 Ref. 192 Ref. 204 Ref. 197 Ref. 190 Ref. 206
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. 204 Ref. 203 Ref. 192 Ref. 190 Ref. 206
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. 202 Ref. 205 Ref. 192 Ref. 190

Species	Distribution and habitat	Biological stock range	Reproduction and recruitment	Spawning season	References
					Ref. 206
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. 198 Ref. 191 Ref. 199 Ref. 200 Ref. 201 Ref. 206

4.4.1.4 Pearling and aquaculture

Pearling and aquaculture operations in the northwest are typically restricted to inland and shallow coastal waters.

The OA and Sound EMBA occur offshore and do not have any interface with the coast or shallow coastal waters, and there is no overlap with any known licenced aquaculture or pearling operations.

The Hydrocarbon EMBAs do interface with some nearshore and coastal areas, including the Montebello Islands, the west coast of Barrow Island and Thevenard Island (Figure 4-1). There are known pearl farm leases in nearshore waters around Montebello Islands. There are no known aquaculture licences within the Hydrocarbon EMBAs.

4.4.2 Recreational fisheries

Recreational fishing is one of the most popular activities in WA with an estimated third of the population fishing recreationally (Ref. 334). The WA Department of Primary Industries and Regional Development (DPIRD) conducts state-wide recreational fishing surveys every two years, with the first survey completed in 2011. The survey collects information from more than 3,000 recreational fishers who record their catches in logbooks over a 12-month period with DPIRD also conducting interviews throughout the State and monitoring the number of boat launches and retrievals using cameras at various boat ramps.

The 2020–2021 survey report (Ref. 335) identified that most boat-based recreational fishing effort occurred in nearshore habitat (46% and 54% for North-Coast and Gascoyne Coast respectively), followed by inshore demersal habitats (32% and 39% for North Coast and Gascoyne Coast respectively). Most fishing effort was attributed to line fishing (87% and 91% for North-Coast and Gascoyne Coast respectively).

Tour Operator fishing effort recorded over a 10-year period (2012–2021) (Ref. 27) identified there were up to three vessels present within the OA and Sound EMBA; however there was no fish catch or release data associated with the 10 nm graticular reporting blocks that intersect these areas.

Some shore-based fishing may occur in the coastal areas within the Hydrocarbon EMBAs (Section 4.3.5).

4.4.3 Traditional fisheries

Customary fishing applies to person who has a traditional connection with the area being fished, and is fishing for personal, domestic, ceremonial, educational or non-commercial needs (Ref. 336). A Customary Fishing Policy has been incorporated into the *Fish Resources Management Act 1994* (WA), which allows for customary fishing by applicable persons to occur within a sustainable fisheries management framework. Customary fishing does not apply to other species of marine fauna (e.g. crocodile, turtle, or dugong).

Under amendments made in 2012 to the *Conservation and Land Management Act 1984* (WA) Aboriginal people can undertake customary activities which includes hunting (except in marine sanctuary zones or marine nature reserves) for dugong, turtle, or crocodiles in WA.

As described in Section 4.3.5.2.1, ongoing use of marine and coastal resources, including customary fishing, is expected to occur in NWMR and adjacent coastal waters. However, it is expected that much of this activity will occur within shallow coastal waters and therefore would not intersect with the OA or Sound EMBA. Where shore-based fishing is undertaken, this may intersect with the Hydrocarbon EMBAs.

The EMBA does not intersect with the MoU Box that allows for traditional Indonesian fishers within Australian waters. The MoU Box is managed via a bilateral agreement between Australian and Indonesian governments.

4.4.4 Commercial 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 4-12, 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 4-12). 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 comprises offshore support vessels for petroleum activities.

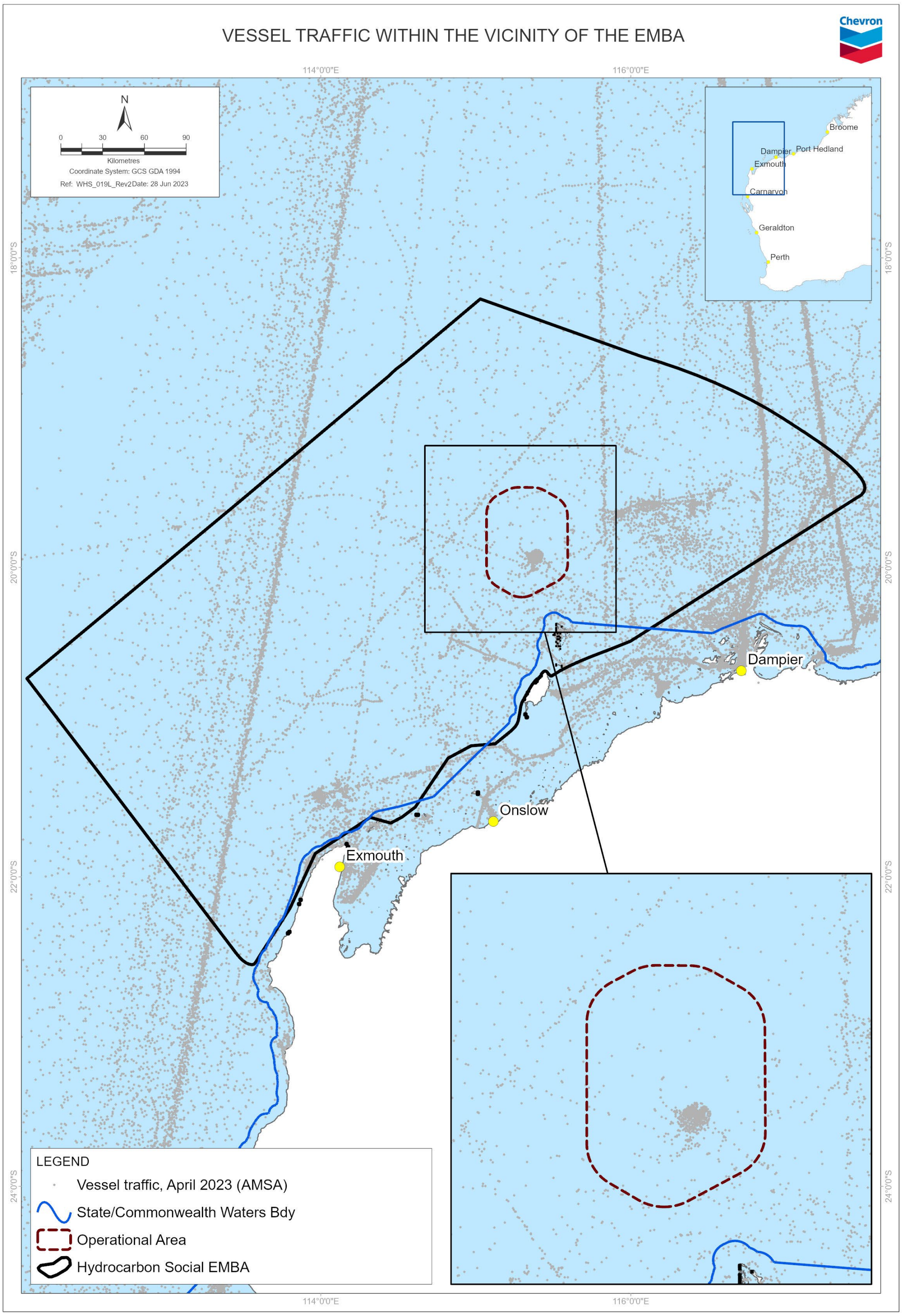


Figure 4-12: Vessel traffic within the vicinity of the OA

4.4.5 Tourism and recreation

Tourism is an important industry for WA, directly employing 56,300 people and indirectly employing a further 22,100 (Ref. 337). Charter fishing, diving, snorkelling, wildlife watching, and cruising are some of the commercial tourism activities in and adjacent to the NWMR (Ref. 85). With the exception of offshore charter fishing, most marine tourism activities occur in the shallower State waters (Ref. 85).

The OA and Sound EMBA occur offshore and do not have any interface with nearshore waters or the coast, and as such there is expected to be limited tourism and recreational activities within the OA and Sound EMBA (Section 4.4.2).

The Hydrocarbon EMBAs do interface with some nearshore and coastal areas, including Montebello and Barrow islands (Figure 4-1).Occasional recreational fishing may occur 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.

As described in Section 4.3.5.1, tourism and recreational activities may occur around the Montebello Islands. 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.

The Gascoyne and Pilbara regions are popular visitor destinations for both Australian and international tourists. The main marine nature-based tourist activities within the Gascoyne Region are concentrated around and within the Ningaloo Coast World Heritage property (~180 km southwest of the OA; Section 4.6). Activities undertaken include recreational fishing, snorkelling and scuba diving, wildlife watching and encounters (including Whale Sharks, Manta Rays, Humpback Whales and turtles) (Ref. 338), as well as beach access, surfing and paddling sports. Recreational fishing within the Pilbara region tends to be concentrated in State waters adjacent to population centres.

4.4.6 Other marine and coastal industries

Several other marine and coastal industries may be present within the EMBA (Table 4-19). There were no offshore renewable energy facilities, salt mines, or onshore processing facilities identified within the EMBA.

Table 4-19: Presence of industries

Industry	OA	Sound EMBA	Hydrocarbon Social EMBA
Defence			✓
Petroleum exploration and production	✓	✓	✓
Port (Varanus Island Port)			✓
Submarine cable (Darwin-Jakarta-Singapore Cable)			✓

The Northern Carnarvon Basin is one of the most heavily explored and developed petroleum basins in Australia. The Northern Carnarvon, Browse and Bonaparte basins together comprise most of Australia's natural gas reserves (Ref. 297). The Carnarvon Basin supports >95% of WA's oil and gas production, and accounts for ~63% of Australia's total production of crude oil, condensate, and natural gas (Ref. 297). Infrastructure from the existing Wheatstone and Pluto projects are located within the OA including platforms, pipelines, flowlines and umbilicals. Other petroleum activities iwhtin the vicinity of the OA are described in further detail in Section 4.4.6.1.

The Royal Australian Air Force (RAAF) have a base located at Learmonth, and there is a designated maritime firing practices and exercise area associated with this base (Ref. 342). There are no known sites of unexploded ordnance within the OA (Ref. 365).

Submarine telecommunications cables are underwater infrastructure linking Australia with other countries; the submarine communications cables carry the bulk of Australia's international voice and data traffic. Only one submarine cable intersects with the EMBA, the Darwin-Jakarta-Singapore Cable (Table 4-19), with landing port in Port Headland. The submarine cable is expected to be completed by mid-2023.

Under Part 2 of the *Telecommunications Act 1997* (Cth), the Australian Communications and Media Authority can declare protection zones covering the cables to prohibit and/or restrict activities that may damage them. The protection zones are generally the area within 1.85 km (1 nm) either side of the cable and include both the waters and seabed within the area. No protection zone has been declared to the Darwin-Jakarta-Singapore Cable.

4.4.6.1 Petroleum exploration and production

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:

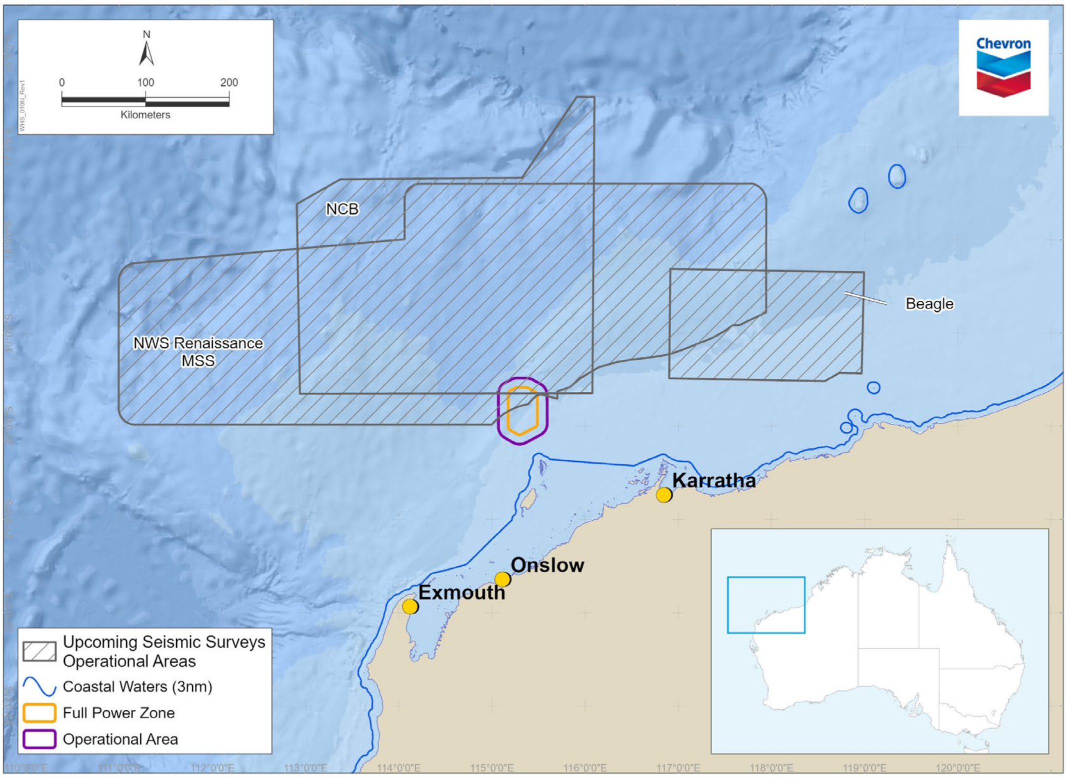
- Santos operated John Brooks platform (~32 km from OA, and ~43 km from FPZ)
- Woodside Energy operated Goodwyn Alpha platform (~32 km from OA, and ~43 km from FPZ).

In order to identify the potential for concurrent seismic surveys, surveys currently being assessed by NOPSEMA or approved[15] (but not yet conducted) were identified from the NOPSEMA website (Ref. 174). Those surveys that may occur concurrently within ~100 km of the OA[16] are described in Table 4-20, and approximate OAs shown in Figure 4-13. Given EP approval expiry dates there will be no temporal overlap with the 4D MSS, and therefore no interaction from concurrent seismic surveys is expected.

[15] EPs with an approved status and with either (i) an acceptance date beyond a 5-year in-force period, or (ii) with start and stop activity notifications dates indicating activities are complete, were not included in the assessment.

[16] The 100 km buffer used for the review of concurrent seismic surveys is considered a conservative approach to potential cumulative impacts, given that the maximum horizontal distance to behavioural or auditory effects for any receptor from the Wheatstone 4D MSS was predicted to be <13.5 km from the seismic source (Section 7.6).

Review of the NOPIMS database (Ref. 277) indicated that within the previous five-year period (2019–2023) there have been four seismic surveys within 100 km of the OA (Table 4-20). Two of these (Pluto 4D MSS and Harmony 4D MSS) have survey areas that overlap with the Wheatstone 4D MSS OA.).



'NWS Renaissance MSS' refers to the North West Shelf Renaissance North Multi Client Marine Seismic Surveys described in Table 4-20. 'Beagle' and 'NCB' (Northern Carnarvon Basin) are part of the Rollo Multiclient Marine Seismic Surveys described in Table 4-20.

Figure 4-13: Proposed seismic surveys within the vicinity of the OA

The potential for concurrent other petroleum activities was also reviewed based on a 10 km buffer from the OA[17]. The resultant ongoing operations and/or once-off activities are described in Table 4-21. To date, engagement with Woodside Energy as part of the access authority process has not indicated any concern regarding the proposed timing of the 4D MSS.

In addition, given that the OA overlaps with the Montebello Marine Park[18], other planned petroleum activities within the AMP have also been identified (Table 4-21).

[17] The largest predicted environment that may be affected for planned activities (except those relating to underwater sound from seismic activities), is ~5 km beyond the OA for behavioural disturbance to marine mammals from underwater sound from general vessel operations (Section 7.7). As such, the 10 km buffer used for the review of concurrent petroleum activities is considered a conservative approach to potential cumulative impacts, given that the maximum horizontal distance to impacts and risks from planned activities (except underwater sound from seismic activities) are within ~5 km of the OA for the Wheatstone 4D MSS (Section 7).

[18] For the purposes of cumulative impacts to the Montebello Marine Park, any concurrent petroleum activity within the boundary of the AMP was identified.

Table 4-20: Proposed and historic seismic surveys within the vicinity (≤100 km) of the Wheatstone 4D MSS OA

Activity	Organisation	EP and activity status	Description	Interaction with Wheatstone 4D MSS
Proposed seismic surveys ≤100 km from the 4D MSS OA[19,20]				
Rollo Multiclient Marine Seismic Surveys	PGS Australia Pty Ltd	• Approval: EP accepted by NOPSEMA on 4 October 2018 • Activity: Commenced • Approval expiry: October 2023	• 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	• Area: survey OAs overlap • Timing: given EP approval expiry date, if further surveys occur, there will be no temporal overlap with the 4D MSS; therefore no interaction is expected
North West Shelf Renaissance North Multi Client Marine Seismic Surveys	TGS-NOPEC Geophysical Company Pty Ltd	• Approval: EP accepted by NOPSEMA on 13 June 2018 • Activity: Not commenced • Approval expiry: June 2023	• Proposed acquisition of up to 25,000 km^2 of 3D seismic data over a period of two years	• Area: survey OAs overlap • Timing: given EP approval expiry date, if further surveys occur, there will be no temporal overlap with the 4D MSS; therefore no interaction is expected
Completed seismic surveys during the last five years (2018–2022) ≤100 km from the 4D MSS OA				
Capreolus-2 3D Marine Seismic Survey 2020 – 2024	TGS-NOPEC Geophysical Company Pty Ltd	• Finalised	• Survey completed: 01/01/2023–22/03/2023	• Area: ~100 km west of the OA
Rollo Multiclient Marine Seismic Surveys	PGS Australia Pty Ltd	• Finalised	• Mawson MC 3D MSS • Survey completed: 27/02/2019–08/05/2019	• Area: ~50 km north of the OA

[19] NOPSEMA-accepted seismic surveys within the North West or Pilbara regions that are >100 km from the Wheatstone 4D MSS OA: Sauropod 3D MSS, Petrel Sub-basin South-West 3D MSS, 2D Seismic Survey WA-532-P, WA-533-P and WA-50-L, Keraudren Seismic Survey, Keraudren Extension 3D MSS

[20] Seismic surveys under assessment within the North West or Pilbara regions that are >100 km from the Wheatstone 4D MSS OA: Possum 3D MSS, Scarborough 4D B1 MSS, Bonaparte MC3D MSS

Activity	Organisation	EP and activity status	Description	Interaction with Wheatstone 4D MSS
Pluto 4D MSS	Woodside Energy Ltd	• Finalised	• North-west Australia 4D MSS • Survey completed: 05/01/2020–09/02/2020	• Area: survey OAs overlap
Harmony 4D MSS	Woodside Energy Ltd	• Finalised	• North-west Australia 4D MSS • Survey completed: 12/02/2020–04/03/2020	• Area: survey OAs overlap

Table 4-21: Other petroleum activities within the vicinity (≤10 km) of the Wheatstone 4D MSS OA

Activity	Organisation	EP and activity status	Description	Interaction with Wheatstone 4D MSS
Operation of facility or pipeline ≤10 km from the 4D MSS OA				
Wheatstone Project - Start-Up and Operations	CAPL	• Approval: EP accepted by NOPSEMA on 01 August 2022 • Activity: Ongoing	• Ongoing operation of subsea hydrocarbon system • Ongoing operation of Wheatstone platform • Inspection, maintenance, and repairs (IMR)	• Area: OAs overlap • Timing: Ongoing operations
Julimar Operations	Woodside Energy Julimar Pty Ltd	• Approval: EP accepted by NOPSEMA on 10 March 2021 • Activity: Ongoing	• Ongoing operation of subsea hydrocarbon system • Inspection, monitoring, maintenance, and repairs (IMMR)	• Area: OAs overlap • Timing: Ongoing operations
Pluto Facility Operations	Woodside Burrup Pty Ltd	• Approval: EP accepted by NOPSEMA on 30 May 2019 • Activity: Ongoing	• Ongoing operation of subsea hydrocarbon system • Ongoing operation of Pluto facility • Well clean-ups • IMR	• Area: OAs overlap • Timing: Ongoing operations
Goodwyn Alpha (GWA) Facility Operations	Woodside Energy Ltd	• Approval: EP accepted by NOPSEMA on 03 March 2022 • Activity: Ongoing	• Ongoing operation of subsea hydrocarbon system • Ongoing operation of Goodwyn Alpha facility • IMMR • Well clean-up and commissioning • Well intervention and workovers	• Area: ~5 km east of the OA • Timing: Ongoing operations

Activity	Organisation	EP and activity status	Description	Interaction with Wheatstone 4D MSS
Other petroleum activities ≤10 km from the 4D MSS OA				
WA-49-L Gemtree Exploration Drilling	Woodside Energy Julimar Pty Ltd	• Approval: EP accepted by NOPSEMA on 17 September 2020 • Activity: Commenced in July 2023 • Approval expiry: September 2025	• Exploration drilling of one well • ~50 days • Activities to occur between 2021 to 2024	• Area: OAs overlap, no overlap with FPZ • Timing: Given reported commencement date of July 2023, and estimated duration of activity, there will be no temporal overlap with the 4D MSS; therefore no interaction is expected
Wheatstone Project - Well Intervention and Infill Drilling	CAPL	• Approval: EP accepted by NOPSEMA on 12 February 2018 • Activity: Ongoing	• Ongoing drilling, well intervention, well abandonment	• Area: OAs overlap • Timing: CAPL have confirmed that there are no planned activities for 2023 and H1 2024 • Therefore, no interaction predicted to occur
Balnaves Plug and Abandonment	Woodside Energy Julimar Pty Ltd	• Approval: EP accepted by NOPSEMA on 16 December 2021 • Activity completed July to November 2022 • Activity: commenced July 2023 • Approval expiry: December 2026	• Plug and abandonment of four wells (20–60 days per well; 80–240 days for all four wells to be undertaken between 2022 and 2024; plugging activities are planned between 1 May and 30 October [outside of cyclone season]) • Removal of well infrastructure (up to 4 weeks by end 2024) • IMR activities (as required)	• Area: OAs overlap • Timing: Plug and abandonment activities finalised in November 2022 • Activity is reported as having re-commenced in July 2023, however given the estimated duration of activity, there will be no temporal overlap with the 4D MSS; therefore no interaction is expected

Activity	Organisation	EP and activity status	Description	Interaction with Wheatstone 4D MSS
Echo Yodel Subsea Decommissioning	Woodside Energy Ltd	• Approval: EP accepted by NOPSEMA on 24 March 2022 • Activity: Not commenced • Approval expiry: March 2027	• Removal of pipeline and associated subsea infrastructure • May include subsea acoustic surveys • ~ 8 months of activities between Q2 2022 to 2026	• Area: ~5 km east of OA • Timing: Potential to occur at same time
Scarborough Seabed Intervention and Trunkline Installation	Woodside Energy Scarborough Pty Ltd	• EP under assessment	• Seabed intervention, which may include acoustic surveys (~4–5 months between Q4 2022 and Q2 2023; ~4–6 months between Q4 2023 and Q3 2024) • Trunkline installation (~11 months between Q3 2023 and Q2 2024)	• Area: OAs overlap • Timing: Potential to occur at same time (pending EP acceptance)
Julimar Appraisal Drilling and Surveys	Woodside Energy Julimar Pty Ltd	• EP under assessment	• Appraisal drilling for one well (Julimar South-1), with plug and abandonment (~50 days, during Q3 2023 [or 2024/2025 as contingency) • Geophysical and geotechnical (~45 days during 2023-2025) • Wellhead removal (~2 days in 2025; 2023/2024/2025 as contingency)	• Area: appraisal well is ~9.5 km southwest of OA • Area: titles for geophysical survey overlaps with OA • Timing: Potential to occur at same time (pending EP acceptance)
Other petroleum activities within the Montebello Marine Park				
Scarborough Seabed Intervention and Trunkline Installation	*(details as per above)*			

4.5 Qualities and characteristics of locations, places, and areas

The qualities and characteristics of the protected places present within the EMBA are described in the following sections.

4.5.1 Australian Marine Parks

Marine parks help conserve marine habitats and the marine species that live within and rely on these habitats. Marine parks also provide places for people to watch wildlife, dive, and go boating, snorkeling, or fishing (Ref. 339).

The *North-west Marine Parks Network Management Plan* (Ref. 9) defines the following types of values for the Marine Parks in the North-west Network:

- natural values—habitats, species and ecological communities, and the processes that support their connectivity, productivity and function
- cultural values—living and cultural heritage recognising Indigenous beliefs, practices and obligations for country, places of cultural significance and cultural heritage sites
- heritage values—non-Indigenous heritage that has aesthetic, historic, scientific or social significance
- socioeconomic values—the benefits for people, businesses and/or the economy.

The objectives of the *North-west Marine Parks Network Management Plan* (Ref. 9) are to provide for:

a) the protection and conservation of biodiversity and other natural, cultural and heritage values of marine parks in the North-west Network

b) ecologically sustainable use and enjoyment of the natural resources within marine parks in the North Network, where this is consistent with objective (a).

Australian Marine Parks (AMPs) occur within Commonwealth waters and have been proclaimed under the EPBC Act in 2007 and 2013.

The intersect between the OA for the Wheatstone 4D MSS (as defined Table 3-1) and the Montebello Marine Park are shown in Figure 4-14. The OA overlaps ~15.8%, and the FPZ overlaps ~4.4% of the Montebello Marine Park.

The Montebello Marine Park is zoned as a Multiple Use Zone (IUCN VI), which is a zone “managed to allow ecologically sustainable use while conserving ecosystems, habitats and native species. The zone allows for a range of sustainable uses, including commercial fishing and mining where they are consistent with park values” (Ref. 9).

The presence of AMPs within the EMBA, and a summary of values, is described in Table 4-22.

Table 4-22: Presence of AMPs

Australian Marine Park	OA	Sound EMBA	Hydrocarbon Ecological and Social EMBAs
Gascoyne (Multiple use zone [IUCN VI])]			✓
The Gascoyne Marine Park is located ~20 km off the west coast of the Cape Range Peninsula, adjacent to the Ningaloo Reef Marine Park and the Western Australian Ningaloo Marine Park and extends to the limit of Australia's EEZ. The Marine Park covers an area of 81,766 km² and water depths between 15 m and 6,000 m. **Statement of significance** The Gascoyne Marine Park is significant because it contains habitats, species and ecological communities associated with the Central Western Shelf Transition, Central Western Transition, and Northwest Province. It includes four key ecological features: Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula (valued for unique seafloor features with ecological properties of regional significance); Commonwealth waters adjacent to Ningaloo Reef (valued for high productivity and aggregations of marine life); continental slope demersal fish communities (valued for high levels of endemism and diversity); and the Exmouth Plateau (valued as a unique seafloor feature with ecological properties of regional significance). The Marine Park includes some of the most diverse continental slope habitats in Australia, in particular the continental slope area between North West Cape and the Montebello Trough. Canyons in the Marine Park link the Cuvier Abyssal Plain to the Cape Range Peninsula and are important for their role in sustaining the nutrient conditions that support the high diversity of Ningaloo Reef. **Natural values** The Marine Park includes examples of ecosystems representative of: • Central Western Shelf Transition—continental shelf with water depths up to 100 m, and a significant transition zone between tropical and temperate species • Central Western Transition—characterised by large areas of continental slope; a range of topographic features such as terraces, rises, and canyons; seasonal and sporadic upwelling; and benthic slope communities comprising tropical and temperate species • Northwest Province—an area of continental slope comprising diverse and endemic fish communities. The marine park includes four KEFs characterised by seasonal and sporadic upwelling, nutrient-rich water and aggregations of marine life and high diversity of demersal fish assemblages. The Marine Park supports a range of species including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. BIAs within the Marine Park include breeding habitat for seabirds; internesting habitat for marine turtles; a migratory pathway for Humpback Whales; and foraging habitat and migratory pathway for Pygmy Blue Whales. **Cultural values** Sea country is valued for Indigenous cultural identity, health and wellbeing. Across Australia, Indigenous people have been sustainably using and managing their sea country for tens of thousands of years. The Baiyungu, Thalanyji and Yinikurtura People have responsibilities for sea country in the marine park. **Heritage values** No international, Commonwealth or national heritage listings apply to the Marine Park, however the Marine Park is adjacent to the Ningaloo Coast World heritage areas. **Social and economic values** Commercial fishing, mining and recreation are important activities in the Marine Park. These activities contribute to the wellbeing of regional communities and the prosperity of the nation			
Montebello (Multiple use zone [IUCN VI])]	✓	✓	✓
The Montebello Marine Park is located offshore of Barrow Island and 80 km west of Dampier extending from the Western Australian state waters boundary and is adjacent to the Western			

Australian Marine Park	OA	Sound EMBA	Hydrocarbon Ecological and Social EMBAs
Australian Barrow Island and Montebello Islands Marine Parks. The Marine Park covers an area of 3,413 km^2 and water depths from <15 m to 150 m. **Statement of significance** The Montebello Marine Park is significant because it contains habitats, species, and ecological communities associated with the Northwest Shelf Province. It includes one KEF: the ancient coastline at the 125 m depth contour (valued as a unique seafloor feature with ecological properties of regional significance). The Marine Park provides connectivity between deeper waters of the shelf and slope, and the adjacent Barrow Island and Montebello Islands Marine Parks. A prominent seafloor feature in the Marine Park is Trial Rocks consisting of two close coral reefs. The reefs are emergent at low tide. **Natural values** The Marine Park includes examples of ecosystems representative of the Northwest Shelf Province—a dynamic environment influenced by strong tides, cyclonic storms, long-period swells, and internal tides. The bioregion includes diverse benthic and pelagic fish communities, and ancient coastline. The ancient coastline at the 125 m depth contour KEF intersects the north-west boundary of the park, thought to be an important sea floor feature and migratory pathway for Humpback Whales (Section 4.3.6.1). The Marine Park supports a range of species including species listed as threatened, migratory, marine, or cetacean under the EPBC Act. BIAs within the Marine Park include breeding habitat for seabirds; internesting, foraging, mating, and nesting habitat for marine turtles; a migratory pathway for Humpback Whales; and foraging habitat for Whale Sharks. **Cultural values** Sea country is valued for Indigenous cultural identity, health and wellbeing. Across Australia, Indigenous people have been sustainably using and managing their sea country for tens of thousands of years. At the commencement of this plan, there is limited information about the cultural significance of this Marine Park. The Yamatji Marlpa Aboriginal Corporation is the Native Title Representative Body for the Pilbara region. **Heritage values** No international, Commonwealth or national listings apply to the Marine Park, however the Marine Park is adjacent to the Western Australia Barrow Island and the Montebello– Barrow Island Marine Conservation Reserves which have been nominated for national heritage listing. The Marine Park contains two known shipwrecks listed under the UCH Act*:* *Trial* (wrecked in 1622), the earliest known shipwreck in Australian waters and *Tanami* (unknown date). **Social and economic values** Tourism, commercial fishing, mining and recreation are important activities in the Marine Park. These activities contribute to the wellbeing of regional communities and the prosperity of the nation.			
Ningaloo (Recreational Use Zone [IUCN IV])			✓
The Ningaloo Marine Park stretches approximately 300 km along the west coast of the Cape Range Peninsula and is adjacent to the Western Australian Ningaloo Marine Park and Gascoyne Marine Park. The Marine Park covers an area of 2435 km^2 and a water depth range of 30 m to more than 500 m. **Statement of significance** The Ningaloo Marine Park is significant because it contains habitats, species and ecological communities associated with the Central Western Shelf Transition, Central Western Transition, Northwest Province, and Northwest Shelf Province. It includes three key ecological features: canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula (valued for unique seafloor features with ecological properties of regional significance); Commonwealth waters			

Australian Marine Park	OA	Sound EMBA	Hydrocarbon Ecological and Social EMBAs
adjacent to Ningaloo Reef (valued for high productivity and aggregations of marine life); and continental slope demersal fish communities (valued for high levels of endemism and diversity). The Marine Park provides connectivity between deeper offshore waters of the shelf break and coastal waters of the adjacent Western Australian Ningaloo Marine Park. It includes some of the most diverse continental slope habitats in Australia, in particular the continental slope area between North West Cape and the Montebello Trough. Canyons in the Marine Park are important for their role in sustaining the nutrient conditions that support the high diversity of Ningaloo Reef. The Marine Park is located in a transition zone between tropical and temperate waters and sustains tropical and temperate plants and animals, with many species at the limits of their distributions. **Natural values** The Marine Park includes examples of ecosystems representative of: • Central Western Shelf Transition—continental shelf of water depths up to 100 m, and a significant transition zone between tropical and temperate species • Central Western Transition—characterised by large areas of continental slope, a range of topographic features such as terraces, rises and canyons, seasonal and sporadic upwelling, and benthic slope communities comprising tropical and temperate species • Northwest Province—an area of continental slope comprising diverse and endemic fish communities • Northwest Shelf Province—a dynamic environment, influenced by strong tides, cyclonic storms, long-period swells and internal tides. The bioregion includes diverse benthic and pelagic fish communities, and ancient coastline thought to be an important seafloor feature and migratory pathway for humpback whales. Key ecological features of the Marine Park include Canyons linking the Cuvier Abyssal Plain and the Cape Range Peninsula, Commonwealth waters adjacent to Ningaloo Reef and Continental slope demersal fish communities (Section 4.3.6.1). Ecosystems represented in the Marine Park are influenced by interaction of the Leeuwin Current, Leeuwin Undercurrent and the Ningaloo Current. The Marine Park supports a range of species including species listed as threatened, migratory, marine or cetacean under the EPBC Act. BIAs within the Marine Park include breeding and or foraging habitat for seabirds, internesting habitat for marine turtles, a migratory pathway for humpback whales, foraging habitat and migratory pathway for pygmy blue whales, breeding, calving, foraging and nursing habitat for dugong and foraging habitat for whale sharks. **Cultural values** Sea country is valued for Indigenous cultural identity, health and wellbeing. Across Australia, Indigenous people have been sustainably using and managing their sea country for tens of thousands of years. The Gnulli people have responsibilities for sea country in the Marine Park. The Yamatji Marlpa Aboriginal Corporation is the Native Title Representative Body for the Yamatji region. **Heritage values** The Marine Park is within the Ningaloo Coast World Heritage Property, recognised for its outstanding universal heritage values, meeting world heritage listing criteria vii and x. In addition to the Marine Park, the world heritage area includes the Western Australian Ningaloo Marine Park, the Muiron Islands, the Western Australian Cape Range National Park and other terrestrial areas. The area is valued for high terrestrial species endemism, marine species diversity and abundance, and the interconnectedness of large-scale marine, coastal and terrestrial environments. The area connects the limestone karst system and fossil reefs of the ancient Cape Range to the nearshore reef system of Ningaloo Reef, to the continental slope and shelf in Commonwealth waters. The Marine Park overlaps with the National heritage listing and the Commonwealth Heritage List. The Marine Park contains more than 15 known shipwrecks listed under the UCH Act.			

Australian Marine Park	OA	Sound EMBA	Hydrocarbon Ecological and Social EMBAs
Social and economic values Tourism and recreation, including fishing, are important activities in the Marine Park. These activities contribute to the wellbeing of regional communities and the prosperity of the nation.			

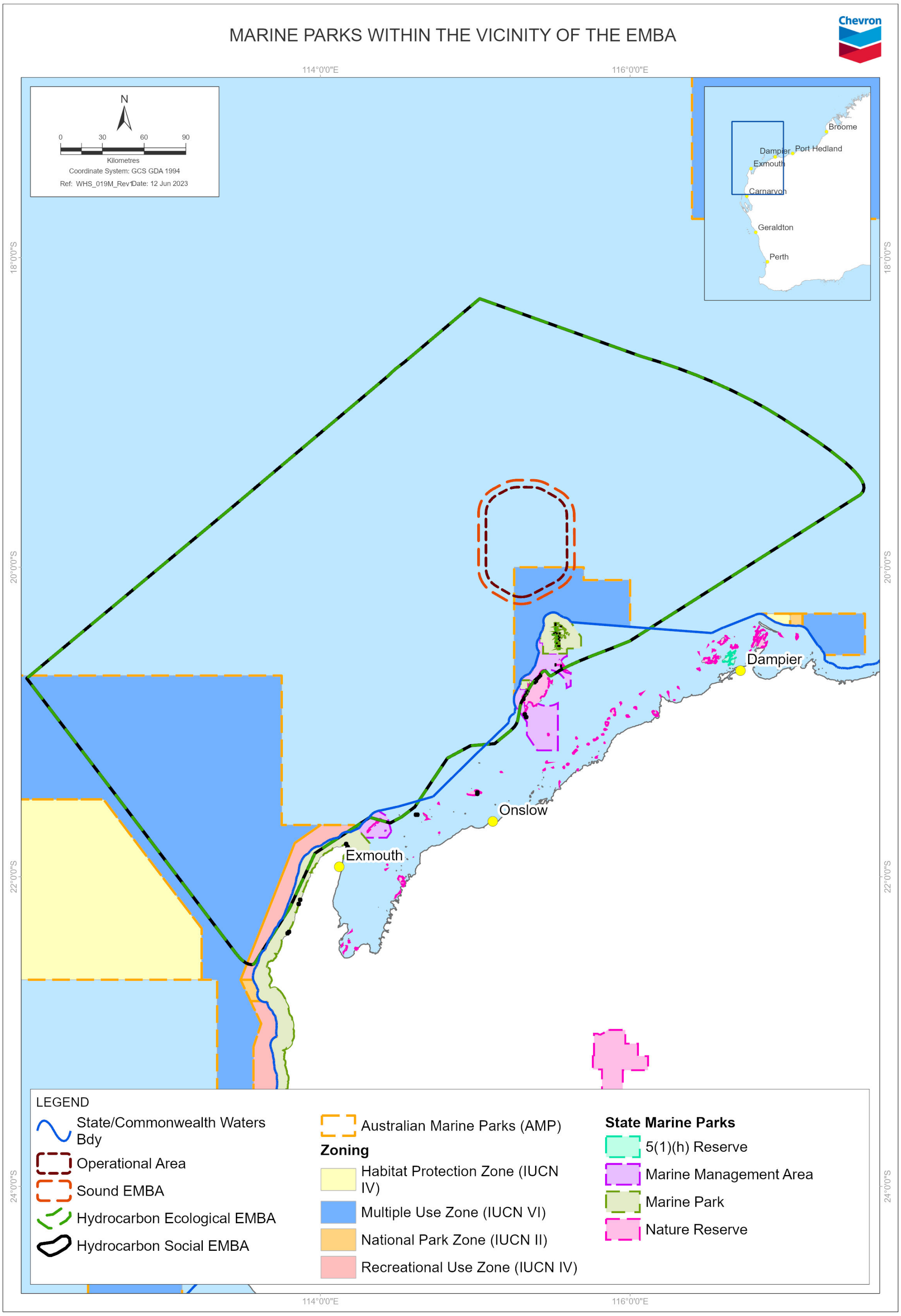


Figure 4-14: Commonwealth and State marine protected areas within the vicinity of the EMBA

4.5.2 State marine protected areas

State marine parks and management areas, proclaimed under the *Conservation and Land Management Act 1984* (WA) (CALM Act), are located in State waters and are vested in the WA Conservation and Parks Commission.

There are no State marine parks or management areas within the OA or Sound EMBA; the closest is the Montebello Marine Park located ~18 km and ~13 km from the southern extent of the OA and Sound EMBA respectively (Figure 4-14). The presence of marine parks or management areas within the EMBA are shown in Table 4-23.

Table 4-23: Presence of State marine protected areas

State marine protected area	Zone Type (IUCN category)	OA	Sound EMBA	Hydrocarbon Ecological EMBA	Hydrocarbon Social EMBA
Barrow Island Marine Park	Unassigned (IUCN IA)			✓	✓
Barrow Island Marine Management Area	Unassigned (IUCN VI)			✓	✓
Montebello Islands Marine Park	General Use Zone (IUCN II)			✓	✓
	Recreation Zone (IUCN II)			✓	✓
	Sanctuary Zone (IUCN IA)			✓	✓
	Special Purpose Zone (Benthic Protection) (IUCN IV)			✓	✓
	Special Purpose Zone (Pearling) (IUCN VI)			✓	✓
Muiron Islands Marine Management Area	Conservation Area (IUCN IA)			✓	✓
	Unclassified (IUCN VI)			✓	✓
Ningaloo Marine Park	General Use (IUCN II)			✓	✓
	Recreation Area (IUCN II)			✓	✓
	Sanctuary Zone (IUCN IA)			✓	✓
	Special Purpose Zone (Benthic Protection) (IUCN IV)			✓	✓
	Special Purpose Zone (Shore Based Activities) (IUCN II)				✓

4.5.3 State terrestrial protected areas

Terrestrial protected areas, proclaimed under the CALM Act, are located on State lands and are vested in the WA Conservation and Parks Commission.

The OA and Sound EMBA occur offshore and do not have any interface with the coast. The Hydrocarbon EMBAs do interface with the coast (due to predicted shoreline loading associated with unplanned hydrocarbon release events;

Table 4-1). The Hydrocarbon Ecological EMBA includes the Montebello Islands; and the Hydrocarbon Social EMBA includes the Montebello, Lowendal, Barrow (west coast), Boodie, Thevenard, and Flat islands, and small areas on west and northern coast of the North West Cape peninsula (Figure 4-1). The State terrestrial protected areas that intersect with the Hydrocarbon EMBAs are shown in Table 4-24.

Table 4-24: Presence of State terrestrial protected areas

State terrestrial protected area	Zone Type (IUCN category)	OA	Sound EMBA	Hydrocarbon Ecological EMBA	Hydrocarbon Social EMBA
Barrow Island Nature Reserve*	Nature Reserve (IUCN Ia)				✓
Boodie Island Nature Reserve*	Nature Reserve (IUCN Ia)				✓
Cape Range National Park^	National Park (IUCN II)				✓
Montebello Islands Conservation Park^	Conservation Park (IUCN II)			✓	✓
Pilbara Islands Nature Reserves[21]*^	Nature Reserve (IUCN Ia)				✓

** Protected area is landward of LWM.*
^ Protected area is landward of HWM.

4.6 Heritage value of places

Listed World Heritage properties, and National Heritage places, are MNES under the EPBC Act, and a particular value and sensitivity under the OPGGS(E)R. Table 4-25 identifies the presence of these, and other marine or coastal heritage protected places, within the EMBA.

Table 4-25: Presence of heritage value

Feature	OA	Sound EMBA	Hydrocarbon Ecological EMBA	Hydrocarbon Social EMBA
World Heritage property				
The Ningaloo Coast			✓	✓
National Heritage place				
The Ningaloo Coast			✓	✓
Commonwealth Heritage place				

[21] The Pilbara Inshore Islands management plan includes 20 existing nature reserves, with several small unallocated Crown Land islands proposed to become nature reserves. Of the existing nature reserves, the Hydrocarbon Social EMBA intersects with Lowendal and Thevenard islands.

Feature	OA	Sound EMBA	Hydrocarbon Ecological EMBA	Hydrocarbon Social EMBA
Ningaloo Marine Area – Commonwealth Waters			✓	✓
Indigenous Protected Areas				
N/A	*(none identified within the EMBA)*			
Sites or artefacts protected under the *Underwater Cultural Heritage Act 2018* (Cth)				
Historic shipwrecks (>75 years old)	✓	✓	✓	✓
Shipwrecks			✓	✓
Sunken aircraft	*(none identified within the EMBA)*			
In situ artefacts	*(none identified within the EMBA)*			
Sites or artefacts protected under the *Aboriginal Cultural Heritage Act 2021* (WA)				
Bloodwood Creek Midden 1 (Artefacts / Scatter, Midden / Scatter)				✓
Bloodwood Creek Midden 2 (Artefacts / Scatter, Midden / Scatter)				✓
Bloodwood Creek Midden 3 (Artefacts / Scatter, Midden / Scatter)				✓
Bloodwood Creek Shoreline (Artefacts / Scatter, Midden / Scatter)				✓
Mandu Mandu Creek North (Artefacts / Scatter, Midden / Scatter)				✓
Mandu Mandu Creek South (Artefacts / Scatter, Midden / Scatter)				✓
Montebello Islands Haynes Cave (Artefacts / Scatter, Midden / Scatter, Rockshelter, Arch Deposit)			✓	✓
Montebello Islands Noala Cave (Artefacts / Scatter, Midden / Scatter, Rockshelter, BP Dating: 27,220 +/- 640)			✓	✓
Determined areas under the *Native Title Act 1993* (Cth)				
Native Title determination WCD2019/016				✓
Claim areas under the *Native Title Act 1993* (Cth)				
N/A	*(none identified within the EMBA)*			

4.6.1 Ningaloo Coast

The Ningaloo Coast is located in WA adjacent to the East Indian Ocean. The area has a high level of terrestrial species endemism, and high marine species diversity and abundance (Ref. 340). The integration of the Ningaloo Reef and Exmouth Peninsula karst system as a cohesive limestone structure is at the heart of the natural heritage significance of the Ningaloo Coast (Ref. 341).

The marine portion of the World Heritage property contains a high diversity of habitats that includes lagoon, reef, open ocean, the continental slope, and the continental shelf (Ref. 340). Intertidal systems such as rocky shores, sandy beaches, estuaries, and mangroves are also present (Ref. 340). The most dominant marine habitat is Ningaloo Reef, which sustains both tropical and temperate marine fauna and flora, including marine reptiles and mammals (Ref. 340).

The main terrestrial feature of the Ningaloo Coast is the extensive karst system and network of underground caves and water courses of the Cape Range (Ref. 340). The karst system includes hundreds of separate features such as caves, dolines, and subterranean water bodies and supports a rich diversity of highly specialised subterranean species (Ref. 340). Above ground, the Cape Range Peninsula belongs to an arid ecoregion recognised for its high levels of species richness and endemism, particularly for birds and reptiles (Ref. 340).

In addition to the natural values of the Ningaloo Coast, Indigenous values are identified under the National Heritage listing (Ref. 341). Archaeological deposits in the rock shelters on Cape Range show First Nations people's sophisticated knowledge of marine resources between 35,000 and 17,000 years ago. The rock shelters are considered to provide the best evidence in Australia for the use of marine resources during the Pleistocene (Ref. 341).

4.6.2 Underwater cultural heritage

Australia's underwater cultural heritage is protected under the UCH Act; this legislation protects shipwrecks, sunken aircraft and other types of underwater heritage, including First Nations underwater cultural heritage in Australian waters[22].

Under section 15 of the UCH Act, underwater cultural heritage is defined as "any trace of human existence that has a cultural, historical, or archaeological character, and is located under water". The UCH Act protects physical sites and artefacts; intangible heritage values with no physical component are not protected under the Act (Ref. 366).

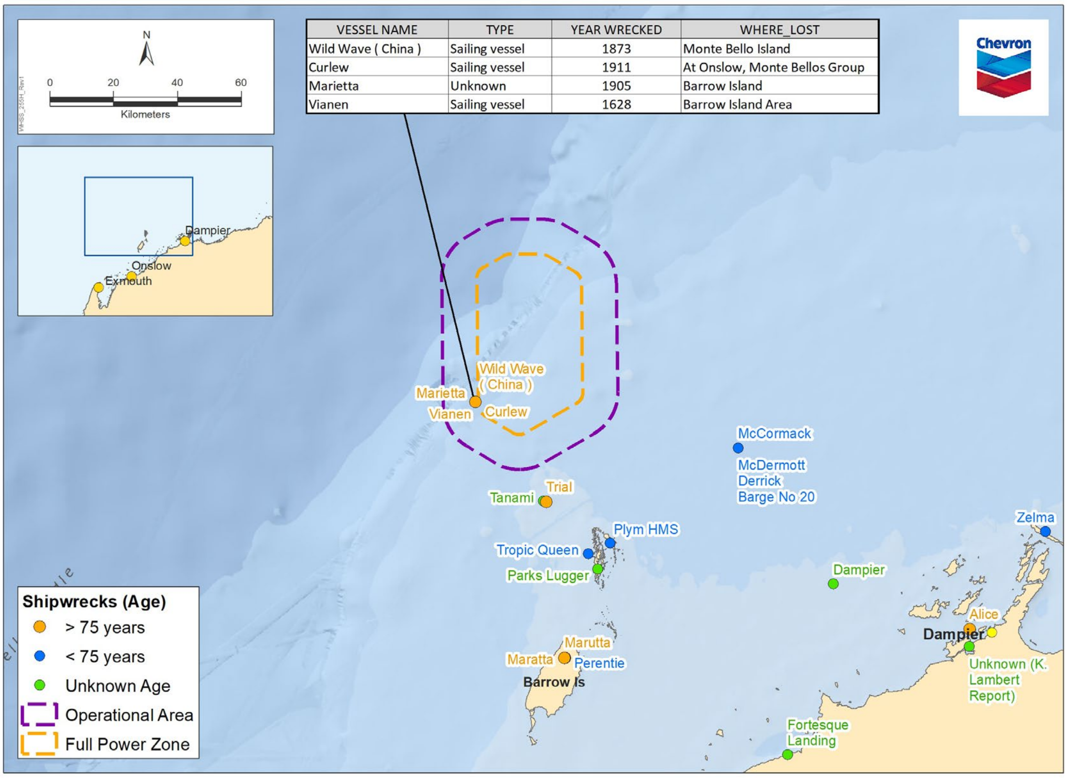
A desktop analysis was undertaken to determine the presence of underwater cultural heritage within the EMBA. This analysis included:

- searches of the online *Australasian Underwater Cultural Heritage Database* (Ref. 30) for known underwater cultural heritage
- consultation with First Nations people and/or representative bodies (relevant persons) to identify presence of underwater cultural heritage artefacts.

Based on the database searches, both historic (>75 years old) shipwrecks and other shipwreck sites were identified in the EMBA (Table 4-25). No sunken aircraft, or other types or artefacts, were identified within the EMBA from the database searches. The Australasian Underwater Cultural Heritage Database (Ref. 30) identified that four historic shipwrecks may be within the OA, and several occur within the spatial extent of the EMBA; and no historic sunken aircrafts were identified within the OA or EMBA (Table 4-25). The historic shipwrecks that may be within the OA are *Curlew* (1911), *Marietta* (1905), *Wild Wave (China)* (1873), and *Vianen* (1628). As shown on Figure 4-15, the wreck coordinates recorded within the database are likely to be indicative only (as the same coordinates are provided for all four shipwrecks) while the wreck location description varies.

[22] The UCH Act applies to all Australian waters, including both State waters (coastal waters) and Commonwealth waters (extending from coastal waters to the edge of continental shelf).

The consultation undertaken during the preparation of this EP is summarised in Section 6. During this consultation, no specific First Nations underwater cultural heritage has been identified within the EMBA.



VESSEL NAME	TYPE	YEAR WRECKED	WHERE_LOST
Wild Wave (China)	Sailing vessel	1873	Monte Bello Island
Curlew	Sailing vessel	1911	At Onslow, Monte Bellos Group
Marietta	Unknown	1905	Barrow Island
Vianen	Sailing vessel	1628	Barrow Island Area

Figure 4-15: Indicative locations of shipwrecks in relation to the OA and FPZ for the Wheatstone 4D MSS

4.6.3 Native Title

Native Title recognises the rights and interests of Aboriginal and Torres Strait Islander people in land and waters according to their traditional laws and customs, and is administer under the *Native Title Act 1993* (Cth).

A Native Title determination (WCD2019/016) extends over the Ningaloo Coast area. The Yinggarda, Baiyungu, and Thalanyji people received recognition as a Native Title holder over an area of 71,354 m^2. The determination area encompasses several pastoral leases, mining tenements, roads, and reserves, as well as portions of the Kennedy Range and Cape Range national parks, Ningaloo Marine Park, Lake MacLeod, and waters in the Exmouth Gulf and Ningaloo Marine Park (Ref. 324). The Yinggarda, Baiyungu and Thalanyji people have each maintained a physical presence in their respective part of the determination area and have a continuing physical or spiritual involvement in that area (Ref. 324). The determination area contains places of special significance, such as cultural, spiritual, and ceremonial sites and natural resources (Ref. 324).

The relevant Prescribed Bodies Corporate (PBC) are the Nganhurra Thanardi Garrbu Aboriginal Corporation (representing the Baiyungu and Thalanyji people) and the Yinggarda Aboriginal Corporation.

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 activity (as described in Section 3) and any potential emergency conditions associated with the activity. 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. 31) 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. 32) and the HB 203:2012 *Managing environment-related risk* (Ref. 33).

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
- relevant persons consultation (Section 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 EMBA is documented in Section 4). In accordance with regulation 13(3) of the OPGGS(E)R, particular values and sensitivities include the following:

- 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 EMBA, CAPL considers that the habitat and/or temporal area that supports protected and endangered fauna (including areas defined as BIAs for these species) is considered part of the particular value or sensitivity.

Environmental values and sensitivities are also considered to be associated with each of the receptor groups identified and described throughout Section 4 (i.e. in addition to those particular values and sensitivities as identified under the OPGGS(E)R). All relevant environmental values and sensitivities have been taken into consideration during the consultation process (and identification in functions, interests, or activities; Section 6), and the impact and risk assessment (Section 7).

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 relevant persons 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 Chevron's 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.

The OPGGS(E)R defines a control measure as a system, an item of equipment, a person or a procedure, that is used as a basis for managing environmental impacts and risk.

5.5.2.1 ALARP decision context

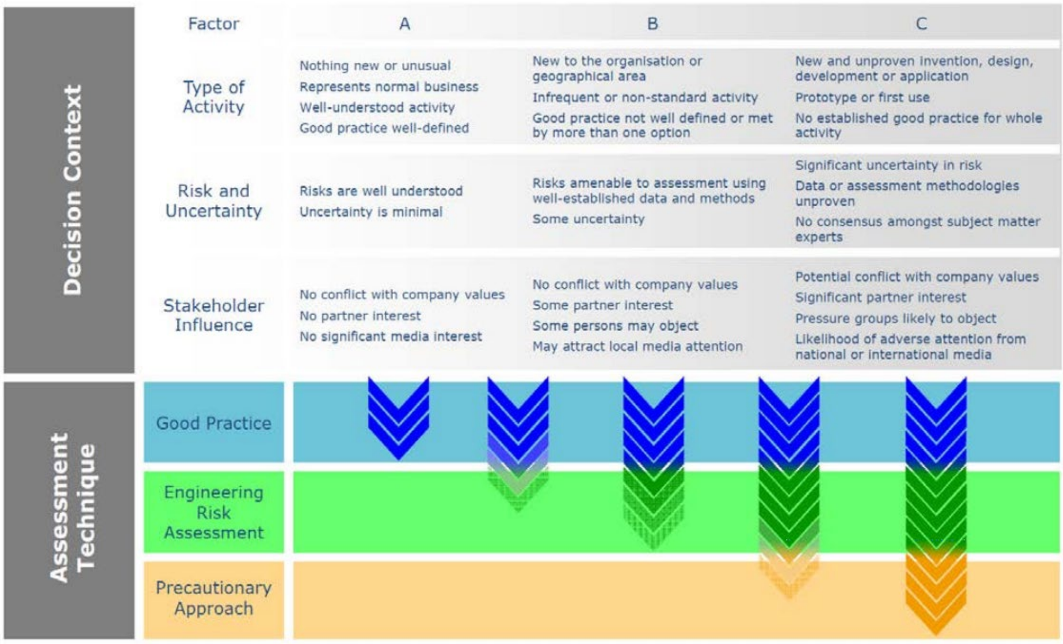
In alignment with NOPSEMA’s ALARP guidance note (Ref. 34), CAPL has adapted the approach developed by Oil and Gas UK (OGUK) (Ref. 35) for use in an environmental context to determine the assessment technique required to demonstrate that impacts and risks are ALARP. Specifically, the framework considers 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. 34)

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 7. The assessment techniques considered include:

- good practice
- engineering risk assessment
- precautionary approach.

5.5.2.2 Good practice

OGUK (Ref. 35) 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. 35), 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. 35) 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. 349). 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, relevant persons consultation).

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. 34), 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. 349) 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. 349), 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 relevant persons consultation

This section provides a description of the methods used, and outcomes of, consultation with relevant authorities, persons, or organisations (a *relevant person*) undertaken during the preparation of this EP, as required under regulation 11A of the OPGGS(E)R.

Public comment, as required under regulation 11B of the OPPGS(E)R for seismic EPs, is described in Section 6.3.

Ongoing consultation, as required under regulation 14(9) of the OPGGS(E)R, is described in Section 8.3.4.2.

6.1 Purpose

Regulation 11A of the OPGGS(E)R allows the titleholder to properly understand all the environmental impacts and risks of the petroleum activity, and enables the titleholder to refine or change the control measures by taking into account the information acquired from relevant persons through consultations. Recent judicial consideration of regulation 11A assists in understanding the purpose of the consultation required under the provision:

> *"Regulation 11A, like most statutory consultation provisions, imposes an obligation that must be capable of practicable and reasonable discharge by the person upon whom it is imposed. Consultation is a "real world" activity, with specific purposes. Here, its purpose is to ensure that the titleholder has ascertained, understood and addressed all the environmental impacts and risks that might arise from its proposed activity. Consultation facilitates this outcome because it gives the titleholder an opportunity to receive information that it might not otherwise have received from others affected by its proposed activity. Consultation enables the titleholder to better understand how others with an objective stake in the environment in which it proposes to pursue the activity perceive those environmental impacts and risks. As the Regulations expressly contemplate, it enables the titleholder to refine or change the measures it proposes to address those impacts and risks by taking into account the information acquired through the consultations. Objectively, the scheme intends that this is likely to improve the minimisation of environmental impacts and risks from the activity."* [23]

The consultation process should also inform the titleholder's understanding of the environment, including (amongst other things) people and communities, the heritage value of places, and their social and cultural features which may be affected by a titleholder's proposed activities (Ref. 347). The purpose of consultation is also to:

- identify the social and cultural features of communities within the ecosystem
- inform the control measures to eliminate, reduce and mitigate impacts and risks to those socio-cultural values and sensitivities in response to relevant persons concerns
- to inform NOPSEMA of relevant persons' identities, the nature of the consultation, and the control measures adopted (Ref. 348 at paragraphs 55–57).

[23] Paragraph 89 of *Santos NA Barossa Pty Ltd v Tipakalippa* [2022] FCAFC 193 (Ref. 374).

Regulation 11A establishes an obligation on titleholders to carry out consultation with relevant persons during preparation of an EP, and this obligation must be discharged prior to submitting an EP to NOPSEMA (Ref. 347).

6.2 Consultation design

The consultation design for preparation of this EP was undertaken in accordance with CAPL's *Stakeholder Engagement and Issues Management Process: ABU Standardised OE Process* (Ref. 46) and further guided by:

- NOPSEMA's *Environment plan decision making guideline* (Ref. 349)
- NOPSEMA's *Environment plan content requirements guidance note* (Ref. 350)
- NOPSEMA's *Consultation in the course of preparing an environment plan guideline* (Ref. 347)
- NOPSEMA's *Consultation with Commonwealth agencies with responsibilities in the marine area guideline* (Ref. 351)
- NOPSEMA's *Petroleum activities and Australian Marine Parks guidance note* (Ref. 352)
- Full Court of the Federal Court of Australia's decision in *Santos NA Barossa Pty Ltd v Tipakalippa* [2022] FCAFC 193 (Ref. 348)
- Commonwealth of Australia's *Engage Early—Guidance for proponents on best practice Indigenous engagement for environmental assessments under the Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)* (Ref. 353)
- Government of Western Australia's *Aboriginal Cultural Heritage Act 2021—Consultation Guidelines* (Ref. 354)
- Relevant requirements under Part 6 (managing activities that may harm Aboriginal cultural heritage) of the *Aboriginal Cultural Heritage Act 2021* (WA), including section 101 (consultation about proposed activities) and section 113 (notice of intention to carry out tier 2 activity)
- WA Department of Mines, Industry Regulation and Safety (DMIRS*) Guideline for the Development of Petroleum, Geothermal and Pipeline Environment Plans in Western Australia* (Ref. 355)
- Australian Fisheries Management Authority's (AFMA) Petroleum industry consultation with the commercial fishing industry (Ref. 356)
- Western Australian Fishing Industry Council's (WAFIC) *Oil & Gas Consultation Approach for Unplanned Events* (Ref. 357)
- DPIRDs *Guidance statement for oil and gas industry consultation with the Department of Fisheries* (Ref. 358)
- WA Department of Transport's (DoT) *Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements* (Ref. 359).

The consultation design is reviewed on a case-by-case basis to incorporate any feedback from relevant persons regarding the type of information or method of engagement that is preferred to ensure that the purpose of the consultation is achieved.

6.2.1 Relevant person

In accordance with regulation 11A(1) of the OPGGS(E)R, a relevant person is defined as:

- regulation 11A(1)(a)—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
- regulation 11A(1)(b)—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
- regulation 11A(1)(c)—the department of the responsible State Minister, or the responsible Northern Territory Minister
- regulation 11A(1)(d)—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
- regulation 11A(1)(e)—any other person or organisation that the titleholder considers relevant.

Following the direction given by the Full Court of the Federal Court in *Santos NA Barossa Pty Ltd v Tipakalippa* [2022] FCAFC 193 (Ref. 348), and subsequent NOPSEMA guidance (Ref. 347), it is clear that the phrase "functions, interests or activities" stated in regulation 11A(1)(d) should be broadly construed[24]on the basis that a broad construction best promotes the objects of the OPGGS(E)R. In *Santos NA Barossa Pty Ltd v Tipakalippa*, the Court construed the following terms used in regulation 11A(1)(d) as follows:

- **functions**—a power or duty to do something[25]
- **interests**—in accordance with the accepted concept of "interest" in other areas of public administrative law, and including "any interest possessed by an individual whether or not the interest amounts to a legal right or is a proprietary or financial interest or relates to reputation"[26]
- **activities**—broadly and is broader than the definition of 'activity' in regulation 4 of the OPGGS(E)R and is likely directed to what the relevant person is already doing[27].

Persons or organisations are considered relevant persons under regulation 11(1)(d) of the OPGGS(E)R if their functions, interests or activities may be affected by the petroleum activity to be carried out under the EP. CAPL's approach has been to take a broad interpretation of "function, interest, and activity" and screen in relevant persons.

Where interests are held communally, CAPL has made a decisional choice to consult with representative bodies (Ref. 348at paragraphs 96–102) and has sought to do so through meetings (Ref. 348at paragraph 104). CAPL has sought to provide sufficient information to individuals who are relevant persons by providing information to representative bodies for dissemination with members and by attending meetings with group members (Ref. 348 at paragraph 47) and

[24] Paragraph 51 of *Santos NA Barossa Pty Ltd v Tipakalippa* [2022] FCAFC 193 (Ref. 374).
[25] Paragraph 60 of *Santos NA Barossa Pty Ltd v Tipakalippa* [2022] FCAFC 193 (Ref. 374).
[26] Paragraphs 63 and 65 of *Santos NA Barossa Pty Ltd v Tipakalippa* [2022] FCAFC 193 (Ref. 374).
[27] Paragraphs 58 and 59 of *Santos NA Barossa Pty Ltd v Tipakalippa* [2022] FCAFC 193 (Ref. 374).

CAPL has also sought to identify those representative body organisations themselves as relevant persons (Ref. 348 at paragraph 48). As documented in the summary of consultation (appendix d), CAPL has asked these representative bodies if there are persons or knowledge holders outside of the individuals they represent who may be relevant persons for the purposes of consultation to endeavour to make all necessary efforts to identify relevant persons.

6.2.2 Sufficient information

Under regulation 11A(2) of the OPGGS(E)R and NOPSEMA's guidelines (Ref. 349; Ref. 347), for the purpose of consultation, the titleholder must provide each relevant person with sufficient information to enable them to make an informed assessment of the possible consequences of the petroleum activity on their functions, interests, or activities.

The base level of information provided to all relevant persons includes:

- maps of the proposed petroleum activity location and the associated EMBA
- a summary of the petroleum activity, including indicative schedule and duration
- a summary of the potential impacts and risks as identified by CAPL
- a preliminary assessment of how the potential impacts and risks may impact the environmental and socio-cultural values and sensitivities
- a summary of the proposed control measures that CAPL has adopted to reduce the predicted consequence and/or likelihood of the potential impact or risk.

This base level of information is the minimum required for relevant persons to make an informed assessment of the potential consequences to the persons' functions, interest, or activity because it informs the relevant person of:

- the activity (including spatial and timing information that may intersect with their function, interest, or activity)
- the impacts and risks of the petroleum activity (including the spatial extent of the EMBA and intersection with BIAs) to allow an assessment of how that may impact or create a risk to the relevant persons' functions, interests, or activities
- the control measures to reduce the impacts or risks of the petroleum activity to environmental and socio-cultural values and sensitivities.

Additional information may be provided to reflect the information requested through co-design of consultation, to better enable them to provide feedback related to potential interactions with their function, interest, or activity, or in response to their objection or claim. This includes verbal information and answers to questions during consultation discussions.

The following is a summary of materials released as part of the consultation for this EP:

- CAPL issued an initial factsheet to identified relevant persons on 08 June 2021 and again between 9–15 November 2021; this factsheet included information about the proposed petroleum activity, potential impacts and risks, control measures, and included maps showing EMBA
- CAPL released information regarding the proposed Gorgon umbilical works to the Online Consultation Hub (https://australia.chevron.com/our-

businesses/upcoming-activities) on 3 February 2023 and emailed the link to relevant persons; the Online Consultation Hub contains all the base level of information as described above

- CAPL published notices in The Australian and The West Australian on 3 February 2023; in the Pilbara News, Mid-West Times, and Northwest Telegraph on 8 February 2023, in Business News on 13 February 2023, and National Indigenous Times on 21 February 2023
- CAPL published a LinkedIn post on 24 February 2023 with a link to the Online Consultation Hub that has information regarding Gorgon umbilical works
- CAPL developed posters, presentation materials, and handouts for use and distribution in face-to-face meetings
- CAPL attended various face-to-face meetings with relevant persons (see appendix d)
- CAPL held an information session in the town of Onslow outlining its planned activities, including Gorgon umbilical works, on 14 March 2023.

A copy of the consultation material is included in appendix c. A summary of the consultation strategy and information provided to each category of relevant persons is included in Table 6-1.

Table 6-1: Consultation strategy and information provided to relevant persons

Category of persons or organisations	Consultation strategy and information provided
Commercial fishery licence holders and/or representative bodies	• initial correspondence with WAFIC to provide base level information on the petroleum activity and link to the CAPL Online Consultation Hub • follow up correspondence with WAFIC to confirm the commercial fishery licence holders to be consulted • in consultation with WAFIC, determine the level of consultation required and whether tailored consultation material needs to be developed • provision of consultation material to WAFIC for distribution to relevant commercial fishery licence holders • WAFIC provides any input received to CAPL ,and CAPL provides information to respond to commercial fishery licence holders; any inputreceived is considered in the development of the EP • where a commercial fishery that is not represented by WAFIC has been determined as relevant, the representative body is provided consultation material and feedback is requested • after a reasonable period has been provided to consider the consultation information (as outlined in Section 6.2.3), CAPL will confirm with WAFIC or the relevant industry body (as required) whether further consultation is required • ongoing consultation with follow up correspondence, phone calls and meetings as required.
First Nations people and/or representative bodies	• initial correspondence with relevant First Nations representative bodies to request a meeting with the board, Elders, and other relevant persons • provision of base level information on the petroleum activity and link to the CAPL Online Consultation Hub as a precursor to face-to-face meetings • initial face-to-face meeting held using bespoke consultation material, including posters, presentations and verbal discussions.

<table>
<tr><th>Category of persons or organisations</th><th>Consultation strategy and information provided</th></tr>
<tr><td></td><td>CAPL attendees include Senior Management, Subject Matter Experts and Community Engagement and Partnerships Advisors. Key objectives of the initial meeting include:
• purpose of consultation is to enhance Environment Plans through relevant person input
– co-design of the consultation strategy going forward
– determine if there are additional relevant persons or knowledge holders not present at the meeting who should be informed and consulted with
– provide an explanation of the proposed activity
– ensure relevant persons are aware of the potential impacts and risks associated with the activity (including the EMBA)
– explain the process for providing input
– determine the adequacy of consultation material provided and confirm if any additional information is required for relevant persons to provide input
– confirmation of CAPL's commitment to ongoing consultation and relationship building
• follow up emails, phone calls and meetings, as required, to ensure the functions, interests and activities of First Nations peoples' have been identified and to gain an understanding of cultural values and sensitivities in the EMBA; any input received is considered in the development of the EP
• site visits on country with First Nations people may be conducted as required
• after a reasonable period has been provided to consider the consultation information (as outlined in Section 6.2.3), CAPL provides the First Nations people and/or representative bodies a summary of consultation undertaken to date and requests agreement on the summary
• ongoing consultation with follow up correspondence, phone calls and meetings as required.</td></tr>
<tr><td>ENGOs</td><td rowspan="6">• provision of base level information on the petroleum activity and link to the CAPL Online Consultation Hub via email with a request for input and an offer to meet face-to-face
• where consultation guidance material is available (as outlined in Section 6.2.2), CAPL tailors its consultation to meet the requirements of the guidance material
• local community / town meetings may be held using presentations, posters and verbal discussions as required
• any input received is responded to and considered in the development of the EP
• after a reasonable period has been provided to consider the consultation information (as outlined in Section 6.2.3), CAPL will determine whether further consultation is required
• ongoing consultation with follow up correspondence, phone calls and meetings as required.</td></tr>
<tr><td>Government departments or agencies</td></tr>
<tr><td>Other petroleum titleholders / commercial industries</td></tr>
<tr><td>Tourism and recreation operators</td></tr>
<tr><td>WA World Heritage advisory committees</td></tr>
<tr><td>Self-identified and other relevant persons</td></tr>
</table>

6.2.3 Reasonable period

Under regulation 11A(3) of the OPGGS(E)R and NOPSEMA's guidelines (Ref. 349; Ref. 347), relevant persons must be provided with a reasonable period for the consultation to occur, allowing the relevant person to make an informed assessment of the possible consequences of the proposed petroleum activity on their functions, interests, or activities and respond to the titleholder. "Reasonable period" was not defined by the Full Federal Court in *Tipakalippa* (Ref. 348), however, consistent with the Court's analysis in the "NTA authorities" section of the judgment, CAPL has sought to identify existing guidelines and practices to help inform what a "reasonable period" may constitute for the relevant person.

Guidance on consultation with Commonwealth departments or agencies indicates that agencies will provide an initial response to consultation requests within 10 business days (Ref. 349) or up to eight weeks (Ref. 352).

Available guidance regarding consultation with State departments or agencies indicates a reasonable period for standard activities is no less than 20 business days (Ref. 358), and up to six weeks (Ref. 359).

Guidance taken from the *Aboriginal Cultural Heritage Act 2021—Consultation Guidelines* (Ref. 354) suggests that up to 12 weeks may be a reasonable period of time to allow identification, contact, and response, from First Nations peoples (subject to any alternative timeframe being agreed through co-design of consultation).

CAPL provided all relevant persons an initial period following the issue of consultation materials to respond. Where no response was received, CAPL followed up with each relevant person (via phone, email, or in person) to enquire if there was any clarifications or additional information required to aid their assessment of any interactions with their functions, interests, or activities.

6.2.4 Sensitive information

Regulation 11(A)(3) of the OPGGS(E)R requires that "[t]he titleholder must tell each relevant person the titleholder consults that:

a) the relevant person may request that particular information the relevant person provides in the consultation not be published; and
b) information subject to such a request is not to be published under this Part".

Under regulation 9(8) of the OPGGS(E)R "[a]ll sensitive information (if any) in an environment plan, and the full text of any response by a relevant person to consultation under regulation 11A in the course of preparation of the plan, must be contained in the sensitive information part of the plan and not anywhere else in the plan".

In accordance with regulations 9(8) of the OPGGS(E)R, the full text of all responses received from relevant persons, as well as sensitive information, are included in the sensitive information report provided separately to NOPSEMA to preserve the privacy of those persons or organisations consulted. Specifically, the sensitive information includes records and responses considered to contain personal information (as defined by the *Privacy Act 1988* (Cth)) or information given by a relevant person in consultation under regulation 11A of the OPGGS(E)R in the course of preparing this EP that relevant persons requested not to be published.

6.2.5 Identification of relevant persons

In accordance with NOPSEMA's guideline for consultation (Ref. 347), titleholders must identify who is a relevant person and the rationale used to determine that identification as a relevant person.

Identifying relevant persons requires an assessment of:

- the petroleum activity (Section 3)

- the environment in which the petroleum activity is being undertaken, including:
  - environmental, socio-economic, and cultural values and sensitivities of the environment
  - the spatial extent of the EMBA
  - any intersection between the EMBA and BIAs
- the possible environmental impacts and risks of the petroleum activity and the possible consequences on the functions, interests, activities of relevant persons.

The process undertaken by CAPL for the identification of relevant persons:

- identified what types of authorities, persons, or organisations may be relevant to the values and sensitivities present within the EMBA
- reviewed the functions, interests, or activities of the types of organisations or individuals identified, and determined if the functions, interests, or activities of organisations or individuals may be affected by the petroleum activity through multiple lines of evidence:
  - existing industry guidance (e.g. Ref. 351; Ref. 352; Ref. 356; Ref. 357; Ref. 358; Ref. 359)
  - CAPL's previous consultation history for activities on the NWS
  - advice from representative industry and/or community bodies
  - online searches
  - review of publicly available databases or registers (e.g. access and use authorisations within AMPs, DPIRD's register of fishery licence holders).

The outcomes of this process are detailed inTable 6-2, which lists the relevant persons that were identified for this EP, and CAPL's reasoning for determining their inclusion.

Table 6-2: Potential authority, persons, or organisations that have functions, interests, or activities that are associated with environmental values or sensitivities present within the EMBA

Environmental aspect (and aspect source)	Values and sensitivities	Function, interest, or activity	Potential impact or risk	Intersection	Category of persons or organisations
Physical presence – other marine users • presence of vessels within the OA during the seismic survey • presence of towed equipment from the seismic vessel.	Commercial shipping	Interest and activity – Commercial shipping	Temporary presence of vessels has the potential to result in disruption to other marine users	The OA is predominantly located outside major shipping fairways, and commercial vessel traffic density within the OA is low. Therefore, the temporary presence of the vessels within the OA are not expected to have consequences for the functions, interests or activities of commercial shipping. Notwithstanding, there may be an intersection with commercial shipping activities and the OA.	Commercial shipping industry Government departments or agencies
	Commercial fishing	Interest and activity – Commercial fishing	Temporary presence of vessels has the potential to result in disruption to other marine users	Although Commonwealth and State fisheries are present, the level of fishing effort within the OA is typically low. Fishing effort records obtained from DPIRD for State managed commercial fisheries indicate that fishing effort within the OA varies each year, but that there may be up to >10 vessels operating some years. The temporary presence of vessels within the OA is not expected to significantly affect commercial fishers, however it is acknowledged there may be an intersection with commercial fishing and the OA.	Commercial fishery licence holders and/or representative bodies Government departments or agencies
	Tourism Recreation	Interest and activity – Recreational fishing Marine recreation	Temporary presence of vessels has the potential to result in disruption to other marine users	Due to the distance from the mainland coast, tourism and recreational activities within the OA are expected to be low. The temporary presence of vessels within the OA is not expected to significantly affect tourism and recreational activities. However it is acknowledged that there is potential	Government departments or agencies Tourism and recreation operators

Environmental aspect (and aspect source)	Values and sensitivities	Function, interest, or activity	Potential impact or risk	Intersection	Category of persons or organisations
				for an intersection with tourism and recreational activities where the OA intersects the Montebello AMP.	
	Other commercial industries	Interest and activity – petroleum exploration / production	Temporary presence of vessels has the potential to result in disruption to other marine users	The OA intersects petroleum titles held by other petroleum titleholders and therefore the functions, interests and activities of other petroleum titleholders may be affected.	Other petroleum titleholders
Physical presence – marine fauna • presence of vessels within the OA during the seismic survey • presence of towed equipment from the seismic vessel.	Marine fauna Cultural values	Interest and activity – Environmental conservation Cultural connections	Unplanned interactions with marine fauna	Several BIAs or habitat critical to the survival of a species overlap with the OA, including: Pygmy Blue Whale (migration and distribution BIAs) Flatback Turtle (internesting buffer BIA, internesting habitat critical to the survival of a species) Whale Shark (foraging BIA). As vessels will be slow-moving whilst implementing the activities within the scope of this EP, incidences of fauna strike are not expected. If a fauna strike occurred and resulted in death, it is not expected to have a detrimental effect on the overall population of protected species; this event would result in a limited environmental impact. However, it is acknowledged that relevant persons may hold interests relating to the protection of marine fauna.	Government departments or agencies First Nations people and/or representative bodies ENGOs
Air emissions – • combustion of marine fuel from vessels within the	Marine environmental quality Cultural values	Interest and activity – Environmental conservation	A localised and temporary reduction in air quality	As reduction in air quality will be temporary and highly localised and due to the overall *de minimis* contribution to the reduction of the	Government departments or agencies

Environmental aspect (and aspect source)	Values and sensitivities	Function, interest, or activity	Potential impact or risk	Intersection	Category of persons or organisations
OA during seismic survey • combustion of aviation fuel from helicopters within the OA during seismic survey			Contribution to the reduction of the global atmospheric carbon budget	global carbon budget from the activities under this EP, it is not expected that the functions, interests or activities of relevant persons will be affected. However it is acknowledged that relevant persons may hold interests relevant to this aspect.	First Nations people and/or representative bodies ENGOs
Light emissions – • navigation and operational lighting from vessels during within the OA during the seismic survey	Marine environmental quality Marine fauna Cultural values	Interest and activity – Environmental conservation Cultural connections	A localised and temporary change in ambient light Attractant for light-sensitive species and in turn affect predator-prey dynamics	CAPL expects that its activities could result in temporary changes to ambient light emissions extending to a radius of ~1.4 km from each of the vessels. Several BIAs and/or habitat critical to the survival of a species also overlap with the OA, including: Flatback Turtle (internesting buffer BIA, internesting habitat critical to the survival of a species) Whale Shark (foraging BIA) Wedge-tailed Shearwater (breeding BIA). Impacts associated with lighting are expected to be temporary and localised, however it is acknowledged that relevant persons may hold interests relevant to the values and sensitivities that may be impacted by this aspect.	Government departments or agencies First Nations people and/or representative bodies ENGOs
Underwater sound – • Seismic acquisition in the OA • field support—vessel or helicopter operations during	Marine environmental quality Marine fauna Cultural values Commercial fishing	Interest and activity – Environmental conservation Cultural connections Commercial fishing Recreational fishing Marine recreation	Localised and temporary change in ambient underwater sound Behavioural disturbance Auditory impairment,	Several BIAs or habitat critical to the survival of a species overlap with the Sound EMBA, including: Pygmy Blue Whale (migration and distribution BIA) Flatback Turtle (internesting buffer BIA, internesting habitat critical to the survival of a species)	Government departments or agencies First Nations people and/or representative bodies ENGOs

Environmental aspect (and aspect source)	Values and sensitivities	Function, interest, or activity	Potential impact or risk	Intersection	Category of persons or organisations
the petroleum activity within the OA	Tourism and recreation		temporary threshold shift (TTS), permanent threshold shift (PTS), recoverable or non-recoverable injury to marine fauna Impacts to marine recreational users Changes to values and sensitivities of marine protected areas	Whale Shark (foraging BIA). CAPL has undertaken underwater sound modelling to inform its assessment on the potential for behavioural impacts, TTS and PTS. In addition, the Sound EMBA intersects the Montebello AMP and areas where commercial fisheries operate. CAPL has adopted control measures to reduce impacts and risks associated with underwater sound, including implementation of: • EPBC Policy Statement 2.1 • EPBC Regulations 2000 – Part 8 Division 8.1 – Interacting with cetaceans • Observation shutdown procedures for marine turtles and Whale Sharks • Seismic source validation • Diving Medical Advisory Committee (DMAC) Guidance • Concurrent operations plan • Adjustment protocol Notwithstanding, it is acknowledged that relevant persons may hold interests relevant to the values and sensitivities that may be impacted by this aspect.	Commercial fishery licence holders and/or representative bodies Tourism and recreation operators
Invasive marine pests – • planned discharged of	Benthic habitat and communities Cultural values	Interest and activity – Environmental conservation Cultural connections	Displacement of, or competition with, native species.	The OA is in water depths of ~50–1,250 m, is located offshore from the mainland coast and large ports, and the seabed is predominantly soft sediments. Thus, the more favourable	Government departments or agencies

Environmental aspect (and aspect source)	Values and sensitivities	Function, interest, or activity	Potential impact or risk	Intersection	Category of persons or organisations
ballast water or the presence of biofouling on vessels undertaking seismic survey activities within the OA				requirements of expansive hard substrate and sufficient light for invasive marine pest survival are not common within the OA. Although it is highly unlikely the activities in this EP would result in the introduction of invasive marine pests, once established, invasive marine pests can be difficult to eradicate and therefore there is the potential for a long-term change in habitat structure. As a result, relevant persons may hold interests relevant to the values and sensitivities that may be impacted by this aspect.	First Nations people and/or representative bodies ENGOs
Planned discharges – vessel operations • vessel operations during the seismic survey within the OA	Marine environmental quality Marine fauna Cultural values	Interest and activity – Environmental conservation Cultural connections	Localised and temporary reduction in water quality Changes to predator-prey dynamics	Impacts and risks associated with planned discharges from vessels are expected to be limited to close to the release location and temporary in nature. It is unlikely the functions and activities of relevant persons would be impacted by planned discharges from vessels, however relevant persons may hold interests relevant to the values and sensitivities that may be impacted by this aspect.	Government departments or agencies First Nations people and/or representative bodies
Unplanned release – waste • vessel operations during seismic survey within the OA	Marine fauna Cultural values	Interest and activity – Environmental conservation Cultural connections	Marine pollution resulting in entanglement or injury/mortality of marine fauna.	Unplanned releases of waste may result in impacts to injury/mortality to individual marine fauna. It is unlikely the functions and activities of relevant persons would be impacted by an unplanned release of waste, however relevant persons may hold interests relevant to the values and sensitivities that may be impacted by this aspect.	Government departments or agencies First Nations people and/or representative bodies

Environmental aspect (and aspect source)	Values and sensitivities	Function, interest, or activity	Potential impact or risk	Intersection	Category of persons or organisations
Unplanned release – loss of equipment • use and handling of seismic equipment during deployment and/or retrieval • mechanical failure/damage to equipment	Benthic habitat and communities Cultural values Commercial fishing Other commercial industries	Interest and activity – Environmental conservation Cultural connections	Disruption to other marine users from temporary navigation hazards Alternation of marine habitats arising from seabed disturbance	If equipment is lost during the survey, 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. 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). Notwithstanding, it is possible this aspect may affect the functions, interests and activities of relevant persons.	Government departments or agencies First Nations people and/or representative bodies Commercial fishery licence holders and/or representative bodies Other petroleum titleholders
Unplanned release – loss of containment • using, handling, and transferring hazardous materials and chemicals on board (<1 m^3) • transferring hazardous materials between vessels (50 m^3)	Marine environmental quality Marine fauna Cultural values	Interest and activity – Environmental conservation Cultural connections	Indirect impacts to fauna arising from chemical toxicity	Based on the nature of the unplanned release – loss of containment scenarios considered credible in this EP, the extent and severity of any potential impact is expected to be spatially and temporally limited. It is unlikely the functions and activities of relevant persons would be impacted by an unplanned release, however relevant persons may hold interests relevant to the values and sensitivities that may be impacted by this aspect.	Government departments or agencies First Nations people and/or representative bodies ENGOs
Unplanned release – vessel collision	Marine environmental quality	Interest and activity – Environmental conservation	Marine pollution resulting in sublethal or lethal	Although highly unlikely, an unplanned emergency event resulting in a hydrocarbon spill may affect the	Government departments or agencies

Environmental aspect (and aspect source)	Values and sensitivities	Function, interest, or activity	Potential impact or risk	Intersection	Category of persons or organisations
• vessel operations within the OA	Benthic habitat and communities Coastal communities Marine fauna Marine protected areas World heritage properties National heritage places Cultural values Tourism Recreation Commercial fishing Commercial shipping Scientific research Other commercial industries	Cultural connections Commercial fishing Commercial shipping Recreational fishing Marine recreation Petroleum exploration / production	effects to marine fauna Smothering of subtidal and intertidal habitats Indirect impacts to commercial fisheries and other industries Reduction in amenity resulting in impacts to tourism and recreation Changes to cultural heritage values Changes to values and sensitivities of marine protected areas	functions, interests and activities of relevant persons within the spatial extent of the EMBA. Refer to Section 4.1 for information on the EMBA for the activity.	First Nations people and/or representative bodies WA World Heritage advisory committees ENGOs Commercial fishery licence holders and/or representative bodies Commercial shipping industry Tourism and recreation operators Other petroleum titleholders Submarine cable operators Research organisations
Ground disturbance – shoreline spill response	Marine fauna Coastal communities Cultural values	Interest and activity – Environmental conservation Cultural connections	Potential to damage terrestrial habitats (including nests), with subsequent impacts to fauna such as turtles and birds.	Shoreline protection and deflection and clean-up activities have the potential to result in short-term and localised damage to or alteration of habitats and ecological communities. Shoreline activities will only be undertaken where there is likely to be a net benefit and therefore the functions, interests and activities of	Government departments or agencies First Nations people and/or representative bodies

Environmental aspect (and aspect source)	Values and sensitivities	Function, interest, or activity	Potential impact or risk	Intersection	Category of persons or organisations
				relevant persons are unlikely to be affected.	
Physical presence – oiled wildlife response	Marine fauna Coastal communities Cultural values	Interest and activity – Environmental conservation Cultural connections	Potential to cause further harm to oiled fauna due to hazing, barriers, deterrents, and cleaning activities, and has the potential to cause injury/death.	Oiled wildlife response has the potential to result in injury/mortality to fauna, however will only be undertaken where there is likely to be a net benefit and therefore the functions, interests and activities of relevant persons are unlikely to be affected.	Government departments or agencies First Nations people and/or representative bodies

6.2.5.1 Self-identification

As part of the consultation process (Figure 6-1) CAPL publicly advertised upcoming petroleum activities (refer to Section 6.2.2), to allow for any authorities, persons, or organisations that have not already been identified through the identification process to review information about the petroleum activity, self-identify as a relevant person, and register as a relevant person with CAPL.

This self-identification pathway was included in the consultation process to facilitate a sufficiently broad capture of ascertainable persons and allow for feedback that CAPL may not have otherwise received.

Where an authority, person, or organisation does self-identify, CAPL conducted an assessment of the merits and claims and a response was progressed (as per the process in Section 6.3.6).

6.3 Consultation process

The consultation undertaken during the preparation of this EP used the following process (Figure 6-1):

- described the petroleum activity
- identified environmental aspects
- defined the EMBA and identified environmental values and sensitivities
- evaluated environmental impacts and risks and demonstrated these are reduced to ALARP and acceptable levels
- identified functions, interests, or activities that may be affected
- identified relevant persons
- undertook consultation, including provision of sufficient information to enable relevant persons to understand how this activity may affect their functions, interests, or activities
- requested input from all relevant persons with the intent of identifying opportunities to better manage the activity and enhance the EP for the activity
- considered all input provided and assessed the merit of any objections or claims raised by the relevant persons
- provided a response to the objection or claim, and ensured the response was captured in the EP.

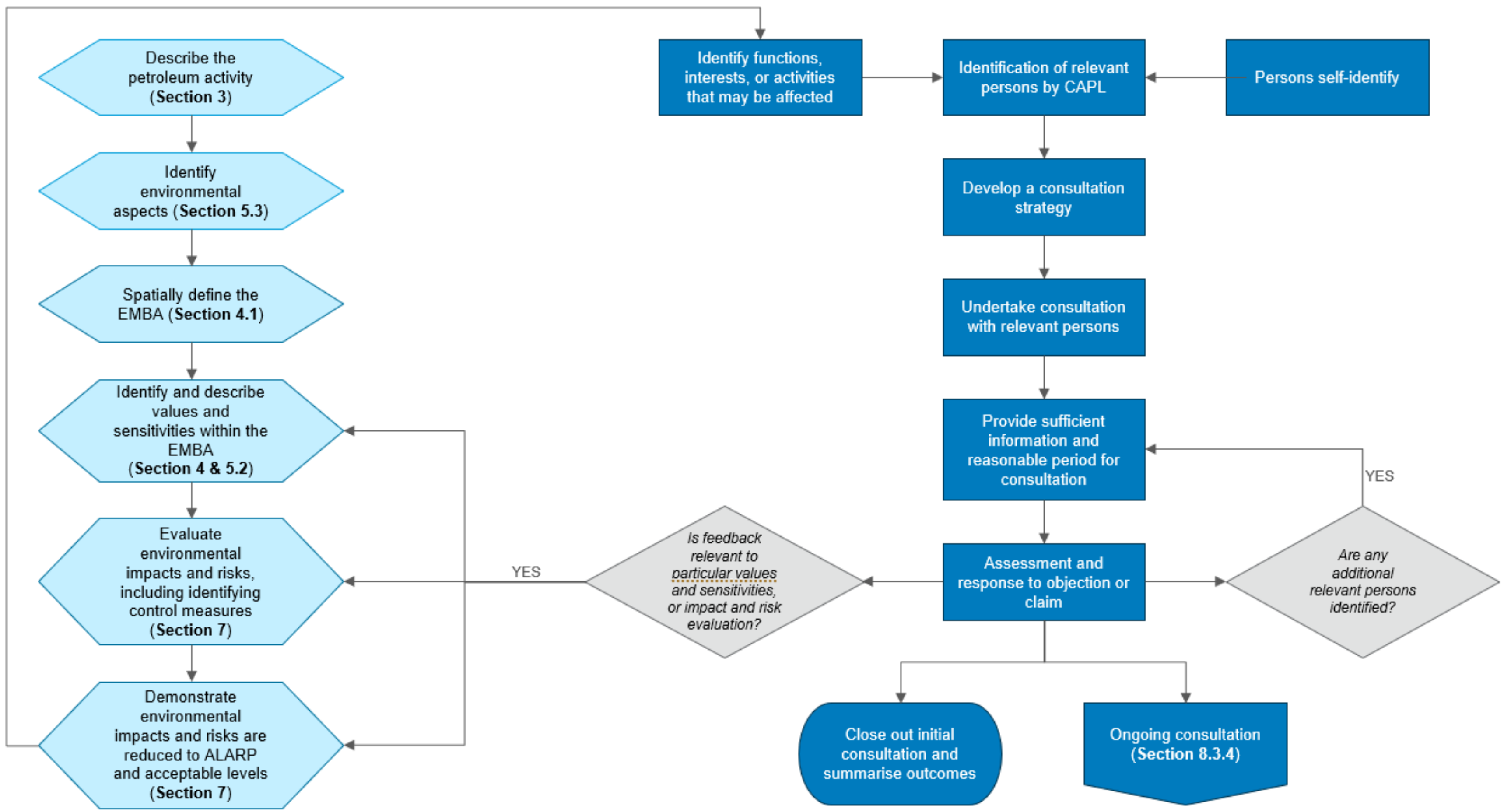


Figure 6-1: Relevant persons consultation process

6.3.1 Relevant persons under regulation 11A(a) and (b)

In accordance with the OPGGS(E)R, relevant persons include the Commonwealth and State departments or agencies to which activities under this EP may be relevant (Section 6.2.1).

CAPL determined relevant persons under these regulations by considering:

- the spatial extent of the EMBA
- the environmental aspects, and potential environmental impacts and risks associated with the petroleum activity
- the responsibilities of the Commonwealth or State department or agency, which was determined by:
  - CAPL's previous consultation history for petroleum activities on the NWS
  - online searches
  - published guidance, including NOPSEMA's *Consultation with Commonwealth agencies with responsibilities in the marine area* guideline (Ref. 351).

The Commonwealth and State departments or agencies that were identified as a relevant person for consultation during the preparation of this EP are presented in Table 6-4.

6.3.2 Relevant persons under regulation 11A(c)

In accordance with the OPGGS(E)R, the department or agency of the responsible State Minister is a relevant person (Section 6.2.1).

The petroleum activity within scope of this EP occurs in Commonwealth waters, off the coast of WA. As such, the Department of Mines, Industry, Regulation and Safety (DMIRS) has been identified as a relevant person for consultation during the preparation of this EP (Table 6-4).

6.3.3 Relevant persons under regulation 11A(d)

In accordance with the OPGGS(E)R, relevant persons include a person or organisation whose functions, interests or activities may be affected by the activities under this EP (Section 6.2.1).

The persons or organisations that were identified as a relevant person for consultation during the preparation of this EP are presented in Table 6-4.

Table 6-3: Considerations for determining relevance of a person or organisation

Category of persons or organisations	Considerations for identifying a relevant person
Commercial fishery licence holders and/or representative bodies	Commonwealth commercial fisheries: • fishery management area intersects with the EMBA, and a record of recent active fishing effort (based on annual ABARES data) occurring within the EMBA • fishing method, preferred locations or water depths, fishing season • key target species, distribution, and behaviour • potential for temporal and/or spatial interaction between petroleum activity and the commercial fishery State commercial fisheries:

Category of persons or organisations	Considerations for identifying a relevant person
	• guidance from WAFIC (Ref. 357) regarding separate consultation strategies for unplanned events such as oil spills, where the titleholder can demonstrate likelihood of an event is "extremely low" • fishery management area intersects with the OA, and a record of recent active fishing effort (based on DPIRD FishCube data) occurring within the OA • fishing method, preferred locations or water depths, fishing season • key target species, distribution, and behaviour • potential for temporal and/or spatial interaction between petroleum activity and the commercial fishery Peak industry bodies: • where a fishery has been determined as relevant, the representative body is also considered relevant.
ENGOs	• CAPL's operating experience in the NWS and pre-existing knowledge of local ENGOs • intersection between the spatial extent of the EMBA and/or values and sensitivities of the environment and the ENGO's interests
First Nations people and/or representative bodies	First Nations people utilise the coast and marine areas for their cultural identity, health and wellbeing, and their domestic and commercial economies. Therefore, the activities under the EP may be relevant to First Nations people who have an enduring cultural and spiritual connection to the sea. First Nations people or groups were identified through: • Native Title claims or determinations intersecting with, or within the vicinity of the EMBA • where an AMP is present within the EMBA, a review of any identified First Nations people or groups • review of Native Title determinations to determine cultural and/or spiritual link with BIAs Representative bodies: • CAPL's operating experience in the NWS and previous interactions with First Nations representative bodies • where a group has been determined as relevant, the representative body is also considered relevant.
Local government departments or agencies	• local government boundary intersects with the EMBAs
Other petroleum titleholders	• CAPL's operating experience in the NWS and pre-existing knowledge of other petroleum operators • other Commonwealth (based on spatial data from NOPTA) petroleum titles that intersect with the EMBA, and with current or proposed activities occurring (based on publicly available EPs from NOPSEMA's EP submission website) within the EMBA • other State (based on spatial data from DMIRS) petroleum titles that intersect with the EMBA, and with current or proposed activities occurring (based on publicly available EP summaries from DMIRS EARS database) within the EMBA • potential for temporal and/or spatial interaction between petroleum activity and the operator of another petroleum title
Tourism and recreation operators	Tourism and recreation operators: • CAPL's operating experience in the NWS and pre-existing knowledge of local tour and recreational operators

Category of persons or organisations	Considerations for identifying a relevant person
	• a record of recent active tour operator fishing effort (based on DPIRD FishCube data) occurring within the EMBA • where an AMP is present within the EMBA, a review of the 'authorisations issued' from Parks Australia (Ref. 361) • potential for temporal and/or spatial interaction between petroleum activity and the tourism/recreational operator Peak industry bodies: • where a tourism or recreational operator has been determined as relevant, the representative body is also considered relevant.
WA World Heritage advisory committees	• World Heritage area intersects with the EMBA, and an Australian World Heritage advisory committee exists

6.3.4 Relevant persons under regulation 11A(e)

In accordance with the OPGGS(E)R, relevant persons may include any other person or organisation that CAPL considers relevant.

Where a person or organisation on this list does not already become a relevant person under regulation 11(A)(d) (using the process as described in Section 6.3.3), CAPL may voluntarily opt to include them in the consultation for the petroleum activity as part of wider and ongoing engagement with their broad stakeholder base.

6.3.5 Conclusion on relevant persons identified

As a result of application of the methodology and identification, the relevant persons identified for the purposes of regulation 11A of the OPGGS(E)R are listed in Table 6-4. CAPL is confident that it has used multiple lines of evidence to identify all relevant persons.

Table 6-4: Relevant persons identified for consultation during preparation of this Wheatstone 4D MSS EP

Relevant person	Rationale
Commonwealth department or agencies (regulation 11A(1)(a))	
Australian Communications and Media Authority (ACMA)	ACMA is a relevant agency for consultation where an activity has the potential to impact economic or social benefits communications infrastructure for Australia. As identified in Section 4.4.6, the EMBA overlaps existing submarine cables. Therefore, the activities under the EP may be relevant to ACMA.
Australian Fisheries Management Authority (AFMA)	As identified in NOPSEMA's consultation guideline (Ref. 351) AFMA is a relevant agency for consultation where an activity can impact or has the potential to impact on fisheries resources in AFMA managed fisheries. Commonwealth fishery management areas have been identified as overlapping with the EMBA (Section 4.4.1). Therefore, the activities under the EP may be relevant to the AFMA.
Australian Hydrographic Office (AHO)	As identified in NOPSEMA's consultation guideline (Ref. 351) AHO is a relevant agency for consultation when nautical products or other maritime safety information is required to be updated. Vessel operations are required for the activities within scope of this EP (Section 3.3), a safety exclusion zone will be requested around the vessels (Section 3.3). Therefore, the activities under the EP may be relevant to the AHO.
Australian Maritime Safety Authority (AMSA)	As identified in NOPSEMA's consultation guideline (Ref. 351) AMSA is a relevant agency for consultation where a proposed activity may impact on the safe navigation of commercial shipping in Australian waters. The EMBA for this EP intersects with shipping routes (Section 4.4.4). Therefore, the activities under the EP may be relevant to the AMSA.
Department of Agriculture, Fisheries and Forestry (DAFF)	As identified in NOPSEMA's consultation guideline (Ref. 351) DAFF is a relevant agency for consultation where an activity has the potential to impact on fishing operations and/or fishing habitats in Commonwealth waters. Commonwealth and State managed fisheries have been identified as overlapping with the EMBA (Section 4.4.1). Therefore, the activities under the EP may be relevant to DAFF.
Director of National Parks (DNP)	As identified in NOPSEMA's consultation guideline (Ref. 351) DNP is a relevant agency for consultation where • the activity or part of activity is within the boundaries of a proclaimed AMP • activities proposed to occur outside a reserve may impact on the values within an AMP • an environmental incident occurs in Commonwealth waters surrounding an AMP and may impact on the values within the park. The EMBA for this EP intersects with AMPs (Section 4.5.1). Therefore, the activities under the EP may be relevant to the DNP.
Department of Climate Change, Energy, Environment and Water (DCCEEW) – Underwater Cultural Heritage	As identified in NOPSEMA's consultation guideline (Ref. 351) DCCEEW is a relevant agency for consultation where an activity has the potential to directly or indirectly adversely impact on protected underwater cultural heritage. The EMBA for this EP overlaps with underwater cultural heritage sites (shipwrecks) (Section 4.6.2). Therefore, the activities under the EP may be relevant to the DCCEEW.
Department of Defence (DoD)	As identified in NOPSEMA's consultation guideline (Ref. 351) DoD is a relevant agency for consultation where:

Relevant person	Rationale
	• a proposed activity may impact DoD training and operational requirements; • a proposed activity encroaches on known training areas and/or restricted airspace • there is a risk of unexploded ordnance in the area where the activity is taking place. DoD areas and/or facilities do intersect with the EMBA (Section 4.6). Therefore, the activities under the EP may be relevant to the DoD.
State or Northern Territory departments or agencies (regulation 11A(1)(b))	
Department of Biodiversity, Conservation and Attractions (DBCA)	DBCA promotes biodiversity and conservation through sustainable management of WA's species, ecosystems, lands and the attractions in their care. The EMBA for this EP intersects with State terrestrial and marine protected areas (Sections 4.5.2 and 4.5.3). Therefore, the activities under the EP may be relevant to DBCA.
Department of Primary Industries and Regional Development (DPIRD)	DPIRD's responsibility is to conserve, sustainably develop and share the use of WA's aquatic resources and their ecosystems. As identified in their consultation guideline (Ref. 358), DPIRD considers that it is a relevant person where a petroleum activity may potentially affect commercially and recreationally important fish species, their prey and habitats, and the business activities of the fishers who harvest these resources in State or Commonwealth waters. State managed commercial fisheries and recreational fisheries have been identified as overlapping with the EMBA (Sections 4.4.1.2 and 4.4.2). Therefore, the activities under the EP may be relevant to DPIRD.
Department of Transport (DoT) - Maritime Environmental Emergency Response (MEER) - Marine Pollution	DoT (MEER) is the hazard management agency for marine oil pollution and maritime transport emergencies in Western Australian waters. The MEER's role is to develop marine oil spill response capabilities, provide resources and support during response operations, training programs, assist in the development of oil spill contingency plans and raise community awareness about the impact of oil spills. MEER considers that it is a relevant person if activities have the potential to cause a marine oil pollution incident in State waters (Ref. 359). While the unplanned hydrocarbon release events identified for this EP will occur in Commonwealth waters, some areas of State waters may be exposed (Section 7.12). Therefore, the activities under the EP may be relevant to DoT.
Department of Water and Environment (DWER)	DWER supports Western Australia's community, economy and environment by managing and regulating the state's environment and water resources on behalf of the Minister for the Environment. Therefore, the activities under this EP may be relevant to DWER.
Pilbara Ports Authority	The Pilbara Ports Authority assumes oversight of Barrow Island, Onslow, Port of Ashburton and more and operates as a corporatized entity that reports to the State Government of Western Australia's Minister of Ports. The activity occurs within Commonwealth and State waters, requires vessels and ports for use. Therefore, the activities under the EP may be relevant to the Pilbara Ports Authority.
Department of the responsible State or Northern Territory Minister (regulation 11A(1)(c))	
Department of Mines, Industry, Regulation and Safety (DMIRS)	DMIRS is the department of the responsible State Minister. Therefore, they are considered a relevant person as per Regulation 11A(1)(c) of the OPGGS(E)R.

Relevant person	Rationale
Person or organisation whose functions, interests, or activities may be affected by the petroleum activity (regulation 11A(1)(d))	
First Nations people and/or representative bodies	
Nganhurra Thanardi Garrbu Aboriginal Corporation Baiyungu People Thalanyji People Yinggarda People	The Nganhurra Thanardi Garrbu Aboriginal Corporation (NTGAC) was registered in 2019 to represent, protect and support the interests of the Baiyungu, Thalanyji and Yinggarda People. Native Title determination WCD2019/016 intersects with the EMBA (Section 4.6.3). The Baiyungu, Thalanyji and Yinggarda People were also identified within the *North-west Marine Parks Network Management Plan* (Ref. 9) as having responsibilities for sea country in the Commonwealth Gascoyne Marine Park (Section 4.5.1). Therefore, the activities under the EP may be relevant to this PBC and the Baiyungu, Thalanyji and Yinggarda People.
Yinggarda Aboriginal Corporation Yinggarda People	The Yinggarda Aboriginal Corporation was registered in 2019 to represent, protect and support the interests of the Yinggarda People. Native Title determination WCD2019/016 intersects with the EMBA (Section 4.6.3). Therefore, the activities under the EP may be relevant to this PBC and the Yinggarda People.
Commercial fishery license holders and/or representative bodies	
Aquaculture Council of Western Australia Commonwealth Fisheries Association Western Australian Fishing Industry Council (WAFIC)	These organisations are peak bodies representing the commercial fishers within Commonwealth or State-managed commercial fisheries. Commonwealth and State managed fisheries have been identified within the EMBA (Section 4.4.1). As such, these organisations have functions, interests, or activities, that may be affected by the activities to be carried out under the EP.
Haysito Holdings Pty Ltd.	Haysito Holdings Pty Ltd. is a commercial fishing license holder that has functions, interests or activities that may be affected by the activities to be carried out under the EP.
Tourism and recreation operators	
Recfishwest	This organisation is the peak body representing the State-managed recreational fisheries. Recreational fishing has been identified within coastal and nearshore areas of the EMBA (Section 4.4.2). As such, this organisation has functions, interests, or activities, that may be affected by the activities to be carried out under the EP.
Ningaloo Visitor Centre	Ningaloo Visitor Centre is located in Exmouth and provides advice and services to both locals and tourists. The EMBA for this EP intersects Commonwealth and State waters offshore, and some small areas of coast, within the Pilbara and Gascoyne regions. As such, this organisation has functions, interests, or activities, that may be affected by the activities to be carried out under the EP.
Boating Industry Association Western Australia (BIAWA)	BIAWA is the voice of the West Australian recreational boating industry, with the main purpose to promote and encourage safe boating and other aquatic sports and pastimes within WA. The EMBA for this EP intersects Commonwealth and State

Relevant person	Rationale
	waters offshore, and some small areas of coast, within the Pilbara and Gascoyne regions. As such, this organisation has functions, interests, or activities, that may be affected by the activities to be carried out under the EP.
Ashburton Anglers	Ashburton Anglers are a local fishing club. The EMBA for this EP intersects Commonwealth and State waters offshore, and some small areas of coast, within the Pilbara and Gascoyne regions. As such, this organisation has functions, interests, or activities, that may be affected by the activities to be carried out under the EP.
Apache Fishing Charters	Recreational fisheries, tourism and recreational activities have been identified as occurring within or adjacent to the EMBA (Sections 4.4.2 and 4.4.5). As such, these businesses may have functions, interests, or activities, that may be affected by the activities to be carried out under the EP.
Archipelago Adventures	
Blue Horizon Charters	
Blue Juice Charters	
Blue Lightning Fishing Charters	
Bluesun 2 Boat Charters	
Cape Immersion Tours	
Ebb and Flow / Glass Bottom Boats	
Exmouth Dive and Whalesharks Ningaloo	
Image Dive and Charters	
Live Ningaloo	
Mackerel Islands	
Mahi Mahi Charters	
Montebello Island Safaris	
Ningaloo Blue Dive	
Ningaloo Glass Bottom Boat	
Ningaloo Whaleshark n Dive	
Ningaloo Whaleshark Swim	
Sail Ningaloo	

Relevant person	Rationale
Top Gun Charters	
View Ningaloo	
Wilderness Island	
Local government departments or agencies	
Exmouth Chamber of Commerce and Industry	The EMBA for this EP does intersect with the small areas of coast (Section 4.3.5.1). Therefore, local governments may be considered relevant persons under regulation 11A(1)(d) of the OPGGS(E)R.
Onslow Chamber of Commerce and Industry	
Shire of Ashburton	
Shire of Exmouth	
WA World Heritage advisory committees	
Ningaloo Coast World Heritage Advisory Committee (NCWHAC)	The NCWHAC provides advice to the Commonwealth and State Environment Ministers on the protection, conservation and management specific to Ningaloo Coast World Heritage Area. The EMBA for this EP does intersect with Ningaloo Coast World and National heritage areas (Section 4.6). Therefore, NCWHAC is considered a relevant person under regulation 11A(1)(d) of the OPGGS(E)R.
Other petroleum titleholders	
British Petroleum (BP)	Petroleum operations have been identified to occur within the spatial extent of the EMBA (Section 4.4.6). Therefore, other petroleum titleholders are considered relevant persons under regulation 11A(1)(d) of the OPGGS(E)R.
Carnarvon Energy	
Jadestone Energy	
Kato Energy	
Kufpec	
PGS Australia Pty Ltd	
Santos	
Sapura OMVUPstream	
Terrafirma Offshore Pty Ltd	

Relevant person	Rationale
TGS NOPEC Geophysical Company Pty Ltd	
Vermillion Oil and Gas	
Western Gas	
Woodside	
ENGOs	
Australian Marine Conservation Society	NGOs are organisations concerned about public welfare, people and the environment. Several environmental receptors intersect with the EMBA (Section 4). Therefore, NGOs may be considered relevant persons under regulation 11A(1)(d) of the OPGGS(E)R.
Cape Conservation Group	
Protect Ningaloo	
Other	
Australian Institute of Marine Science (AIMS)	AIMS undertake research at Rankin Bank. The EMBA for this EP overlaps Rankin Bank (Section 4.3.1). Therefore, AIMS may be considered relevant persons under regulation 11A(1)(d) of the OPGGS(E)R.
Australian Marine Oil Spill Response Centre (AMOSC)	AMOSC are a person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the environment plan. Therefore, they are considered relevant persons under regulation 11A(1)(d) of the OPGGS(E)R.
Oil Spill Response Limited	Oil Spill Response Limited are a person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the environment plan. Therefore, they are considered relevant persons under regulation 11A(1)(d) of the OPGGS(E)R.
Vocus Communications	Vocus Communications are a person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the environment plan. Therefore, they are considered relevant persons under regulation 11A(1)(d) of the OPGGS(E)R.
Any other person or organisation that the titleholder considers relevant (regulation 11A(1)(e))	
First Nations people and/or representative bodies	
Baiyungu Aboriginal Corporation (BAC)	The Baiyungu Aboriginal Corporation was registered to represent, protect and support the interests of the Baiyungu People. While no Native Title determination currently exists within the EMBA and this group have not been identified as having responsibilities for sea country for the AMPs within the EMBA, under regulation 11(A)(1)(e) CAPL selected to include the BAC in consultation. Note that CAPL has consulted NTGAC which also represents the Baiyungu People.

Relevant person	Rationale
Buurabalayji Thalanyji Aboriginal Corporation (BTAC)	The Buurabalayji Thalanyji Aboriginal Corporation was registered in 2008 to represent, protect and support the interests of the Thalanyji People. While no Native Title determination currently exists within the EMBA and this group have not been identified as having responsibilities for sea country for the AMPs within the EMBA, under regulation 11(A)(1)(e) CAPL selected to include the BTAC in consultation. Note that CAPL has consulted NTGAC which also represents the Thalanyji People.
Ngarluma Registered Native Title Body Corporate (NRNTBC)	The Ngarluma Registered Native Title Body Corporate was registered in 2005 to represent, protect and support the interests of the Ngarluma and Yindjibarndi People. While no Native Title determination currently exists within the EMBA and this group have not been identified as having responsibilities for sea country for the AMPs within the EMBA, under regulation 11(A)(1)(e) CAPL selected to include the NRNTBC in consultation.
Ngarluma Yindjibarndi Foundation Ltd (NYFL)	The Ngarluma Yindjibarndi Foundation Ltd. Is the Traditional Owner organisation that delivers social and economic outcomes for its members and broader community. While no Native Title determination currently exists within the EMBA and this group have not been identified as having responsibilities for sea country for the AMPs within the EMBA, under regulation 11(A)(1)(e) CAPL selected to include the NYFL in consultation.
Wirrawandi Aboriginal Corporation (WAC) Registered Native Title Body Corporate	Wirrawandi Aboriginal Corporation RNTBC was registered in 2018 to hold and manage the native title rights and interests for the Mardudhunera and Yaburara people. While no Native Title determination currently exists within the EMBA and this group have not been identified as having responsibilities for sea country for the AMPs within the EMBA, under regulation 11(A)(1)(e) CAPL selected to include the WAC in consultation.
Yamatji Marlpa Aboriginal Corporation (YMAC)	YMAC is the native title representative body for the Traditional Owners of the Pilbara, Midwest, Murchison and Gascoyne regions of WA. While no Native Title determination currently exists within the EMBA and this group have not been identified as having responsibilities for sea country for the AMPs within the EMBA, under regulation 11(A)(1)(e) CAPL selected to include the YMAC in consultation.
Commercial fishery licence holders and/or representative bodies	
Australian Council of Prawn Fisheries	Australian Council of Prawn Fisheries is made up of industry bodies and companies that deal with wild prawns or the prawn industry. Commercial prawn fisheries operate outside the boundary of EMBA, however under regulation 11(A)(1)(e) CAPL selected to include the council in consultation.
Northern Prawn Fishery	Northern Prawn Fishery targets prawns in northern Australian waters. The Northern Prawn Fishery operates outside the boundary the EMBA, however under regulation 11(A)(1)(e) CAPL selected to include the fishery in consultation.
Pearl Producers Association	Pearl Producers Association are the peak representative body of the Australian South Sea Pearling Industry. Relevant pearling operations occur outside the boundary of EMBA, however under regulation 11(A)(1)(e) CAPL selected to include the council in consultation.

Relevant person	Rationale
Cygnet Bay Pearl Farm	These pearling operators have operations occurring outside the boundary of EMBA, however under regulation 11(A)(1)(e) CAPL selected to include the council in consultation.
Maxima Pearling Company	
Paspaley Pearls	
Western Rock Lobster Council	Western Rock Lobster (WRL) is the peak industry body representing the interests of the western rock lobster fishery. The WRL fishery operates outside the boundary of EMBA, however under regulation 11(A)(1)(e) CAPL selected to include the WRL Council in consultation.
Tourism and recreation operators	
Tourism Western Australia	The EMBA for this EP intersects Commonwealth and State waters offshore, and some small areas of coast, within the Pilbara and Gascoyne regions, and therefore under regulation 11(A)(1)(e) CAPL selected to include this organization in consultation.
Karratha Tourism and Visitor Centre	The EMBA for this EP intersects Commonwealth and State waters offshore, and some small areas of coast, within the Pilbara and Gascoyne regions, and therefore under regulation 11(A)(1)(e) CAPL selected to include this organization in consultation.
Local government departments or agencies	
Carnarvon Chamber of Commerce	The EMBA for this EP intersects Commonwealth and State waters offshore, and some small areas of coast, within the Pilbara and Gascoyne regions, and therefore under regulation 11(A)(1)(e) CAPL selected to include this organization in consultation.
City of Karratha	
Gascoyne Development Commission	
Karratha and Districts Chamber of Commerce and Industry	
Shire of Carnarvon	
Other	
Member for Pilbara	The EMBA for this EP intersects Commonwealth and State waters offshore, and some small areas of coast, within the Pilbara and Gascoyne regions, and therefore under regulation 11(A)(1)(e) CAPL selected to include this organization in consultation.
Member of Legislative Authority – North West Central	
Member of Mining and Pastoral Region	

Relevant person	Rationale
Minister for Environment WA	The Minister of the Environment is tasked with the protecting the natural environment and promoting conservation. The EMBA for this EP intersects Commonwealth and State waters offshore, and some small areas of coast, within the Pilbara and Gascoyne regions, and therefore under regulation 11(A)(1)(e) CAPL selected to include this organization in consultation.
Pilbara Development Commission	The Pilbara Development Commission works across government to support economic growth, stimulate job growth and increase industry innovation among other things. The EMBA for this EP intersects Commonwealth and State waters offshore, and some small areas of coast, within the Pilbara and Gascoyne regions, and therefore under regulation 11(A)(1)(e) CAPL selected to include this organization in consultation.
Exmouth Gulf Taskforce	The Exmouth Gulf Taskforce provides high level advice to the Minister for Environment on the environmental management of the Exmouth Gulf and its surrounds, to help preserve the region's unique environmental, cultural and social values. The EMBA for this EP intersects Commonwealth and State waters around Exmouth, and therefore under regulation 11(A)(1)(e) CAPL selected to include this organization in consultation.
Gascoyne Junction Community Resource Centre	The EMBA for this EP intersects Commonwealth and State waters offshore, and some small areas of coast, within the Pilbara and Gascoyne regions, and therefore under regulation 11(A)(1)(e) CAPL selected to include this organization in consultation.
Coral Bay Progress Association	
Care for Hedland Environmental Association	
WA Coastal and Marine Community Network	
WA Marine Science Institute	The Western Australian Marine Science Institution (WAMSI) is a collaboration of state and federal government and academic science organisations working together to provide independent marine research for the benefit of the environment, the community and the Blue Economy. The EMBA for this EP intersects Commonwealth and State waters offshore, and some small areas of coast, within the Pilbara and Gascoyne regions, and therefore under regulation 11(A)(1)(e) CAPL selected to include this organization in consultation.
Western Australian Museum	The Western Australian Museum is the State's premier cultural organisation, housing WA's scientific and cultural collection. The EMBA for this EP intersects Commonwealth and State waters offshore, and some small areas of coast, within the Pilbara and Gascoyne regions, and therefore under regulation 11(A)(1)(e) CAPL selected to include this organization in consultation.
Centre for Whale Research Western Australia	The Centre for Whale Research (Western Australia) Inc. is a non-profit research established in 1993 to conduct scientific research into marine mammals. The EMBA for this EP intersects Commonwealth and State waters offshore, and some small areas of coast, within the Pilbara and Gascoyne regions, and therefore under regulation 11(A)(1)(e) CAPL selected to include this organization in consultation.
Wilderness Society	

Relevant person	Rationale
Whale and Dolphin Conservation Society	ENGOs are organisations concerned about public welfare, people and the environment. The EMBA for this EP intersects Commonwealth and State waters offshore of the Pilbara and Gascoyne regions, and therefore under regulation 11(A)(1)(e) CAPL selected to include this organization in consultation.
International Fund for Animal Welfare (IFAW)	
Greenpeace	
Coral Futures Corporation	
Australian Conservation Foundation	

6.3.6 Assessment and response

CAPL has assessed the merits of all objections and claims regarding the consequences of the petroleum activity on a relevant persons functions, interests, or activities received during the consultation period that relate to the petroleum activity, consistent with regulation 16(b)(ii) of the OPGGS(E)R. This was done by evaluating appropriate evidence, including evidence provided by the relevant person submitting the objection or claim, and identifying potential impacts or risks on the totality of the values and sensitivities that could be affected by the petroleum activity. Potentially adverse impacts of the petroleum activity may need to be mitigated through the application of appropriate control measures. CAPL considers all input received from relevant persons with the intent of identifying opportunities to better manage its activities and enhance its EPs.

Claims or objections not directly related to the petroleum activity (such as statements of fundamental objection to the oil and gas industry) are not considered to have merit under the OPGGS(E)R because they are not relevant to the petroleum activity itself, or the impacts and risks of the petroleum activity. However, the consultation report summarises these statements and explains why they have not been considered in preparing the EP.

A summary of the outcomes of consultation undertaken with relevant persons during the preparation of this EP is provided in appendix d. The table provides a description of the matters, objections or claims, assessment of the merits of the objection or claim, how CAPL responded to the relevant person, and where or how any changes resulting from the consultation were incorporated into the EP.

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

6.3.7 Summary information

Regulation 16 of the OPGGS(E)R requires that an EP contain:

- a report on all consultations under regulation 11A of any relevant person by the titleholder, that contains:
  - a summary of each response made by a relevant person
  - an assessment of the merits of any objection or claim about the adverse impact of each activity to which the EP relates
  - a statement of the titleholder’s response, or proposed response, if any, to each objection or claim
  - a copy of the full text of any response by a relevant person.

Regulation 10A(g)(ii) of the OPGGS(E)R requires that the EP demonstrates that “the measures (if any) that the titleholder has adopted, or proposes to adopt, because of the consultations are appropriate”.

A summary of each response, CAPL’s assessment of the merits of any objection or claim, and CAPL’s response to each objection or claim is provided within the EP in Section 6.3.6. The consultation summary also describes what (if any) changes to the EP, including control measures, were made in response to each objection or claim.

6.3.8 Conclusion on consultation

CAPL has provided sufficient information and reasonable time to enable these relevant persons to make an informed assessment of the possible impacts and risks of the petroleum activity on their functions, interests or activities, and sufficient time to provide relevant feedback for CAPL to assess relevant persons claims and action the assessment and response. CAPL commits to ongoing consultation with relevant persons as outlined in Section 8.3.4.2.

6.4 Public comment

6.4.1 2022 public comment period (closed)

The Wheatstone 4D MSS EP was previously submitted to NOPSEMA for assessment in February 2022. In accordance with regulation 11B of the OPGGS(E)R, the Wheatstone 4D MSS EP was published on the NOPSEMA website between 1–31 March 2022 with an invitation for any person to provide written comments on the content of the EP. To promote the public comment period, CAPL also published notices in The Australian, The West Australian, The Pilbara News, and on the homepage of the Chevron Australia website. Copies of the CAPL published notices are included in the sensitive information report.

No comments were received via the NOPSEMA website during the March 2022 public comment period, and as such CAPL was not required to prepare and submit a written response statement.

6.4.2 2023 public comment period (open)

As part of the re-submission of the Wheatstone 4D MSS EP in June 2023, and in accordance with regulation 11B of the OPGGS(E)R, the EP will be released for another 30-day public comment period by NOPSEMA, with an invitation for any person to provide written comments on the content of the EP. This public comment period occurs after the submission of the EP to NOPSEMA.

If comments are received during this public comment period, CAPL will respond to comments in alignment with NOPSEMA's Responding to public comment on environment plans guidance note (Ref. 360), and the EP will be updated as required prior to resubmission to NOPSEMA for assessment.

7 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 7-1 summarises the impacts and risks that were identified and evaluated for this activity.

Table 7-1: Summary of impact and risk evaluation

Section	Aspect	Impact	Risk			Decision context	ALARP	Acceptable
		C^	C^	L	R			
7.1	Physical presence—other marine users	–	6	4	9	A	Yes	Yes
7.2	Physical presence—marine fauna	–	6	4	9	A	Yes	Yes
7.3	Air emissions	6	–	–	–	A	Yes	Yes
7.4	Light emissions	6	5	5	9	A	Yes	Yes
7.5	Underwater sound—seismic acquisition	5	5	3	7	B	Yes	Yes
7.6	Underwater sound—field support operations	5	5	6	10	A	Yes	Yes
7.7	Invasive marine pests	–	2	6	7	A	Yes	Yes
7.8	Planned discharges—vessel operations	6	6	6	10	A	Yes	Yes
7.9	Unplanned release—waste	–	6	5	10	A	Yes	Yes
7.10	Unplanned release—loss of equipment	–	6	4	9	A	Yes	Yes
7.11	Unplanned release—loss of containment	–	5	5	9	A	Yes	Yes
7.12	Unplanned release—vessel collision event	–	4	5	8	A	Yes	Yes
7.13.4.1	Ground disturbance – shoreline spill response	–	5	5	9	A	Yes	Yes
7.13.4.2	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.

7.1 Physical presence—other marine users

Source			
Activities identified as having the potential to result in an interaction with other marine users are: • 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	–	Unplanned interactions with other marine uses may result in: • disruption to commercial shipping and fishing vessels • disruption to other petroleum facilities or activities	 6 6
Consequence evaluation			

Disruption to commercial shipping and fishing vessels

The seismic vessel and at least one of the support vessels will be present within the OA for the duration of the 4D MSS (~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 km^2.

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.

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.

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. 29; Figure 4-8). Specifically, during 2018, fishing effort was recorded in blocks outside the FPZ with <3 fishing vessels present (Figure 4-8). The Mackerel Managed Fishery vessels are primarily active during May to November (Ref. 28), which is outside of the proposed timing of the seismic survey (Section 3.1.3).

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 4-9).

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 4-10).

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. 29; Figure 4-7). 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 during the 2019–20 fishing season, and six permits during the 2020-2020 season (Section 4.4.1.1).

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 4-12).

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

expected to impact on the functions, interests, or activities of other marine users (as confirmed by relevant persons 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 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 petroleum 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 gazetted 500 m radius PSZ in place (Section 4.4.6.1). 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. Vessel-based activities (e.g., IMR/IMMR surveys) may be associated with ongoing operations of both platforms and the adjacent Julimar operations (Table 4-21). Should concurrent vessel-based activities be scheduled within proximity to each other, these are typically managed via concurrent operations plans. The OA associated with the GWA Facility is located ~5 km east from the Wheatstone 4D MSS OA (Table 4-21), and as such, disruption to GWA activities due to the presence of seismic and support vessels within the Wheatstone 4D MSS OA is not expected to occur. There is no potential for concurrent seismic activities within the vicinity of the OA based on existing approved seismic surveys (Section 4.4.6.1). While the operational areas for two approved survey scopes overlap the OA (Figure 4-13), given the EP expiry dates, there will be no temporal overlap with the timing of the Wheatstone 4D MSS survey (Table 4-20). As such, any disruption to other seismic activities due to the presence of vessels within the Wheatstone 4D MSS OA is not expected to occur[28]. However, should concurrent seismic surveys be scheduled within proximity to each other, these are typically managed via concurrent operations plans and time-sharing arrangements. There are other petroleum activities that also have the potential to temporally and/or spatially overlap with the Wheatstone 4D MSS. Of those identified in Table 4-21, only one (Woodsides' Balnaves Plug and Abandonment) has commenced activities; however no temporal overlap with the 4D MSS is expected (Table 4-21). Engagement (to date) with Woodside Energy has also identified that activities associated with the Scarborough trunkline installation are indicatively scheduled to occur at the same time as the 4D MSS, pending environmental approvals for the activities (Table 4-21). Should concurrent activities be ongoing or scheduled to occur within proximity to each other, these are typically managed via concurrent operations plans. 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 relevant persons 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	
Control measure	**Description**
Relevant persons engagement	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.

[28] Impacts and risks associated with underwater sound from concurrent seismic surveys is assessed separately in Section 7.6.

	In addition to consultation undertaken during the preparation of this EP (Section 6), where requested, relevant persons will also be notified prior to the commencement of activities in accordance with Table 8-6.
Maritime safety information	Maritime safety information, such as AUSCOAST radio-navigation warnings, are issued by the Joint Rescue Coordination Centre (JRCC) Australia, part of AMSA. Under the *Navigation Act 2012*, the AHO is also responsible for maintaining and disseminating navigational charts and publications, including providing safety-critical information to mariners (including any change to prohibited/restricted areas, obstructions to surface navigation, etc.) via the Notice to Mariners system. Notice to Mariners can be permanent or temporary notifications. As per Table 8-6, 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. There will be a 500 m radius SNA requested around the seismic vessel and towed array for the duration of activities.
Safe Navigation Area (SNA)	As described in Section 3.3, there will be a 500 m radius 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. Presence of the SNA will reduce the likelihood of interfering with other marine users.
Marine Standard	*Chevron's Marine Standard Non Tankers: Corporate OE Standard* (Ref. 40) ensures that various legislative requirements are met. These include: • crew meet the minimum standards for safely operating a vessel, including watchkeeping requirements • navigation, radar equipment, and lighting meets industry standards. These requirements will ensure that direct vessel radio contact is available to other marine users operating in this area to enable ease of communication in highlighting risks and SNAs.
Managing Safe Work (MSW) process	CAPL's *Managing Safe Work OE Process* (Ref. 39) ensures that workplace safety and health hazards are assessed and managed. The permit to work (PTW) system is part of this process and includes simultaneous operations (SIMOPS) and hazard analysis. Where required under the MSW process, a SIMOPS Plan will be developed to identify and manage hazards arising from the 4D MSS activities and other CAPL planned petroleum activities when occurring within the same area. The potential for concurrent CAPL petroleum activities was reviewed (Table 4-21), and identified that the Wheatstone Platform is within the OA for the 4D MSS. Consequently, a SIMOPS Plan will be in place prior to the petroleum activity commencing for managing the Wheatstone 4D MSS in conjunction with Wheatstone Platform operations. There is currently no planned vessel-based activities under CAPL operational control scheduled to occur during the Wheatstone 4D MSS (mid-December to mid-April) (Table 4-21). As described in Section 8.3.1.1, if additional SIMOPS Plans are required to be developed because of a change in scheduled CAPL activities within the OA, these will be in place prior to the 4D MSS commencing.
Concurrent operations plan (COP)	Where required, a COP (or equivalent) 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. The potential for concurrent (non-CAPL) petroleum activities was reviewed (Table 4-21), and identified that the Pluto Platform is within the OA for the 4D MSS. A COP (or equivalent) will be in place prior to the petroleum activity commencing for managing the Wheatstone 4D MSS in

	conjunction with Pluto Platform operations and/or any associated vessel-based activities. As noted in Section 4.4.5, no concurrent seismic surveys within or adjacent to the 4D MSS OA are currently scheduled, and as such no COP is required. Engagement (to date) with Woodside Energy (Table 4-21) has indicated the potential for other petroleum activities (e.g. the Scarborough trunkline installation [pending environmental approvals] to occur at the same time asthe 4D MSS. As described in Section 8.3.1.1, if COPs are required to be developed because ongoing consultation with other operators identifies concurrent operations, these will be in place prior to the 4D MSS commencing.	
Petroleum safety zones	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.	
DMAC Guidance	Guidance note DMAC 12 issued by the UK Diving Medical Advisory Committee (DMAC) "Safe Diving Distance from Seismic Surveying Operations" (Ref. 253) 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. 253).	
Lookahead update	The seismic vessel will provide lookahead updates to those operators as identified within SIMOPS Plans and/or COPs, notifying them of the planned 4D MSS acquisition and vessel location in each upcoming 24-hour period. The seismic vessel may also provide these updates to other on-the-water vessel operators (e.g. a commercial fishing vessel within the vicinity of the acquisition area). Communication of the 4D MSS survey schedule to other marine users ensures they are informed and aware, thereby reducing the likelihood of interference with other marine users.	
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 8.3.4.1). 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. As part of the notification prior to the commencement of activities (Table 8-6), commercial fisheries will be provided with information regarding the implementation of CAPL's adjustment protocol (e.g., when and where it applies, what is covered, etc.).	
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 interaction with other marine users is considered low. As such, CAPL consider that the likelihood of the consequence occurring is Unlikely (4).	
Risk level	Very low (9)	

<table>
<tr><th colspan="3">Determination of acceptability</th></tr>
<tr><td>Principles of ESD</td><td colspan="2">The risks associated with this aspect are associated with unplanned interactions causing incidental disruption to other marine users, which is not considered as having the potential to affect biological diversity and ecological integrity.
The consequence associated with this aspect is Incidental (6).
Therefore, no further evaluation against the Principles of ESD is required</td></tr>
<tr><td rowspan="3">Relevant environmental legislation and other requirements</td><td colspan="2">Legislation and other requirements considered relevant for this aspect include:
• Navigation Act 2012 (Cth).
CAPL considers that impact and risk management is consistent with these requirements, as demonstrated below.</td></tr>
<tr><td>Requirement</td><td>Demonstration</td></tr>
<tr><td>Navigation Act 2012
Notice to Mariners</td><td>Requirement to issue a Notice to Mariners has been incorporated into the maritime safety information control measure.</td></tr>
<tr><td>Internal context</td><td colspan="2">These CAPL management processes or procedures were deemed relevant for this aspect:
• Marine Standard Non Tankers: Corporate OE Standard (Ref. 40)
• MSW process (Ref. 39).
Control measures related to each of the above management processes or procedures have been described for this aspect. As such, CAPL considers that impact and risk management is consistent with company policy, culture, and standards.</td></tr>
<tr><td>External context</td><td colspan="2">During relevant persons consultation, no objections or claims were raised regarding interaction with other marine users arising from the activity.</td></tr>
<tr><td>Defined acceptable level</td><td colspan="2">These risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.</td></tr>
</table>

Environmental performance outcome	Environmental performance standard	Measurement criteria
Other marine users are aware of the 4D MSS	**Relevant persons engagement** Relevant persons that have requested notifications will be advised of the commencement and expected completion dates of the activity and any relevant SNA information in accordance with Table 8-6	Relevant persons 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
	Marine Standard Vessels will meet the crew competency, navigation equipment, and radar	Records indicate that vessels meet the crew competency, navigation equipment, and radar requirements of the Marine Standard

	requirements of the Marine Standard	
Reduce disruption to other titleholders' petroleum activities within the OA from vessel activity associated with the 4D MSS	**Safe navigation area** Establish and maintain a 500 m radius SNA around the seismic vessel and towed array for the duration of the survey	Records demonstrate that the SNA has been established and details have been communicated to approaching third-party vessels
	MSW process CAPL will develop and implement SIMOPS Plan(s) to manage 4D MSS and other planned petroleum activities within CAPL operational control within the OA	Records demonstrate that a SIMOPS Plan for the 4D MSS and Wheatstone Platform operations was in place prior to the 4D MSS commencing, and was implemented for the duration of the survey
		Records indicate that if other concurrent CAPL activities within the OA are identified, additional SIMOPS Plans were developed and in place prior to the 4D MSS commencing, and implemented for the duration of the survey
	Concurrent operations plan CAPL will develop and implement COPs (or equivalent) to manage 4D MSS and other planned petroleum activities within the OA	Records demonstrate that a COP (or equivalent) for the 4D MSS and Pluto Platform operations was in place prior to the 4D MSS commencing, and was implemented for the duration of the survey
		Records indicate that if other concurrent petroleum activities within the OA are identified, additional COPs were developed and in place prior to the 4D MSS commencing, and implemented for the duration of the survey
	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 PSZs, without an approved application for entry and presence, within the OA
	DMAC Guidance If diving activities are scheduled to occur at the time of the 4D MSS acquisition, consultation and management of activities will be undertaken as per the Guidance DMAC 12: Safe Diving Distance from Seismic Surveying Operations	If required, records demonstrate that DMAC guidance was implemented for concurrent seismic and diving operations
	Lookahead update Lookahead updates provided to operators (as identified within SIMOPS Plans or COPs), and to other on-the-water vessel operators, for the duration of the 4D MSS acquisition period	Records demonstrate that lookahead updates were provided for the duration of the 4D MSS acquisition period
Reduce the impact to commercial fishery licence holders within	**Adjustment protocol** Relevant commercial fisheries will be advised of the Adjustment	Relevant persons consultation records

the OA from vessel activity associated with the 4D MSS	Protocol at least four weeks prior to commencing offshore activities	
	Adjustment protocol CAPL will assess any evidence-based claims from commercial fishery licence holders for compensation in line with the adjustment protocol (Section 8.3.4.1)	Records show that any evidence-based claim from commercial fishery licence holders was assessed and decision finalised
	Adjustment protocol If an independent third-party is required to be appointed (Section 8.3.4.1), they will be provided with the Adjustment Protocol and claim details (including supporting evidence)	Records show that the independent third-party was appointment by agreement of both CAPL and the fishery licence holder
	Adjustment protocol If an independent third-party is required to be appointed (Section 8.3.4.1), they will be provided with the Adjustment Protocol and claim details (including supporting evidence)	Records show that the independent third-party was appointment by agreement of both CAPL and the fishery licence holder
		Copies of the Adjustment Protocol, claim details, and supporting evidence were provided to the independent third-party to enable them to provide a claim assessment decision

7.2 Physical presence—marine fauna

Source			
Activities identified as having the potential to result in an interaction with marine fauna are: • 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	–	Unplanned interactions with marine fauna may result in: • injury or death of marine fauna • changes to cultural heritage values	 6 6
Consequence evaluation			

Injury or death of marine fauna

Surface-dwelling fauna are the species most at risk from this aspect and thus are the focus of this evaluation. As identified in Section 4.3.3, 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 habitat critical to the survival of a species also overlap with the OA, including:

- Pygmy Blue Whale (migration and distribution BIAs)
- Flatback Turtle (internesting buffer BIA, internesting habitat critical to the survival of a species)
- Whale Shark (foraging BIA).

As identified in Section 4.5.1, the OA overlaps with the Montebello Marine Park. Natural values of this AMP include species listed as threatened, migratory, marine, or cetacean under the EPBC Act, as well as any identified BIAs for regionally significant marine fauna.

A review of the documents made or implemented under the EPBC Act for all turtle, shark and cetacean species likely to be present within the OA (i.e., Flatback Turtles [Ref. 58], Whale Sharks [Ref. 60], Fin Whale [Ref. 61], Sei Whale [Ref. 62], and Blue Whale [Ref. 63]) indicates that either vessel disturbance or interaction (such as collisions) as a key threat to the recovery of the species.

The *Recovery Plan for Marine Turtles in Australia* (Ref. 58) 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 OA for the 4D MSS occurs in Commonwealth waters only, and does not include shallow coastal habitats. The Recovery Plan defines the habitat critical to the survival of a species for internesting as a distance seaward from nesting habitat critical to the survival of a species of 60 km for Flatback Turtles (Ref. 58). However, recent studies (Ref. 64) have indicated that the internesting behaviour of Flatback Turtles on the NWS appears more spatially restricted than that suggested by the Recovery Plan (Ref. 58). Whittock et. Al. (Ref. 64) 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. 64). Other previous studies (e.g., Ref. 258; Ref. 259; Ref. 260) have also presented findings that Flatback Turtle internesting behaviour was only observed in water depths of <40 m. This suggests that although the OA does overlap with some internesting habitat critical to the survival of a species and internesting buffer BIA, due to the OA being located offshore (>25 km from the Montebello Islands) and with increasing water depths (from >50 m and up to ~1,250 m) it is considered unlikely that Flatback Turtles would be aggregating within the OA during their internesting period.

For all cetacean species likely to be present within the OA, the Recovery Plans or Conservation Advices indicate that management actions are limited to reporting of incidents via the national database (included within reporting requirements in Section 8.4.2) and ensuring that the risk of vessel strike is assessed (see the following text below).

Cetaceans are naturally inquisitive marine mammals that are often attracted to offshore vessels and facilities. The reaction of whales to the approach of a vessel is quite variable. Some species remain motionless when near a vessel, while others are curious and often approach vessels that have stopped or are slow moving, although they generally do not approach, and sometimes avoid, faster-moving vessels (Ref. 65). There have been recorded instances of cetacean deaths in Australian waters (e.g., a Bryde's Whale in Bass Strait in 1992) (Ref. 67), although the data indicates deaths are more likely to be associated with container ships and fast ferries. Mackay et al. (Ref. 68) report that four fatal and three non-fatal collisions with Southern Right Whales were recorded in Australian waters between 1950 and 2006, with one fatal and one non-fatal collision reported between 2007 and 2014.

The *Conservation Management Plan for the Blue Whale 2015–2025* (Ref. 63 indicates 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. 66) 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 4.3.3.1.1, 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 vessel presence in the OA 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 4.3.3.1.1, 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 4.3.3.1.2). 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. 69, Ref. 70) 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 with in the BIA (July to November) (Ref. 71). 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). Given the limited impacts expected to marine fauna from vessel strikes, it is therefore expected that there would also be limited environmental impacts to the values of the Montebello Marine Park.

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 populations, and the risks are considered limited with potential consequences for individuals. Therefore, CAPL has ranked the potential consequence to marine fauna from physical presence as Incidental (6).

Changes to cultural heritage values

There are no World, National, or Commonwealth heritage listed places or sites within the OA (Section 4.6).

Based on the outcomes of relevant persons consultation, CAPL considers that indirect impacts to intangible First Nations cultural values may occur due to impacts on marine fauna. The consequence evaluations to these receptors are provided above, and were risk assessed as Incidental (6). Given the offshore location of the OA (~30 km from the Montebello Islands, and ~119 km from the mainland; Figure 3-1) and duration of the campaign (~75 days), a significant adverse change to cultural values attributed to the offshore marine area is not predicted to occur. As such, CAPL has ranked the consequence for cultural values consistent with that for marine fauna, 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 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.

During relevant persons consultation, no objections or claims were raised regarding interaction with marine fauna arising from the activity.

The risks arising from the physical presence of vessels are considered lower-order risks in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect. Notwithstanding this, CAPL has considered additional mitigation measures that could potentially further reduce the risk of physical interaction with marine fauna species (in addition to legislated requirements for cetaceans).

Good practice control measures

Control measure	Description
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.
4D MSS timing	The 4D MSS will be scheduled to minimise overlap with regional peak migration periods for cetaceans and shark species to reduce the likelihood of high numbers of individuals transiting through the OA. Vessel-based activities for the 4D MSS are scheduled to occur over a ~75 day period between mid-December to mid-April (Section 3.1.3). Presence within the Whale Shark foraging BIA is expected from July to November (Section 4.3.3.3.1), and as such there is no temporal overlap with the timing for the 4D MSS. The peak periods of Pygmy Blue Whale migration are considered to be April to August (northern migration) and November to December (southern migration) (Section 4.3.3.1.1). The timing for the 4D MSS has the potential for either a small (~2 weeks) overlap with the end of the peak southern migration or the start of the peak northern migration period.

Additional control measures and cost-benefit analysis

Control measure	Benefit	Cost
Interacting with Whale Sharks	While vessel operations within the OA for the 4D MSS (mid-	The detection of Whale Sharks within the vicinity of vessel

	December to mid-April) do not coincide with the use of the migration BIA (July to November), there is the potential for occasional transient Whale Sharks to be present within the OA during activities. The implementation of separation distances and speed limits between vessels and Whale Sharks would decrease the risk of adverse physical interactions.	operations may lead to increased survey duration and overall costs. However, the benefit of reducing impacts to Whale Sharks is considered to outweigh the financial costs from not implementing this control. Therefore, control measure has been adopted for use.
Interacting with marine turtles	Vessel operations within the OA for the 4D MSS (mid-December to mid-April) do coincide with the nesting and internesting periods of marine turtles on the NWS. While the OA does overlap with the internesting BIA and internesting habitat critical to the survival of a species for the Flatback Turtles, it is considered that internesting behaviour is likely to occur closer to shore than within the OA (Section 4.3.3.2.1). However, if Flatback Turtles or other marine turtles did occur within the OA, the use of separation distances and vessel speed limits would decrease the risk of adverse physical interactions.	The detection of marine turtles within the vicinity of vessel operations may lead to increased survey duration and overall costs. However, the benefit of reducing impacts to marine turtles is considered to outweigh the financial costs from not implementing this control. Therefore, control measure has been adopted for use.
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: • EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans • *Conservation Management Plan for the Blue Whale 2015–2025* (Ref. 63) • *Conservation Advice Balaenoptera borealis Sei Whale* (Ref. 62) • *Conservation Advice Balaenoptera physalus Fin Whale* (Ref. 61) • *Conservation Advice Rhincodon typus Whale Shark* (Ref. 60)	

- *Recovery Plan for Marine Turtles in Australia* (Ref. 58)
- *Approved Conservation Advice for Dermochelys coriacea (Leatherback Turtle)* (Ref. 59)
- *North-west Marine Parks Network Management Plan 2018* (Ref. 9).

CAPL considers that impact and risk management is consistent with these requirements, as demonstrated below.

Requirement	**Demonstration**
EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans Caution and no approach zones for interacting with cetaceans from vessels	Requirements of Regulation 8.05 and 8.06 for vessels interacting with cetaceans has been incorporated into the **EPBC Regulations 2000 – Part 8 Division 8.1 – Interacting with cetaceans** control measure.
Conservation Management Plan for the Blue Whale 2015–2025 <u>Management action A.4.2</u>: Ensure all vessel strike incidents are reported in the National Ship Strike Database <u>Management action A.4.3</u>: Ensure the risk of vessel strikes on blue whales is considered when assessing actions that increase vessel traffic in areas where blue whales occur and, if required, appropriate mitigation measures are implemented	Requirements to report vessel strike incidents is included in Section 8.4.2. This section provides a risk evaluation for vessel strikes on Blue Whales, and control measures have been identified. Therefore, the 4D MSS is not considered to be inconsistent with the *Conservation Management Plan for the Blue Whale.*
Conservation Advice Balaenoptera borealis Sei Whale <u>Conservation action</u>: Ensure all vessel strike incidents are reported in the National Vessel Strike Database	Requirements to report vessel strike incidents is included in Section 8.4.2. Therefore, the 4D MSS is not considered to be inconsistent with the *Conservation Advice Balaenoptera borealis Sei Whale.*
Conservation Advice Balaenoptera physalus Fin Whale <u>Conservation action</u>: Ensure all vessel strike incidents are reported in the National Vessel Strike Database	Requirements to report vessel strike incidents is included in Section 8.4.2. Therefore, the 4D MSS is not considered to be inconsistent with the *Conservation Advice Balaenoptera physalus Fin Whale.*
Conservation Advice Rhincodon typus Whale Shark <u>Conservation action</u>: Minimise 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) and along the northward migration route that follows the northern Western Australian coastline along the 200 m isobath	Wheatstone 4D MSS is scheduled for mid-December to mid-April, which is outside the northward migration (July to November) period. As such, no transit of vessels during this migration period will occur. Therefore, the 4D MSS is not considered to be inconsistent with the *Conservation Advice Rhincodon typus Whale Shark.*
Recovery Plan for Marine Turtles in Australia	N/A

<table>
<tr><td rowspan="3"></td><td colspan="2">No specific management action identified.</td><td colspan="2"></td></tr>
<tr><td colspan="2">Approved Conservation Advice for Dermochelys coriacea (Leatherback Turtle)
No specific conservation action identified.</td><td colspan="2">N/A</td></tr>
<tr><td colspan="2">North-west Marine Parks Network Management Plan 2018
No specific zone rules identified.</td><td colspan="2">N/A</td></tr>
<tr><td>Internal context</td><td colspan="4">No CAPL management processes or procedures were deemed relevant for this aspect.</td></tr>
<tr><td>External context</td><td colspan="4">During relevant persons consultation, no objections or claims were raised regarding interaction with marine fauna arising from the activity.</td></tr>
<tr><td rowspan="6">Defined acceptable level</td><td colspan="4">These risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.
However, in alignment with Section 5.6.2, where the aspect is listed as threat to a protected matter, or identified as a concern to a listed conservation value, CAPL will define an acceptable level of impact that aligns with the objectives of these documents. Objectives of the relevant documents are shown below:</td></tr>
<tr><td>Plan</td><td colspan="3">Objective</td></tr>
<tr><td>Conservation Management Plan for the Blue Whale 2015–2025</td><td colspan="3"><u>Recovery objective</u>: Minimise anthropogenic threats to allow for their conservation status to improve so that they can be removed from the EPBC Act threatened species list.
<u>Interim objective 4</u> Anthropogenic threats are demonstrably minimised.</td></tr>
<tr><td>Recovery Plan for Marine Turtles in Australia</td><td colspan="3"><u>Recovery objective</u>: The long-term recovery objective for marine turtles is to minimise anthropogenic threats to allow for the conservation status of marine turtles to improve so that they can be removed from the EPBC Act threatened species list.
<u>Interim objective 3</u>: Anthropogenic threats are demonstrably minimised.</td></tr>
<tr><td>North-west Marine Parks Network Management Plan 2018</td><td colspan="3">As per Section 4.5.1.</td></tr>
<tr><td colspan="4">Therefore, CAPL has defined the following acceptable level of impact such that it is not inconsistent with these documents:
• no vessel collision incidents to Pygmy Blue Whales or marine turtles such that it would prevent the long-term recovery of the species
• no adverse change to the values of the Montebello Marine Park.
CAPL considers that the petroleum activity, with the control measures as described for this aspect in place, meet this acceptable level. In particular that by managing the risk to marine fauna, that the risk to values of the AMP are also subsequently managed to this acceptable level.</td></tr>
</table>

Environmental performance outcome	Environmental performance standard	Measurement criteria
No injury or mortality to marine fauna within the OA from vessel activities associated with the 4D MSS No adverse change to the values of Australian Marine Parks from the 4D MSS	**EPBC Regulations 2000 – Part 8 Division 8.1 – Interacting with cetaceans** Seismic and support vessels will implement caution and no approach zones, where practicable: • caution zone (300 m either side of whales; 150 m either side of dolphins)–vessels must operate at ≤6 knots within in this zone, maximum of three vessels within zone, and vessels should not enter if a calf is present • no approach zone (300 m to the front and rear of whales and 100 m either side; 300 m for whale calves; 150 m to the front and rear of dolphins and 50 m either side)–vessels should not enter this zone, and should not wait in front of the direction of travel of an animal ***Exception**: does not apply to the seismic vessel when towing equipment as it is operating with constrained manoeuvrability; or to any vessel in the event of an emergency.*	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
	Interacting with whale sharks Seismic and support vessels will implement the following, where practicable: • vessels will implement a separation distance of 30 m from Whale Sharks • vessels must operate at ≤6 knots within 250 m of a Whale Shark. ***Exception**: does not apply to the seismic vessel when towing equipment as it is operating with constrained manoeuvrability; or to any vessel in the event of an emergency.*	Induction materials include relevant marine fauna interaction requirements
		Training records confirm personnel involved in offshore vessel activities have completed the induction
		Vessel records show if marine fauna interaction occurred within separation distance, and what mitigation (e.g., divert or slow vessel) measure was implemented
	Interacting with marine turtles Seismic and support vessels will implement the following, where practicable: • vessels will implement a separation distance of 30 m from marine turtles • vessels must operate at ≤6 knots within 250 m of a marine turtles. ***Exception**: does not apply to the seismic vessel when towing equipment as it is operating with constrained*	Induction materials include relevant marine fauna interaction requirements
		Training records confirm personnel involved in offshore vessel activities have completed the induction
		Vessel records show if marine fauna interaction occurred within separation distance, and what mitigation (e.g., divert or slow vessel) measure was implemented

	manoeuvrability; or to any vessel in the event of an emergency.	
	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)
	4D MSS timing Vessel operations for the seismic survey scheduled to minimise overlap with regional peak migration periods for cetaceans and shark species	Records confirm that vessel operations for the seismic survey occurred during a period from mid-December to mid-April

7.3 Air emissions

Source			
Activities identified as having the potential to result in air emissions are: • combustion of marine fuel from vessels within the OA during 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: • localised and temporary reduction in air quality • contribution to the reduction of the global atmospheric carbon budget	 6 6	N/A	–
Consequence evaluation			
Localised and temporary reduction in air quality Modelling was undertaken for nitrogen dioxide (NO_2) emissions from a mobile offshore drilling unit MODU power generation for another offshore project (Ref. 72). NO_2 is the focus of the modelling because it is considered the main (non-greenhouse) atmospheric pollutant of concern, with larger predicted emission volumes compared to other pollutants, and has potential to impact on human health (as a proxy for environmental receptors). Results of this modelling indicate that on an hourly average, there is the potential for an increase in ambient NO_2 concentrations of 0.0005 ppm within 10 km of the emission source and an increase of <0.1 µg/m^3 (0.00005 ppm) in ambient NO_2 concentrations >40 km away. The *National Environmental Protection (Ambient Air Quality) Measure* (NEPM) recommends that hourly exposure to NO_2 is <0.12 ppm with annual average exposure <0.03 ppm. Given that referencing this modelling is considered overly conservative as the volume of fuel required for power generation is expected to be significantly less for the seismic and support vessels when compared to MODU operations, and as the highest hourly averages (0.00039 ppm or 0.74 µg/m^3) were restricted to a distance of ~5 km from the MODU (Ref. 72), exposures from vessel activities covered under this EP would be well below NEPM standards and thus any impacts were considered to be Incidental (6).			
Contribution to the reduction of the atmospheric carbon budget One of the main principles of greenhouse gas (GHG) accounting and reporting is relevance, of which an integral aspect is defining an appropriate GHG emissions inventory boundary (Ref. 273). CAPL has defined the emissions boundary for the assessment of direct GHG emissions in relation to the planned petroleum activities[29] within the OA as described in Section 3 of this EP. Any unplanned activities, including emergency events, have been excluded from the emissions inventory. The following activities have been identified as direct emission sources for planned field support activities under this EP: • fuel combustion by vessels during seismic activities within the OA • fuel combustion by helicopters supporting seismic activities within the OA. Seismic equipment is powered by the vessel itself, and as such these don't represent an additional emission source to that already accounted for by the vessel. Based on the boundary and inventory described above, an estimate of direct GHG emissions from activities within this EP are estimated to be ~0.013 Mtpa CO_2-e[30]. These direct emissions represent ~0.003% of national Australian emissions (when compared to December 2022 inventory) (Ref. 73). To determine the relevance of indirect GHG emissions to the activities under this EP, CAPL undertook an assessment against the factors for determining what is an indirect consequence, in			

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

[30] Emissions calculation is conservatively based on 75 days of vessel activity (for one seismic vessel and two support vessels), and 1 day of helicopter activity, using NGER energy content and emissions factors (Ref. 371).

accordance with the '*Indirect consequences' of an action: Section 527E of the EPBC Act Policy Statement'*. For the purposes of the assessment:

- the "primary action" is the 4D MSS as described in Section 3 of this EP
- the "secondary action" is the operation of the Wheatstone Project, which is out of scope of this EP (Section 2.3)
- the "indirect consequence" is indirect GHG emissions.

For the following reasons, CAPL do not consider that indirect GHG emissions are an indirect consequence of the primary action (i.e., undertaking the 4D MSS), nor that the primary action facilitates to a major extent the secondary action (i.e., the operation of the Wheatstone Project):

- as described in Section 3.1.1, the 4D MSS is being undertaken to monitor the reservoirs within production licences WA-46-L, WA-47-L, and WA-48-L
- the Wheatstone Project, that extracts hydrocarbons from the reservoirs within these production licences is already in operation[31], and would continue to be in operation, with or without the 4D MSS (i.e., the primary action does not facility to a major extent the secondary action)
- the GHG emissions associated with the extraction, operations, processing, transport, and third party end-use of hydrocarbons from the Wheatstone Project are consequently also already occurring, and would continue to occur, with or without the 4D MSS (i.e., these GHG emissions would occur without the primary action, and the primary action is not a substantial cause of these GHG emissions)
- the GHG emissions associated with the extraction, operations, processing, transport, and third party end-use of hydrocarbons from the Wheatstone Project are considered remote from both the scope and geographical extent of the 4D MSS
- the GHG emissions associated with the extraction, operations, processing, transport, and third party end-use of hydrocarbons from the Wheatstone Project are evaluated and managed under the NOPSEMA-accepted *Wheatstone Project: Start-up and Operations Environment Plan* (Ref. 3).

Therefore, as there are no indirect emissions identified for activities under this EP, no further consequence evaluation of indirect GHG emissions is required.

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} (*medium confidence*) and has likely been growing at an increasing rate since the 1970s, [and] . . . Over 1750–2019, CO_2 increased by 131.6 ± 2.9 ppm (47.3%)."[32]

The IPCC defines the term "carbon budget" as "refer[ing] to the maximum amount of cumulative net global anthropogenic CO_2 emissions that would result in limiting global warming to a given level with a given probability, taking into account the effect of other anthropogenic climate forcers. This is referred to as the total carbon budget when expressed starting from the pre-industrial period, and as the remaining carbon budget when expressed from a recent specified date. Historical cumulative CO_2 emissions determine to a large degree warming to date, while future emissions cause future additional warming. The remaining carbon budget indicates how much CO_2 could still be emitted while keeping warming below a specific temperature level."[33]

The remaining carbon budget for a 50% likelihood to limit global warming to 1.5°C, 1.7°C, and 2°C is respectively, 500 Gt CO_2, 850 Gt CO_2, and 1350 Gt CO_2.[34]

If the total direct GHG emissions from activities associated with this EP are ~0.013 Mt CO_2-e, then the activities under this EP may contribute ~1.0–2.7 x10 $^{-6}$ percent to the reduction in the total remaining global carbon budget, which is a *de minimis* decrease.

Due to the overall *de minimis* 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.

[31] The Wheatstone Project was approved with conditions under the EPBC Act on 22 September 2011 (EPBC 2008/4469); this approval has effect until 31 December 2060. The Wheatstone Project was approved with conditions under the *Environmental Protection Act 1986* (WA) on 30 August 2011 (MS 873, and as amended by MS 903, MS 922, MS 931 and Attachments 1 to 4).

[32] IPCC, AR6, WG1, at TS-35 (Ref. 81).

[33] IPCC, AR6, WG1, at SPM-48 footnote 43 (Ref. 82).

[34] IPCC, AR6, WG1, at SPM-29 Table SPM.2 (Ref. 82).

<table>
<tr><th colspan="3">ALARP decision context justification</th></tr>
<tr><td colspan="3">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 air emissions are well defined via legislative requirements that are considered standard industry practice. These are well understood and implemented by the petroleum industry and CAPL.
During relevant persons consultation, no objections or claims were raised regarding air emissions arising from the activity.
The impacts arising from air emissions constitute lower-order impacts (Table 5-3). As such, CAPL applied ALARP Decision Context A for this aspect.</td></tr>
<tr><th colspan="3">Good practice control measures</th></tr>
<tr><th>Control measure</th><th colspan="2">Description</th></tr>
<tr><td>Reduced sulfur content fuel</td><td colspan="2">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.</td></tr>
<tr><td>Marine Order 97: Marine Pollution Prevention – Air Pollution</td><td colspan="2">Prior to commencement of activities, Chevron’s Marine Standard Non Tankers: Corporate OE Standard (Ref. 40) is used to verify that all vessels comply with Marine Order 97: Marine Pollution Prevention – Air Pollution (appropriate to vessel class) for emissions from combusting fuel, including:
vessels will hold a valid International Air Pollution Prevention (IAPP) certificate and a 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.</td></tr>
<tr><td>Fuel consumption</td><td colspan="2">The combustion of fuels has been identified as the source of direct GHG emissions associated with the 4D MSS. Consequently, fuel usage will be monitored and recorded during the 4D MSS such that usage (and therefore associated GHG emissions) are managed to only those required to perform the petroleum activity.</td></tr>
<tr><th colspan="3">Additional control measures and cost benefit analysis</th></tr>
<tr><th>Control measure</th><th>Benefit</th><th>Cost</th></tr>
<tr><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><th colspan="3">Likelihood and risk level summary</th></tr>
<tr><td>Likelihood</td><td colspan="2">N/A</td></tr>
<tr><td>Risk level</td><td colspan="2">N/A</td></tr>
<tr><th colspan="3">Determination of acceptability</th></tr>
<tr><td>Principles of ESD</td><td colspan="2">The potential impact associated with this aspect is limited to a direct reduction in air quality for a localised area for a short time, which is not considered to have the potential to affect biological diversity and ecological integrity.
The impact associated with this aspect is a de minimis 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.
The consequence associated with this aspect is Incidental (6).
Therefore, no further evaluation against the Principles of ESD is required.</td></tr>
</table>

<table>
<tr><td rowspan="3">Relevant environmental legislation and other requirements</td><td colspan="2">Legislation and other requirements considered relevant to this aspect include:
• Marine Order 97
• MARPOL 73/78.
CAPL considers that impact and risk management is consistent with these requirements, as demonstrated below.</td></tr>
<tr><td>Requirement</td><td>Demonstration</td></tr>
<tr><td>Marine Order 97
Gives effect to Annex VI of MARPOL 73/78</td><td>Prescribed limits (as per Division 7) for sulfur content of fuel oil have been incorporated into the reduced sulfur content fuel control measure
IAPP and IEE certificate (as per Division 2), SEEMP (as per Division 6), and nitrogen oxides emission requirements (as per Division 3) have been incorporated into the Marine Order 97: Marine Pollution Prevention – Air Pollution control measure</td></tr>
<tr><td>Internal context</td><td colspan="2">These CAPL management processes or procedures were deemed relevant for this aspect:
• Marine Standard Non Tankers: Corporate OE Standard (Ref. 40).
Control measures related to each of the above management processes or procedures have been described for this aspect. As such, CAPL considers that impact and risk management is consistent with company policy, culture, and standards.</td></tr>
<tr><td>External context</td><td colspan="2">During relevant persons consultation, no objections or claims were raised regarding air emissions arising from the activity.</td></tr>
<tr><td>Defined acceptable level</td><td colspan="2">These impacts are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.</td></tr>
<tr><td>Environmental performance outcome</td><td>Environmental performance standard</td><td>Measurement criteria</td></tr>
<tr><td rowspan="2">Planned air emissions from vessel operations during the 4D MSS will meet Marine Order 97 requirements

Direct GHG associated with the 4D MSS will be managed to ensure only those necessary to perform the petroleum activity are generated</td><td>Reduced sulfur content fuel
Only low-sulfur (0.50 mass % concentration [m/m]) fuel oil will be used to minimise SO_x emissions</td><td>Bunker receipts verify the use of low-sulfur fuel oil</td></tr>
<tr><td>Marine Order 97: Marine Pollution Prevention – Air Pollution
Prior to commencement of activities, the following will be verified, as per the Marine Standard:
• 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</td><td>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</td></tr>
</table>

	• Vessel engine nitrous oxides (Nox) emission levels will comply with Regulation 13 of MARPOL 73/78 Annex VI.	
	Fuel combustion Fuel usage will be recorded during the 4D MSS	Records confirm fuel usage during the 4D MSS

7.4 Light emissions

Source

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

- navigation and operational lighting from vessels within the OA during seismic survey.

Potential impacts and risks

Impacts	C	Risks	C
Light emissions may result in: • localised and temporary change in ambient light.	6	A change in ambient light may result in: • change in fauna behaviour for light-sensitive species	5

Consequence evaluation

Localised and temporary change in ambient light

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.

Monitoring undertaken by Woodside (Ref. 74) indicates that light density from navigational lighting on a MODU attenuated to below 1.0 lux and 0.03 lux at distances of ~300 m and ~1.4 km, respectively. Light densities of 1.0 lux and 0.03 lux are comparable to natural light densities experienced during deep twilight and during a quarter moon.

Based on Woodside (Ref. 74), 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.

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).

Change in fauna behaviour for light-sensitive species

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. 75), so light is not considered to be a significant factor in cetacean behaviour or survival.

Light-sensitive fauna (including reptiles, birds, and fish) are the species most at risk from this aspect and thus are the focus of this evaluation. As identified in Section 4.3.3, 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 habitat critical to the survival of a species also overlap with the OA, including:

- Flatback Turtle (internesting buffer BIA, internesting habitat critical to the survival of a species)
- Whale Shark (foraging BIA)
- Wedge-tailed Shearwater (breeding BIA).

As identified in Section 4.5.1, the OA overlaps with the Montebello Marine Park. Natural values of this AMP include species listed as threatened, migratory, marine, or cetacean under the EPBC Act, as well as any identified BIAs for regionally significant marine fauna.

The *National Light Pollution Guidelines* (Ref. 8) 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. 76; Ref. 77) and fledgling seabirds grounded in response to artificial light 15 km away (Ref. 78).

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. 79) and that lighting can attract birds from large catchment areas (Ref. 80). 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. 81). Fledglings are considered more vulnerable to artificial light than adults for several factors, including immature development of ganglions in the eyes, disturbance to sea-finding cues, and potential connection between light and food (Ref. 367). 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.

Anthropogenic disturbance (including artificial lighting) is identified as a threat within the *Wildlife Conservation Plan for Migratory Shorebirds* (Ref. 82) and light pollution is identified as a threat within the *Wildlife Conservation Plan for Seabirds* (Ref. 367).. It is possible that nocturnally active seabirds and/or migratory shorebirds may be affected by light-spill and make alterations to their normal behaviours. It is suggested that procellariforms (shearwaters, petrels and albatross) species that forage at night are instinctively attracted to light because they exploit bioluminescent prey (Ref. 270; Ref. 80). The presence of the Wedge-tailed Shearwater is seasonal, typically occurring between mid-August to April in the Pilbara; and they are known to forage either relatively close to breeding islands or over a large area, depending on prey availability (Section 4.3.3.4.1). If the 4D MSS extends into April, there is the potential for up to two week overlap of with the period when Wedge-tailed Shearwaters are starting to depart on their migration north to the Indian Ocean. The mechanism of birds being attracted to light is not proven, but it is proposed that the artificial lighting may override the internal magnetic compass of migratory shorebirds or nocturnal seabirds (Ref. 272). However, Marquenie (Ref. 271) estimated that a change in migratory behaviour of birds was limited to <5 km from the source. Therefore, this type of impact is expected to be spatially restricted to the immediate vicinity of the vessel/s and affect only individuals (rather than populations).

The *Recovery Plan for Marine Turtles in Australia* (Ref. 58) identifies light emissions as a key threat because it can disrupt critical behaviours, such as nesting, hatchling orientation, sea finding, and dispersal behaviour.

The *Recovery Plan for Marine Turtles in Australia* (Ref. 58) defines the habitat critical to the survival of a species for nesting for each species at a stock level. The closest nesting habitat critical to the survival of a species to the OA for Flatback Turtles include Barrow and Montebello islands (Ref. 58). 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. 58) defines the habitat critical to the survival of a species for internesting as a distance seaward from nesting habitat critical to the survival of a species of 60 km for Flatback Turtles. However, recent studies (Ref. 64) 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. 58). Whittock et. al. (Ref. 64) 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. 64). This suggests that although the OA does overlap with some internesting habitat critical to the survival of a species, 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 habitat critical to the survival of a species.

Artificial light may result in varied ecological changes to fish, including changes to predatory behaviour and abundance (Ref. 278, Ref. 281), altering hatching success (Ref. 279), acting as an attractant for plankton (Ref. 280), or altering circadian behavioural rhythms (Ref. 281).

The Whale Shark BIA is associated with foraging behaviours during northward migration from the Ningaloo Reef seasonal aggregation area, along the 200 m isobath during July to November Ref. 60). The use of this foraging BIA (July to November) does not coincide with vessel activity for the 4D MSS (mid-December to mid-April). Light has also not been identified as a key threat for the Whale Shark (Ref. 60).

Given the limited spatial and temporal exposures to marine fauna from moving vessel/s artificial light, it is therefore expected that there would also be no long-term or significant impacts to the values of the Montebello Marine Park.

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).

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 relevant persons 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		
Control measure	**Description**	
Marine Standard	Chevron's *Marine Standard Non Tankers: Corporate OE Standard* (Ref. 40) 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 (~75 days between mid-December to mid-April) overlaps with the turtle nesting season (September to March). Recent studies of habitat suitability for internesting Flatback Turtles (Ref. 64) 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. If the 4D MSS extends into April, there is the potential for up to a two week overlap of with the period when Wedge-tailed Shearwaters are starting to depart on their migration north to the Indian Ocean. As a conservative management measure, seismic and support vessels working at night within during the 4D MSS will be required to reduce external lighting to the minimum required for safe operations (and where practicable have this lighting directed downwards). The vessels will also make use of window coverings (e.g. blinds) during night operations to shield internal lights from view (unless this lighting is required as part of safe operational light for activities). The OA is located ~25 km from the nearest coast and as such, no measurable change in light from the vessels will occur at coastal locations. This control measure is consistent with the following light management options identified within the *National Light Pollution Guidelines* (Ref. 8) for marine turtles, seabirds, and migratory shorebirds: • implement light management actions during nesting and hatchling (marine turtles), breeding (seabirds), or peak migration (migratory shorebirds) periods • aim lights downwards and direct them away from nesting areas (marine turtles, seabirds), • reduce unnecessary lighting at sea by restricting external lighting to the minimum required for safe operations and navigation, and using window blinds to shield internal lights.	
Additional control measures and cost-benefit analysis		
Control measure	**Benefit**	**Cost**
External vessel lighting to use: • flashing or intermittent lights instead of fixed beam • motion sensors to turn on lights only when needed • luminaires with spectral content	Replacing external lighting on vessels with lighting that is flashing, intermittent, or motion triggered, or of a particular spectral signature and/or intensity, may have the potential to further reduce the impact of artificial light on marine fauna. Light emissions from vessels are expected to result in a change to ambient conditions up to ~1.4 km from the vessel; and at its closest,	The cost of retrofitting external lighting of the seismic and support vessels is considered grossly disproportionate to the limited environmental benefit (and no change in risk consequence) they may provide for marine fauna. Therefore, control measure <u>has not</u> been adopted for use.

appropriate for the species present • avoid high intensity light of any colour.	the OA is located ~25 km from any coast and potential nesting area. The implementation of these additional light management controls are considered to be of limited environmental benefit, and would not result in a reduction of risk consequence.	
Use curfews to manage lighting	The *National Light Pollution Guidelines* (Ref. 8) suggests the use of curfews may assist in managing artificial lighting around nesting beaches (marine turtles), rookeries during fledgling period (seabirds), or near nocturnal foraging and roosting areas in coastal habitats (migratory seabirds). One of the mechanisms for implementing this is the use of motion sensors—this has been considered in the above control measure, and is not repeated here. Other mitigation options refer to the user of timers to extinguish lighting around turtle nesting beaches after 8 pm, or near seabird or migratory shorebird rookeries after 7 pm. The intent of the curfews is to manage artificial light in coastal areas to minimise any disruption to biological important behaviours. Given that the light emissions from vessels are expected to result in a change to ambient conditions up to ~1.4 km from the vessel, and at its closest, the OA is located ~25 km from any coast, the implementation of curfews are considered to be of limited environmental benefit, and would not result in a reduction of risk consequence.	The cost of implementing lighting curfews, either by retrofitting external lighting with motion sensors (as considered above), or by implementing restricted night operations (e.g., no operations after 7 pm or 8 pm) is considered grossly disproportionate to the limited environmental benefit (and no change in risk consequence) they may provide for marine fauna. Therefore, control measure <u>has not</u> been adopted for use.
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 (9)	
Determination of acceptability		
Principles of ESD	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. The impact associated with this aspect is Minor (5). Therefore, no further evaluation against the Principles of ESD is required.	
Relevant environmental	Legislation and other requirements considered for this aspect include: • *Navigation Act 2012* (Cth) • *National Light Pollution Guidelines* (Ref. 8)	

<table>
<tr><td>legislation and other requirements</td><td>

Recovery Plan for Marine Turtles in Australia (Ref. 58)
Wildlife Conservation Plan for Migratory Shorebirds (Ref. 82)
Wildlife Conservation Plan for Seabirds (Ref. 367)
Conservation Advice Rhincodon typus Whale Shark (Ref. 60)
North-west Marine Parks Network Management Plan 2018 (Ref. 9).

CAPL considers that impact and risk management is consistent with these requirements, as demonstrated below.
<table>
<tr><th>Requirement</th><th>Demonstration</th></tr>
<tr><td>Navigation Act 2012
Appropriate lighting, navigation and communication to inform other users</td><td>Legislative requirements have been incorporated into the Marine Standard control measure.</td></tr>
<tr><td>National Light Pollution Guidelines
Undertake an environmental impact assessment</td><td>This section provides an impact assessment and consideration of control measures as identified within the mitigation toolboxes for marine turtles, seabirds, and migratory shorebirds.</td></tr>
<tr><td>Recovery Plan for Marine Turtles in Australia
<u>Management action A8.1</u>: 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</td><td>The control measures identified above are considered appropriate to manage the risk to marine turtles to ALARP. Given the unsuitability of the OA as internesting habitat, the distance to nesting areas, and the control measures in place, the 4D MSS is not considered to be inconsistent with the Recovery Plan for Marine Turtles in Australia.</td></tr>
<tr><td>Wildlife Conservation Plan for Migratory Shorebirds
No specific action identified.</td><td>N/A</td></tr>
<tr><td>Conservation Advice Rhincodon typus Whale Shark
<u>Conservation action</u>: Assess the impacts of offshore installations and associated environmental changes (light spill, chronic noise, changed water temperature, localised nutrient levels) on whale sharks and mitigation options for these impacts</td><td>This section provides an impact assessment and consideration of control measures for vessel light spill.
Therefore, the 4D MSS is not considered to be inconsistent with the Conservation Advice Rhincodon typus Whale Shark.</td></tr>
<tr><td>North-west Marine Parks Network Management Plan
No specific zone rules identified.</td><td>N/A</td></tr>
</table>
</td></tr>
<tr><td>Internal context</td><td>These CAPL environmental performance standards or procedures were deemed relevant for this aspect:

Marine Standard Non Tankers: Corporate OE Standard (Ref. 40)

Control measures related to each of the above management processes or procedures have been described for this aspect. As such, CAPL considers that impact and risk management is consistent with company policy, culture, and standards.</td></tr>
<tr><td>External context</td><td>During relevant persons consultation, no objections or claims were raised regarding light emissions arising from the activity.</td></tr>
</table>

<table>
<tr><td>Defined acceptable level</td><td colspan="2">These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.
However, in alignment with Section 5.6.2, where the aspect is listed as threat to a protected matter, or identified as a concern to a listed conservation value, CAPL will define an acceptable level of impact that aligns with the objectives of these documents. Objectives of the relevant documents are shown below:
<table>
<tr><th>Plan</th><th>Objective</th></tr>
<tr><td>Recovery Plan for Marine Turtles in Australia</td><td><u>Recovery objective</u>: The long-term recovery objective for marine turtles is to minimise anthropogenic threats to allow for the conservation status of marine turtles to improve so that they can be removed from the EPBC Act threatened species list.
<u>Interim objective 3</u>: Anthropogenic threats are demonstrably minimised.</td></tr>
<tr><td>Wildlife Conservation Plan for Migratory Shorebirds</td><td><u>Objective 1: Protection of important habitats for migratory shorebirds has occurred throughout the East Asian-Australasian Flyway (EAAF)</u>
<u>Objective 3</u>: Anthropogenic threats to migratory shorebirds in Australia are minimised or, where possible, eliminated.</td></tr>
<tr><td>Wildlife Conservation Plan for Seabirds</td><td>Objective 2: Seabirds and their habitats are identified, protected and managed in Australia.</td></tr>
<tr><td>North-west Marine Parks Network Management Plan 2018</td><td>As per Section 4.5.1.</td></tr>
</table>
Therefore, CAPL has defined the following acceptable level of impact such that it is not inconsistent with these documents:
• no displacement of marine turtles from habitat critical to the survival of a species such that it would prevent the long-term recovery of the species
• no disruption of biologically important behaviors of marine turtles within biologically important areas such that it would prevent the long-term recovery of the species
• no disruption of biologically important behaviors of migratory shorebirds or seabirds within important habitats such that it would prevent the conservation of the species and their habitat
• no adverse change to the values of the Montebello Marine Park.
CAPL considers that the petroleum activity, with the control measures as described for this aspect in place, meet this acceptable level. In particular that by managing the risk to marine fauna, that the risk to values of the AMP are also subsequently managed to this acceptable level.</td></tr>
<tr><th>Environmental performance outcome</th><th>Environmental performance standard</th><th>Measurement criteria</th></tr>
<tr><td>Avoid displacement of marine fauna, or disruption of biologically important</td><td>Marine Standard
Vessels will meet the lighting requirements of the Marine Standard</td><td>Records indicate that vessels meet lighting requirements of the Marine Standard</td></tr>
</table>

behaviours of marine fauna, from biologically important areas, important habitats, or habitat critical to the survival of a species from vessel activities associated with the 4D MSS No adverse change to the values of Australian Marine Parks from the 4D MSS	**Light management** Seismic and support vessels working at night will be required to: • reduce external lighting to the minimum required for safe operations and navigation • where practicable, operational lighting directed downwards to working deck area • use window coverings to shield internal lights from view (unless required to be uncovered for safe operations).	Inspection records during night operations confirm only minimum lighting for safe operations and navigation is in use, where practicable operational lighting is directed downwards to working deck area, and internal window coverings are used

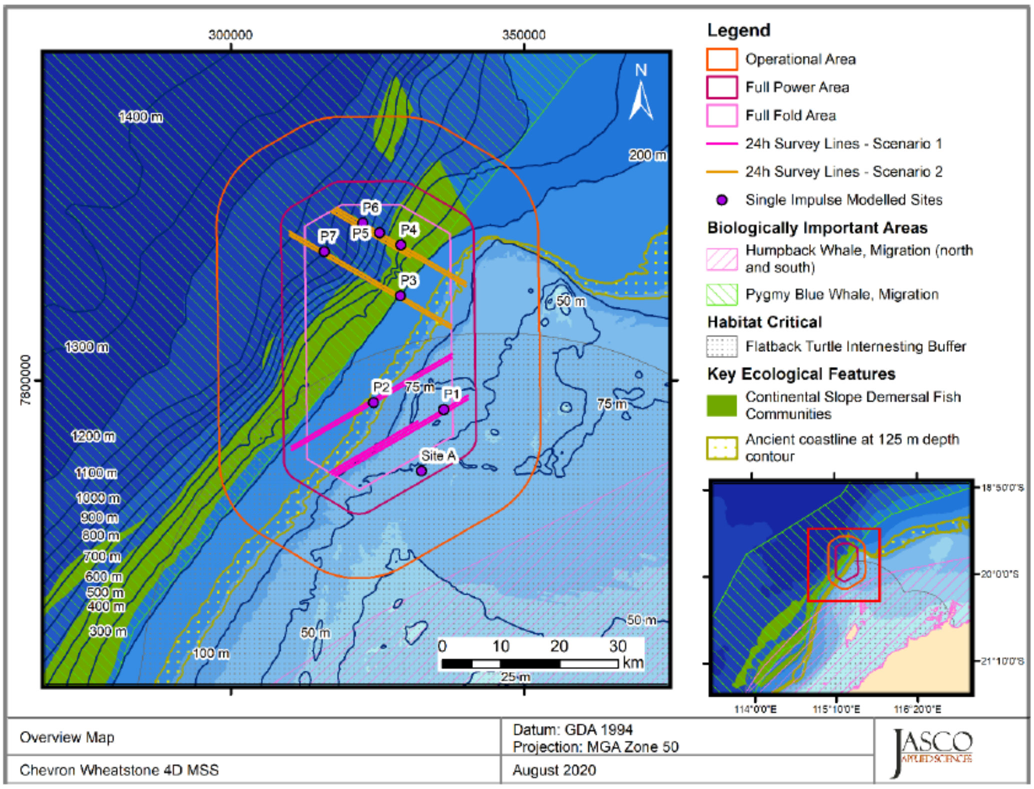
7.5 Underwater sound—seismic acquisition

7.5.1 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. 175; appendix e). 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. 175).

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. 175). AASM accounts for individual airgun volumes, airgun bubble interactions, and array geometry to yield accurate source predictions (Ref. 175). Complementary underwater acoustic propagation models were used in conjunction with the array signature to estimate sound levels (Ref. 175). 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. 175). Peak pressure levels were modelled either as maximum-over-depth ($PK_{over\text{-}depth}$) or as seafloor peak pressure levels ($PK_{seafloor}$, $PK\text{-}PK_{seafloor}$)

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 7-1; Table 7-2).



Source: Ref. 175

Figure 7-1: Locations for acoustic modelling

Table 7-2: 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

7.5.1.1 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. 175) 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. 168) for the onset of permanent threshold shift (PTS)[35] and temporary threshold shift (TTS)[36] in marine mammals (Table 7-3)
- marine mammal behavioural threshold based on the current NOAA (Ref. 177) criterion for marine mammals of 160 dB re 1 µPa (SPL) for impulsive sound sources (Table 7-3)
- peak pressure levels (PK) and frequency-weighted accumulated sound exposure levels (SEL_{24h}) from Finneran et al. (Ref. 170) for the onset of PTS and TTS in marine turtles (Table 7-3)
- marine turtle behavioural response threshold of 166 dB re 1 µPa (SPL) (Ref. 178), as applied by the US NMFS, along with a sound level associated with behavioural disturbance 175 dB re 1 µPa (SPL) (Ref. 167; Ref. 181) (Table 7-3)

[35] PTS is a physical injury to an animals hearing organs.

[36] 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[37] (including plankton) (Ref.171) (Table 7-3)
  - the peak pressure level criteria was applied both through the water column ($PK_{over\text{-}depth}$) and at the seafloor ($PK_{seafloor}$)
- peak-peak pressure levels (PK-PK) at the seafloor ($PK\text{-}PK_{seafloor}$) to help assess effects of noise on crustaceans [no effect sound level of 202 dB re 1 μPa, and maximum sound level of 209–213 dB re 1 μPa] and bivalves [maximum sound level of 212–213 dB re 1 μPa] through comparing to results in Day et al. (Ref. 180), Day et al. (Ref. 182), Day et al. (Ref. 181), Day et al. (Ref. 183) and Payne et al. (Ref.184)
- for comparison to current literature, a no effect sound level for sponges and corals of 226 dB re 1 μPa ($PK_{seafloor}$), is reported for comparing to Heyward et al. (Ref. 185).
- an SPL human health assessment threshold of 145 dB re 1 μPa (SPL) for sound exposure to people swimming and diving derived from Parvin (Ref.186) and considering Ainslie (Ref. 187).

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. 189).

[37] Single pulse PK noise effect criteria for fish have been modelled as maximum-over-depth within the water column ($PK_{over\text{-}depth}$) and at the seafloor ($PK_{seafloor}$).

Table 7-3: 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 μPa²s PK: 219 dB re 1 μPa	SEL_{24h}: 168 dB re 1 μPa²s 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 μPa²s PK: 230 dB re 1 μPa	SEL_{24h}: 170 dB re 1 μPa²s 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 μPa²s PK: 202 dB re 1 μPa	SEL_{24h}: 140 dB re 1 μPa²s 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 μPa²s PK: 232 dB re 1 μPa	SEL_{24h}: 189 dB re 1 μPa²s 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. 175

7.5.1.2 Modelling outputs

The modelled sound contours were not symmetrical around the sound source (Ref. 175). 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. 175). 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. 175).

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 7-4 (Ref. 175). Distances to noise effect criteria varied between the individually modelled sites and scenarios, the largest of these has been reported in Table 7-4. The largest R_{max} value was applied to from the edge of the FPZ to determine ensonified areas for use in the risk assessment (Section 7.5.3). Given the variability in R_{max} distances the individually modelled sites and scenarios, this is considered a conservative approach for risk assessment purposes.

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. 175). Where the modelled SEL_{24h} exposure is larger than those for PK pressure criteria, they often represent an unlikely worst-case scenario (Ref. 175). 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. 175).

The maximum horizonal distance for exposure to the $PK\text{-}PK_{seafloor}$ no effect sound level at the seafloor was for crustaceans was 0.431–0.913 km (Figure 7-6; Figure 7-7) depending on the modelled site (Ref. 175). The maximum distance for exposure to the $PK\text{-}PK_{seafloor}$ maximum sound level at the seafloor for crustaceans was 0.101–0.366 km depending on the modelled site (Ref. 175). The maximum distance for exposure to the $PK\text{-}PK_{seafloor}$ maximum sound level at the seafloor for bivalves was 0.159–0.241 km depending on the modelled site (Ref. 175).

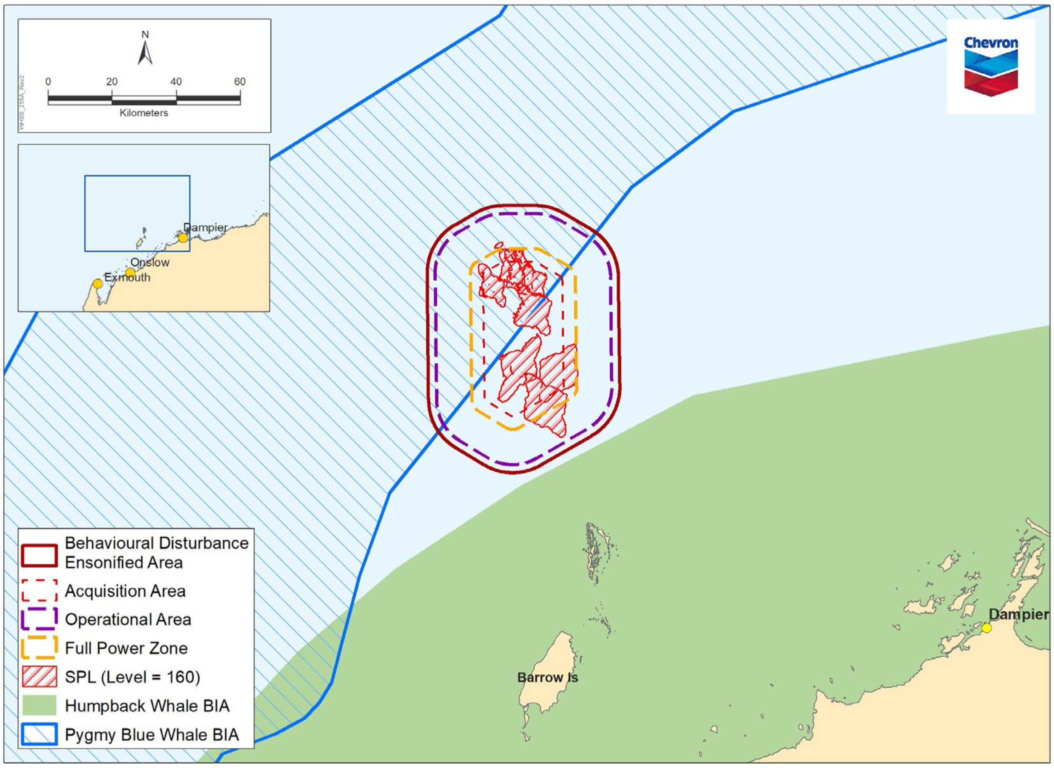
The $PK_{seafloor}$ noise effect criteria at the seafloor for sponges and corals was not reached (Ref. 175).

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. 175).

Table 7-4: Modelled maximum horizontal distances (R_{max}) from modelled sites or scenarios to reach noise effect criteria for impulsive sound

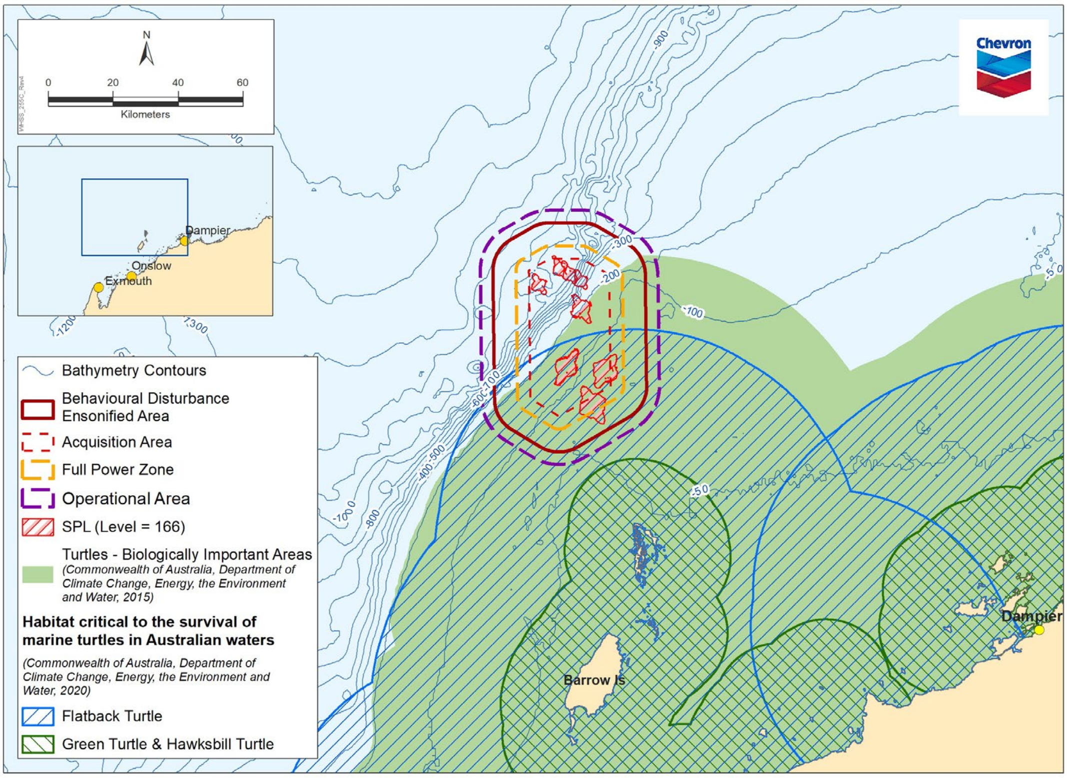
Receptor	Mortal or potential mortal injury	Recoverable injury	Permanent threshold shift	Temporary threshold shift	Masking	Behavioural
Low-frequency cetaceans	N/A	N/A	SEL_{24h}: 6.61 km PK: 0.04 km	SEL_{24h}: 95.4 km PK: 0.07 km	N/A	SPL: 13.45 km (Figure 7-2)
Mid-frequency cetaceans	N/A	N/A	SEL_{24h}: – PK: –	SEL_{24h}: – PK: 0.02 km	N/A	SPL: 13.45 km (Figure 7-2)
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 (Figure 7-2)
Marine turtles	N/A	N/A	SEL_{24h}: <0.02 km PK: –	SEL_{24h}: 3.84 km (Figure 7-4) PK: 0.02 km	N/A	SPL: 7.11 km (Figure 7-3)
Fish (no swim bladder) (relevant to sharks)	SEL_{24h}: <0.02 km $PK_{seafloor}$: 0.096 km $PK_{over-depth}$: 0.07 km	SEL_{24h}: <0.02 km $PK_{seafloor}$: 0.096 km $PK_{over-depth}$: 0.07 km	N/A	SEL_{24h}: 8.63 km (Figure 7-5)	N/A	N/A
Fish (swim bladder not involved in hearing)	SEL_{24h}: <0.02 km $PK_{seafloor}$: 0.237 km $PK_{over-depth}$: 0.27 km	SEL_{24h}: <0.02 km $PK_{seafloor}$: 0.237 km $PK_{over-depth}$: 0.27 km	N/A	SEL_{24h}: 8.63 km (Figure 7-5)	N/A	N/A
Fish (swim bladder involved in hearing)	SEL_{24h}: <0.02 km $PK_{seafloor}$: 0.237 km $PK_{over-depth}$: 0.27 km	SEL_{24h}: <0.02 km $PK_{seafloor}$: 0.237 km $PK_{over-depth}$: 0.27 km	N/A	SEL_{24h}: 8.63 km (Figure 7-5)	N/A	N/A
Fish eggs and fish larvae (relevant to plankton)	SEL_{24h}: <0.02 km $PK_{seafloor}$: 0.237 km $PK_{over-depth}$: 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. 175.



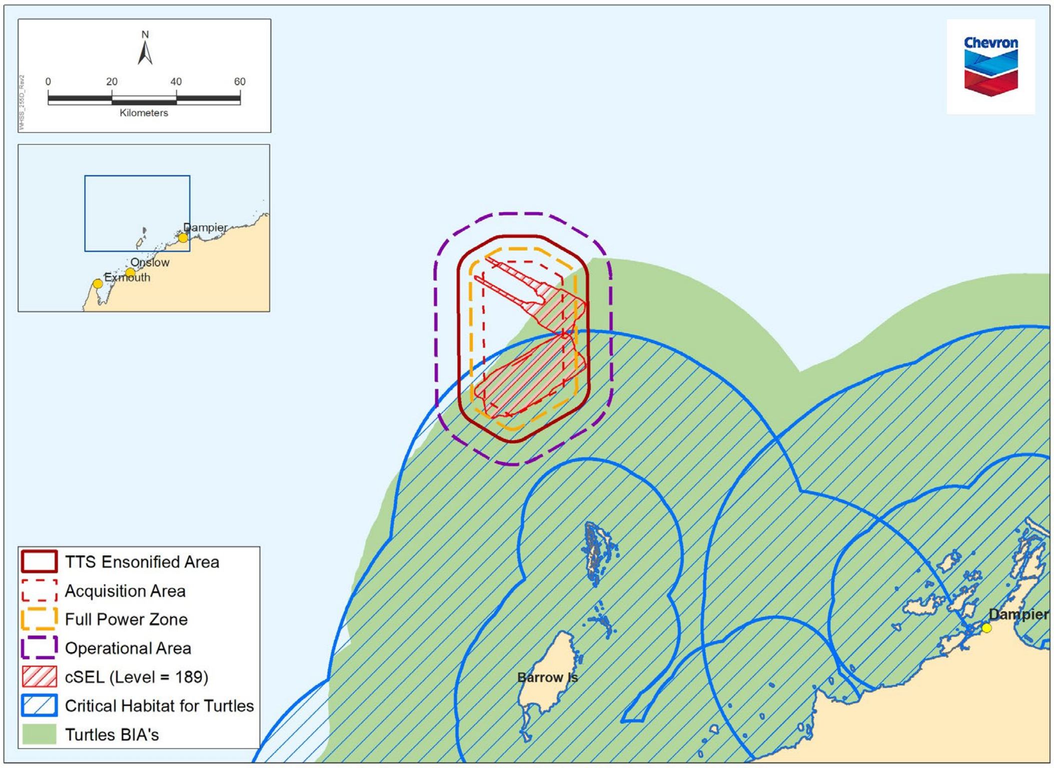
Behavioural Disturbance Ensonified Area is the maximum Rmax from all modelled sites (Table 7-4) applied as a buffer around the FPZ. SPL levels are shown for each of the modelling sites (as per Table 7-2).

Figure 7-2: Predicted behavioural disturbance areas for marine mammals



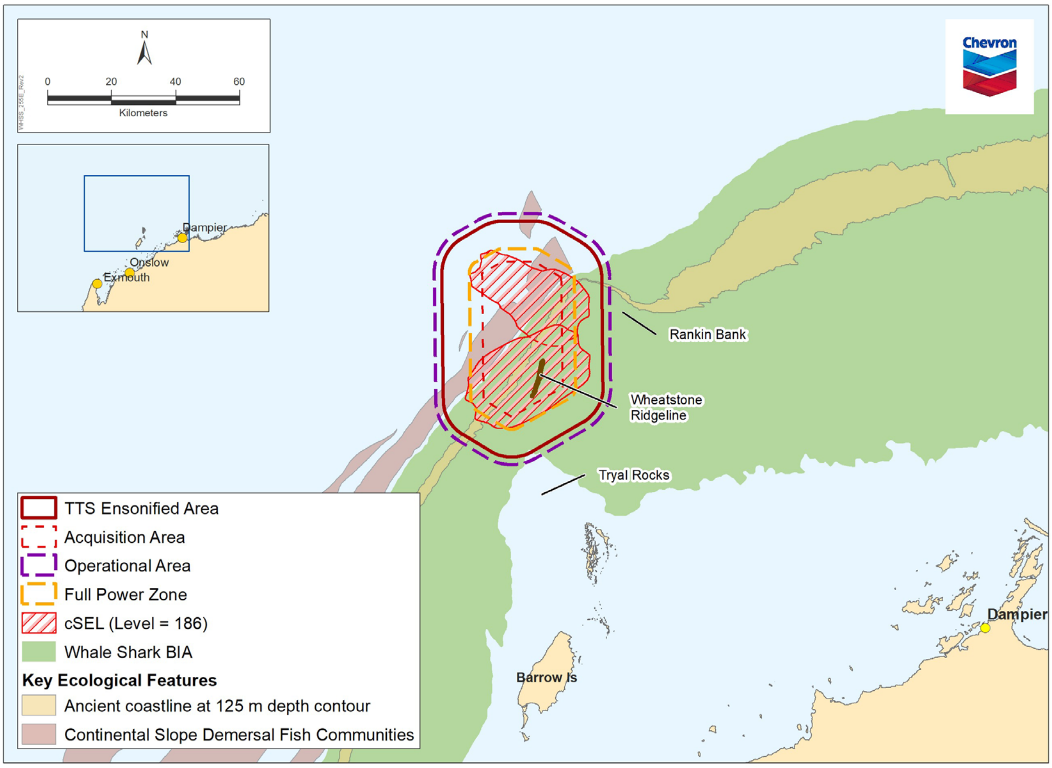
Behavioural Disturbance Ensonified Area is the maximum R_{max} from all modelled sites (Table 7-4) applied as a buffer around the FPZ. SPL levels are shown for each of the modelling sites (as per Table 7-2).

Figure 7-3: Predicted behavioural disturbance areas for marine turtles



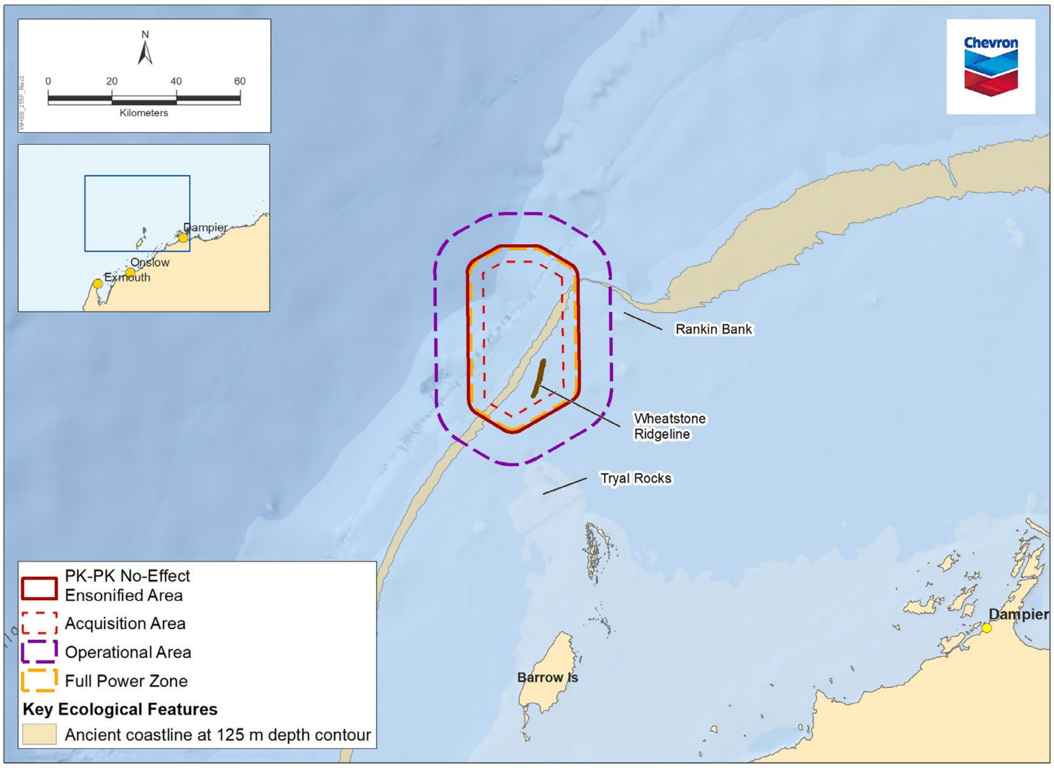
TTS Ensonified Area is the maximum R_{max} from all modelled sites (Table 7-4) applied as a buffer around the FPZ. SEL levels are shown for each of the two modelling scenarios (as per Table 7-2).

Figure 7-4: Predicted auditory impairment (TTS) areas for marine turtles



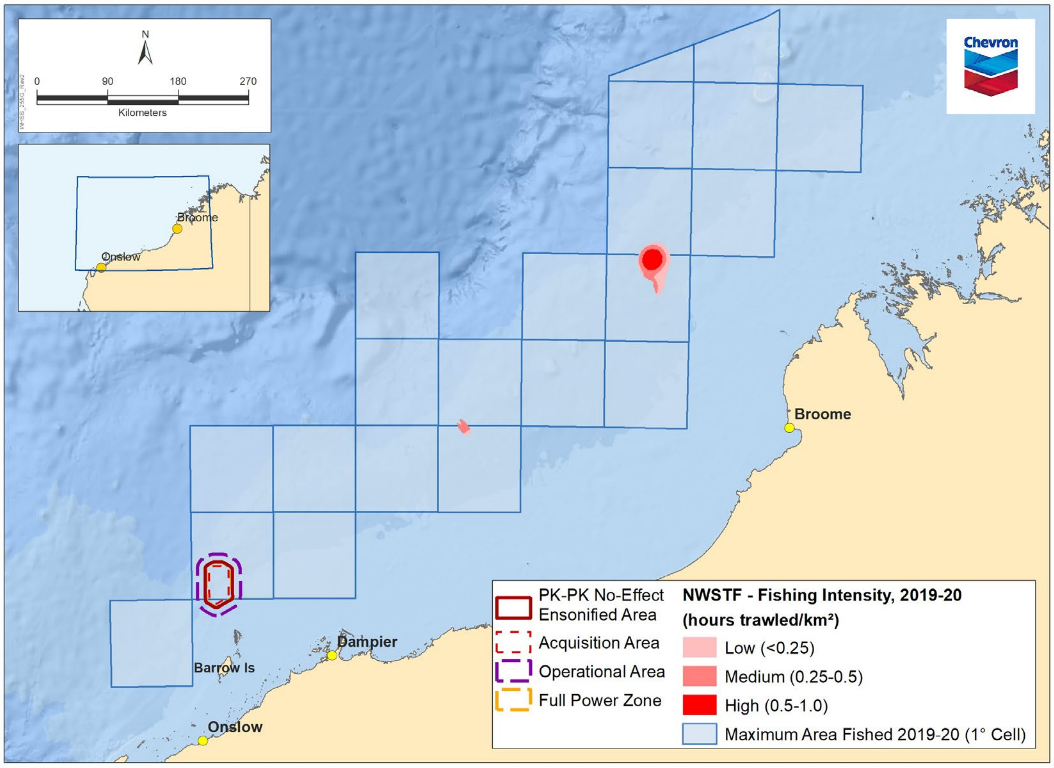
TTS Ensonified Area is the maximum R_{max} from all modelled sites (Table 7-4) applied as a buffer around the FPZ. SEL levels are shown for each of the two modelling scenarios (as per Table 7-2).

Figure 7-5: Precited auditory impairment (TTS) areas for fish



PK-PK$_{seafloor}$ No Effect Ensonified Area is the maximum modelled R_{max} (Section 7.5.1.2) applied as a buffer around the FPZ.

Figure 7-6: Predicted no effect areas for crustaceans (in relation to marine habitats)



PK-PK$_{seafloor}$ No Effect Ensonified Area is the maximum modelled R_{max} (Section 7.5.1.2) applied as a buffer around the FPZ.

Figure 7-7: Predicted no effect areas for crustaceans (in relation to the NWSTF)

7.5.2 Pygmy Blue Whale exposure modelling

In addition to the acoustic modelling study, JASCO undertook an acoustic exposure analysis for migrating Pygmy Blue Whales (Ref. 176; appendix f), 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. 176). 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. 176). The resulting sound fields from the acoustic modelling study (Section 7.5.1; Ref. 175) 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 7.5.1.1 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 7-5 (Ref. 176). The largest $ER_{95\%}$ value was applied to from the edge of the FPZ to determine ensonified areas for use in the risk assessment (Section 7.5.3). For comparison, the horizontal maximum distances (R_{max}) for low-frequency cetaceans from the acoustic modelling in Section 7.5.1 are repeated in Table 7-5.

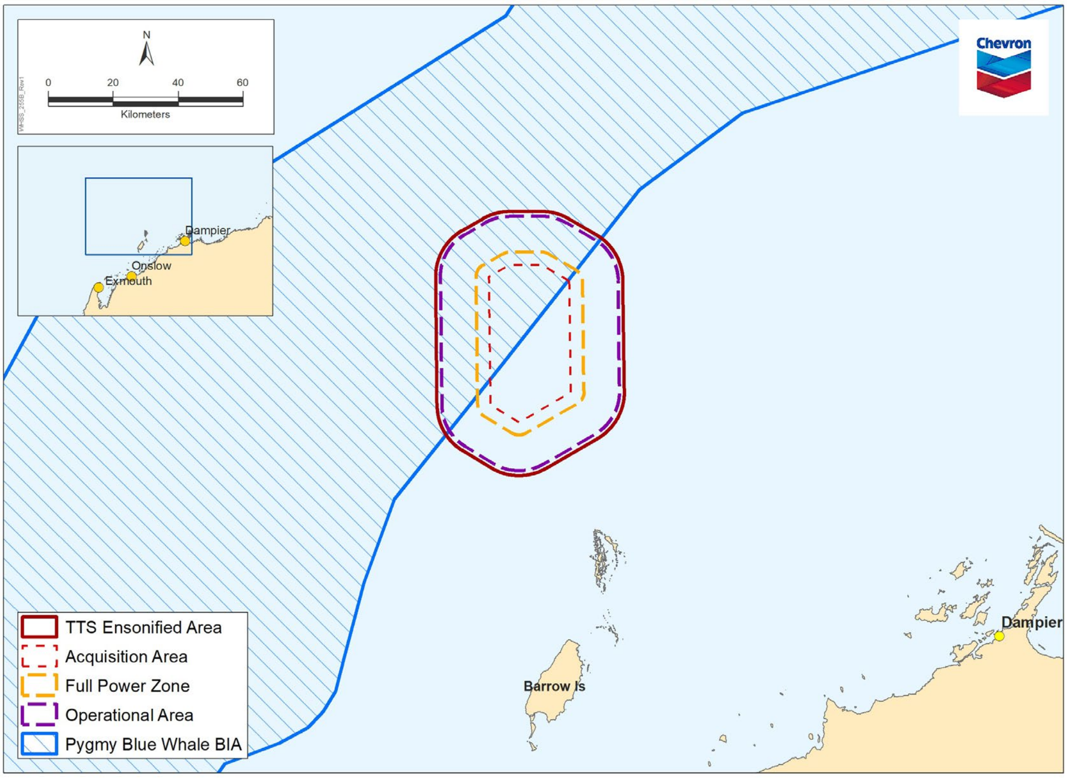
The $ER_{95\%}$ to both the PTS and TTS SEL_{24h} noise effect criteria thresholds are substantially lower than distances predicted by acoustic modelling (Table 7-5; Ref. 176). Acoustic modelling is inherently more conservative as it does not incorporate the complex interactions of both a moving sound field and moving receivers (Ref. 176).

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. 176).

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. 176). 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. 176).

Table 7-5: 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 (Figure 7-8) PK: 0.06 km	SPL: 12.43 km
	Probability of exposure	SEL_{24h}: 70% PK: 78%	SEL_{24h}: 65% PK: 88%	SPL: 68%



TTS Ensonified Area is the maximum modelled ER95% (Table 7-5) applied as a buffer around the FPZ.

Figure 7-8: Precited auditory injury (TTS) areas for Pygmy Blue Whales

7.5.3 Risk assessment

Source			
Activities identified as having the potential to result in underwater sound are: • seismic acquisition within the OA. These activities result in the emission of the impulsive sound.			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
Underwater sound emissions may result in:	5	A change in ambient underwater sound may result in: • behavioural disturbance	5

• localised and temporary change in ambient underwater sound.		• auditory impairment, temporary threshold shift (TTS), permanent threshold shift (PTS), recoverable or non-recoverable injury to marine fauna	5
		• injury or auditory impairment to humans	6
		• changes to values and sensitivities of marine protected areas	5
		• changes to cultural heritage values	5

Consequence evaluation

Localised and temporary change in ambient underwater sound

Anthropogenic underwater sound emitted during the 4D MSS activities will result in a change in ambient noise levels.

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. 208). 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. 208).

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. 188). A seismic sound source is typically a short, discrete, non-continuous, low-frequency pulse.

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. 175). 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 acoustic footprints (Ref. 175). 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 µPa^{2}m^{2}s in the broadside direction and 229.2 dB 1 µPa^{2}m^{2}s in the endfire direction. The peak SPL in the same directions was 250.1 dB re 1 µPa m and 248.2 dB re 1 µPa m, respectively (Ref. 175).

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 localised 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 (within all hearing groups) was 13.45 km (Table 7-3, Table 7-4, Figure 7-2).

As identified in Section 4.2, several marine mammal species listed as threatened and/or migratory under the EPBC Act have the potential to occur within the OA. The threatened and/or migratory cetaceans that may be present within the OA are low-frequency and mid-frequency cetaceans (Section 4.2). In addition, a migration and distribution BIA for the Pygmy Blue Whale also overlaps with the OA and FPZ (Section 4.3.3.1.1), with northbound migration occurring between April and August (i.e., there is a small [~2 weeks] temporal overlap with the 4D MSS acquisition period). The Humpback Whale migration BIA is located ~5 km from the OA and ~16 km from the FPZ (Section 4.3.3.1.2), with migration for this species occurring between June and October (i.e., there is no temporal overlap with the 4D MSS acquisition period). High-frequency cetaceans (e.g., *Kogia* spp.) were identified as species or species habitat that may occur within the OA (appendix b), but are not listed as threatened and/or migratory under the EPBC Act. Except for Pygmy Blue Whales and Humpback Whales, there are no known biologically important areas for other cetacean species within or adjacent to the OA for the 4D MSS; it is expected that any presence within the OA would be of a transitory nature. As such, the following consequence evaluation for marine mammals focusses on Pygmy Blue Whales as a representative case for worst-case consequence evaluation.

The predicted behavioural disturbance ensonified area for marine mammals does intersect with the migration BIA for Pygmy Blue Whales (Figure 7-2); and therefore there is the potential for Pygmy Blue Whales to be present within this area during migration periods. However, given the acquisition timing (January 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 (moving) seismic vessel operating, it is not expected that the 4D MSS would result in a significant change to migration behaviours. Data from satellite tracking studies has also suggested that northern migration by Pygmy Blue Whales occurs in deeper waters and further offshore than the defined BIA (e.g., distances 238±14 km offshore, and in water depths of 2,617±143.5 m north of North West Cape [Section 4.3.3.1.1]; the OA does not occur within these distances or water depth ranges). 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. 6). 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. 6). The OA is not within a confined migratory corridor, and no breeding or resting critical behaviours are not expected.

The ‘Possible Foraging Areas’ as defined within the *Conservation Management Plan for the Blue Whale* (Ref. 63), and characterised as foraging BIAs, occur ~225 km southwest and ~810 km northeast of the OA respectively. Data from a recent study (Ref. 274) has identified ‘most important areas’ for foraging for the Pygmy Blue Whale based on proxy indicators; and there is a small overlap in the northwest OA (but not within the FPZ) (Figure 4-5; Section 4.3.3.1.1). The same study also showed that monthly spatial predictions indicated higher densities around the Montebello Island region during May and June (northern migration) and November and December (southern migration) (Ref. 274). These months of predicted higher densities of Pygmy Blue Whales are outside of the proposed acquisition window (January to mid-April) for the 4D MSS. Therefore, while foraging activity may occur in a small northwest section of the OA (Figure 4-5), the numbers of Pygmy Blue Whales expected to be present during April may still be low.

The predicted behavioural disturbance ensonified area for marine mammals does not intersect with the migration BIA for Humpback Whales (Figure 7-2), and therefore there is not spatial or temporal overlap with when Humpback Whales would be expected to be present in the region. If other marine mammal species are present during the acquisition period (January to mid-April), it is expected to be of a transitory nature only. As such any such temporary displacement during a seismic survey is considered unlikely to result in any real biological cost as no critical behaviours are predicted to occur (Ref. 6).

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).

Masking

Auditory masking impacts may occur when there is a reduction in audibility for one sound (signal) caused by the presence of another sound (noise), impeding the ability of an animal to perceive a signal (Ref. 283, Ref. 284). For this to occur, the noise must be loud enough and have a similar frequency to the signal and both signal and noise must occur at the same time. Masking and the potential effects of masking on communication and listening space of marine mammals are not fully understood and remain an area of active research (Ref. 285, Ref. 286, Ref. 287, Ref. 288). Currently, there are no specific received level thresholds for reliably assessing or regulating masking responses to seismic noise (Ref. 289).

A study undertaken by Clark et al (Ref. 290), suggests that masking impacts from vessel noise can be extended to non-continuous sources of noise (e.g. the low-frequency energy from seismic airgun arrays). This study considers the potential for masking and communication impacts is classified as high near the vessel (within tens of metres), moderate within hundreds of metres, and low within thousands of metres (Ref. 290). Some cetaceans might respond acoustically to seismic survey noise in a range of ways, including by increasing the amplitude of their calls (Lombard effect), changing their spectral (frequency content) or temporal vocalisation properties, and in some cases, cease vocalising (Ref. 291, Ref. 292, Ref. 293, Ref. 294, Ref. 295).

Given the relatively small predicted ensonified area (i.e. up to hundreds of metres from the seismic vessel) for masking effects, the transient nature of the seismic source, and the mobile nature of cetacean species, only localised short-term masking impacts to transient individuals have the potential to arise from these activities and have therefore been evaluated as Minor (5).

TTS and PTS

High-frequency cetaceans

Acoustic modelling indicated that the R_{max} from the source to TTS and PTS single pulse PK noise effect criteria for high-frequency cetaceans was 1.00 km and 0.45 km respectively (Table 7-3, Table 7-4). These distances are well within the mandatory precaution zones required for all seismic surveys under EPBC Policy Statement 2.1 (Ref. 6), and therefore instantaneous TTS and PTS impacts to high-frequency cetaceans are not expected to occur, and no further evaluation has been undertaken.

Acoustic modelling also indicated that the R_{max} from the source to TTS and PTS SEL_{24h} noise effect criteria for high-frequency cetaceans was 1.63 km and <0.02 km respectively (Table 7-3, Table 7-4). 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.

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 b). All cetacean species are expected to be transiting through the area; no areas of known aggregation within or around the OA have been identified. Given the transitory cetacean, and a moving sound source, an exposure requiring a high-frequency cetaceans to remain consistently within 1.63 km for TTS, and ~20 m for PTS, for a 24-hour period is not considered credible, and no further evaluation has been undertaken.

Mid-frequency cetaceans

The SEL_{24h} threshold for mid-frequency cetaceans was not reached within the limits of the modelling resolution (20 m) (Table 7-3, Table 7-4). The PK threshold for mid-frequency cetaceans was 0.02 km for TTS and was not reached for PTS (Table 7-3, Table 7-4). 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. 6). As such, no further evaluation of mid-frequency cetaceans (e.g., dolphins, Sperm Whale) has been undertaken.

Low-frequency cetaceans

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 (Table 7-3, Table 7-4).

Acoustic modelling also indicated that the R_{max} from the source to TTS and PTS SEL_{24h} noise effect criteria for low-frequency cetaceans was 95.4 km and 6.61 km respectively (Table 7-3, Table 7-4). 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.

While relatively high R_{max} values were estimated for the cumulative 24-hour exposures (SEL_{24h}) 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 7-5; Figure 7-8). While this exposure modelling (Ref. 176) 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. 175) for 24-hour exposure are likely substantially over conservative.

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, and Sei Whales (Section 4.2). A migration and distribution BIA for the Pygmy Blue Whale also overlaps a small proportion of the OA and FPZ (Section 4.3.3.1.1). The Humpback Whale migration BIA is located ~5 km from the OA and ~16 km from the FPZ (Section 4.3.3.1.2), 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 as a representative case for worst-case consequence evaluation.

Pygmy Blue Whales

As detailed in Section 4.3.3.1.1, 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 acquisition is planned between January to mid-April there is the potential for some overlap with the start of the northern migration period (April). However, as discussed in Section 4.3.3.1.1, 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 further offshore.

Based on the exposure modelling (Ref. 176) 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 a for 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 7-5). 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. 176) 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 7-5; Figure 7-8). However, it is noted that the exposure modelling (Ref. 176) conservatively assumes Pygmy Blue Whales do not exhibit avoidance behaviour from the seismic source; however, in reality, avoidance behaviour is expected to occur (Ref. 6). This expected avoidance behaviour is supported by other studies. For example, Moulten and Holst (Ref. 209) 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. 210) 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 7-4) 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 FPZ is ~56.5 km at its maximum northern and southern extent. Based on estimated travel speeds (Section 4.3.3.1.1), a northbound whale travelling a 2.4 km/hr could be within the FPZ for up to ~23.5 hours, and a southbound whale travelling at 4.5 km/hr could be within the FPZ for up to ~12.5 hours. Taking into consideration that the seismic sound source is also moving at ~7.4–9.3 km/hr (4–5 knots; Table 3-3) along a 120° or 60° survey line, a whale transiting through the FPZ in a northerly direction, that would also likely show some natural avoidance behaviours, would consequently not consistently be exposed to the sound above the noise effect criteria consistently for a 24-hour period for TTS to occur.

The *Conservation Management Plan for the Blue Whale* (Ref. 63) 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 4-6). 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. Data from a recent study (Ref. 274) has identified 'most important areas' for foraging for the Pygmy Blue Whale based on proxy indicators; and there is a small overlap in the northwest OA (but not within the FPZ) (Figure 4-5; Section 4.3.3.1.1). The same study also showed that monthly spatial predictions indicated higher densities around the Montebello Island region during May and June (northern migration) and November and December (southern migration) (Ref. 274). These months of predicted higher densities of Pygmy Blue Whales are outside of the proposed acquisition window (January to mid-April) for the 4D MSS. Therefore, while foraging activity may occur in a small northwest section of the OA (Figure 4-5), the numbers of Pygmy Blue Whales expected to be present during April may still be low. As the area identified for probable foraging is located only in the northwest section of the OA (outside of the FPZ), and given the moving seismic sound source, it is not considered credible for TTS SEL_{24h} (considered as an injury to Pygmy Blue Whales; Ref. 189) to occur as even if the whale was temporarily stationary and/or slower moving while foraging, as the sound source is not, and 24-hours of continuous accumulated exposure would not occur.

Double et al. (Ref. 211) 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. In summary, based on the relatively small (e.g., up to two weeks) potential of temporal overlap with the Pygmy Blue Whale northbound migration, the small spatial overlap (i.e., the FPZ overlaps ~720 km^2 (~0.23%) of the Pygmy Blue Whale migration BIA), the absence of critical behaviours (e.g., breeding, and resting), the absence of important areas such as narrow migratory corridors, that data indicates that migration pathways are likely to occur to the northwest and offshore from the OA (i.e., not necessarily within the eastern extent of the BIA), and the implementation of mandatory precaution zones and other standard and additional management measures that are inherently required for all seismic surveys under EPBC Policy Statement 2.1 (Ref. 6), the predicted sound levels from seismic acquisition are not expected to result in accumulated sound exposure levels (SEL_{24h}) resulting in TSS, and as such 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 7-3, Table 7-4, Figure 7-3). McCauley et al. (Ref. 179) 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. 213) 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. 170) identified 175 dB SPL as the level at which marine turtles are expected to actively avoid seismic sound exposure. As identified in Section 4.3.3.2, 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 internesting BIA and habitat critical to the survival of a species for Flatback Turtles also overlaps with the OA and FPZ (Section 4.3.3.1.1). The *Recovery Plan for Marine Turtles in Australia* (Ref. 58) 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. 58) 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 4.3.3.2.1, although the defined internesting BIA and habitat critical to the survival of a species 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 internesting period due to the habitat suitable for internesting being in shallower and nearshore waters. As shown in Figure 7-3 the behavioural disturbance ensonified area for marine turtles occurs in water depths of >50 m. This is greater than water depths of observed Flatback Turtle internesting behaviour of <40 m (Ref. 258; Ref. 259; Ref. 260) and <25 m (Ref. 64). There is no evidence to date to indicate Flatback Turtles swim out into deep offshore waters during the internesting period. Given that the ensonified area for behavioural disturbance is not predicted to overlap with the habitat suitable for internesting, 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 7-3, Table 7-4). 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 7-3, Table 7-4, Figure 7-4). 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 7-4) 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 moving seismic source). In addition, ensonification for TTS SEL_{24h} noise effect criteria is not expected to extend into the areas defined as suitable habitat for internesting Flatback Turtles in accordance with recent studies (Section 4.3.3.2.1). As shown in Figure 7-3 the TTS ensonified area for marine turtles occurs in water depths of >50 m. This is greater than water depths of observed Flatback Turtle internesting behaviour of <40 m (Ref. 258; Ref. 259; Ref. 260) and <25 m (Ref. 64).

Given that the ensonified area for SEL_{24h} TTS and PTS is not predicted to overlap with the habitat suitable for internesting, 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 4.3.3.3, 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 7-3).

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. 212). 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 $PK_{over\text{-}depth}$ and $PK_{seafloor}$ noise effect criteria for fish (with no swim bladder) was 0.07 km and 0.096 km respectively (Table 7-3, Table 7-4).

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 <0.02 km (Table 7-3, Table 7-4). 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 (measured over the water column or at the seafloor) 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 7-3, Table 7-4, Figure 7-5). 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.

<u>Whale Sharks</u>

Whale Shark migration along the WA coast occurs mainly between July and November (Section 4.3.3.3.1). Based on the 4D MSS acquisition timing of January 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.171) 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. <u>Pelagic fish species including commercial fish species such as mackerel</u> 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.171), 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 7-6 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. 212), 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.
<u>Fish (with swim bladder)</u> 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. 175), 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 7-3). 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. 212). 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 $PK_{over\text{-}depth}$ and $PK_{seafloor}$ noise effect criteria for fish (with swim bladders) was <0.27 km and 0.237 km respectively (Table 7-3, Table 7-4).

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 7-3, Table 7-4). 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 (measured over the water column or at the seafloor) 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. 214; Ref. 215; Ref.171; Ref. 216). 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. 217)).

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 7-3, Table 7-4, Figure 7-5). 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. 171) 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. 171) 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.

<u>Demersal fish species (including commercial species)</u>

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. 222; Ref. 223; Ref. 179; Ref. 224; Ref. 225; Ref. 226; Ref. 227; Ref. 228), 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 (SEL_{24h}) to 270 m ($PK_{over\text{-}depth}$) (Table 7-4). 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. 218; Ref. 217; Ref. 219; Ref. 220; Ref. 221). 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 7-4). 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. 171), 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. 255) 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. 229). Table 7-6 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. 230)
- 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. 255)
- 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 7-6) indicates adequate stock status, breeding stock and fishery catch levels (Ref. 229)
- 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. 26).

As detailed in Table 7-2, 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 m (SEL_{24h}) to 150 m ($PK_{over\text{-}depth}$) (Ref. 175). The modelled distance to the TTS 24-hr cumulative sound exposure guideline is 7.56 km (Ref. 175). Thus, there is the potential for some fishes to experience TTS; but as detailed by Popper (Ref. 171) 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. 230)
- 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. 71) 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.

<u>Fish species associated with the Ancient Coastline at 125 m Depth Contour KEF</u>

There is little information in relation to fish species associated with the Ancient Coastline at 125 m Depth Contour KEF. DEWHA (Ref. 231) 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. 232). Thus, substantial benthic communities that would support site-attached fish species are not likely to be present. AIMS (Ref. 233) 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 multidens*) 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 7-2, 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 (SEL_{24h}) to 192 m ($PK_{seafloor}$) (Ref. 175). 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. 175). Thus, there is the potential for some fishes to experience TTS, but as detailed by Popper (Ref. 171) 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. 230)
- 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. 71) 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.

The biomass, diversity and abundance of fishes is typically greatest in the photic and upper mesophotic zones (<60 m depth) where biota such as hard corals are most abundant. The disappearance of live coral cover and corresponding lower fish diversity is often reported in water depths greater than 60 m (Ref. 369; Ref. 370; Ref. 371; Ref. 372; Ref. 373; Ref. 303). The water depths in the FPZ range between ~60 m and 1,130 m (Table 3-1), and the Wheatstone ridgeline itself occurs in water depths of ~60–100 m. As described in Section 4.3.1.1, the benthic communities cover is low and spatially variable, typically 2–10% cover dominated by gorgonians and sponges. As such, any site-attached fish communities that may be associated with the Wheatstone ridgeline are likely to be of low biomass, diversity, and abundance given the deeper water depths and lack of habitat complexity.

As detailed in Table 7-2, Site 1 (water depth ~82 m) 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 m (SEL_{24h}) to 270 m ($PK_{over\text{-}depth}$) (Ref. 175). The modelled distance for Site 2 (water depth ~126 m) to $PK_{seafloor}$ was 192 m. 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. 175). Thus, there is the potential for some fishes to experience TTS, but as detailed by Popper (Ref. 171) 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. 230)
- 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. 175; Section 7.5.1.1), 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 7-3).

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. 71). 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 $PK_{over\text{-}depth}$ and $PK_{seafloor}$ noise effect criteria for fish eggs and fish larvae was <0.27 km and 0.237 km respectively (Table 7-3, Table 7-4).

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 7-3, Table 7-4). 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. 234). In a review of mortality estimates (Ref. 235) 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. 236) 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. 237) 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. 238) modelled the results from McCauley et al. (Ref. 239) 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. 238).

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.

<u>Foraging BIA for Whale Sharks</u>

As described in Section 4.3.3.3.1, 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 4.3.3.3.1). The acquisition timing (January 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.

<u>Fish eggs and larvae for commercial fisheries</u>

DPIRD (Ref. 239) 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. 239). Spanish Mackerel is the exception as they form spawning schools around inshore reefs (Ref. 239).

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. 240) 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 7-6 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. 239) 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 7-6).

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. 234, Ref. 235, Ref. 236, Ref. 237).

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. 229) 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 7-6: 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% (1,644/124,441)	31% (75/243)
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.		
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% (1,644/177,449)	31% (75/245)
Stock range (area within depth range): 177,449 km^2 A single biological stock from the Lacepede Islands to Abrolhos Islands.		
Spawning period: 245 days (Jun-Dec, Mar)		
Blue-spotted Emperor*		
Principal depth range: 5 – 110 m	0.9% (1,644/177,449)	27% (75/274)
Stock range (area within depth range): 177,449 km^2 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% (1,644/43,572)	49% (75/152)
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.		
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$_{seafloor}$ no effect sound level at the seafloor for crustaceans was 0.913 km (Figure 7-6, Figure 7-7); and to the maximum sound level at the seafloor was 0.366 km (Section 7.5.1.2). Acoustic modelling indicated that the maximum distance from the source to the PK-PK$_{seafloor}$ maximum sound level for bivalves was 0.241 km (Section 7.5.1.2).

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. 241; Ref. 242) 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. 175).

There have been several recent reviews of seismic underwater sound impacts to invertebrates — Carroll et al. (Ref. 216), Edmonds et al. (Ref. 243), Ref. 244 and Webster et al. (Ref. 212). 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. 245). 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. 246) 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. 245) 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. 247; Ref. 248; Ref. 249; Ref. 250) have focussed on commercial scallops (*Pecten fumatus*). Przeslawski et al. (Ref. 247; Ref. 248) 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. 249; Ref. 250) 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. 249) 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. 247). 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. 249).

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.

<u>Scampi (crustaceans) associated with the North West Slope Trawl Fishery</u>

As identified in Section 4.4.1.1, 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. 251). 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. 252). 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.

<u>Invertebrate communities associated with the ancient coastline at 125 m depth contour KEF</u>

The FPZ overlaps ~0.75% of the ancient coastline at 125 m depth contour KEF (122/16,242 km^2). 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. 233). 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.

<u>Invertebrate communities associated with the Wheatstone ridgeline</u>

As detailed in Section 4.3.3.4.1, the Wheatstone ridgeline comprises hard rock with a sand veneer (Ref. 84). Benthic surveys identified that for sessile benthic organisms, gorgonians and sponges were dominant (Ref. 83); 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 $PK_{seafloor}$ no effect sound level at the seafloor for sponges and corals was not reached (Section 7.5.1.2). As such, no further evaluation of coral and sponge habitats has been undertaken.
Changes to values and sensitivities of marine protected areas *4D MSS* As identified in Section 4.5.1, the OA overlaps with the Montebello Marine Park. The Montebello Marine Park is zoned as a Multiple Use Zone (IUCN VI), which is a zone "managed to allow ecologically sustainable use while conserving ecosystems, habitats and native species. The zone allows for a range of sustainable uses, including commercial fishing and mining where they are consistent with park values" (Ref. 9). Natural values of this AMP include species listed as threatened, migratory, marine, or cetacean under the EPBC Act, as well as any identified BIAs for regionally significant marine fauna. Natural values of also include the ancient coastline at 125 m depth contour KEF. Social and economic values of this AMP include commercial fishing. As shown in above consequence evaluations, given the limited spatial and temporal exposures to marine fauna (including EPBC listed species), commercial fish species, or fish species associated with the KEF, from underwater impulsive sound above the noise effect criteria from the moving seismic vessel, it is therefore expected that there would also be no long-term or significant impacts to the values of the Montebello Marine Park. CAPL consider that the 4D MSS can be undertaken in a manner that is not inconsistent with the objectives of the North-west Marine Parks Network Management Plan (Ref. 9). *Concurrent activities* As identified in Table 4-21, there are no other confirmed petroleum activities proposed within the Montebello Marine Park that could potentially occur at the same time as the 4D MSS. However, engagement (to date) with Woodside Energy has identified that activities associated with the Scarborough trunkline installation are indicatively scheduled to occur at the same time as the 4D MSS, pending environmental approvals for those activities (Table 4-21). The Scarborough installation scope may include the use of acoustic survey techniques (an impulsive sound source). The spatial extent of exposure from acoustic surveys are typically small (e.g. hundreds of metres from the source). As such, there would be limited potential for the overlap in sound emissions from this activity with the 4D MSS, should they occur during the same time period. In addition, if the activities were scheduled to occur within proximity to each other, these are typically managed via concurrent operations plans, which is likely to further reduce any potential for cumulative impulsive sound emissions. As such, no further evaluation on the risks from repeated seismic (or other impulsive sound sources) surveys 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, or John Brookes 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. 175), 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. 175). 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, and Goodwyn Alpha facilities, which are located within 45 km of the OA (Section 4.4.5). 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. 253). 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.
<u>Concurrent operations</u> 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 seismic surveys* For seismic surveys that occur at the same time, the Bureau of Ocean Energy Management (Ref. 254) 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 4.4.5, 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 4-20 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 4-20 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 seismic surveys* A review of previous seismic surveys over or adjacent to the OA identified: • Woodside Pluto and Harmony 4D MSS undertaken between early-January to early-March 2020. An earlier survey (late-February to early-May 2019) was also undertaken ~50 km north of the OA (Table 4-20). 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. 238). • 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 early-January to early-March 2020, there will be a gap of approximately 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. *Concurrent other petroleum activities* Activity scopes that involve impulsive underwater sound (e.g., use of multibeach echo sounders, sidescan sonar, etc.) may be associated with ongoing operations or once-off scopes (Table 4-21) have the potential to occur within the same and time period has the 4D MSS. Engagement (to date) with Woodside Energy has identified that activities associated with the Scarborough trunkline installation are indicatively scheduled to occur at the same time as the 4D MSS, pending environmental approvals for the activities. Should concurrent activities be scheduled within proximity to each other, these are typically managed via COPs The nature and scale of impulsive sounds for geophysical surveys is much lower than compared to a seismic survey, and as such limited cumulative impacts for these types of activities is expected. As such, no further evaluation on the risks from repeated seismic surveys has been undertaken.
Changes to cultural heritage values There are no World, National, or Commonwealth heritage listed places or sites within the OA (Section 4.6). Based on the outcomes of relevant persons consultation, CAPL considers that indirect impacts to intangible First Nations cultural values may occur due to impacts on marine fauna. The consequence evaluations to these receptors are provided above, and were risk assessed as Minor (5). Given the offshore location of the OA (~30 km from the Montebello Islands, and ~119 km from the mainland; Figure 3-1) and duration of the campaign (~75 days), a significant adverse change to cultural values attributed to the offshore marine area is not predicted to occur. As such, CAPL has ranked the consequence for cultural values consistent with that for marine fauna, as Minor (5).
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 relevant persons 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	
Control measure	**Description**
Source validation	A pre-survey technical audit will be undertaken of the selected seismic vessel and seismic source prior to the mobilisation of the 4D MSS commencing. This audit will confirm the configuration and characteristics or the seismic source (e.g., array layout, volume, tow depth, airgun firing pressures) onboard the vessel are consistent with those used during the acoustic modelling (Ref. 175; Ref. 176) that was undertaken to inform this risk assessment. Note, as this is a 4D MSS, the seismic source needs to be similar to the previous 3D MSS for the acquisition to be successful (Section 3.2), and as such the seismic source specifications were issued as part of the tender request. In addition, it is considered good industry practice to confirm that during the 4D MSS: • source volume used is equal to or less than 4,130 cu.in • seismic source is not discharged at full power outside of the FPZ • seismic source is not discharged outside the OA • seismic source is not discharged prior to agreed timing (i.e., no discharge during December; Section 3.1.3).
Acquisition timing	The 4D MSS will be scheduled to minimise overlap with regional peak migration periods for cetaceans species, and nesting periods for turtle

	species, to reduce the likelihood of high numbers of individuals transiting through the OA. The peak periods of Pygmy Blue Whale migration are considered to be April to August (northern migration) and November to December (southern migration) (Section 4.3.3.1.1). The timing for the acquisition for the 4D MSS has the potential for a small (~2 weeks) overlap with the start of the peak northern migration period, and no overlap with southern migration. Given the southern migration typically occurs in short and sharp pules, compared to the more protracted northbound migration, it was considered more important to exclude the southern migration period from the acquisition window, while still allowing enough operational flexibility for the 4D MSS. The Montebello Islands supports Flatback Turtle nesting, occurring from October to March, with a peak in December to January (Section 4.3.3.2.1). The timing for the acquisition for the 4D MSS has the potential for ~4 week overlap with peak nesting during January. However, while the OA does overlap with the internesting BIA and internesting habitat critical to the survival of a species for the Flatback Turtles, it is considered that internesting behaviour is likely to occur closer to shore, rather than within the OA, and as such any presence of Flatback Turtles within the OA is expected to be limited (Section 4.3.3.2.1).
EPBC Act Policy Statement 2.1 – Standard Management Procedures	The requirements to manage interactions between offshore seismic vessels and whales are detailed in the *EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales*. 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). By implementing these control measures and managing interactions with cetaceans near the seismic vessel, the potential risks from underwater sound are reduced. 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. <u>Precaution zones</u> As per the requirements of EPBC Act Policy Statement 2.1 and the results of acoustic modelling (Ref. 175), the following precaution zones will apply during the 4D MSS: • 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. <u>Part A – Standard management procedures</u> • A.1 Pre-survey planning: • A.2 Trained crew: • A.3 During surveys: • A.4 Compliance and sighting reports 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 acquisition for the 4D MSS is scheduled to occur between January and mid-April, and therefore overlaps with the beginning of the Pygmy Blue Whale peak northbound migration period (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.
DMAC Guidance	Guidance note DMAC 12 issued by the UK Diving Medical Advisory Committee (DMAC) "Safe Diving Distance from Seismic Surveying Operations" (Ref. 253) 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. 253).
BOEM Guidance	For seismic surveys that occur at the same time, the Bureau of Ocean Energy Management (BOEM) (Ref. 254) 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.
Concurrent operations plan (COP)	Where required, a COP (or equivalent) will be developed to identify and manage hazards arising from the 4D MSS activities and other planned seismic surveys, or other planned petroleum activities involving diving, when occurring within the same area. The potential for concurrent petroleum activities was reviewed, and as noted in Section 4.4.5, no concurrent seismic surveys within or adjacent to the 4D MSS OA are currently scheduled, and as such no COP is required. As described in Section 8.3.1.1, if additional COPs are required to be developed because ongoing consultation with other operators identifies concurrent operations, these will be in place prior to the 4D MSS commencing.
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 8.3.4.1). 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. As part of the notification prior to the commencement of activities (Table 8-6), commercial fisheries will be provided with information regarding the implementation of CAPL's adjustment protocol (e.g., when and where it applies, what is covered, etc.).

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 (on the seismic vessel for full survey period)	The policy recommends considering this management procedure when the likelihood of encountering whales increases. The 4D MSS is scheduled to occur outside the period of Humpback Whale migration, and predominantly outside the peak Pygmy Blue Whale migration (with only the potential for a two-week temporal overlap with beginning of the northbound migration during April). 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.	Costs for engaging a MFO are expected to be in the order of ~$800-1,000/day. 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. However, the cost of MFOs on the seismic vessel 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.

EPBC Act Policy Statement 2.1 – Additional Management Procedures – B.1 Marine Mammal Observers (on support vessels for full survey period)	While the use of MFOs can increase visual detection of cetaceans, the use of dedicated MFOs on support vessels is considered to be of limited environmental benefit in consistently providing additional visual detection of cetaceans within proximity to the seismic vessel due to practical constraints. The support vessels provide a lower viewing height (and therefore viewing distance) in comparison to the seismic vessel itself. As such, the observation field is likely to be represent part of that already with the field of view of the seismic vessel. The location of the support vessels in relation to the seismic vessel will also vary (e.g., while one will always be within the OA, the other could be travelling to and from port; or the support vessel within the OA may not always be in front of the seismic vessel but could be to the side or behind the seismic vessel depending on survey activities, etc.).	Costs for engaging a MFO are expected to be in the order of ~$800-1,000/day. For an~75-day acquisition, this would result in up to $300,000 in personnel costs (allowing for two MFOs per support vessel) for the 4D MSS. Given the limited environmental benefit of dedicated MFOs on the support vessels, these additional financial costs are considered grossly disproportionate to the environmental benefit. Therefore, control measure has not been adopted for use.
EPBC Act Policy Statement 2.1 – Additional Management Procedures – B.2 Night-time/Poor-visibility	Limiting seismic operations during night-time or poor-visibility conditions would reduce the probability of a cetacean occurring the low power or shut down zones and not being detected.	Reducing operational timing to daylight hours only would significantly 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 January to mid-April acquisition window; both of which would also introduce additional environmental risks. Given the small temporal overlap of the peak migratory period for Pygmy Blue Whales (northbound during April) and the 4D MSS acquisition (January 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 has not been adopted for use.
EPBC Act Policy Statement 2.1 – Additional Management Procedures – B.3 Spotter Vessel(s) and Aircraft	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. 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 predominantly outside the peak Pygmy Blue Whale	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. Given the small temporal overlap of the migratory period for Pygmy Blue Whales (northbound during

	migration with only the potential for a small temporal overlap with beginning of the northbound migration during April.	April) and the 4D MSS acquisition (January 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 has not been adopted for use.
EPBC Act Policy Statement 2.1 – Additional Management Procedures – B.4 Increased Precaution zones	The policy recommends considering this management procedure when surveys are in or near important habitats, such as feeding areas, to ensure that disturbance or displacement of whales does not occur. The OA for the 4D MSS does not intersect with any Foraging Areas (annual high use, known, or possible) as defined within the *Conservation Management Plan for the Blue Whale 2015–2025* (Ref. 63). However, recent studies suggest that the 'most important areas' for foraging along the WA coast include discontinuous use of the shelf edge from Ningaloo Reef to Rowley Shoals (Ref. 274). The OA intersects with a small extent of this most important area for foraging; the FPZ is outside of these areas (Figure 4-5). As the OA for the 4D MSS does intersect with areas where foraging is indicated, adaptive management is recommended by DAWE and NOPSEMA (Ref. 189). The following precaution zones will be implemented during April: • Observation zone: 3+ km horizontal radius from the acoustic source • Low power zone: 3 km horizontal radius from the acoustic source • Shut-down zone: 500 m horizontal radius from the acoustic source.	Increasing the low power zone due during peak migration periods for Pygmy Blue Whale could increase the duration and operational cost of the MSS. However, given the small temporal overlap of the peak migratory period for Pygmy Blue Whales (northbound during April) and the 4D MSS acquisition (January to mid-April), the additional operational costs are disproportionate to the environmental benefit. Therefore, control measure has been adopted for use.
EPBC Act Policy Statement 2.1 – Additional Management Procedures – B.4 Buffer zones	The policy recommends considering this management procedure (i.e., the use of buffer [exclusion] zones) for surveys being undertaken in the broad vicinity of known breeding or resting areas. There are no known breeding grounds or resting areas within or adjacent to the OA. As such there is no environmental benefit gained (i.e., no further protection afforded to breeding or resting areas) from implementation of this control. Therefore, the use of a buffer (exclusion) zone is not required to be considered.	N/A

EPBC Act Policy Statement 2.1 – Additional Management Procedures – B.5 Passive Acoustic Monitoring (for low-frequency cetaceans)	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. 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). Verfuss et al. (Ref. 256) 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.	Sophisticated PAM systems are required to effectively filter low frequency cetacean calls and such systems are not readily available on all seismic vessels. Costs for engaging a trained PAM operator are expected to be in the order of ~$1,000/day (~$150,000 for the survey [allowing for two operators]). However, there are also additional costs (e.g., provision of equipment, operator support, mobilisation costs, etc.). Therefore, it is estimated the total cost for PAM operations during the 4D MSS would be in the order of ~$180,000. 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
EPBC Act Policy Statement 2.1 – Additional Management Procedures – B.5 Passive Acoustic Monitoring (during peak Pygmy Blue Whale migration periods only)	Potential to detect vocalising cetaceans which might not otherwise be visible at the sea surface. However, as per above discussion, 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, including Pygmy Blue Whales.	Costs for engaging a trained PAM operator are expected to be in the order of ~$1,000/day (i.e., up to ~$28,000 allowing for a two-week overlap with the northbound peak migration period). However, there are also additional costs associated with the provision of equipment, operator support, mobilisation costs and other logistical considerations (e.g., the PAM operator may be unable to leave the vessel immediately after the peak migration period). Therefore, it is estimated the total cost for PAM operations during the April peak migratory period would be in the order of ~$45,000. The significant additional cost of having a trained PAM operator on board for the duration of peak migration periods during 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 has not been adopted for use.
EPBC Act Policy Statement 2.1 – Additional Management Procedures – B.5 Passive Acoustic Monitoring (for mid and high frequency cetaceans)	PAM is one of the additional management procedures to be considered for seismic surveys operating in areas where the likelihood of encountering whales is moderate to high. Where moderate to high likelihood is defined as “spatially and/or temporally proximate to aggregation areas, migratory pathways and/or areas considered to provide biologically important habitat”. No known aggregation areas, migratory pathways, or BIAs for mid or high frequency cetaceans have been identified within or adjacent to the OA. Therefore, use of PAM for mid and high frequency cetaceans is not required to be considered under the Policy. However, as mid- and high-frequency cetaceans may be present within the OA (Section 4.2), and PAM is effective in detecting these hearing groups, the use of PAM has the potential to detect vocalising cetaceans which might not otherwise be visible at the sea surface.	Costs for engaging a trained PAM operator are expected to be in the order of ~$1,000/day (~$150,000 for the survey [allowing for two operators]). However, there are also additional costs (e.g., provision of equipment, operator support, mobilisation costs, etc.). Therefore, it is estimated the total cost for PAM operations during the 4D MSS would be in the order of ~$180,000. However, as mid- and high-frequency cetaceans may be present within the OA (Section 4.2), and PAM is effective in detecting these hearing groups, this, control measure has been adopted for use, given that the potential increase in ability to detect mid- and high-frequency cetaceans and subsequently reducing impacts to these cetaceans is considered to outweigh the financial costs. Implementing this control is considered a conservative approach to adaptive management.
EPBC Act Policy Statement 2.1 – Additional Management Procedures – B.6 Adaptive Management (peak PBW migration period)	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. The acquisition period of the 4D MSS is from January to mid-April. This acquisition period may overlap with the beginning of the peak Pygmy Blue Whale northbound migration period during April (i.e., there is potential for up to an approximate two-week overlap period during the end of the survey). The OA for the 4D MSS does not intersect with any Foraging Areas (annual high use, known, or possible) as defined within the *Conservation Management Plan for the Blue Whale 2015–2025* (Ref. 63). However, recent studies suggest that the ‘most important areas’ for foraging along the WA coast include discontinuous use of the shelf edge from Ningaloo Reef to Rowley Shoals (Ref. 274). The OA intersects with a small extent of this most important area for foraging; the	Potentially reducing operational timing to daylight hours only when consistently observed within low-power or shut-down zones during peak migration periods for Pygmy Blue Whale would increase the duration and operational cost of the MSS. However, given the small temporal overlap of the peak migratory period for Pygmy Blue Whales (northbound during April) and the 4D MSS acquisition (January to mid-April), the additional cost of limiting seismic operations during night-time or poor-visibility conditions is not considered grossly disproportionate to the environmental benefit. Therefore, control measure has been adopted for use.

	FPZ is outside of these areas (Figure 4-5). As the OA for the 4D MSS does intersect with areas where foraging is indicated, adaptive management is recommended by DAWE and NOPSEMA (Ref. 189). In recognition of this temporal and spatial overlap with the beginning of the predicted peak northbound migration periods, and the potential for foraging in the northwest of the OA, adaptive management for night and/or low visibility conditions may assist in managing the potential increased likelihood of encountering whales during peak migration periods and decrease the risk of a cumulative sound exposure (SEL_{24h}) to any slower moving whales that may be foraging. The following will be implemented during April within 12.5 km of the 'most important areas' for foraging as identified in Figure 4-3: • if a Pygmy Blue Whale is observed within the 500 m shut-down zone (or where conditions allow for positive identification of a Pygmy Blue Whale, the zone will extend to the field of view of the MFO) during daylight acquisition, then: – seismic operations will not be undertaken during the following night or low visibility period – seismic acquisition can resume during daylight hours.	
EPBC Act Policy Statement 2.1 – Additional Management Procedures – B.6 Adaptive Management (peak PBW migration period)	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. The acquisition period of the 4D MSS is from January to mid-April. This acquisition period may overlap with the beginning of the peak 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). In recognition of this temporal and spatial overlap with the start of the predicted peak northbound migration period, the following will be implemented during April: • the pre start-up visual observation period will be extended to 60 minutes before	Increasing pre start-up observation timing in April will increase the operational cost of the MSS. However due to the potential for the presence of Pygmy Blue Whales within the OA during April, the additional cost of increasing pre start-up visual observations is not considered grossly disproportionate to the environmental benefit. Therefore, control measure has been adopted for use

	the commencement of the soft start procedure.	
EPBC Act Policy Statement 2.1 – Additional Management Procedures – B.6 Adaptive Management (non-peak whale periods)	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. The acquisition period of the 4D MSS is from January to mid-April. With the exception of northbound migration for the Pygmy Blue Whales, this period does not coincide with other peak periods of presence for whale species identified in Section 4.2. However, it is acknowledged that some of these species could be present and transiting within or adjacent to the OA. As a conservative approach to adaptive management, the following will be implemented during the 4D MSS acquisition (January to mid-April) • if the survey is required to shut-down or power-down as a result of the presence of a whale, then the – pre start-up visual observation period will be extended to 60 minutes before the commencement of the soft start procedure – low power zone will be extended to 3 km horizontal radius from the acoustic source • the pre start-up visual observation period cannot revert to the standard 30 minutes, and the low power zone to the standard 2 km, until there has been a 24-hour period during good visibility conditions during which no shut-downs or power-downs have occurred for whales.	Increasing pre start-up observation timing and low power zones when cetaceans are observed within low-power or shut-down zones would potentially increase the duration and operational cost of the MSS. This increase in duration could require the survey to either be split over multiple years or extend beyond the January to mid-April acquisition window; both of which would also introduce additional environmental risks. However due to the expected low presence of cetaceans during most of the survey period, the additional cost of increase pre start-up visual observations and low power zones is not considered grossly disproportionate to the environmental benefit. Therefore, control measure has been adopted for use.
EPBC Act Policy Statement 2.1 – Additional Management Procedures – B.6 Adaptive Management (supplementary marine fauna observations)	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. The 4D MSS acquisition may overlap 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 at the end of the survey). In recognition of this temporal and spatial overlap with the beginning of predicted migration periods, and	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. However, the benefit of reducing impacts to cetaceans is considered to outweigh the financial costs from not implementing this control. Therefore, control measure has been adopted for use.

	acknowledging that the predicted SEL_{24h} TTS extends up to 12.5 km from a sound source, the use of an extended observation zone during April pre start-up procedures is proposed. 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.	
EPBC Act Policy Statement 2.1 – Additional Management Procedures – B.6 Adaptive Management (dedicated MFOs on support vessels during peak PBW migration period)	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. The 4D MSS acquisition may overlap 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 at the end of the survey). The use of a dedicated MFO on support vessels will be of limited environmental benefit given the practical constraints including the lower viewing height (and therefore viewing distance) from the support vessels, the timing and position of the support vessels in relation to the seismic vessel (e.g., while one will always be within the OA, the other could be travelling to and from port, the support (chase) vessel on site may not always be in front of the seismic vessel which provide the better observation coverage, but could be to the side or behind the seismic vessel depending on survey activities, etc.).	Costs for engaging a MFO are expected to be in the order of ~$800-1,000/day. For a two-week period, this would result in up to $56,000 personnel costs (allowing for two MFOs per support vessel), plus increase in schedule (which may introduce subsequent risk of activities extending further into a peak migration period) and operational costs of mobilising an MFO teams to the support vessels for the short April deployment. Given the limited environmental benefit of a dedicated MFO on the support vessels, these additional financial costs and schedule implications are considered grossly disproportionate to the environmental benefit. Therefore, control measure has not been adopted for use.
EPBC Act Policy Statement 2.1 – Additional	The spatial exclusion of the migration BIA for the Pygmy Blue Whale from the acquisition area of the 4D MSS	Spatially restricting the 4D MSS acquisition area to exclude the Pygmy Blue Whale migration BIA,

Management Procedures – B.6 Adaptive Management (buffer zones around BIAs)	would remove the risk of acoustic impacts to fauna transiting through the BIA. However, as described in Section 4.3.3.1.1, recent studies suggest 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). As such the environmental benefit of spatially excluding the migration BIA (plus a buffer distance) may be minimal in reducing the exposure to transient Pygmy Blue Whales.	plus a buffer (e.g., 12.5 km) would reduce the acquisition area to ~15% of the required survey target area. In this occurred, the 4D MSS would not meet technical requirements (given the locations of the target reservoirs throughout the acquisition area) and would not be acquired. Therefore, control measure <u>has not</u> been adopted for use.
Survey timed to avoid nesting season for Flatback Turtles	The Montebello Islands supports Flatback Turtle nesting, occurring from October to March, with a peak in December to January (Section 4.3.3.2.1). The Recovery Plan (Ref. 58) lists the Montebello Islands as a critical nesting location and applies a 60 km internesting buffer. This internesting habitat critical to the survival of a species, as well as an internesting BIA for Flatback Turtles overlap with the OA and FPZ (Section 4.3.3.1.1). However, as discussed in Section 4.3.3.2.1, although the defined internesting BIA and habitat critical to the survival of a species 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 internesting period due to the habitat suitable for internesting being in shallower and nearshore waters. Timing the 4D MSS to avoid the nesting season for Flatback Turtles 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 the nesting season for turtles. It is not possible to time the 4D MSS to avoid both periods of turtle nesting and cetacean migration, as this would not allow for a sufficient window of time to acquire the seismic survey.	If all nesting season for Flatback Turtles 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.
Observation and shutdown	Extending fauna observations to include marine turtles will minimise the potential for acoustic impacts to	There is the potential for increased operational costs due to additional and/or prolonged

procedures for marine turtles	internesting turtles should there be a presence within the OA. The use of a shutdown zone is considered to be a practicable measure to implement. A shutdown zone for marine turtles has been nominated as a minimum of 100 m from the seismic vessel, and where conditions allow for positive identification, the zone will extend to the field of view of the MFO. This 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). The seismic source will be shut down, or start-up will be delayed for 30 minutes, if a turtle is observed within the shut-down zone. Operation of the seismic source using soft-start shall only resume when 30 minutes have lapsed since the turtle sighting or the turtle has been observed to move outside the shutdown zone.	shutdowns due to marine turtle sightings. However, the cost of MFOs and the benefit of reducing impacts to marine turtles is considered to outweigh the financial costs from not implementing this control. Therefore, control measure has been adopted for use.
Observation and shutdown procedures for Whale Sharks	Extending fauna observations to include Whale Sharks will minimise the potential for acoustic impacts to transiting Whale Sharks should there be a presence within the OA. The use of a shutdown zone is considered to be a practicable measure to implement. A shutdown zone for Whale Sharks has been nominated as a minimum of 100 m from the seismic vessel, and where conditions allow for positive identification, the zone will extend to the field of view of the MFO. This shutdown zone is considered to be conservative given that PK mortal, potential mortal, or recoverable injury effects were predicted to be limited to <20 m from the seismic source. The seismic source will be shut down, or start-up will be delayed for 30 minutes, if a Whale Shark is observed within the shut-down zone. Operation of the seismic source using soft-start shall only resume when 30 minutes have lapsed since the Whale Shark sighting or the Whale Shark has been observed to move outside the shutdown zone.	There is the potential for increased operational costs due to additional and/or prolonged shutdowns due to Whale Shark sightings. However, the cost of MFOs and the benefit of reducing impacts to Whale Sharks is considered to outweigh the financial costs from not implementing this control. Therefore, control measure has been adopted for use.
Adaptive management for marine turtles and Whale Sharks	As a conservative approach to adaptive management should there be a presence of marine turtles or Whale Sharks within the OA, the following will be implemented during the 4D MSS acquisition (January to mid-April)	Increasing pre start-up observation timing when marine turtles or Whale Sharks are observed within low-power or shut-down zones would potentially increase the duration and operational cost of the MSS. This increase in duration could require the survey to either be

	• if the survey is required to shut-down or power-down as a result of the presence of a marine turtle or Whale Shark, then the pre start-up visual observation period will be extended to 60 minutes before the commencement of the soft start procedure • the pre start-up visual observation period cannot revert to the standard 30 minutes until there has been a 24-hour period during good visibility conditions during which no shut-downs or power-downs have occurred for marine turtle or Whale Shark.	split over multiple years or extend beyond the January to mid-April acquisition window; both of which would also introduce additional environmental risks. However due to the expected low presence of marine turtles or Whale Sharks during most of the survey period, the additional cost of increase pre start-up visual observations is not considered grossly disproportionate to the environmental benefit. Therefore, control measure has been adopted for use.
Survey timed to avoid spawning times for commercially targeted key indicator species	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). 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 spawning periods for fish species which have been shown to be less sensitive. 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.	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 has not been adopted for use.
Survey design to avoid Wheatstone ridgeline	The exclusion of the Wheatstone ridgeline area from the acquisition area of the 4D MSS would remove the risk of acoustic impacts to these habitats and communities.	If the Wheatstone ridgeline was spatially avoided, the 4D MSS would not meet technical requirements (given the relative position of the ridgeline to the target reservoirs) and would not be acquired. Therefore, control measure has not been adopted for use.
Adaptive management for site-attached fish of Wheatstone ridgeline	By not returning to sites with known site-attached fish assemblages, it would reduce the risk of TTS occurring. Therefore, the following will be implemented during the 4D MSS acquisition (January to mid-April):	Cost of implementing this control is not considered grossly disproportionate to the environmental benefit. Therefore, control measure has been adopted for use.

	• no reacquisition shot points will occur within 1 km horizontal distance of the Wheatstone ridgeline within a 24-hour period.	
Likelihood and risk level summary		
Likelihood	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. 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).	
Risk level	Low (7)	
Determination of acceptability		
Principles of ESD	The impacts and risks associated with this aspect are assessed as localised and short-term, which are not considered as having the potential to affect biological diversity or ecological integrity. The impacts and risks associated with this aspect are assessed as localised and short-term, which is not considered to have the potential to affect intergenerational equity. Underwater sound emissions from the seismic acoustic source will not result in impacts to the “health, diversity and productivity of the environment” over generational timeframes. The aspect and potential interactions are well understood, the risk assessment is based on peer reviewed and published literature, and managed in accordance with applicable industry and government standards and industry good practice. It is acknowledged that there is some uncertainty in relation to where and when biologically important behaviours may occur, and as such, an adaptive management approach has been incorporated into the control measures to take into account this uncertainty. The suite of control measures identified above are considered to reduce the impacts and risks associated with this aspect to ALARP and an acceptable level. The consequence associated with this aspect is Minor (5), and subsequently the potential for serious or irreversible environmental damage is not expected. Therefore, no further evaluation against the Principles of ESD is required.	
Relevant environmental legislation and other requirements	Legislation and other requirements considered applicable for this aspect include: • EPBC Policy Statement 2.1 – Interaction between offshore seismic exploration and whales: industry guidelines • *Conservation Management Plan for the Blue Whale 2015–2025* (Ref. 63) • *Conservation Advice Balaenoptera borealis Sei Whale* (Ref. 62) • *Conservation Advice Balaenoptera physalus Fin Whale* (Ref. 61) • *Conservation Advice Rhincodon typus Whale Shark* (Ref. 60) • *Recovery Plan for Marine Turtles in Australia* (Ref. 58) • *Approved Conservation Advice for Dermochelys coriacea (Leatherback Turtle)* (Ref. 59) • *North-west Marine Parks Network Management Plan 2018* (Ref. 9). CAPL considers that impact and risk management is consistent with these requirements, as demonstrated below.	

	Requirement	Demonstration
	EPBC Policy Statement 2.1 – Interaction between offshore seismic exploration and whales: industry guidelines Management measures: • Precaution zones • Management Procedures Part A • Management Procedures Part B	Precaution zones and Management Procedures Part A have been applied as control measures as per requirements of Section 6.1 and 6.2 of EPBC Policy Statement 2.1. Management Procedures Part B have been considered and applied as relevant as control measures as per requirements of Section 6.3 of EPBC Policy Statement 2.1.
	Conservation Management Plan for the Blue Whale 2015–2025 Management action A.2.3: 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 Management action A.2.4: EPBC Act Policy Statement 2.1—Interaction between offshore seismic exploration and whales is applied to all seismic survey	The 4D MSS is not considered to be inconsistent with the *Conservation Management Plan for the Blue Whale.* The OA does not intersect with designated Foraging Areas for the Pygmy Blue Whale. 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 the 4D MSS. A recent study has indicated areas of probable foraging along the North West Shelf based on proxy indicators (Section 4.3.3.1.1), and there is a small overlap with the OA. In accordance with guidance from DAWE and NOPSEMA (Ref. 189), activities occurring outside designated Foraging Areas must adopt adaptive management approaches should indicators of whale foraging be evident. Adaptive management control measures have been considered and adopted for use within this risk assessment. Injury (TTS or PTS) to Pygmy Blue Whales is not predicted to occur within the BIA: • instantaneous exposures to PK noise effect criteria are not expected to occur as the predicted distances (~60 m for TSS and ~30 m for PTS) are well within mandatory precaution zones required for all seismic surveys under EPBC Policy Statement 2.1 (Ref. 6) • accumulated exposures to SEL_{24h} for PTS are not expected to occur as the predicted distance (~30 m) is well within mandatory precaution zones required for

		all seismic surveys under EPBC Policy Statement 2.1 (Ref. 6) • accumulated exposure to SEL_{24h} for TTS is not expected to occur given the natural avoidance behaviour of cetaceans as well as the application of mandatory precaution zones and other adaptive management controls. As per above demonstration, the requirements of *EPBC Policy Statement 2.1 – Interaction between offshore seismic exploration and whales: industry guidelines* have been considered and adopted as control measures.
	Conservation Advice Balaenoptera borealis Sei Whale No specific conservation action identified.	N/A
	Conservation Advice Balaenoptera physalus Fin Whale No specific conservation action identified.	N/A
	Conservation Advice Rhincodon typus Whale Shark No specific conservation action identified.	N/A
	Recovery Plan for Marine Turtles in Australia **Management actions:** A1.5–Manage anthropogenic activities to ensure marine turtles are not displaced from identified habitat critical to the survival A1.5– Manage anthropogenic activities in Biologically Important Areas to ensure that biologically important behaviour can continue	The 4D MSS is not considered to be inconsistent with the *Recovery Plan for Marine Turtles in Australia.* Given that the ensonified area for behavioural disturbance and accumulated exposure to SEL_{24h} for TTS is not predicted to overlap with the habitat suitable for internesting, the distance to nesting areas, and the control measures in place, the continued use of habitat critical to the survival of a species and BIAs without displacement or disruption to biologically important behaviours is expected.
	North-west Marine Parks Network Management Plan 2018 The class approval for mining operations within a multiple use zone requires a NOPSEMA-accepted EP to be in place before activities commence	This EP has been submitted to NOPSEMA for assessment. Therefore, the 4D MSS is not considered to be inconsistent with the *North-west Marine Parks Network Management Plan.*
Internal context	No CAPL management processes or procedures were deemed relevant for this aspect.	

<table>
<tr><td>External context</td><td colspan="2">During relevant persons consultation concerns were raised by WAFIC and individual persons (Section 6).

All relevant persons 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.</td></tr>
<tr><td rowspan="6">Defined acceptable level</td><td colspan="2">These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.

However, in alignment with Section 5.6.2, where the aspect is listed as threat to a protected matter, or identified as a concern to a listed conservation value, CAPL will define an acceptable level of impact that aligns with the objectives of these documents.

Objectives of the relevant documents are shown below:</td></tr>
<tr><td>Plan</td><td>Objective</td></tr>
<tr><td>Conservation Management Plan for the Blue Whale 2015–2025</td><td><u>Recovery objective</u>: Minimise anthropogenic threats to allow for their conservation status to improve so that they can be removed from the EPBC Act threatened species list.

<u>Interim objective 4</u> Anthropogenic threats are demonstrably minimised.</td></tr>
<tr><td>Recovery Plan for Marine Turtles in Australia</td><td><u>Recovery objective</u>: The long-term recovery objective for marine turtles is to minimise anthropogenic threats to allow for the conservation status of marine turtles to improve so that they can be removed from the EPBC Act threatened species list.

<u>Interim objective 3</u>: Anthropogenic threats are demonstrably minimised.</td></tr>
<tr><td>North-west Marine Parks Network Management Plan 2018</td><td>As per Section 4.5.1.</td></tr>
<tr><td colspan="2">Therefore, CAPL has defined the following acceptable level of impact such that it is not inconsistent with these documents:
• no auditory injury (TTS or PTS) to Pygmy Blue Whales within a BIA resulting from underwater sound from the petroleum activity
• no displacement of Pygmy Blue Whales from foraging areas resulting from underwater sound from the petroleum activity such that it would prevent the long-term recovery of the species
• no displacement of marine turtles from habitat critical to the survival or a species resulting from underwater sound from the petroleum activity such that it would prevent the long-term recovery of the species
• no disruption of biologically important behaviors of marine turtles within biologically important areas, resulting om underwater sound from the petroleum activity such that it would prevent the long-term recovery of the species
• no adverse change to the values of the Montebello Marine Park.

CAPL considers that the petroleum activity, with the control measures as described for this aspect in place, meet this acceptable level. In particular that by managing the risk to marine fauna, that the risk to values of the AMP are also subsequently managed.</td></tr>
</table>

Environmental performance outcome	Environmental performance standard	Measurement criteria
Source levels for the selected seismic source for the 4D MSS are consistent with levels assessed in this EP	**Source validation** Pre-survey technical audit confirms that the seismic source is equivalent with the specifications used in the acoustic modelling to inform the risk assessment	Records demonstrate that seismic source onboard contracted seismic vessel is equivalent to that used in acoustic modelling studies
	Source validation In the event there is a significant difference between source specifications used in modelling to that onboard the contracted seismic vessel, then additional acoustic source modelling (using AASM) will be undertaken to confirm whether the sound levels are consistent with levels assessed as acceptable in this EP	Where required, records demonstrate that additional acoustic source modelling report for selected seismic source has been completed
Acquisition for the 4D MSS is undertaken as described in this EP	**Source validation** Operation of the seismic source will meet the following requirements during the 4D MSS: • source volume is equal to or less than 4,130 cu.in • seismic source is not discharged at full power outside of the FPZ • seismic source is not discharged outside the OA • seismic source is not discharged during December.	Records demonstrate that spatial data for boundaries of the FPZ and OA have been provided to the seismic vessel contractor Records demonstrate that the seismic source volume did not exceed 4,130 cu.in Records demonstrate that the seismic source was not discharged at full power outside of the FPZ Records demonstrate that the seismic source was not discharged outside of the OA Records demonstrate that the seismic source was not discharged during December
	Acquisition timing Seismic acquisition scheduled to minimise overlap with regional peak migration periods for cetaceans and peak nesting periods for marine turtles	Records confirm that the seismic acquisition occurred during a period from January to mid-April
No injury to marine fauna from underwater sound emissions from the seismic source associated with the 4D MSS Avoid displacement of marine fauna, or disruption of biologically important behaviours of	**EPBC Act Policy Statement 2.1 – Standard Management Procedures** The following precaution zones for whales will be implemented during the 4D MSS: • 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 Daily MFO observation records and reports from seismic vessel

marine fauna, from biologically important areas or habitat critical to the survival of a species from the seismic sound associated with the 4D MSS	**EPBC Act Policy Statement 2.1 – Additional Management Procedures – B.4 Increased Precaution zones** The following increased low power zone for whales will be implemented for the 4D MSS during April: • Low power zone: 3 km horizontal radius from the acoustic source.	Daily MFO observation records and reports from seismic vessel
No adverse change to the values of Australian Marine Parks from the 4D MSS	**EPBC Act Policy Statement 2.1 – Standard Management Procedures** The following standard procedures will be implemented during the 4D MSS: • Pre start-up visual observation • Soft 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
	EPBC Act Policy Statement 2.1 – Standard Management Procedures In accordance with Standard Management Procedure A.4, a report on the conduct of the survey, and any whale interactions, should be provided to DCCEEW within two months of survey completion	The compliance and sighting report is submitted to DCCEEW within two months of the completion of the 4D MSS
	EPBC Act Policy Statement 2.1 – Additional Management Procedures – B.1 Marine Mammal Observers (on seismic vessel for full survey period) 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.	Daily MFO observation records and reports from seismic vessel
	EPBC Act Policy Statement 2.1 – Additional Management Procedures – B.1 Marine Mammal Observers (on seismic vessel for full survey period) Two trained MFOs will be available on the seismic vessel during the 4D MSS acquisition to allow for a second MFO to be brought on-duty if required under the EPBC Policy 2.1 standard management procedures (e.g., start-up delay procedures)	Records show that two trained MFOs were always onboard the seismic vessel during the 4D MSS acquisition
		Records show that MFOs onboard the seismic vessel during the 4D MSS meet the training and competency requirements described in Table 8-2
	EPBC Act Policy Statement 2.1 – Additional Management Procedures – B.5 Passive Acoustic Monitoring (for mid and high frequency cetaceans)	Daily MFO observation records and reports from seismic vessel

	A minimum of one dedicated PAM operator will be on-duty on the seismic vessel during all active operations during the 4D MSS. The on-duty PAM operator will be responsible for undertaking fauna observations via the PAM system	
	EPBC Act Policy Statement 2.1 – Additional Management Procedures – B.5 Passive Acoustic Monitoring (for mid and high frequency cetaceans) Two trained PAM operators will be available on the seismic vessel during the 4D MSS acquisition to allow for monitoring during both day and night active operations	Records show that two trained PAM operators were always onboard the seismic vessel during the 4D MSS acquisition Records show that the PAM operators onboard the seismic vessel during the 4D MSS meet the training and competency requirements described in Table 8-2
	EPBC Act Policy Statement 2.1 – Additional Management Procedures – B.6 Adaptive Management (supplementary marine fauna observations) Supplementary whale observations from the support vessel/s will be implemented during April: • 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	Induction records show support vessels bridge-watch crew were provided with whale observations and reporting guidelines Whale observation reports from support vessels during April
	EPBC Act Policy Statement 2.1 – Additional Management Procedures – B.6 Adaptive Management (peak PBW migration period) The following night and low visibility procedures will be implemented during April within 12.5 km of the ‘most important areas’ for foraging as identified in Figure 4-5: • if a Pygmy Blue Whale^ is observed within the 500 m shut-down zone (positive identification of a Pygmy Blue Whale, the zone will extend to the field of view of the MFO) during daylight acquisition, then: – seismic operations will not be undertaken during the following night or low visibility period – seismic acquisition can resume during daylight hours.	Records demonstrate that spatial data for boundaries of the most important foraging areas have been provided to the seismic vessel contractor Daily MFO observation records and reports from seismic vessel
	EPBC Act Policy Statement 2.1 – Additional Management Procedures – B.6 Adaptive	Daily MFO observation records and reports from seismic vessel

	Management (peak PBW migration period) The following increased timeframe for pre start-up visual observations will be implemented for the 4D MSS during April • the pre start-up visual observation period will be extended to 60 minutes before the commencement of the soft start procedure.	
	EPBC Act Policy Statement 2.1 – Additional Management Procedures – B.6 Adaptive Management (non-peak whale periods) The following will be implemented during the 4D MSS acquisition (January to April) • if the survey is required to shut-down or power-down as a result of the presence of a whale, then the – pre start-up visual observation period will be extended to 60 minutes before the commencement of the soft start procedure – low power zone will be extended to 3 km horizontal radius from the acoustic source • the pre start-up visual observation period cannot revert to the standard 30 minutes, and low power zone to the standard 2 km, until there has been a 24-hour period during good visibility conditions during which no shut-downs or power-downs have occurred for whales.	Daily MFO observation records and reports from seismic vessel
	Observation shutdown procedures for marine turtles and Whale Sharks Marine fauna observations from the seismic vessel will include marine turtles and Whale Sharks during the 4D MSS, during the pre start-up visual observation period.	Daily MFO observation reports from seismic vessel
	Observation shutdown procedures for marine turtles and Whale Sharks A shut-down zone (minimum 100 m horizontal radius from the acoustic source, and where conditions allow for positive identification, the zone will extend to the field of view of the MFO) for marine turtles and Whale Sharks, will be implemented for the 4D MSS:	Records demonstrate that seismic operations were undertaken in accordance with the additional turtle and Whale Shark shutdown procedures

	• the seismic source will be shut down, or start-up will be delayed for 30 minutes, if a marine turtle or Whale Shark is observed within the shut-down zone. • operation of the seismic source using soft-start shall only resume when 30 minutes have lapsed since the turtle sighting or the turtle has been observed to move outside the shutdown zone.	
	Adaptive management for marine turtles and Whale Sharks The following will be implemented during the 4D MSS acquisition (January to April) • if the survey is required to shut-down or power-down as a result of the presence of a whale, then the pre start-up visual observation period will be extended to 60 minutes before the commencement of the soft start procedure • the pre start-up visual observation period cannot revert to the standard 30 minutes until there has been a 24-hour period during good visibility conditions during which no shut-downs or power-downs have occurred for marine turtles or Whale Sharks.	Daily MFO observation reports from seismic vessel
Reduce the risk of accumulated sound exposure to site-attached fish communities during the 4D MSS	**Adaptive management for site-attached fish of Wheatstone ridgeline** No reacquisition shot points will occur within 1 km horizontal distance of the Wheatstone ridgeline within a 24-hour period during the 4D MSS	Records demonstrate that spatial data for boundaries of the Wheatstone ridgeline have been provided to the seismic vessel contractor
		Records demonstrate that the seismic source was not discharged at full power within 1 km of the Wheatstone ridgeline more than once within a 24-hour period
No injury to divers from underwater sound emissions from the seismic source associated with the 4D MSS	**DMAC Guidance** If diving activities are scheduled to occur at the time of the 4D MSS acquisition, consultation and management of activities will be undertaken as per the Guidance DMAC 12: Safe Diving Distance from Seismic Surveying Operations	If required, records demonstrate that DMAC guidance was implemented for concurrent seismic and diving operations
	Concurrent operations plan CAPL will develop and implement COPs (or equivalent) to manage 4D MSS and other planned petroleum activities involving diving within or adjacent to the OA	Records indicate that if concurrent diving operations within the OA are identified, COPs were developed and in place prior to the 4D MSS commencing, and implemented for the duration of the survey
Reduce the risk of cumulative	**BOEM Guidance**	If required, records demonstrate that a 40 km separation distance

underwater sound emissions from concurrent petroleum activities	For concurrent seismic surveys, a separation distance of 40 km between seismic sources will be maintained	was maintained for concurrent seismic operations
	Concurrent operations plan CAPL will develop and implement COPs (or equivalent) to manage 4D MSS and other planned seismic surveys within or adjacent to the OA	Records indicate that if other concurrent seismic surveys within or adjacent to the OA are identified, COPs were developed and in place prior to the 4D MSS commencing, and implemented for the duration of the survey
Reduce the impact to commercial fishery licence holders from underwater sound emissions from the seismic source associated with the 4D MSS	**Adjustment protocol** Relevant commercial fisheries will be advised of the Adjustment Protocol at least four weeks prior to commencing offshore activities	Relevant persons consultation records
	Adjustment protocol CAPL will assess any evidence-based claims from commercial fishery licence holders for compensation in line with the adjustment protocol (Section 8.3.4.1)	Records show that any evidence-based claim from commercial fishery licence holders was assessed and decision finalised
	Adjustment protocol If an independent third-party is required to be appointed (Section 8.3.4.1), they will be provided with the Adjustment Protocol and claim details (including supporting evidence)	Records show that the independent third-party was appointment by agreement of both CAPL and the fishery licence holder
		Copies of the Adjustment Protocol, claim details, and supporting evidence were provided to the independent third-party to enable them to provide a claim assessment decision

^ where the observation is of a positively identified Pygmy Blue Whale, or a large baleen whale that is considered likely to be a Pygmy Blue Whale.

7.6 Underwater sound—field support operations

7.6.1 Acoustic modelling

Acoustic modelling undertaken by Woodside for pipelay and support vessels (Ref. 172) 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. 172) 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. 172) are summarised throughout the subsequent risk and impact assessment (Section 7.6.2).

In the absence of modelling, the estimates of SPL from helicopter operations (149–162 dB re 1 μPa) (Ref. 165; Ref. 166) 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 criterions is not relevant.

7.6.1.1 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. 168) for the onset of PTS and TTS[38] in marine mammals (Table 7-7)
- un-weighted SPL for behavioural threshold for marine mammals based on NOAA (Ref. 169) (Table 7-7)
- frequency-weighted accumulated sound exposure levels (SEL_{24h}) from Finneran et al. (Ref. 170) for the onset of PTS and TTS in marine turtles (Table 7-7)
- sound exposure guidelines for fish, fish eggs and larvae (including plankton) (Ref.171) (Table 7-7).

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. 189).

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

Table 7-7: 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 µPa²s	SEL_{24h}: 179 dB re 1 µPa²s	N/A	SPL: 120 dB re 1 µPa
Mid-frequency cetaceans	N/A	N/A	SEL_{24h}: 198 dB re 1 µPa²s	SEL_{24h}: 178 dB re 1 µPa²s	N/A	SPL: 120 dB re 1 µPa
High-frequency cetaceans	N/A	N/A	SEL_{24h}: 173 dB re 1 µPa²s	SEL_{24h}: 153 dB re 1 µPa²s	N/A	SPL: 120 dB re 1 µPa
Marine turtles	N/A	N/A	SEL_{24h}: 220 dB re 1 µPa²s	SEL_{24h}: 200 dB re 1 µPa²s	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]).

7.6.2 Risk assessment

Source			
Activities identified as having the potential to result in underwater sound are: • vessels or helicopter operations within the OA. These activities result in the emission of continuous sound.			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
Underwater sound emissions may result in:		A change in ambient underwater sound may result in:	
• localised and temporary change in ambient underwater sound.	5	• behavioural disturbance	5
		• auditory impairment, temporary threshold shift (TTS), permanent threshold shift (PTS), recoverable or non-recoverable injury to marine fauna	–
		• changes to cultural heritage values	5
Consequence evaluation			
Localised and temporary change in ambient underwater sound Anthropogenic underwater sound emitted during the 4D MSS activities will result in a change in ambient noise levels. 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. 208). 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. 208). 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. 163). When underway at ~12 knots vessel sound of 120 dB re 1 µPa was recorded at 0.5–1 km (Ref. 163). 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. Sound emitted from helicopter operations is typically below 500 Hz (Ref. 164). 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. 165; Ref. 166). Richardson et al. (Ref. 165) 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. 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.			
Marine Mammals *Behavioural disturbance* Acoustic modelling for support vessels indicate that the maximum radial distance in any direction from the source to noise effect criteria of 120 dB re 1 µPa (for all hearing groups) was 4.9 km (Ref. 172). As identified in Section 4.2, several marine mammal species listed as threatened and/or migratory under the EPBC Act have the potential to occur within the OA. The threatened and/or migratory cetaceans that may be present within the OA are low-frequency and mid-frequency cetaceans (Section 4.2). In addition, a migration and distribution BIA for the Pygmy Blue Whale also overlaps with the OA and FPZ (Section 4.3.3.1.1). The Humpback Whale migration BIA is located ~5 km from the OA (Section 4.3.3.1.2), 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. High-frequency cetaceans (e.g., *Kogia* spp.) were identified as species or species habitat that may occur within the OA (appendix b), but are not listed as threatened and/or migratory under the EPBC Act. Except for Pygmy Blue Whales and Humpback Whales, there are no known biologically important areas for other cetacean species within or adjacent to the OA for the 4D MSS; it is expected that any presence within the OA would be of a transitory nature. As identified in Section 4.5.1, the OA overlaps with the Montebello Marine Park. Natural values of this AMP include species listed as threatened, migratory, marine, or cetacean under the EPBC Act, as well as any identified BIAs for regionally significant marine fauna.

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. Data from satellite tracking studies has also suggested that migration by Pygmy Blue Whales occurs in deeper waters and further offshore than the defined BIA (Section 4.3.3.1.1).

The 'Possible Foraging Areas' as defined within the *Conservation Management Plan for the Blue Whale* (Ref. 63), and characterised as foraging BIAs, occur ~225 km southwest and ~810 km northeast of the OA respectively. Data from a recent study (Ref. 274) has identified 'most important areas' for foraging for the Pygmy Blue Whale based on proxy indicators; and there is a small overlap in the northwest OA (but not within the FPZ) (Figure 4-5; Section 4.3.3.1.1). The same study also showed that monthly spatial predictions indicated higher densities around the Montebello Island region during May and June (northern migration) and November and December (southern migration) (Ref. 274). These months of predicted higher densities of Pygmy Blue Whales are predominantly outside of the proposed 4D MSS period (mid-December to mid-April). Therefore, while foraging activity may occur in a small northwest section of the OA (Figure 4-5), the numbers of Pygmy Blue Whales expected to be present during April may still be low.

Estimates of SPL for helicopters range 149–162 dB re 1 μPa (Ref. 165; Ref. 166), 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. 165). 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.

Given the limited spatial and temporal exposures to marine mammals from underwater continuous sound above the noise effect criteria for behavioural disturbance from the moving seismic and support vessels, it is therefore expected that there would also be no long-term or significant impacts to the values of the Montebello Marine Park.

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).

Masking

Auditory masking impacts may occur when there is a reduction in audibility for one sound (signal) caused by the presence of another sound (noise), impeding the ability of an animal to perceive a signal (Ref. 283, Ref. 284). For this to occur, the noise must be loud enough and have a similar frequency to the signal and both signal and noise must occur at the same time. Masking and the potential effects of masking on communication and listening space of marine mammals are not fully understood and remain an area of active research (Ref. 285, Ref. 286, Ref. 287, Ref. 288).

A study undertaken by Clark et al (Ref. 290) considers the potential for masking impacts from vessel sounds is classified as high near the vessel (within tens of metres), moderate within hundreds of metres, and to low within thousands of metres (Ref. 290).

Given the relatively small predicted ensonified area (i.e., up to hundreds of metres from the seismic vessel) for masking effects, the transient nature of the vessel source, and the mobile nature of cetacean species, only localised short-term masking 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 μPa^2.s was <0.010 km, and to a SEL_{12h} threshold of 158 dB re μPa^2.s was <0.097 km (Ref. 172). 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 7-7), these distances (<10–100 m) are considered a conservative estimate. Consequently, TTS and PTS for marine mammals from continuous sound sources from vessels 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. The helicopter operations covered under this EP (i.e., crew transfers for seismic vessel) are expected to be infrequent. Therefore, exposure to continuous sound from this source for an extended period (e.g., 24 hours) is not credible, and comparison against an accumulated sound exposure levels is not relevant, and no further evaluation is required.
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 µPa^2.s was <0.010 km, and to a SEL_{12h} threshold of 158 dB re µPa^2.s was <0.097 km (Ref. 172). Given that the noise exposure criteria for marine turtles for TTS and PTS is based on a SEL_{24h} at higher thresholds (Table 7-7), these distances (<10–100 m) are considered a conservative estimate. Consequently, TTS and PTS for marine turtles from continuous sound sources from vessels 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. The helicopter operations covered under this EP (i.e., crew transfers for seismic vessel) are expected to be infrequent. Therefore, exposure to continuous sound from this source for an extended period (e.g., 24 hours) is not credible, and comparison against an accumulated sound exposure levels is not relevant, and no further evaluation is required.
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 7-7). 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. 171). 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 4.3.3.3, 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. As identified in Section 4.5.1, the OA overlaps with the Montebello Marine Park. Natural values of this AMP include species listed as threatened, migratory, or marine under the EPBC Act, as well as any identified BIAs for regionally significant marine fauna. Whale Shark migration along the WA coast occurs mainly between July and November (Section 4.3.3.3.1). 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. 173). 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. Given that there is no exposure to migrating Whale Sharks from underwater continuous sound from the moving seismic and support vessels (due to timing of the 4D MSS), it is therefore expected that there would also be no long-term or significant impacts to the values of the Montebello Marine Park. 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 7-7).

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. 172).

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 from continuous sound sources from vessels are considered credible, and have therefore not been considered further.

The helicopter operations covered under this EP (i.e., crew transfers for seismic vessel) are expected to be infrequent. Therefore, exposure to continuous sound from this source for an extended period (e.g., 24 hours) is not credible, and comparison against an accumulated sound exposure levels is not relevant, and no further evaluation is required.

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 7-7).

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. 71). 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 7-7), and as such are not discussed further.

Changes to cultural heritage values

There are no World, National, or Commonwealth heritage listed places or sites within the OA (Section 4.6).

Based on the outcomes of relevant persons consultation, CAPL considers that indirect impacts to intangible First Nations cultural values may occur due to impacts on marine fauna. The consequence evaluations to these receptors are provided above, and were risk assessed as Minor (5). Given the offshore location of the OA (~30 km from the Montebello Islands, and ~119 km from the mainland; Figure 3-1) and duration of the campaign (~75 days), a significant adverse change to cultural values attributed to the offshore marine area is not predicted to occur. As such, CAPL has ranked the consequence for cultural values consistent with that for marine fauna, as Minor (5).

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 relevant persons 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	
Control measure	**Description**
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**
Adaptive management for Pygmy Blue Whales	A recent study has indicated areas of probable foraging along the NWS based on proxy indicators (Section 4.3.3.1.1), and there is a small overlap with the OA (outside of the FPZ). In accordance with guidance from DAWE and NOPSEMA (Ref. 189), activities occurring outside designated Foraging Areas must adopt adaptive management approaches should indicators of whale foraging be evident. The use of these areas for foraging would occur during seasonal migration for the Pygmy Blue Whales. In recognition of the temporal and spatial overlap with the predicted peak northbound migration period, the following increased caution zone will be implemented during December and April: • 1 km either side of whales • maximum of two vessels within zone Increasing the caution zone would decrease the risk of displacement from foraging.	Increasing caution zone distances and decreasing the number of vessels allowed within the zone would potentially increase the duration and operational cost of the MSS. However, given the small temporal overlap of the peak migratory period for Pygmy Blue Whales (northbound during April) and the 4D MSS (mid-December to mid-April), the additional operational costs are not considered grossly disproportionate to the environmental benefit. Therefore, control measure has been adopted for use.

Likelihood and risk level summary	
Likelihood	Due to the nature and scale of the general vessel activities within scope of this EP, the predicted consequence was a localised and temporary behaviour disturbance, with no risk of auditory impairment or injury. 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).
Risk level	Very low (10)

Determination of acceptability	
Principles of ESD	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, internesting, or foraging behaviours, nor impact on individuals or the wider population. As

<table>
<tr><td></td><td>such, this aspect is not considered as having the potential to affect biological diversity and ecological integrity.
The consequence associated with this aspect is Minor (5).
Therefore, no further evaluation against the Principles of ESD is required.</td></tr>
<tr><td>Relevant environmental legislation and other requirements</td><td>Legislation and other requirements considered applicable for this aspect include:

EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans
Conservation Management Plan for the Blue Whale 2015–2025 (Ref. 63)
Conservation Advice Balaenoptera borealis Sei Whale (Ref. 62)
Conservation Advice Balaenoptera physalus Fin Whale (Ref. 61)
Conservation Advice Rhincodon typus Whale Shark (Ref. 60)
Recovery Plan for Marine Turtles in Australia (Ref. 58)
Approved Conservation Advice for Dermochelys coriacea (Leatherback Turtle) (Ref. 59)
North-west Marine Parks Network Management Plan 2018 (Ref. 9).

CAPL considers that impact and risk management is consistent with these requirements, as demonstrated below.
<table>
<tr><th>Requirement</th><th>Demonstration</th></tr>
<tr><td>EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans
Caution and no approach zones for interacting with cetaceans from vessels.
Vertical and horizontal distances for helicopter operations.</td><td>Requirements of Regulation 8.05 and 8.06 for vessels, and 8.07 for aircraft, interacting with cetaceans has been incorporated into the EPBC Regulations 2000 – Part 8 Division 8.1 – Interacting with cetaceans control measure.</td></tr>
<tr><td>Conservation Management Plan for the Blue Whale 2015–2025
<u>Management action A.2.3</u>: 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</td><td>The 4D MSS is not considered to be inconsistent with the Conservation Management Plan for the Blue Whale.
The OA does not intersect with designated Foraging Areas for the Pygmy Blue Whale. 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 the 4D MSS.
A recent study has indicated areas of probable foraging along the NWS based on proxy indicators (Section 4.3.3.1.1), and there is a small overlap with the OA (outside of the FPZ). In accordance with guidance from DAWE and NOPSEMA (Ref. 189), activities occurring outside designated Foraging Areas must adopt adaptive management approaches should indicators of whale foraging be evident. Adaptive management control measures have been considered and adopted for use within this risk assessment.</td></tr>
</table>
</td></tr>
</table>

		TTS and PTS from accumulated SEL_{24h} exposures to continuous sounds from vessels or helicopters is not predicted to occur. Therefore, continued use of the BIA without injury is expected.
	Conservation Advice Balaenoptera borealis Sei Whale No specific conservation action identified.	N/A
	Conservation Advice Balaenoptera physalus Fin Whale No specific conservation action identified.	N/A
	Conservation Advice Rhincodon typus Whale Shark No specific conservation action identified.	N/A
	Recovery Plan for Marine Turtles in Australia Management action A1.5: Manage anthropogenic activities to ensure marine turtles are not displaced from identified habitat critical to the survival Management action A1.6: Manage anthropogenic activities in Biologically Important Areas to ensure that biologically important behaviour can continue	The 4D MSS is not considered to be inconsistent with the *Recovery Plan for Marine Turtles in Australia.* TTS and PTS from accumulated SEL_{24h} exposures to continuous sounds from vessels or helicopters is not predicted to occur. Therefore, continued use of habitat critical to the survival of a species and BIAs without displacement or disruption to biologically important behaviours is expected.
	Approved Conservation Advice for Dermochelys coriacea (Leatherback Turtle) No specific conservation action identified.	N/A
	North-west Marine Parks Network Management Plan 2018 No specific zone rules identified.	N/A
Internal context	No CAPL management processes or procedures were deemed relevant for this aspect.	
External context	During relevant persons consultation, no objections or claims were raised regarding underwater sound emissions arising from the activity.	
Defined acceptable level	These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan. However, in alignment with Section 5.6.2, where the aspect is listed as threat to a protected matter, or identified as a concern to a listed conservation value, CAPL will define an acceptable level of impact that aligns with the objectives of these documents. Objectives of the relevant documents are shown below:	
	Plan	**Objective**
	Conservation Management	Recovery objective: Minimise anthropogenic threats to allow for their conservation status to improve so that

<table>
<tr><td rowspan="4"></td><td>Plan for the Blue Whale 2015–2025</td><td>they can be removed from the EPBC Act threatened species list.
<u>Interim objective 4</u> Anthropogenic threats are demonstrably minimised.</td></tr>
<tr><td>Recovery Plan for Marine Turtles in Australia</td><td><u>Recovery objective</u>: The long-term recovery objective for marine turtles is to minimise anthropogenic threats to allow for the conservation status of marine turtles to improve so that they can be removed from the EPBC Act threatened species list.
<u>Interim objective 3</u>: Anthropogenic threats are demonstrably minimised.</td></tr>
<tr><td>North-west Marine Parks Network Management Plan 2018</td><td>As per Section 4.5.1.</td></tr>
<tr><td colspan="2">Therefore, CAPL has defined the following acceptable level of impact such that it is not inconsistent with these documents:
• no auditory injury (TTS or PTS) to Pygmy Blue Whales within a BIA resulting from underwater sound from the petroleum activity
• no displacement of Pygmy Blue Whales from foraging areas resulting from underwater sound from the petroleum activity such that it would prevent the long-term recovery of the species
• no displacement of marine turtles from habitat critical to the survival or a species resulting from underwater sound from the petroleum activity such that it would prevent the long-term recovery of the species
• no disruption of biologically important behaviors of marine turtles within biologically important areas, resulting om underwater sound from the petroleum activity such that it would prevent the long-term recovery of the species
• no adverse change to the values of the Montebello Marine Park.
CAPL considers that the petroleum activity, with the control measures as described for this aspect in place, meet this acceptable level. In particular that by managing the risk to marine fauna, that the risk to values of the AMP are also subsequently managed to this acceptable level.</td></tr>
</table>

<table>
<tr><th>Environmental performance outcome</th><th>Environmental performance standard</th><th>Measurement Criteria</th></tr>
<tr><td rowspan="3">No injury to marine fauna from underwater sound emissions from vessel and helicopter activities within the OA associated with the 4D MSS

Avoid displacement of marine fauna, or disruption of biologically important behaviours of marine fauna, from biologically important areas or habitat critical to the survival</td><td rowspan="3">EPBC Regulations 2000 – Part 8 Division 8.1 – Interacting with cetaceans
Seismic and support vessels will implement caution and no approach zones, where practicable:
• 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</td><td>Induction materials include relevant marine fauna caution and no approach zone requirements</td></tr>
<tr><td>Training records confirm personnel involved in offshore vessel activities have completed the induction</td></tr>
<tr><td>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</td></tr>
</table>

of a species from vessel or helicopter activities associated with the 4D MSS No adverse change to the values of Australian Marine Parks from the 4D MSS	this zone, and should not wait in front of the direction of travel or an animal or pod, or follow directly behind. ***Exception**: does not apply to the seismic vessel when towing equipment as it is operating with constrained manoeuvrability; or to any vessel in the event of an emergency.*	
	Adaptive management for Pygmy Blue Whales Seismic and support vessels will implement the following increased caution zone during December and April, where practicable: • caution zone (1,000 m either side of Pygmy Blue Whales^– vessels must operate at ≤6 knots within this zone, maximum of two vessels within zone, and vessels should not enter if a calf is present ***Exception:** does not apply to the seismic vessel when towing equipment as it is operating with constrained manoeuvrability; or to any vessel in the event of an emergency.*	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
	EPBC Regulations 2000 – Part 8 Division 8.1 – Interacting with cetaceans Helicopters will: • not operate at a height lower than 1,650 feet or within a horizontal radius of 500 m for a cetacean • not approach a cetacean from head on. ***Exception**: does not apply during helicopter take-off or landing (on the vessel) if these cannot be delayed due to safe operation requirements; or to any helicopter in the event of an emergency*	Helicopter records show if marine fauna interaction occurred, and what mitigation (e.g., divert) measure was implemented

^ where the observation is of a positively identified Pygmy Blue Whale, or a large baleen whale that is considered likely to be a Pygmy Blue Whale.

7.7 Invasive marine pests

Source			
Activities identified as having the potential to result in the introduction of an invasive marine pest (IMP) are: • planned discharged of ballast water or the presence of biofouling on vessels undertaking seismic survey activities within the OA.			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
N/A	–	An introduction of an IMP may result in: • displacement of, or compete with, native species.	2
Consequence evaluation			
IMPs are likely to have little or no natural competition or predators, thus potentially outcompeting native species for food or space, preying on native species, or changing the nature of the environment. It is estimated that Australia has >250 introduced marine pests, and that approximately one in six introduced marine species becomes a pest (Ref. 95). 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. 207) estimates that the median risk of establishment[39] at 3 nm, 12 nm and 24 nm is ~40%, ~28%, and ~9% respectively. 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. The particular values and sensitivities within the OA with the potential to be impacted by the introduction of an IMP within the OA include: • continental slope demersal fish communities (KEF) • ancient coastline at 125 m depth contour (KEF) • ridgeline habitat and associated communities. As identified in Section 4.5.1, the OA overlaps with the Montebello Marine Park. Natural values of this AMP include the ancient coastline at 125 m depth contour KEF. The benthic habitat within the OA predominantly comprises soft substrates (Section 4.3.1.1). 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. Once established, some IMPs can be difficult to eradicate (Ref. 96) 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. 97; Ref. 98; Ref. 99; Ref. 100). Although invasive species are identified as being of concern to marine reptile species under the *North-west Marine Bioregional Plan* (Ref. 71), the risk is associated with terrestrial based species, and thus is not relevant to the activities covered under this EP. If an IMP was introduced, and if it did colonise an area, there is the potential for that colony to spread outside the OA resulting in a widespread long-term impact, therefore resulting in a Severe (2) consequence.			
ALARP decision context justification			
Offshore commercial vessel operations, and subsequent planned discharges, are commonplace and well-practiced locally, nationally, and internationally.			

[39] In this context, establishment refers to an organism being able to find suitable habitat and survive.

The causes resulting in an introduction of an IMP from a planned release of ballast water or hull biofouling are well understood by the industry and CAPL. The control measures to manage the risk associated with the introduction of an IMP are well defined via legislative requirements that are considered standard industry practice. These control measures are well understood and implemented by the petroleum industry and CAPL. Specifically, CAPL has worked in the region for over 10 years, thus has a demonstrated understanding of industry requirements and their operational implementation in these areas.

The risk of introducing an IMP is considered a lower-order risk in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.

Good practice control measures

Control measure	Description
Quarantine procedure	CAPL's *Quarantine Procedure Marine Vessels* (Ref. 45) 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: • ballast water management in line with the *Australian Ballast Water Management Requirements* (Ref. 4) • undertaking biofouling risk assessments in line with the with the *National Biofouling Management Guidance for the Petroleum Production and Exploration Industry* (Ref. 101) and DPIRD Vessel Check system • requirements for biofouling management plans and/or biofouling record books, in accordance with the *Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species (Biofouling Guidelines)* MPEC.207(62) 2011 (Ref. 7) and *Australian Biofouling Management Requirements* (Ref. 5). As described in Section 8.3.3.2, all vessels operating in title areas must comply with applicable Australian biofouling and ballast water requirements to prevent the introduction and spread of marine pests. The quarantine procedure requires that all vessels complete and submit to CAPL a *Quarantine Questionnaire – Marine Vessels*, of which Section 3 addresses ballast water and Section 4 addresses biofouling, including that all relevant biofouling information (e.g., Biofouling Management Plan, Biofouling Record Book, evidence of last vessel clean to remove biofouling. antifouling certificates, etc.) is provided to enable suitable risk assessments to be completed prior to vessel mobilisation to a title area. Once CAPL are satisfied that the vessel meets marine quarantine requirements, CAPL will issue authorisation to mobilise via the *Quarantine Certificate - Vessel Mobilisation.*
Ballast water management	The *Australian Ballast Water Management Requirements* (Ref. 4) describes the management requirements for ballast water exchange, including: • non-discharge of 'high-risk' ballast water in Australian ports or waters • full ballast exchange outside Australian territorial seas • documentation of all ballast exchange activities.
Anti-fouling certificate	The *Protection of the Sea (Harmful Anti-fouling Systems) Act 2006* (Cth) enacts Marine Order 98 (Marine pollution – anti-fouling systems). This marine order describes the conditions for when an antifouling certificate is required.
Maritime Arrivals Reporting System (MARS)	Under the *Biosecurity Act 2015* (Cth), pre-arrival information must be reported through MARS before a vessel arrives in Australian waters. In accordance with the *Australian Biofouling Management Requirements* (Ref. 5), from 15 June 2022, all operators of vessels intending to enter Australian territorial waters must also provide information relating to biofouling management as part of the pre-arrival reporting via MARS.

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

Likelihood and risk level summary	
Likelihood	As vessel activities are occurring in deeper Commonwealth waters (not within shallow coastal areas), and with the well-known and implemented IMP control measures in place, it is considered Rare (6) that an IMP would be introduced resulting in impacts to the ecological functions of benthic habitats within or in close proximity to the OA.
Risk level	Low (7)

Determination of acceptability		
Principles of ESD	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. The consequence associated with this aspect is Severe (2). Therefore, further evaluation against the remaining Principles of ESD is required. There is little uncertainty associated with this aspect as the activities and cause pathways are well known and the activities are well regulated and managed. The habitat within the OA is known from baseline studies, thus the understanding of benthic habitat at these locations is well understood. As such, there is limited scientific uncertainty associated with this aspect; consequently the precautionary principle has not been applied.	
Relevant environmental legislation and other requirements	Legislation and other requirements considered relevant for this aspect include: • *Biosecurity Act 2015* (Cth) • *Protection of the Sea (Harmful Anti-fouling Systems) Act 2006* (Cth) (enacted by Marine Order 98 [Marine pollution – anti-fouling systems]) • *Australian Ballast Water Management Requirements* (Ref. 4) • *Australian Biofouling Management Requirements* (Ref. 5) • *Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species (Biofouling Guidelines)* MPEC.207(62)) 2011 (Ref. 7) • *National Biofouling Management Guidance for the Petroleum Production and Exploration Industry* (Ref. 101) • *North-west Marine Parks Network Management Plan 2018* (Ref. 9). CAPL considers that impact and risk management is consistent with these requirements, as demonstrated below.	
	Requirement	**Demonstration**
	Biosecurity Act 2015 Pre-arrival reporting through MARS	Requirement for pre-arrival reporting has been incorporated into the **MARS** control measure.
	Protection of the Sea (Harmful Anti-fouling Systems) Act 2006 Gives effect to Marine Order 98	Anti-fouling certifications (as per Division 2) have been incorporated into the **anti-fouling certificate** control measure
	Australian Ballast Water Management Requirements Best practice guidance for ballast water management within Australian seas, including legislative	Requirement for ballast water exchange has been incorporated into the **ballast water management** control measure Proactive management of ballast water (e.g., use of ballast water

	obligations under *Biosecurity Act 2015*	management plan) has been incorporated into the **quarantine procedure** control measure
	Australian Biofouling Management Requirements Best practice guidance for biofouling management within Australian seas, including legislative obligations under *Biosecurity Act 2015*	Requirement for pre-arrival reporting has been incorporated into the **MARS** control measure Proactive management of biofouling (e.g., use of biofouling management plan) has been incorporated into the **quarantine procedure** control measure
	Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species (Biofouling Guidelines) A biofouling management plan and record book to be available and maintained	Proactive management of biofouling (e.g., use of biofouling management plan) has been incorporated into the **quarantine procedure** control measure
	National Biofouling Management Guidance for the Petroleum Production and Exploration Industry Undertake a biofouling risk assessment	Biofouling risk assessments for vessels have been incorporated into the **quarantine procedure** control measure
	North-west Marine Parks Network Management Plan The Plan requires that "[b]allast water discharge and exchange must be compliant with Australian ballast water management requirements administered by the Australian Maritime Safety Authority".	The Montebello Marine Park is a multiple use zone (IUCN VI). The control measures identified for the management of ballast water are in accordance with Australian requirements, and therefore also in accordance with the requirements of the multiple use zone of an Australian Marine Park.
Internal context	This CAPL environmental management process or procedure was deemed relevant for this aspect: • *Quarantine Procedure Marine Vessels* (Ref. 45). Control measures related to each of the above management processes or procedures have been described for this aspect. As such, CAPL considers that impact and risk management is consistent with company policy, culture, and standards.	
External context	During relevant persons consultation, no objections or claims were raised regarding IMPs arising from the activity.	
Defined acceptable level	These risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan. However, in alignment with Section 5.6.2, where the aspect is listed as threat to a protected matter, or identified as a concern to a listed conservation value, CAPL will define an acceptable level of impact that aligns with the objectives of these documents. Objectives of the relevant documents are shown below:	
	Plan	**Objective**
	North-west Marine Parks Network Management Plan 2018	As per Section 4.5.1.
	Therefore, CAPL has defined the following acceptable level of impact such that it is not inconsistent with these documents:	

	• No adverse change to the values of the Montebello Marine Park. CAPL considers that the petroleum activity, with the control measures as described for this aspect in place, meet this acceptable level. In particular that by managing the biofouling and ballast water, that the risk to values of the AMP are also subsequently managed.	
Environmental performance outcome	**Environmental performance standard**	**Measurement criteria**
No introduction and establishment of invasive marine pests from vessel activities within the OA associated with the 4D MSS No adverse change to the values of Australian Marine Parks from the 4D MSS	**Quarantine procedure** All marine vessels undertaking activities in the OA must meet the relevant requirements of the *Quarantine Procedure Marine Vessels*, including that where required*:* • *Quarantine Questionnaire – Marine Vessels* has been completed and submitted to CAPL • biofouling risk assessments are completed • biofouling management plans and/or biofouling record books are available.	*The Quarantine Certificate - Vessel Mobilisation* issued by CAPL confirm that relevant vessels meet requirements of the *Quarantine Procedure Marine Vessels*
	Ballast water management International marine vessels will be required to comply with the key *Australian Ballast Water Management Requirements*, which are: • non-discharge of 'high-risk' ballast water in Australian ports or waters • full ballast exchange outside Australian territorial seas • documentation of all ballast exchange activities.	For international marine vessels, records show compliance with the *Australian Ballast Water Management Requirements*
	Anti-fouling certificate Marine vessels greater than 400 GT with an anti-foul coating are to maintain up-to-date international antifouling coating certification in accordance with *Protection of the Sea (Harmful Anti-fouling Systems) Act 2006* and/or the International Convention on the Control of Harmful Anti-fouling Systems on Ships	Inspection reports confirm that international antifouling coating certifications are up-to-date
	Maritime arrivals reporting system Vessels entering into the Australian territorial sea from outside Australian territory will complete pre-arrival reporting (unless Excepted under Biosecurity Determination 2016), in accordance with the *Biosecurity Act 2015*	Records confirm that international vessels completed pre-arrival reporting (or can demonstrate meeting conditions for an exception)

7.8 Planned discharges—vessel operations

Source

Activities identified as having the potential to result in planned discharges are:

- vessels operations (during the seismic survey) within the OA.

The types of planned vessel discharges include deck wash-water, fire-fighting foam, sewage, greywater, food wastes, cooling water, and oily bilge water.

Potential impacts and risks

Impacts	C	Risks	C
Planned discharges from vessels may result in: • localised and temporary reduction in water quality.	6	A change in ambient water quality may result in: • changes to predator-prey dynamics.	6

Consequence evaluation

Localised and temporary reduction to water quality

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.

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. 102). 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. 102). This outcome was verified by sewage discharge monitoring for another offshore project (Ref. 103), which determined that a 10 m^3 sewage discharge reduced to ~1% of its original concentration within 50 m of the discharge location. In addition, monitoring at distances 50 m, 100 m, and 200 m downstream, and at five different water depths, confirmed that discharges were rapidly diluted and no elevations in water quality monitoring parameters (e.g., total nitrogen, total phosphorous, and selected metals) were recorded above background levels at any station. This modelling was based on volumes that far exceed volumes expected during vessel operations for the 4D MSS. Therefore, the extent of impacts are expected to be localised to the discharge location.

Monitoring of desalination brine of continuous wastewater discharges (including cooling water) undertaken by Woodside for its Torosa South-1 drilling program in the Scott Reef complex found that discharge water temperature decreases quickly as it mixes with the receiving waters, with the discharge water temperature being <1 °C above ambient within 100 m (horizontally) of the discharge point, and 10 m vertically (Ref. 103).

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

Testing of fire-fighting deluge systems onboard vessels often leads to a release of fire-fighting foams offshore. Toxicological effects from these types of foams is typically only associated with prolonged or frequent exposures, such as on land and in watercourses near firefighting training areas (Ref. 104; Ref. 105). 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. 106; Ref. 107) and further dilution of the foam mixtures in dispersive aquatic environments may then occur before there is any substantial demand for dissolved oxygen (Ref. 108).

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

Changes to predator / prey dynamics

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

However, the rapid consumption of this food waste by scavenging fauna, and physical and microbial breakdown, ensures that the impacts of food waste discharges are insignificant and temporary and that all receptors that may potentially be in the water column are not impacted. 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). As identified in Section 4.5.1, the OA overlaps with the Montebello Marine Park. Natural values of this AMP include species listed as threatened, migratory, marine, or cetacean under the EPBC Act, as well as any identified BIAs for regionally significant marine fauna; and also the ancient coastline at 125 m depth contour KEF. 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. 102). 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. 109) 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. 110; Ref. 111; Ref. 112). 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). Given the limited impacts expected to predatory-prey dynamics from planned vessel discharges, it is therefore expected that there would also be limited environmental impacts to the values of the Montebello Marine Park.	
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 relevant persons 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. Notwithstanding this, CAPL has considered additional mitigation measures that could potentially further reduce the impacts and risks from planned discharges to Montebello Marine Park.	
Good practice control measures	
Control measure	**Description**
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.

<table>
<tr><th colspan="3">Additional control measures and cost benefit analysis</th></tr>
<tr><th>Control measure</th><th>Benefit</th><th>Cost</th></tr>
<tr><td>Spatial restriction of vessel discharges within an AMP</td><td>The impacts and risks associated with intermittent vessel discharges have been assessed as Incidental (i.e., limited environmental impact).
In accordance with the rules for multiple use zones of Australian Marine Parks, waste from normal operations of vessels is allowable if compliant with legislative requirements. The intermittent discharge of waste from vessels during the 4D MSS within the boundary of the Montebello Marine Park is not inconsistent with the rules allowed for a multiple use zone. In addition, given the limited environmental impacts expected to occur, these are not considered to be inconsistent with the overall objectives of the North-west Marine Park Management Plan.
Therefore, applying a spatial restriction to vessel discharges would not further reduce the consequence of the impacts and risks. However, given that there is the potential for concurrent vessel-based petroleum activities within the Marine Park (Table 4-21), the application of a spatial restriction to vessel discharges may reduce the potential for cumulative impacts to the Montebello Marine Park.</td><td>Implementing this control measure may result in an increase in operational costs (e.g., longer survey length due to changes in operational schedules, etc.)
However, due to the values identified for the Montebello Marine Park, the additional cost of implementing this measure is not considered grossly disproportionate to the limited environmental benefit gained.
Therefore, this control measure has been adopted for use.</td></tr>
<tr><th colspan="3">Likelihood and risk level summary</th></tr>
<tr><td>Likelihood</td><td colspan="2">Given the nature and scale of this activity with standard control measures in place, it is considered Rare (6) that these discharges would result in any impact to the ecological function of the particular values and sensitivities present within the OA.</td></tr>
<tr><td>Risk level</td><td colspan="2">Very low (10)</td></tr>
<tr><th colspan="3">Determination of acceptability</th></tr>
<tr><td>Principles of ESD</td><td colspan="2">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.</td></tr>
<tr><td>Relevant environmental legislation and other requirements</td><td colspan="2">Legislation and other requirements considered relevant to this aspect include:
• Marine Order 91
• Marine Order 95
• Marine Order 96
• MARPOL 73/78 Annex I, IV and V
• North-west Marine Parks Network Management Plan 2018 (Ref. 9).</td></tr>
</table>

<table>
<tr><td></td><td>CAPL considers that impact and risk management is consistent with these requirements, as demonstrated below.
<table>
<tr><th>Requirement</th><th>Demonstration</th></tr>
<tr><td>Marine Order 91
Gives effect to Annex IV of MARPOL 73/78</td><td>Requirements for offshore discharge of sewage have been incorporated into the MARPOL 73/78 sewage discharge control measure</td></tr>
<tr><td>Marine Order 95
Gives effect to Annex V of MARPOL 73/78</td><td>Requirements for offshore discharge of food have been incorporated into the MARPOL 73/78 food waste discharge control measure</td></tr>
<tr><td>Marine Order 96
Gives effect to Annex I of MARPOL 73/78</td><td>Requirements for offshore discharge of oily bilge water from vessels have been incorporated into the MARPOL 73/78 oily bilge water discharge control measure</td></tr>
<tr><td>North-west Marine Parks Network Management Plan 2018
The Plan requires that “waste from normal operations of vessels must be compliant with requirements under the International Convention for the Prevention of Pollution from Ships (MARPOL), the International Maritime Organisation (IMO) convention covering prevention of pollution of the marine environment by ships from operational or accidental causes”.</td><td>The Montebello Marine Park is a multiple use zone (IUCN VI). The control measures identified for the management of planned discharges from vessel operations are in accordance with MARPOL requirements, and therefore also in accordance with the requirements of the multiple use zone of an Australian Marine Park.</td></tr>
</table></td></tr>
<tr><td>Internal context</td><td>These CAPL environmental performance standards or procedures were deemed relevant for this aspect:
• Marine Standard Non Tankers: Corporate OE Standard (Ref. 40).
Control measures related to each of the above management processes or procedures have been described for this aspect. As such, CAPL considers that impact and risk management is consistent with company policy, culture, and standards.</td></tr>
<tr><td>External context</td><td>During relevant persons consultation, no objections or claims were raised regarding planned discharges from vessel operations arising from the activity.</td></tr>
<tr><td>Defined acceptable level</td><td>These impacts and risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.
However, in alignment with Section 5.6.2, where the aspect is listed as threat to a protected matter, or identified as a concern to a listed conservation value, CAPL will define an acceptable level of impact that aligns with the objectives of these documents.
Objectives of the relevant documents are shown below:
<table>
<tr><th>Plan</th><th>Objective</th></tr>
<tr><td>North-west Marine Parks Network Management Plan 2018</td><td>As per Section 4.5.1.</td></tr>
</table>
Therefore, CAPL has defined the following acceptable level of impact such that it is not inconsistent with these documents:</td></tr>
</table>

<table>
<tr><td></td><td colspan="2">• vessel discharges are compliant with MARPOL requirements
• no adverse change to the values of the Montebello Marine Park.
CAPL considers that the petroleum activity, with the control measures as described for this aspect in place, meet this acceptable level. In particular that by managing the planned vessel discharges, that the risk to values of the AMP are also subsequently managed.</td></tr>
<tr><th>Environmental performance outcomes</th><th>Environmental performance standard</th><th>Measurement criteria</th></tr>
<tr><td rowspan="3">Planned discharges from vessel operations within the OA during the 4D MSS will meet MARPOL requirements</td><td>MARPOL 73/78 sewage discharge
Offshore discharge of sewage from vessels will be in accordance with these MARPOL 73/78 Annex IV requirements:
• An IMO approved comminution and disinfection system to discharge (greater than 3 nm from the nearest land); or
• An IMO approved Sewage Treatment Plant at any location; or
• Untreated sewage discharged ≥12 nm from the nearest land while the vessel is proceeding at no less than 4 knots.</td><td>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)</td></tr>
<tr><td>MARPOL 73/78 food waste discharge
Offshore discharge of food waste from vessels will be in accordance with these MARPOL 73/78 Annex V requirements:
• macerated to no greater than 25 mm and when the marine vessel is at least 3 nm from the nearest land; or
• unmacerated when the marine vessel is at least 12 nm from the nearest land.</td><td>Records show food waste is discharged in accordance with MARPOL 73/78 Annex V</td></tr>
<tr><td>MARPOL 73/78 oily bilge water discharge
Oily bilge water will be discharged to marine environment only when the concentration is <15 ppm in accordance with MARPOL 73/78, Annex I:
• through an IMO approved on board oil-water separator; and
• when the marine vessel is en route.</td><td>Records show oily bilge water is discharged in accordance with MARPOL 73/78 Annex I, including current International Oil Pollution Prevention (IOPP) Certificate</td></tr>
<tr><td rowspan="2">No adverse change to the values of Australian Marine Parks from the 4D MSS</td><td rowspan="2">Spatial restriction of vessel discharges within an AMP
No vessel-based discharges of sewage, food waste, or oily bilge water, will occur within the boundary of the Montebello Marine Park during the 4D MSS</td><td>Records demonstrate that spatial data for the boundary of the Commonwealth Montebello Marine Park have been provided to the seismic and support vessel contractors</td></tr>
<tr><td>Records show planned discharges from vessels during the 4D MSS were outside the Montebello Marine Park</td></tr>
</table>

7.9 Unplanned release—waste

Source			
Activities identified as having the potential to result in the unplanned release of waste are: • vessel operations during seismic survey within the OA. Because waste is generated on board vessels, inappropriate management and storage has the potential to result in a release to the environment.			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
N/A	–	Unplanned release of waste to the environment may result in: • marine pollution resulting in entanglement or injury of marine fauna	6
Consequence evaluation			
Marine pollution resulting in entanglement or injury of marine fauna If hazardous or non-hazardous waste is lost overboard, the extent of exposure to the environment is limited. Marine fauna most at risk from marine pollution include marine reptiles and seabirds, through ingestion or entanglement (Ref. 58; Ref. 60). 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. 113). The national Threat Abatement Plan (Ref. 113) 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”. The *Recovery Plan for Marine Turtles in Australia* (Ref. 58), the *Conservation Advice for Whale Sharks* (Ref. 60), and the *Wildlife Conservation Plan for Seabirds* (Ref. 367) identifies marine debris as a threat. Several species, including cetaceans, marine reptiles, and birds are also identified in the *Threat Abatement Plan for the Impacts of Marine Debris* (Ref. 113) as species adversely impacted by marine debris. Marine debris ingested by marine reptiles may result in ecotoxicological effects, physical blockages and internal injuries. The throat structure of marine turtles prevents the turtles regurgitating swallowed items and therefore swallowed items are trapped in the gut where they decompose and leak gases into the body cavity, resulting in injury or mortality (Ref. 368). Many species ingest considerable quantities of plastic and other marine debris, which has a wide range of lethal or sublethal effects (Ref. 367). This debris can cause physical damage to the body, or perforate, block or impair the digestive system, resulting in starvation (Ref. 367). Given the restricted exposures and the limited quantity of waste with the potential to cause marine pollution that is expected to be generated from petroleum activities, it is expected that any impacts from marine pollution would result in limited impacts to individuals. Thus, CAPL ranked this consequence as Incidental (6).			
ALARP decision context justification			
Offshore commercial vessel operations, and the subsequent management of waste, are commonplace and well-practiced activities within the industry. The control measures to manage the risk associated with an accidental release of waste are well defined via legislative requirements that are considered standard industry practice. There is a good understanding of the release pathways, and the control measures required to manage these events are well understood and implemented by the petroleum industry and CAPL. During relevant persons consultation, no objections or claims were raised regarding waste management arising from the activity. An unplanned release of waste is a lower-order risk in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.			

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

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

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: • Marine Order 95 • MARPOL 73/78 • *Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans (2018)* (Ref. 113) • *Conservation Advice Rhincodon typus Whale Shark* (Ref. 60) • *Recovery Plan for Marine Turtles in Australia* (Ref. 58) • *Conservation Management Plan for the Blue Whale 2015–2025* (Ref. 63) • *National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011–2016* (Ref. 114) • *Wildlife Conservation Plan for Migratory Shorebirds* (Ref. 82) • *Wildlife Conservation Plan for Seabirds* (Ref. 367) • *North-west Marine Parks Network Management Plan 2018* (Ref. 9). CAPL considers that impact and risk management is consistent with these requirements, as demonstrated below.	
	Requirement	**Demonstration**
	Marine Order 95 Gives effect to Annex V of MARPOL 73/78	Requirements for the prevention of pollution from garbage have been incorporated into the **Marine Order 95 (Marine pollution prevention – garbage** control measure
	Threat Abatement Plan for the impacts of marine debris on the	N/A

	vertebrate wildlife of Australia's coasts and oceans No specific action identified.	
	Conservation Advice Rhincodon typus Whale Shark No specific conservation action identified.	N/A
	Recovery Plan for Marine Turtles in Australia No specific management action identified.	N/A
	Conservation Management Plan for the Blue Whale No specific management action identified.	N/A
	National Recovery Plan for Threatened Albatrosses and Giant Petrels No specific action identified.	N/A
	Wildlife Conservation Plan for Migratory Shorebirds No specific action identified.	N/A
	Wildlife Conservation Plan for Seabirds No specific action identified.	N/A
	North-west Marine Parks Network Management Plan 2018 The Plan requires that "waste from normal operations of vessels must be compliant with requirements under the International Convention for the Prevention of Pollution from Ships (MARPOL), the International Maritime Organisation (IMO) convention covering prevention of pollution of the marine environment by ships from operational or accidental causes".	The Montebello Marine Park is a multiple use zone (IUCN VI). The control measures identified for the management of planned discharges from vessel operations are in accordance with MARPOL requirements, and therefore also in accordance with the requirements of the multiple use zone of an Australian Marine Park.
Internal context	No CAPL management processes or procedures were deemed relevant for this aspect.	
External context	During relevant persons consultation, no objections or claims were raised regarding waste management arising from the activity.	
Defined acceptable level	These risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan. However, in alignment with Section 5.6.2, where the aspect is listed as threat to a protected matter, or identified as a concern to a listed conservation value, CAPL will define an acceptable level of impact that aligns with the objectives of these documents. Objectives of the relevant documents are shown below:	
	Plan	**Objective**
	Conservation Management Plan for	Recovery objective: Minimise anthropogenic threats to allow for their conservation status to

	the Blue Whale 2015–2025	improve so that they can be removed from the EPBC Act threatened species list. Interim objective 4 Anthropogenic threats are demonstrably minimised.
	Recovery Plan for Marine Turtles in Australia	Recovery objective: The long-term recovery objective for marine turtles is to minimise anthropogenic threats to allow for the conservation status of marine turtles to improve so that they can be removed from the EPBC Act threatened species list. Interim objective 3: Anthropogenic threats are demonstrably minimised.
	National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011–2016	Overall objective: To ensure the long term survival and recovery of albatross and giant petrel populations breeding and foraging in Australian jurisdiction by reducing or eliminating human related threats at sea and on land
	Wildlife Conservation Plan for Migratory Shorebirds	Objective 3: Anthropogenic threats to migratory shorebirds in Australia are minimised or, where possible, eliminated.
	Wildlife Conservation Plan for Seabirds	Objective 2: Seabirds and their habitats are identified, protected and managed in Australia.
	North-west Marine Parks Network Management Plan 2018	As per Section 4.5.1.
	Therefore, CAPL has defined the following acceptable level of impact such that it is not inconsistent with these documents: • no injury or mortality to Pygmy Blue Whales, marine turtles, seabirds or migratory shorebirds from unplanned release of solid wastes from the petroleum activitys such that it would prevent the long-term recovery of the species • no adverse change to the values of the Montebello Marine Park. CAPL considers that the petroleum activity, with the control measures as described for this aspect in place, meet this acceptable level. In particular that by managing the unplanned release of waste, that the risk to marine fauna and/or values of the AMP are also subsequently managed.	

Environmental performance outcome	Environmental performance standard	Measurement criteria
No unplanned release of waste to the environment during the 4D MSS No injury or mortality to marine fauna from an unplanned release of waste within the OA associated with the 4D MSS	**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)

No adverse change to the values of Australian Marine Parks from the 4D MSS	**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	Current International Air Pollution Prevention (IAPP) Certificate (for marine vessels >400 T or certified to carry >15 persons)
		Current and completed Garbage Record Book (for marine vessels >400 T or certified to carry >15 persons).

7.10 Unplanned release—loss of equipment

Source			
Activities identified as having the potential to result in the unplanned loss of equipment are: • 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	–	Unplanned release of equipment to the environment may result in:	
		• disruption to other marine users from temporary navigation hazards	6
		• alternation of marine habitats arising from seabed disturbance	6
Consequence evaluation			
Disruption to other marine users from temporary navigation hazards 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).			
Alternation of marine habitats arising from seabed disturbance 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. The particular values and sensitivities within the OA with the potential to be impacted by unplanned seabed disturbance within the OA include: • continental slope demersal fish communities (KEF) • ancient coastline at 125 m depth contour (KEF) • ridgeline habitat and associated communities. As identified in Section 4.5.1, the OA overlaps with the Montebello Marine Park. Natural values of this AMP include the ancient coastline at 125 m depth contour KEF. 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 4.3.1.1). 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). Given that the potential impacts to marine habitats associated with the ancient coastline KEF are not expected to be ecologically significant, it is therefore expected that there would also be no long-term or significant impacts to the values of the Montebello Marine Park.			
ALARP decision context justification			
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			

<table>
<tr><td colspan="3">During relevant persons consultation, no objections or claims were raised regarding waste management arising from the activity.
An unplanned release of waste is a lower-order risk in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.</td></tr>
<tr><td colspan="3">Good practice control measures</td></tr>
<tr><td>Control measure</td><td colspan="2">Description</td></tr>
<tr><td>Operating procedures</td><td colspan="2">Operating procedures for seismic equipment will be implemented to ensure:
• streamers are fitted with appropriate equipment to allow for safe deployment, operation and recovery (if required), including:
– 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.</td></tr>
<tr><td>Relevant persons engagement</td><td colspan="2">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.</td></tr>
<tr><td>Marine incident report</td><td colspan="2">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.</td></tr>
<tr><td>Lost equipment</td><td colspan="2">In the event of an unplanned loss of equipment, prior to the completion of the 4D MSS the lost equipment will be recovered where considered safe and practicable to do so.
Considerations for determining if equipment retrieval is safe and practicable include:
• risk to personnel
• whether the location of the equipment is in recoverable water depths
• equipment’s proximity to subsea infrastructure
• ability to recover the equipment (e.g., nature of equipment, lifting equipment, suitable weather, etc.).</td></tr>
<tr><td colspan="3">Additional control measures and cost benefit analysis</td></tr>
<tr><td>Control measure</td><td>Benefit</td><td>Cost</td></tr>
<tr><td>N/A</td><td>N/A</td><td>N/A</td></tr>
<tr><td colspan="3">Likelihood and risk level summary</td></tr>
<tr><td>Likelihood</td><td colspan="2">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).</td></tr>
<tr><td>Risk level</td><td colspan="2">Very low (9)</td></tr>
<tr><td colspan="3">Determination of acceptability</td></tr>
<tr><td>Principles of ESD</td><td colspan="2">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.</td></tr>
</table>

<table>
<tr><td></td><td>The consequence associated with this aspect is Incidental (6).
Therefore, no additional evaluation against the Principles of ESD is required.</td></tr>
<tr><td>Relevant environmental legislation and other requirements</td><td>Legislation and other requirements considered relevant to this aspect include:
• North-west Marine Parks Network Management Plan 2018 (Ref. 9).
CAPL considers that impact and risk management is consistent with these requirements, as demonstrated below.
<table>
<tr><th>Requirement</th><th>Demonstration</th></tr>
<tr><td>North-west Marine Parks Network Management Plan 2018
No specific zone rules identified.</td><td>N/A</td></tr>
</table></td></tr>
<tr><td>Internal context</td><td>No CAPL management processes or procedures were deemed relevant for this aspect.</td></tr>
<tr><td>External context</td><td>During relevant persons consultation, no objections or claims were raised regarding loss of equipment arising from the activity.</td></tr>
<tr><td>Defined acceptable level</td><td>These risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.
However, in alignment with Section 5.6.2, where the aspect is listed as threat to a protected matter, or identified as a concern to a listed conservation value, CAPL will define an acceptable level of impact that aligns with the objectives of these documents. Objectives of the relevant documents are shown below:
<table>
<tr><th>Plan</th><th>Objective</th></tr>
<tr><td>North-west Marine Parks Network Management Plan 2018</td><td>As per Section 4.5.1.</td></tr>
</table>
Therefore, CAPL has defined the following acceptable level of impact such that it is not inconsistent with these documents:
• No adverse change to the values of the Montebello Marine Park.
CAPL considers that the petroleum activity, with the control measures as described for this aspect in place, meet this acceptable level. In particular that by managing the unplanned release of equipment, that the risk to values of the AMP are also subsequently managed.</td></tr>
</table>

Environmental performance outcome	Environmental performance standard	Measurement criteria
No loss of seismic equipment from vessel activities within the OA during the 4D MSS	**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.
No adverse change to the values of Australian Marine	**Operating procedures** Equipment is routinely checked and maintained to ensure integrity	Records show that all equipment is routinely checked

Parks from the 4D MSS	**Operating procedures** Deployment, operation, and retrieval of streamers as per operational procedures, including: • 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
	Relevant persons 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
Reduce the risk of impacts to the environment from the unplanned loss of equipment during the 4D MSS	**Lost equipment** Lost equipment will be retrieved, where safe and practicable to do so	Records show that where assessed as safe and practicable, the lost equipment has been retrieved

7.11 Unplanned release—loss of containment

Source			
The operation of vessels includes handling, using, and transferring hazardous materials, and has the potential to result in a loss of containment (LOC) event. Based on the activities described in this EP, the following potential LOC scenarios were identified: • using, handling, and transferring hazardous materials and chemicals on board (<1 m^3)[1] • transferring hazardous materials between vessels (50 m^3)[2]. *[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 m^3 based on the loss of an entire intermediate bulk container due to rupture while handling.* *[2] AMSA (Ref. 115) suggests the maximum credible spill volume from a refuelling incident with continuous supervision is approximately the transfer rate × 15 minutes. Assuming failure of dry-break couplings and an assumed 200 m^3/h transfer rate (based on previous operations), this equates to an instantaneous spill volume of ~50 m^3.*			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
N/A	–	Unplanned release of hazardous material to the environment may result in: • indirect impacts to fauna arising from chemical toxicity	5
Consequence evaluation			

Indirect impacts to fauna arising from chemical toxicity

Upon release, a loss of 50 m^3 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 7.12.2.1), the small 50 m^3 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 m^3 of MDO are much less than those associated with a loss of MDO from a vessel collision (Section 7.12), and thus are not evaluated in detail here.

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:

- Pygmy Blue Whale (migration and distribution BIAs)
- Flatback Turtle (internesting buffer BIA, internesting habitat critical to the survival of a species)
- Whale Shark (foraging BIA).
- continental slope demersal fish communities (KEF)
- commercial fisheries.

As identified in Section 4.5.1, the OA overlaps with the Montebello Marine Park. Natural values of this AMP include species listed as threatened, migratory, marine, or cetacean under the EPBC Act, as well as any identified BIAs for regionally significant marine fauna; and also, the ancient coastline at 125 m depth contour KEF. Social and economic values of this AMP include commercial fishing.

Based on the nature of these unplanned releases, which are non-continuous and expected to occur in a location where no specific sedentary behaviours for values and sensitivities have been identified, the extent and severity of any potential impact is expected to be limited.

Given the nature of unplanned releases covered under this EP and the transient nature of identified values and sensitivities, fauna would need to pass directly through the plume almost immediately upon release to be impacted.

Any potential impact from such an event is expected to be short term and limited to a small number of individuals, thus the consequence level was determined as Minor (5). Given the limited spatial and temporal exposures to marine fauna from a minor LOC event, it is therefore expected that there would also be limited environmental impacts to the values of the Montebello Marine Park.

ALARP decision context justification		
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. Modelling was undertaken for several scenarios associated with this aspect to support the environmental risk evaluation. Modelling has removed some of the uncertainty associated with this aspect and supports the evaluation that due to the distance offshore and distance to sensitive receptors, these risks are lower-order risks in accordance with Table 5-3. As such, CAPL applied ALARP Decision Context A for this aspect.		
Good practice control measures		
Control measure	**Description**	
Marine Standard	Chevron's *Marine Standard Non Tankers: Corporate OE Standard* (Ref. 40) ensures that various legislative requirements and CAPL standards are met. Specifically, pre-mobilisation inspections may include: • visual checks of accessible equipment and hydraulic hoses for defects • confirmation that dry-break couplings or similar automated stop devices are available for use on marine vessels that are refuelled at sea • secondary containment is available for hydrocarbons and chemicals stored on the deck of marine vessels • bunkering procedures are available.	
Ship Oil Pollution Emergency Plan (SOPEP)/ Shipboard Marine Pollution Emergency Plan	MARPOL 73/78 Annex I and Marine Order 91 (Marine pollution prevention – oil) requires that vessels (as appropriate to vessel class) have an approved SOPEP in place. To prepare for a spill event, the SOPEP details: • response equipment available to control a spill event • review cycle to ensure that the SOPEP is kept up to date • testing requirements, including the frequency and nature of these tests. In the event of a spill, the SOPEP details: • reporting requirements and a list of authorities to be contacted • activities to be undertaken to control the discharge of oil • procedures for coordinating with local officials.	
Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
Spatial restriction on vessel bunkering within an AMP	There is no rule associated with multiple use zones of Australian Marine Parks regarding the bunkering of vessels within marine park boundaries. The risks associated with an unplanned release of marine fuel from vessel bunkering has been assessed as minor (i.e., localised, short-term impacts). Applying a spatial restriction to vessel bunkering within the boundaries of the Montebello Marine Park would remove the associated environmental risks from occurring within the marine	Implementing this control measure may result in an increase in operational costs (e.g., longer survey length due to changes in operational schedules, etc.) However, due to the values identified for the Montebello Marine Park, the additional cost of implementing this measure is not considered grossly disproportionate to the environmental benefit gained. Therefore, this control measure has been adopted for use.

	park and potentially having a minor effect on marine park values.	
Likelihood and risk level summary		
Likelihood	The likelihood that a LOC event results in a Minor (5) consequence was determined to be Remote (5). With the control measures in place, it was considered very unlikely that a large LOC event associated with this activity would occur, and even more unlikely that such an event would impact any of the identified values and sensitivities, which are known to be transient and unlikely to be present at the exact location of the LOC.	
Risk level	Very low (9)	
Determination of acceptability		
Principles of ESD	The potential 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. The consequence associated with this aspect is Minor (5). Therefore, no additional evaluation against the Principles of ESD is required.	
Relevant environmental legislation and other requirements	Legislation and other requirements considered relevant for this aspect include: • Marine Order 91, Marine pollution prevention – oil • MARPOL 73/78 • *North-west Marine Parks Network Management Plan 2018* (Ref. 9). CAPL considers that impact and risk management is consistent with these requirements, as demonstrated below.	
	Requirement	**Demonstration**
	Marine Order 91 Gives effect to Annex I of MARPOL 73/78	Requirements for a vessel to have a SOPEP have been incorporated into the **SOPEP / Shipboard Marine Pollution Emergency Plan** control measure
	North-west Marine Parks Network Management Plan The Plan requires that “[a]ctions required to respond to oil pollution incidents, including environmental monitoring and remediation, in connection with mining operations authorised under the OPGGS Act may be conducted in all zones. The Director should be notified in the event of an oil pollution incident that occurs within, or may impact upon, an Australian Marine Park and, so far as reasonably practicable, prior to a response action being taken within a marine park.”	The Montebello Marine Park is a multiple use zone (IUCN VI). The control measures identified for the management of an unplanned LOC provide for the response to an oil pollution incident, Requirements to report oil pollution incidents that occur within, or may impact upon, an AMP is included in Section 8.4.2. Therefore, the 4D MSS is not considered to be inconsistent with the *North-west Marine Parks Network Management Plan.*
Internal context	These CAPL management processes or procedures were deemed relevant for this aspect: • *Marine Standard Non Tankers: Corporate OE Standard* (Ref. 40). Control measures related to each of the above management processes or procedures have been described for this aspect. As such, CAPL considers that impact and risk management is consistent with company policy, culture, and standards.	

External context	During relevant persons consultation, no objections or claims were raised regarding LOC management arising from the activity.
Defined acceptable level	These risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan. However, in alignment with Section 5.6.2, where the aspect is listed as threat to a protected matter, or identified as a concern to a listed conservation value, CAPL will define an acceptable level of impact that aligns with the objectives of these documents. Objectives of the relevant documents are shown below:

Plan	Objective
North-west Marine Parks Network Management Plan 2018	As per Section 4.5.1.

Therefore, CAPL has defined the following acceptable level of impact such that it is not inconsistent with these documents:

- No adverse change to the values of the Montebello Marine Park.

CAPL considers that the petroleum activity, with the control measures as described for this aspect in place, meet this acceptable level. In particular that by managing the unplanned release, that the risk to values of the AMP are also subsequently managed.

Environmental performance outcome	Environmental performance standard	Measurement criteria
No unplanned release of hydrocarbons or hazardous materials to the environment during the 4D MSS No adverse change to the values of Australian Marine Parks from the 4D MSS	**Marine Standard** Prior to commencement of activities, the following will be undertaken during a pre-mobilisation vessel inspection, as per the Marine Standard: • 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
	Marine Standard Refuelling is undertaken in accordance with CAPL-approved refuelling / bunkering procedures, which include the appropriate weather / sea / visibility conditions, as determined by the Vessel Master.	Records confirm that refuelling is undertaken in accordance with CAPL-approved refuelling / bunkering procedure
	Spatial restriction on vessel bunkering within an AMP	Records demonstrate that spatial data for the boundary of the Commonwealth Montebello Marine

	No vessel bunkering will occur within the boundary of the Montebello Marine Park during the 4D MSS	Park have been provided to the seismic and support vessel contractors
		Records show any vessel bunkering activities during the 4D MSS were outside the Montebello Marine Park
Reduce the risk of impacts to the environment from the unplanned release of hydrocarbons or hazardous materials during the 4D MSS	**SOPEP** Marine vessels (as appropriate to vessel class) will carry on board a Shipboard Oil Pollution Emergency Plan (SOPEP) in accordance with MARPOL 73/78 Annex I – Prevention of Oil Pollution	OVIS report / ABU Marine OE Inspection Checklist confirms an approved SOPEP is on board marine vessels (as appropriate to vessel class)
		Inspection records (or similar) show drills conducted in accordance with SOPEP
		Inspection records (or similar) show spill kits available in accordance with SOPEP
	SOPEP In the event of a vessel-based spill event, emergency response activities will be implemented in accordance with the vessel SOPEP (or equivalent)	Records confirm that emergency response activities were implemented in accordance with the vessel SOPEP in the event of a vessel-based spill.

7.12 Unplanned release—vessel collision event

7.12.1 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. 115) as being a surface release of ~1,000 m^3 of MDO.

7.12.1.1 Spill Modelling

7.12.2 Spill modelling

CAPL commissioned RPS to conduct spill modelling to inform the risk assessment associated with a vessel collision event (Ref. 116). 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 7-8).

A three-dimensional oil spill model (SIMAP) was used to simulate the drift, spread, weathering and fate of the spilled oil (Ref. 116). 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 7-8 summarises the model settings; Table 7-9 summarises the hydrocarbon properties for MDO; and Table 7-10 describe the modelled environmental impact thresholds.

Table 7-8: 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 7-9: Physical properties and boiling point ranges for MDO

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

Table 7-10: Hydrocarbon environmental impact thresholds

Environmental impact threshold	Justification
Surface ≥1 g/m^2 (low)	In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 117), 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. 118) 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. 117), 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. 118) 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. 117). This threshold is consistent with observations ranging from physical oiling to toxicity effects for marine fauna within literature, including French et al. (Ref. 119), French-McCay (Ref. 120), Engelhardt (Ref. 121), Clark (Ref. 122), Geraci and St. Aubin (Ref. 123) and Jenssen (Ref. 124).
In-water (dissolved) ≥50 ppb (moderate)	Laboratory studies have shown that dissolved oil exert most of the toxic effects of oil on aquatic biota (e.g., Carls et al. [Ref. 125], Nordtug et al. [Ref. 126], Redman [Ref. 127]). 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. 117), CAPL has set the in-water (dissolved) impact threshold for sublethal ecological effects at ≥50 ppb. This threshold is considered by NOPSEMA to approximate potential toxic effects, particularly sublethal effects to sensitive species (Ref. 117). This threshold is based on an instantaneous concentration, and therefore only requires the dissolved oil to be at this concentration for one-hour (based on minimum model time-step) to trigger this threshold.
In-water (dissolved) ≥4,800 ppb.hrs (moderate)	Toxicity is the relative ability of a substance to cause adverse effects; and this relative ability is dependent on factors including both dose and duration. As such, CAPL has set the in-water (dissolved) impact threshold for lethal ecological effects at ≥4,800 ppb.hrs. This threshold is based on the instantaneous concentration (50 ppb) recommended by NOPSEMA but also applies a duration component of

Environmental impact threshold	Justification
	96 hours. Therefore, dissolved oil needs to be at this concentration consistently for 96 hours to trigger this threshold. French-McCay (Ref. 128) reviewed toxicity data for marine biota exposed to dissolved oil and found that 95% of species and life stages exhibited 50% population mortality (LC50) for total PAH concentrations between 6–400 ppb (with an average of 50 ppb) after 96 hours exposure.
In-water (entrained) ≥100 ppb (high)	Entrained oil are insoluble droplets suspended in the water column, and as such exposure pathways are direct contact with external tissue or direct oil consumption. In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 117), CAPL has set the in-water (entrained) impact threshold for sublethal ecological effects at ≥100 ppb. This threshold is considered by NOPSEMA as appropriate for informing risk evaluation (Ref. 117). This threshold is based on an instantaneous concentration, and therefore only requires the entrained oil to be at this concentration for one-hour (based on minimum model time-step) to trigger this threshold. French-McCay (Ref. 129) identified that if total hydrocarbons in entrained oil droplets was to be evaluated as a risk, 100 ppb would be an extremely conservative sublethal threshold.
In-water (entrained) ≥9,600 ppb.hrs (high)	CAPL has set the in-water (entrained) impact threshold for lethal ecological effects at ≥9,600 ppb.hrs. This threshold is based on the instantaneous concentration (100 ppb) recommended by NOPSEMA but also applies a duration component of 96 hours. Therefore, entrained oil needs to be at this concentration consistently for 96 hours to trigger this threshold. It is however noted that entrained oil, especially when in weathered state, is typically not considered toxic.
Shoreline ≥10 g/m^2 (low)	In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 117), CAPL has set the shoreline impact threshold for socio-economic effects at ≥10 g/m^2. This threshold is equivalent to ~10 mL/m^2 or ~2 teaspoons/m^2. At this concentration, oil on the shoreline is expected to be visible. Due to this visibility, there is the potential to impact nature-based activities (such as tourism or recreational use) via a reduction in aesthetics.
Shoreline ≥100 g/m^2 (moderate)	In accordance with NOPSEMA's oil spill modelling bulletin (Ref. 117), CAPL has set the shoreline impact threshold for ecological effects at ≥100 g/m^2. This threshold is equivalent to ~100 mL/m^2 or 20 teaspoons/m^2. French et al. (Ref. 119) and French-McCay (Ref. 120) define shoreline oil accumulation at ≥100 g/m^2 as potentially harmful to wildlife (including invertebrates, birds, furbearing aquatic mammals and marine reptiles), based on studies for sub-lethal and lethal impacts. Impacts on vegetated habitats (such as saltmarsh and mangroves) have been observed at higher concentrations of shoreline oil. Observations by Lin and Mendelssohn (Ref. 130) demonstrated that loadings of >1,000 g/m^2 of oil during the growing season would be required to impact marsh plants significantly. Similar thresholds have been found in studies assessing oil impacts on mangroves (e.g., Grant et al. [Ref. 131], Suprayogi and Murray [Ref. 132]).

^ *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.*

7.12.2.1 Weathering and fate

MDO is a light-persistent fuel oil used in the maritime industry. It has a density of 829.1 kg/m^3, an API of 37.6, and a low pour point (−14 °C) (Table 7-9). 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. 116).

7.12.2.2 Modelling outputs

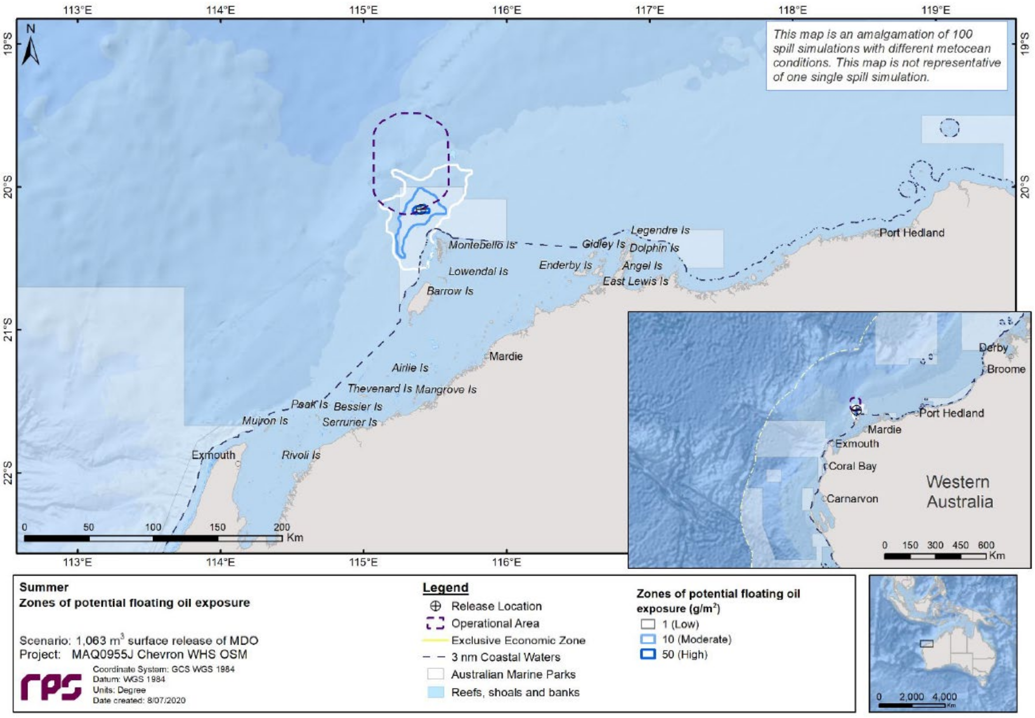
Stochastic modelling outputs from RPS (Ref. 116) are summarised in Table 7-11 having regard to the particular values and sensitivities identified in Section 4.

For the 1,063 m^3 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/m^2 visible impact threshold was ~64 km south-southwest (transitional), and ~38 km south-southwest (summer) for the ≥10 g/m^2 impact threshold. No exposure above the ≥10 g/m^2 impact threshold was predicted to occur within State waters during any season; and only a very low probability (1%) of exposure above the visible ≥1 g/m^2 threshold during the summer season.
- The probability of contact to any shoreline at ≥10 g/m^2 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 m^3. The maximum length of shoreline exposed at ≥10 g/m^2 was ~27 km, and at ≥100 g/m^2 was ~10 km. The Montebello Islands was the only coast predicted to be potentially exposed above the ≥100 g/m^2 impact threshold, however this only occurred during summer and with a very low probability (2%) of occurrence. The probability of exposures above the visible impact ≥10 g/m^2 threshold was also very low for adjacent shorelines (e.g., 3% at Montebello Islands, 2% at Barrow Island, and 1% Lowendal Islands).
- 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 ≥100 ppb at depths >10 m below the surface predicted to occur during any season. There was only a very low probability (4%) of exposure above the impact threshold during the summer season for State waters; and this decreased to a 1% probability of exposure during winter and transitional seasons. Of the State marine protected areas, Montebello Islands Marine Park had a 1% probability of exposure to ≥100 ppb in the 0–10 m water depth layer

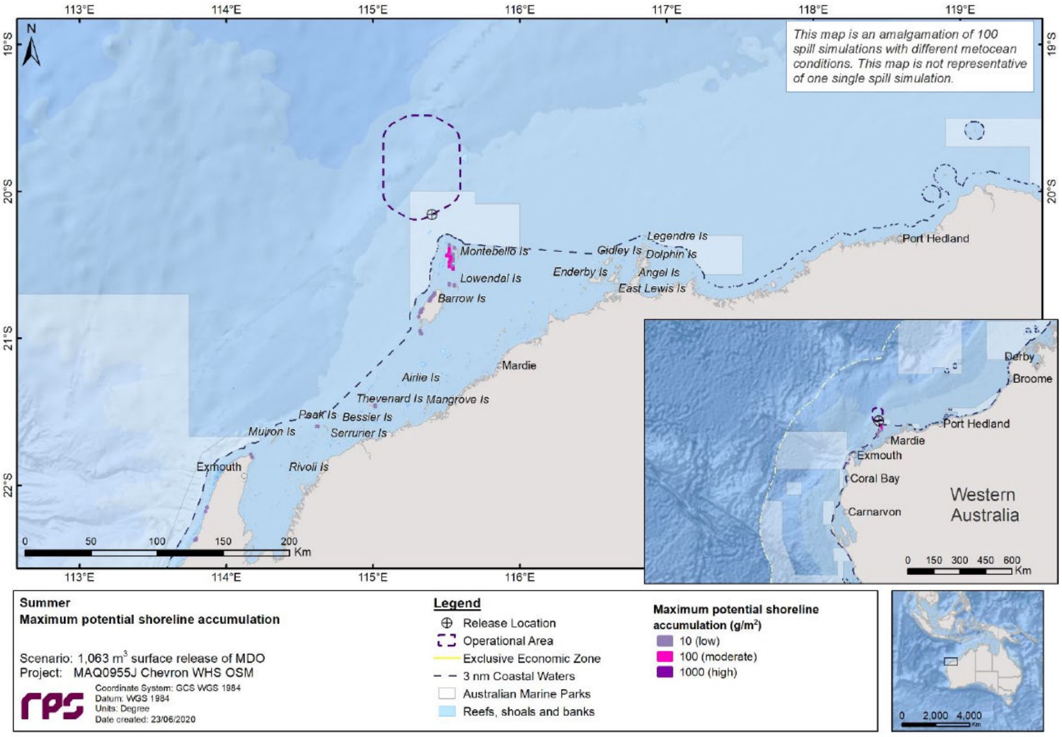
during summer and winter seasons; no other State marine protected areas were predicted to be exposed.

Results of stochastic modelling from the summer scenarios for surface, shoreline, and entrained are shown in Figure 7-9, Figure 7-10, and Figure 7-11 respectively. In alignment with Table 7-10, the thresholds relevant to the risk assessment (Section 7.12.3) are clarified beneath each figure.



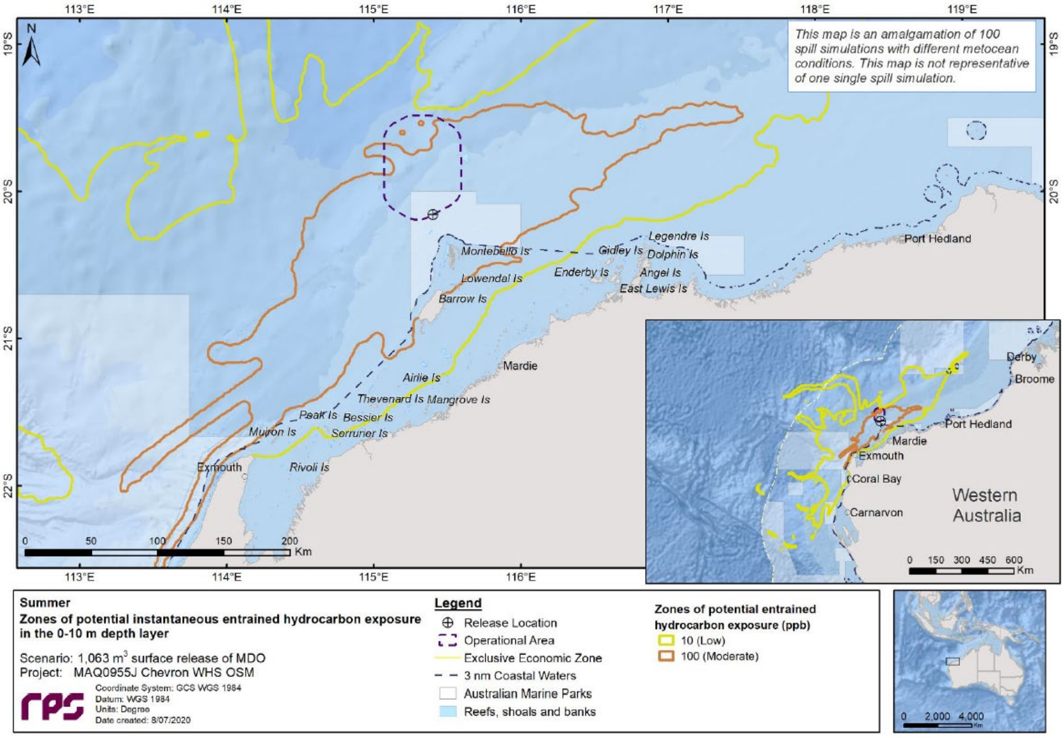
Source: Ref. 116. The relevant thresholds for environmental impact assessment are 1 g/m² (visible) and 10 g/m² (ecological).

Figure 7-9: Predicted zones of potential surface oil exposure during summer from stochastic modelling



Source: Ref. 116. The relevant thresholds for environmental impact assessment are 10 g/m^2 (visible) and 100 g/m^2 (ecological).

Figure 7-10: Predicted zones of potential shoreline oil exposure during summer from stochastic modelling



Source: Ref. 116. The relevant threshold for environmental impact assessment is 100 ppb.

Figure 7-11: Predicted zones of potential entrained oil exposure (0–10 m below water depth) during summer from stochastic modelling

Table 7-11: Vessel collision spill modelling EMBA receptor exposure summary

Sensitivity	Name	Surface^		In-water (dissolved)^	In-water (entrained)^	Shoreline^	
		≥1 g/m²	≥10 g/m²	≥50 ppb	≥100 ppb	≥10 g/m²	≥100 g/m²
		(probability of exposure, minimum time to exposure)		(probability of exposure)	(probability of exposure)	(probability of exposure, minimum time to exposure, mean length of shoreline)	
AMP	Gascoyne	—	—	—	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 *(inferred from Cape Range IBRA, and Exmouth shoreline)*	—	—	—	0–2%	0–2%, ~14.4 days, ~3 km	—
Commonwealth Heritage Properties	Ningaloo Marine Area – Commonwealth Waters *(inferred from Ningaloo IMCRA)*	—	—	—	1–2%	—	—

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

7.12.3 Risk assessment

Source			
Activities identified as having the potential to result in a vessel collision event are: • vessels operations within the OA. A vessel collision event may occur as a result of a loss of DP, navigational error or floundering due to weather.			
Potential impacts and risks			
Impacts	**C**	**Risks**	**C**
N/A	–	The potential environmental impacts associated with hydrocarbon exposures from a vessel collision event are:	
		• marine pollution resulting in sublethal or lethal effects to marine fauna	4
		• smothering of subtidal and intertidal habitats	5
		• indirect impacts to commercial fisheries	5
		• reduction in amenity resulting in impacts to tourism and recreation	5
		• changes to values and sensitivities of marine protected areas	5
		• changes to cultural heritage values	4

Consequence evaluation

Marine pollution resulting in sublethal or lethal effects to marine fauna

Marine mammals

Marine mammals may be exposed to hydrocarbons from an oil spill at the water surface or within the water column. Marine mammals can be exposed to oil externally (e.g., swimming through surface slick) or internally (e.g., swallowing the oil, consuming oil-affected prey, or inhaling of volatile oil related compounds) (Ref. 133; Ref. 134).

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. 135). 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. 135). French-McCay (Ref. 136) identifies that a ≥10 g/m^2 oil thickness threshold has the potential to impart a lethal dose to the species; however, also estimates a probability of 0.1% mortality to cetaceans if they encounter these thresholds based on the proportion of the time spent at surface.

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

Studies have shown little impact on Bottlenose Dolphins after hydraulic and mineral oil immersion and ingestion, although there was evidence of temporary skin damage in dolphins and a Sperm Whale from contact with various oil products including crude oil (Ref. 135; Ref. 137).

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. 135).

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:

- 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 ≥1 g/m^2 (i.e., visible threshold) are present for <5 days following the spill event, with a maximum area of coverage of ~99 km^2 occurring 36 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 ≥1 g/m^2 (i.e., visible threshold) are present for <2 days following the spill event, with a maximum area of coverage of ~32 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 Minor (5) and Moderate (4), 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. 138).

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. 139). 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. 138).

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 ≥100 g/m^2. These islands are identified as habitat critical to the survival of Flatback, Green and Hawksbill turtles (Table 4-8). 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 ≥1 g/m^2 (i.e., visible threshold) are present for <5 days following the spill event, with a maximum area of coverage of ~99 km^2 occurring 36 hours after the spill commenced. This deterministic run also predicted the largest volume of oil ashore as ~24 m^3, and the maximum length of shoreline exposed to ≥100 g/m^2 was ~10 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 Minor (5) and Moderate (4), 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. 140). 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. 141; Ref. 142; Ref. 143).

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. 144). 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. 145). 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. 146). 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/m^2 (i.e., visible threshold) are present for <5 days following the spill event, with a maximum area of coverage of ~99 km^2 occurring 36 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 Minor (5) and Moderate (4), 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. 147; Ref. 139). Damage to external tissues, including skin and eyes, can occur, along with internal tissue irritation in lungs and stomachs (Ref. 148). Acute and chronic toxic effects may result where the product is ingested as the bird attempts to preen its feathers (Ref. 148).

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/m^2.

The deterministic model for the worst-case trajectory for the Montebello Islands indicates that surface hydrocarbons concentrations ≥1 g/m^2 (i.e., visible threshold) are present for <5 days following the spill event, with a maximum area of coverage of ~99 km^2 occurring 36 hours after the spill commenced. This deterministic run also predicted the largest volume of oil ashore as ~24 m^3, and the maximum length of shoreline exposed to ≥100 g/m^2 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 Minor (5) and Moderate (4), respectively.

Smothering of subtidal and intertidal habitats

Subtidal habitats (coral, sponges, 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. 149; Ref. 150), act as a barrier to diffusion of CO_2 across cell walls in macroalgae (Ref. 151), and a decline in metabolic rate and partial mortality in corals (Ref. 152; Ref. 153) and impair respiration and photosynthesis by symbiotic zooxanthellae (Ref. 154; Ref. 155). 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. 156).

The Wheatstone ridgeline which occurs within the OA, is a hard substratum feature with low and variable cover of sessile benthic invertebrates, including gorgonians and sponges (Section 4.3.1.1). The ridgeline occurs in water depths of >60 m. Rankin Bank, to the east of the OA, is a known area of diverse algae, coral, and sponge habitat. This submerged shoal feature occurs in water depths of ~18–30.5 m (Section 4.3.1.2). Stochastic modelling did not predict entrained oil exposure above impact thresholds below 10 m water depth, and no dissolved oil exposure above impact thresholds at any depth. As such, the subtidal marine habitats associated with Wheatstone ridgeline and Rankin Bank are not predicted to be exposed in the event of a vessel spill event, and is not discussed further.

Stochastic modelling predicted the following key values or sensitivities within the EMBA (Table 7-11) have the potential to be exposed to hydrocarbon concentrations above impact thresholds:

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

The Ningaloo marine area is known to support coral reef and macroalgae habitat. 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 above impact thresholds (≥100 ppb) were predicted to remain within the surface layers (≤10 m water depth) only, and no dissolved oil exposure above impact thresholds at any depth. Therefore, exposure to coral reefs or other subtidal habitat types in deeper waters (>10 m) are not predicted to occur, and is not discussed further.

Intertidal habitats (coral, sponges, seagrass, and macroalgae)

Smothering of benthic habitat communities within shallow water environments may occur if a surface slick or in-water entrained oil above impact thresholds occurs in the intertidal area.

No exposure above the ≥10 g/m^2 surface impact threshold was predicted to occur within State waters during any season (Section 7.12.2.2); therefore, smothering from a surface slick is not predicted to occur.

Entrained oil may be present within the water column in water depths of <10 m, however there was a low probability (e.g., 4% during summer within State waters) of occurrence. Similarly, the presence of oil in the water at concentrations to result in shoreline accumulation also had a low probability of occurrence (e.g., 2% of ≥100 g/m2 occurring at Montebello Islands during summer).

The deterministic model for the worst-case trajectory for the Montebello Islands indicates that surface hydrocarbons concentrations ≥1 g/m^2 (i.e., visible threshold) are present for <5 days following the spill event, with a maximum area of coverage of ~99 km^2 occurring 36 hours after the spill commenced. This deterministic run also predicted the largest volume of oil ashore as ~24 m^3, and the maximum length of shoreline exposed to ≥100 g/m^2 was ~10 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 ≥1 g/m^2 (i.e., visible threshold) are present for <2 days following the spill event, with a maximum area of coverage of ~32 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 or other intertidal habitats. 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, shoreline oil, and instantaneous entrained oil, it is expected that only a small proportion of any nearshore benthic habitat would be exposed above the defined impact thresholds. Therefore, the potential impacts of oil to cause smothering was ranked as Minor (5). *Intertidal habitats (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. 157). 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. 157). Stochastic modelling predicted shoreline accumulation above the ≥100 g/m^2 impact threshold may occur at the Montebello Islands during summer; but no accumulation ≥1,000 g/m^2 was predicted to occur. This higher threshold is typically associated with impacts to coastal vegetation communities (Table 7-10), 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. The key indicator fish species for commercially targeted fish stocks in the vicinity of the OA are Goldband Snapper, Rankin Cod, Red Emperor, Blue-spotted Emperor, Giant Ruby Snapper, and Spanish Mackerel (Section 4.4.1.3). The habitats for most of these species is described as water depths of >10 m, with the exception of Spanish Mackerel (Table 4-18). The peak spawning season for Spanish Mackerel is September to December, and as such there is only up to a two-week overlap with vessel activity of the 4D MSS. Spawning for this species also typically occurs in coastal waters, and stochastic modelling shows very low probability (≤4%) of entrained oil occurring within State waters. As such, any potential impacts to reproduction and recruitment of Spanish Mackerel is expected to the limited given the spatial and temporal exposures in relevant shallow water habitats. 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. 158). Regardless of the small potential for tainting, customer perception that tainting has occurred may cause a larger impact then the direct impact itself. However, as this event is singular, non-continuous, and will result in a limited volume of hydrocarbon being released over a short time period, and the low persistence of the hydrocarbon in the environment, customer perceptions are not expected to be altered for a prolonged period. Modelling predicts that inshore exposure would be limited, whilst offshore exposures are expected to dilute and disperse over a longer period of time. In both instances, it is expected that any impacts from this type of event would likely be short term in duration. Therefore, CAPL assesses the consequence to commercial fisheries as localised and short term and it is ranked as Minor (5).
Reduction in amenity resulting in impacts to tourism and recreation Modelling predicts shoreline exposure ≥10 g/m^2 (visible impact threshold) 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/m^2) at any given time was ~23 km, and the maximum volume of oil ashore was ~24 m^3. 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).
Changes to values and sensitivities of marine protected areas Modelling predicts surface exposure ≥10 g/m^2 and entrained exposure ≥100 ppb from a vessel spill event as having a high probability (89–100%) of occurrence within the Montebello Marine Park (Table 7-11). Modelling predicted a low probability (<5%) of entrained oil exposure within the Gascoyne and Ningaloo Marine Parks (Table 7-11). No interaction with seabed was predicted to occur. Modelling also predicted a very low probability (1%) of entrained oil exposure within the 0–10 m water depth layer during summer and winter seasons to the State Montebello Island Marine Park (Section 7.12.2.2). Given the much higher probability of exposure, the following evaluation is focused on the Commonwealth Montebello Marine Park. As identified in Section 4.5.1, the natural values of the Montebello Marine Park include species listed as threatened, migratory, marine, or cetacean under the EPBC Act, as well as any identified BIAs for regionally significant marine fauna. Social and economic values of the Montebello Marine Park include commercial fishing. The consequence evaluations to marine fauna and commercial fisheries are provided above. Given the expected behaviour and weathering of the oil, limited spatial and temporal exposure to marine fauna or commercial fish species above impact exposure thresholds, the potential impacts of a vessel spill event to the values and sensitivities of the Montebello Marine Park has been ranked as Minor (5). In addition, given the minor impacts (i.e., localised and short term) to the values and sensitivities of the Montebello Marine Park, this is not considered to be inconsistent with the objectives of the *North-west Marine Parks Network Management Plan 2018* (Ref. 9) as described in Section 4.5.1.
Changes to cultural heritage value As discussed in Section 4.6, there are heritage listed places or sites within the Hydrocarbon Ecological and Social EMBAs, including shipwrecks, the World, National, and Commonwealth heritage listed Ningaloo area, and Native Title determination areas. Protected land-based sites or artefacts (i.e. those protected under the *Aboriginal Cultural Heritage Act 2021* (WA); Table 4-25) may also occur within the Hydrocarbon Social EMBA) along (or adjacent to) the coast of the North West Cape peninsula. Underwater cultural heritage sites have been identified within the EMBA; these sites are related to shipwrecks, with no other types (e.g. aircraft or other artefacts) identified (Section 4.6.2). At the time of writing this EP, CAPL understands through consultation with the relevant First Nations groups that there are no known artefacts or specific sites of cultural values associated with the seabed within the EMBA (Section 4.6.2 and 6). The waters of the NWMR (and therefore the waters within the Hydrocarbon EMBAs) are acknowledged as potentially having some cultural and spiritual significance to First Nations as well as providing natural resources. Stochastic modelling did not predict interaction with seabed in offshore waters. Therefore, no impacts to seabed-based cultural heritage (e.g. shipwrecks or archaeology) are expected, and no further evaluation has been undertaken. Stochastic modelling predicts shoreline exposure ≥10 g/m^2 (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. 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/m^2) at any given time was ~23 km, and the maximum volume of oil ashore was ~24 m^3. Shoreline loading can impact the visual amenity of coastal areas and limit beach access for users. However, if shoreline contact occurs, it is expected that any impacts from

this type of event would be non-continuous short term in duration and will result in a limited volume ashore. Indirect impacts to cultural values may also occur due to impacts on marine fauna or other natural resources (e.g. fisheries). The consequence evaluations to marine fauna and fisheries within the Hydrocarbon Ecological EMBA are provided above and range from Moderate (4) to Minor (5). However, given the vessel spill event (if it occurs) is singular, non-continuous, and a limited volume of hydrocarbon is released over a short time, only a small proportion of marine fauna population is expected to be affected, and as such a significant adverse change to cultural values associated with the offshore marine area is not predicted to occur. Given the expected behaviour and weathering of the oil, limited spatial and temporal exposure, only a relatively small area is expected to be exposed due to a single spill event. However, it is acknowledged that the sea and coast that may be exposed could represent important cultural values. Therefore, the potential impacts of oil to cause smothering was ranked as Moderate (4).	
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 relevant persons 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	
Control measure	**Description**
Marine Standard	Chevron's *Marine Standard Non Tankers: Corporate OE Standard* (Ref. 40) ensures that various legislative requirements are met. These include: • crew meet the minimum standards for safely operating a vessel, including watchkeeping requirements • navigation, radar equipment, and lighting meets industry standards. These requirements will ensure that direct vessel radio contact is available to other marine users operating in this area to enable ease of communication in highlighting risks and nearby SNAs.
Maritime safety information	Maritime safety information, such as AUSCOAST navigational warnings, are issued by the Joint Rescue Coordination Centre (JRCC) Australia, part of AMSA. Under the *Navigation Act 2012*, the AHO is also responsible for maintaining and disseminating navigational charts and publications, including providing safety-critical information to mariners (including any change to prohibited/restricted areas, obstructions to surface navigation, etc.) via the Notice to Mariners system. Notice to Mariners can be permanent or temporary notifications. Where required, AUSCOAST and/or Notice to Mariners will be issued; thus enabling other marine users to also safely plan their activities.
Managing Safe Work (MSW) process	CAPL's *Managing Safe Work OE Process* (Ref. 39) ensures that workplace safety and health hazards are assessed and managed. The permit to work (PTW) system is part of this process and includes simultaneous operations (SIMOPS) and hazard analysis. Where required under the MSW process, a SIMOPS Plan will be developed to identify and manage hazards arising from the 4D MSS activities and other planned CAPL petroleum activities when occurring within the same area. A SIMOPS Plan will be in place prior to the petroleum activity commencing for managing the Wheatstone 4D MSS in conjunction with Wheatstone Platform operations.

	There is currently no planned vessel-based activities under CAPL operational control scheduled to occur during the Wheatstone 4D MSS (mid-December to mid-April). Should this change, the SIMOPS Plan will be updated to include these additional activities. As described in Section 8.3.1.1, if additional SIMOPS Plans are required to be developed because of a change in CAPL activities within the OA, these will be in place prior to the 4D MSS commencing.	
Concurrent operations plan (COP)	Where required, a COP (or equivalent) 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. A COP (or equivalent) will be in place prior to the petroleum activity commencing for managing the Wheatstone 4D MSS in conjunction with Pluto Platform operations and/or any associated vessel-based activities. As noted in Section 4.4.5, no concurrent seismic surveys within or adjacent to the 4D MSS OA are currently scheduled, and as such no COP is required. Similarly, engagement (to date) with Woodside Energy (Table 4-21) as part of the access authority process has not indicated any concern regarding the proposed timing of the 4D MSS. If this information changes prior to the commencement of the Wheatstone 4D MSS, the requirement for a COP (or equivalent) will be reassessed. As described in Section 8.3.1.1, if additional COPs are required to be developed because of ongoing consultation with other operators identifies concurrent operations, these will be in place prior to the 4D MSS commencing.	
SOPEP / Shipboard Marine Pollution Emergency Plan	MARPOL 73/78 Annex I and Marine Order 91 (Marine pollution prevention – oil) requires that vessels (as appropriate to vessel class) have an approved SOPEP in place. To prepare for a spill event, the SOPEP details: • response equipment available to control a spill event • review cycle to ensure that the SOPEP is kept up to date • testing requirements, including the frequency and nature of these tests. In the event of a spill, the SOPEP details: • reporting requirements and a list of authorities to be contacted • activities to be undertaken to control the discharge of oil procedures for coordinating with local officials.	
Oil Pollution Emergency Plan (OPEP)	Under the OPGGS(E)R, NOPSEMA require that the petroleum activity have an accepted OPEP in place before commencing the activity. If a vessel collision occurs, the OPEP will be implemented. CAPL has developed a NOPSEMA-accepted OPEP (Ref. 1) to support all spill response activities across all its assets.	
Operational and Scientific Monitoring Plan (OSMP)	The OSMP details the arrangements and capability in place for operational and scientific monitoring. Operational monitoring collects information about the oil spill to aid planning and decision making for executing spill response or clean-up operations. Scientific monitoring focuses on the environmental impact attributable to the spill or the associated response activities and informs requirements for remediation (if required). CAPL has developed a NOPSEMA-accepted OSMP (Ref. 2) to support all spill monitoring activities across all its assets.	
Additional control measures and cost benefit analysis		
Control measure	**Benefit**	**Cost**
N/A	N/A	N/A
Likelihood and risk level summary		
Likelihood	Based on industry data, vessel collisions are considered rare, with only 3% of all marine incidents that occurred in Australian waters between 2005 and 2012 associated with a vessel collision event.	

	As most vessel collisions involve the LOC of a forward tank, which are generally double-lined and smaller than other tanks, the loss of the maximum credible volumes used in this scenario is unlikely. Considering the inherent low likelihood of a collision occurring, the safeguards in place, and enactment of the OPEP, the potential likelihood of causing the consequences described in this section is Remote (5)
Risk level	Low (8)
Acceptability summary	
Principles of ESD	The potential impact associated with this aspect would be short term, apply to some individuals, and consequently is not expected to affect biological diversity and ecological integrity. The consequence associated with this aspect is Moderate (4), and subsequently the potential for serious or irreversible environmental damage is not expected. Therefore, no additional evaluation against the Principles of ESD is required.
Relevant environmental legislation and other requirements	Legislation and other requirements relevant for this aspect include: • *Navigation Act 2012* (Cth) • Marine Order 91, Marine Pollution Prevention – oil • Marine Order 30, Prevention of collisions • *Conservation Management Plan for the Blue Whale 2015–2025* (Ref. 63) • *Conservation Advice Balaenoptera borealis Sei Whale* (Ref. 62) • *Conservation Advice Balaenoptera physalus Fin Whale* (Ref. 61) • *Conservation Advice Rhincodon typus Whale Shark* (Ref. 60) • *Recovery Plan for Marine Turtles in Australia* (Ref. 58) • *Conservation Advice for Dermochelys coriacea (Leatherback Turtle) (Ref.* 59) • *North-west Marine Parks Network Management Plan* (Ref. 9). CAPL considers that impact and risk management is consistent with these requirements, as demonstrated below.

Requirement	Demonstration
Navigation Act 2012 Notice to Mariners	Requirement to issue a Notice to Mariners has been incorporated into the **maritime safety information** control measure.
Marine Order 91 Gives effect to Annex I of MARPOL 73/78	Requirements for a vessel to have a SOPEP have been incorporated into the **SOPEP / Shipboard Marine Pollution Emergency Plan** control measure
Marine Order 30 Gives effect to the Prevention of Collisions Convention	Requirements for navigation, lights, and signals have been incorporated into the **Marine Standard** control measure
Conservation Management Plan for the Blue Whale 2015–2025 No specific management action identified.	N/A
Conservation Advice Balaenoptera borealis Sei Whale No specific conservation action identified.	N/A

	Conservation Advice Balaenoptera physalus Fin Whale No specific conservation action identified.	N/A
	Conservation Advice Rhincodon typus Whale Shark No specific conservation action identified.	N/A
	Recovery Plan for Marine Turtles in Australia Management action A4.2: 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	Assessment of spill risk strategies is within scope of the OPEP (Ref. 1). Response and recovery of habitats and marine fauna is within the scope of the OSMP (Ref. 2). Therefore, the 4D MSS is not considered to be inconsistent with the *Recovery Plan for Marine Turtles in Australia.*
	Approved Conservation Advice for Dermochelys coriacea (Leatherback Turtle) No specific conservation action identified.	N/A
	North-west Marine Parks Network Management Plan The Plan requires that "[a]ctions required to respond to oil pollution incidents, including environmental monitoring and remediation, in connection with mining operations authorised under the OPGGS Act may be conducted in all zones. The Director should be notified in the event of an oil pollution incident that occurs within, or may impact upon, an Australian Marine Park and, so far as reasonably practicable, prior to a response action being taken within a marine park."	The Montebello Marine Park is a multiple use zone (IUCN VI). The control measures identified for the management of an unplanned release provide for the response to, and environmental monitoring and remediation of, an oil pollution incident. Requirements to report oil pollution incidents that occur within, or may impact upon, an AMP is included in Section 8.4.2. Therefore, the 4D MSS is not considered to be inconsistent with the *North-west Marine Parks Network Management Plan.*
Internal context	These CAPL management processes or procedures were deemed relevant for this aspect: • *Marine Standard Non Tankers: Corporate OE Standard* (Ref. 40) • MSW process (Ref. 39) • OPEP (Ref. 1) • OSMP (Ref. 2).	
External context	During relevant persons consultation, no objections or claims were raised regarding a vessel collision event arising from the activity.	
Defined acceptable level	These risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential impacts and risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan. However, in alignment with Section 5.6.2, where the aspect is listed as threat to a protected matter, or identified as a concern to a listed conservation value, CAPL will define an acceptable level of impact that aligns with the objectives of these documents. Objectives of the relevant documents are shown below:	

<table>
<tr><td rowspan="5"></td><th>Plan</th><th>Objective</th></tr>
<tr><td>Conservation Management Plan for the Blue Whale 2015–2025</td><td><u>Recovery objective</u>: Minimise anthropogenic threats to allow for their conservation status to improve so that they can be removed from the EPBC Act threatened species list.
<u>Interim objective 4</u> Anthropogenic threats are demonstrably minimised.</td></tr>
<tr><td>Recovery Plan for Marine Turtles in Australia</td><td><u>Recovery objective</u>: The long-term recovery objective for marine turtles is to minimise anthropogenic threats to allow for the conservation status of marine turtles to improve so that they can be removed from the EPBC Act threatened species list.
<u>Interim objective 3</u>: Anthropogenic threats are demonstrably minimised.</td></tr>
<tr><td>North-west Marine Parks Network Management Plan 2018</td><td>As per Section 4.5.1.</td></tr>
<tr><td colspan="2">Therefore, CAPL has defined the following acceptable level of impact such that it is not inconsistent with these documents:
• no injury or mortality to Pygmy Blue Whale or marine turtles such that it would prevent the long-term recovery of the species
• no adverse change to the values of the Montebello Marine Park.
CAPL considers that the petroleum activity, with the control measures as described for this aspect in place, meet this acceptable level. In particular that by managing the unplanned release, that the risk to marine fauna and/or values of the AMP are also subsequently managed.</td></tr>
</table>

<table>
<tr><th>Environmental performance outcome</th><th>Environmental performance standard</th><th>Measurement criteria</th></tr>
<tr><td rowspan="4">No unplanned release of hydrocarbons or hazardous materials to the environment during the 4D MSS

No adverse change to the values of Australian Marine Parks from the 4D MSS</td><td>Marine Standard
Vessels will meet the crew competency, navigation equipment, and radar requirements of the Marine Standard</td><td>Records indicate that vessels meet the crew competency, navigation equipment, and radar requirements of the Marine Standard</td></tr>
<tr><td>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</td><td>Record of lodgment of notification to relevant agency</td></tr>
<tr><td rowspan="2">MSW process
CAPL will develop and implement SIMOPS Plan(s) to manage the 4D MSS and other planned petroleum activities within CAPL operational control within the OA</td><td>Records demonstrate that a SIMOPS Plan for the 4D MSS and Wheatstone Platform operations was in place prior to the 4D MSS commencing, and was implemented for the duration of the survey</td></tr>
<tr><td>Records indicate that if other concurrent CAPL activities within the OA are identified, additional SIMOPS Plans were developed and in place prior to the 4D MSS commencing, and implemented for the duration of the survey</td></tr>
</table>

	Concurrent operations plan CAPL will develop and implement COPs (or equivalent) to manage 4D MSS and other planned petroleum activities within the OA	Records demonstrate that a COP (or equivalent) for the 4D MSS and Pluto Platform operations was in place prior to the 4D MSS commencing, and was implemented for the duration of the survey
		Records indicate that if other concurrent petroleum activities within the OA are identified, additional COPs were developed and in place prior to the 4D MSS commencing, and implemented for the duration of the survey
Reduce the risk of impacts to the environment from the unplanned release of hydrocarbons or hazardous materials during the 4D MSS	**SOPEP** Marine vessels (as appropriate to vessel class) will carry on board a Shipboard Oil Pollution Emergency Plan (SOPEP) in accordance with MARPOL 73/78 Annex I – Prevention of Oil Pollution	OVIS report / ABU Marine OE Inspection Checklist confirms an approved SOPEP is on board marine vessels (as appropriate to vessel class)
		Inspection records (or similar) show drills conducted in accordance with SOPEP
	SOPEP In the event of a vessel-based spill event, emergency response activities will be implemented in accordance with the vessel SOPEP (or equivalent).	Records confirm that emergency response activities were implemented in accordance with the vessel SOPEP in the event of a vessel-based spill.
	OPEP In the event of a spill occurring, the OPEP will be implemented	Records confirm the OPEP has been implemented
	OSMP In the event of a spill occurring, the OSMP will be implemented	Records confirm the OSMP has been implemented

7.13 Spill response

7.13.1 Response option selection

7.13.1.1 Strategic NEBA

CAPL has developed a series of Strategic Net Environmental Benefit Analysis (NEBAs) (Ref. 159) 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. 160). 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.

7.13.1.2 Protection prioritisation process

CAPL has developed a Protection Prioritisation Process (PPP) (Ref. 161) 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. 161) 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. 161) aligns with WA Department of Transport (DoT) PPP (Ref. 162) 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. 161]) 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. 161), the 4-day contact timeframe is based on the expected time it would take CAPL to develop and implement a Tactical Response Guide (TRG) for an area predicted to be impacted. For contact outside this timeframe, it expected that CAPL will have reasonable time to develop and implement a TRG prior to oil contacting the resource.

High and Very High value areas (DoT shoreline cells) identified for contact within this timeframe have been identified in Table 7-12 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 7-12: 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

7.13.2 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. 1). Taking into account the priority planning areas identified in Table 7-12, 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.

7.13.3 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. 1).

7.13.3.1 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. 159) 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.

7.13.3.2 CAPL planned response vessel collision

In accordance with the Strategic NEBA (Ref. 159), 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. 1) 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 m^3 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. 1), each protection team is expected to recover 15.6 m^3 of hydrocarbon per day. On the assumption that 24.4 m^3 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 7-13.

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 m^3 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. 1), each SHC team is expected to recover 1.6 m^3 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 7-13: 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							

7.13.4 Spill response environmental risk assessment

7.13.4.1 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			
Potential impacts of SPD and SHC vary, depending on the method used and the shoreline habitat. General impacts include physical disturbance from using personnel, vehicles, and equipment. Particular values and sensitivities in the area that may be affected by the spill include sensitive shoreline habitats (such as mangroves) and nesting / foraging habitat for fauna species such as turtles and birds. The impacts associated with undertaking SHC may be more than if the hydrocarbon product was left in place and remediated through natural processes. Leaving the product in place is a common response option if continual human and vessel/vehicle traffic has the potential to generate greater impacts than the product itself. This technique has been implemented internationally, including for the Montara spill (where persistent components of the product were left to naturally break down in dense coastal mangroves) and the Macondo spill (where marshes and wetlands that had been impacted by weathered product were allowed to recover naturally). If a smaller extent of shoreline is impacted, the impacts from an SHC response activity may be lessened and more localised. Potential impacts associated with using vehicles, personnel, and equipment during SHC (and/or SPD) can include disturbing wildlife feeding or breeding (including damage to nests) and damaging dune structures, vegetation, or intertidal habitats. These shoreline activities have the potential to result in short-term and localised damage to or alteration of habitats and ecological communities and therefore the consequence is ranked as Minor (5).			
ALARP decision context justification			
The risks associated with shoreline oil spill response techniques are well understood, with the techniques having been applied successfully for a number of large spill events. Although there is a good understanding of these response techniques, there is uncertainty regarding the specific location at which this may be undertaken, and the level of response that may be required in these areas. Spill modelling was used to inform the extent of such a spill, and thus provide a sound basis for response planning (including shoreline response) to such an incident. Control measures to manage the risks associated with shoreline spill response techniques are well defined with most being linked to detailed monitoring plans that feed into tactical planning requirements and NEBAs. During relevant persons consultation, no objections or claims were raised regarding spill response activities. The risks arising from implementing shoreline response techniques in the event of a spill are extremely low, and CAPL consider these to be lower-order risks in accordance with Table 5-3. As such, CAPL considers ALARP Decision Context A should be applied for this aspect.			

Good practice control measures	
Control measure	**Description**
OSMP	The OSMP details the arrangements and capability in place for operational and scientific monitoring. Operational monitoring collects information about the oil spill to aid planning and decision making for executing spill response or clean-up operations. Scientific monitoring focuses on the environmental impact attributable to the spill or the associated response activities and informs requirements for remediation (if required). CAPL has developed an NOPSEMA-accepted OSMP (Ref. 2) to support all spill monitoring activities across all its assets. Specifically, Operational Study 6 – Rapid Seabird and Shorebird Assessment and Operational Study 7 – Rapid Marine Megafauna Assessment provide information on the presence of wildlife with regards to predicted trajectory to understand the level of oiled wildlife response (OWR) required.
Likelihood and risk level summary	
Likelihood	Depending on the clean-up technique and habitat, potential consequences of shoreline cleaning are remote (Note: Mechanical methods are generally expected to have greater consequences than manual cleaning). With the control measures in place, CAPL assessed the likelihood of the consequence described above as Remote (5).
Risk level	Very low (9)
Acceptability summary	
Principles of ESD	The potential impact associated with this aspect is considered to have the potential to result in minor, localised, incidental damage to, or alteration of, habitats and ecological communities; however, this is not expected to affect biological diversity and ecological integrity. The consequence associated with this aspect is Minor (5). Therefore, no additional evaluation against the Principles of ESD is required.
Relevant environmental legislation and other requirements	No legislation and other requirements relevant to this aspect were identified.
Internal context	This CAPL management process or procedure was considered relevant for this aspect: • OSMP (Ref. 2). Control measures related to the above management process or procedure have been described for this aspect. As such, CAPL considers that impact and risk management is consistent with company policy, culture, and standards.
External context	During relevant persons consultation, no objections or claims were raised regarding spill response activities.
Defined acceptable level	These risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.

Environmental performance outcome	Environmental performance standard	Measurement criteria
Reduce the risk of impacts to the environment during event response	**OSMP** In the event of a spill occurring, the OSMP will be implemented	Records confirm the OSMP has been implemented

7.13.4.2 Physical presence—oiled wildlife response

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

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

Good practice control measures		
Control measure	**Description**	
OSMP	The OSMP details the arrangements and capability in place for operational and scientific monitoring. Operational monitoring collects information about the oil spill to aid planning and decision making for executing spill response or clean-up operations. Scientific monitoring focuses on the environmental impact attributable to the spill or the associated response activities and informs requirements for remediation (if required). CAPL has developed a NOPSEMA-accepted OSMP (Ref. 2) to support all spill monitoring activities across all its assets. Specifically, Operational Study 6 – Rapid Seabird and Shorebird Assessment and Operational Study 7 – Rapid Marine Megafauna Assessment provide information on the presence of wildlife with regards to predicted trajectory to understand the level of OWR required.	
Likelihood and risk level summary		
Likelihood	Where there is the possibility for surface oil to impact wildlife, the risks associated with OWR are lower than those associated with inaction. With the control measures in place, the likelihood of the described consequences occurring from OWR activities was determined to be Remote (5).	
Risk level	Very low (9)	
Acceptability summary		
Principles of ESD	The potential impact associated with this aspect is considered as having the potential to result in a localised incidental impact and thus is not expected to affect biological diversity and ecological integrity. The consequence associated with this aspect is Minor (5). Therefore, no additional evaluation against the Principles of ESD is required.	
Relevant environmental legislation and other requirements	No legislation and other requirements considered relevant to this aspect were identified.	
Internal context	The CAPL management process or procedure considered relevant for this aspect is: • OSMP (Ref. 2). Control measures related to the above management process or procedure have been described for this aspect. As such, CAPL considers that impact and risk management is consistent with company policy, culture, and standards.	
External context	During relevant persons consultation, no objections or claims were raised regarding spill response activities.	
Defined acceptable level	These risks are inherently acceptable as they are considered lower-order impacts in accordance with Table 5-3. In addition, the potential risks evaluated for this aspect are not inconsistent with any relevant recovery or conservation management plan, conservation advice, or bioregional plan.	
Environmental performance outcome	**Environmental performance standard**	**Measurement criteria**
Reduce the risk of impacts to the environment during event response	**OSMP** In the event of a spill occurring, the OSMP will be implemented	Records confirm the OSMP has been implemented

8 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 7 are achieved.

CAPL, as nominated titleholder, is responsible for ensuring the petroleum activity within scope of this EP is managed in accordance with this implementation strategy. The seismic contractor for the 4D MSS will be required to comply with the requirements of this EP to ensure that the environmental performance outcomes and standards are achieved. The seismic contractor's HSE documentation will be reviewed for compliance with the relevant requirements described in this EP prior to the commencement of the activity.

8.1 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. 38) 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 8-1):

- **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 8-1) 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 8-1) provides the verification and validation that the safeguards are in place and functioning as intended.

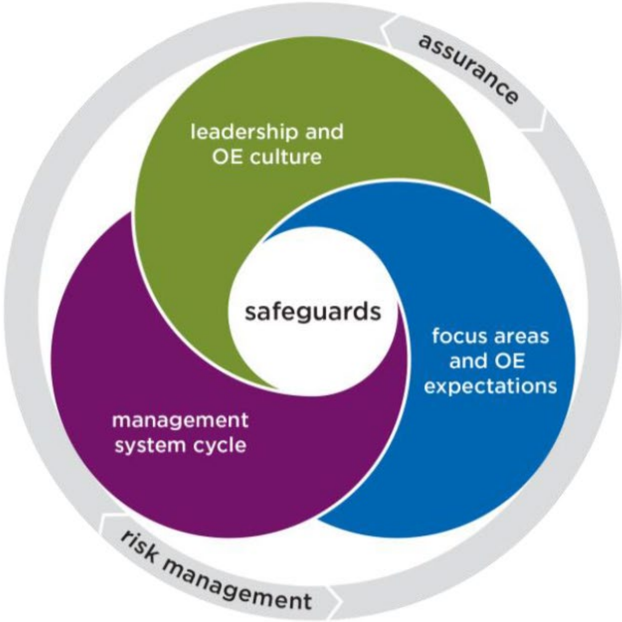


Figure 8-1: Overview of Chevron Corporation's OEMS

8.2 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.

8.2.1 Roles and accountability

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

8.2.1.1 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 8-2.

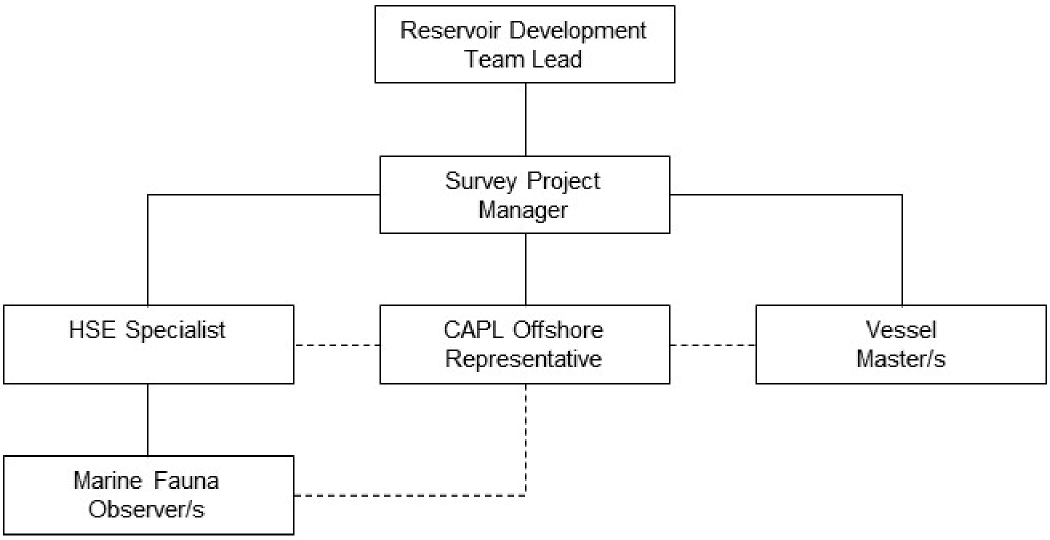


Figure 8-2: Chain of command—4D MSS

8.2.1.2 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 7, and are summarised in Table 8-1.

Table 8-1: Key roles and responsibilities—4D MSS

Role	Responsibilities
Survey Project Manager	• Overall responsibility for implementing, managing, and reviewing this EP Ensure that: • all third-party vessels or contractors are aware of any requirements within this EP, including completion of relevant inductions as per Section 8.2.1.3 • pre-mobilisation inspections of vessels are undertaken to confirm they comply with relevant legislative requirements, and all requirements under this EP • ongoing consultation is conducted in accordance with Section 8.3.4.2 • the seismic contractor's HSE documentation has been reviewed for compliance with the relevant requirements described in this EP prior to the commencement of the activity • the requirement for any SIMOPS or COPs have been identified and developed prior to the commencement of the activity (Section 8.3.1.1) • the Marine Fauna Observer Operations Plan (or equivalent) has been reviewed for compliance with the relevant requirements described in this EP prior to the commencement of the activity • all PAM Operators, Lead MFOs and MFOs meet any relevant training and competency requirements described in Table 8-2 any claims received during or after the 4D MSS are assessed in accordance with the Adjustment Protocol (Section 8.3.4.1) • any MoC is conducted in accordance with Section 8.3.2.2, and notify the CAPL Offshore Representative and HSE Specialist of any scope changes where relevant • environmental incident reporting is completed in accordance with Section 8.4.2 • routine environmental reporting is undertaken in accordance with Section 8.4.3.
CAPL Offshore Representative	Ensure that: • all personnel are made aware of their requirements under this EP and have completed inductions • impacts and risks are continually reduced to ALARP and an acceptable level by implementing this EP in accordance with Section 7 • minimum of one dedicated MFO is an active duty during daylight hours on the seismic vessel • corrective actions identified during weekly environmental inspections are closed out in accordance with Section 8.3.6 • all incidents, including breaches of environmental performance standards, are reported to Survey Project Manager • routine environmental monitoring and reporting is undertaken in accordance with Sections 8.4.1 and 8.4.3 respectively.
HSE Specialist	Ensure that: • all personnel are made aware of their requirements under this EP • impacts and risks are continually reduced to ALARP and an acceptable level by implementing this EP in accordance with Section 7 • all changes to this EP are subject to a MoC assessment as described in Section 8.3.2.2

Role	Responsibilities
	• compliance with this EP is verified in accordance with Section 8.3.6, including: – weekly environmental inspections – collection of evidence against environmental performance standards – regularly review compliance with environmental performance standards – preparation of environmental performance report following completion of survey • assist with review, investigation, and reporting of environmental incidents (as required) • this EP is reviewed in accordance with Section 8.5.
Vessel Master/s	Ensure that: • impacts and risks are continually reduced to ALARP and an acceptable level by implementing this EP in accordance with Section 7 • all necessary vessel-related documentation (e.g., SOPEPs, certificates, etc.) is available in accordance with Section 7 • all marine safety information notifications are issued in accordance with Table 8-6 and Section 7 • vessel operations are being conducted in accordance with the legislative requirements and this EP, including waste management, refuelling, and emergency/oil spill response • maintenance of equipment and records meet statutory requirements • establish and maintain radio contact with other vessels in the 4D MSS OA and adjacent waters • vessels do not enter platform PSZs without prior authorisation • vessels implement cetacean interaction requirements in accordance with EPBC Regulations 2000, EPBC Policy Statement 2.1, and additional marine fauna interaction requirements in accordance with this EP • all incidents are immediately reported to CAPL Offshore Representative • all emissions and discharges are monitored and recorded in accordance with Section 7 • fuel consumption is monitored and recorded in accordance with Section 7.
Marine Fauna Observer/s	• Provide an information session to control room operators and other essential personnel at the start of the survey regarding their fauna observation duties and the communication protocols required with the control room operators to ensure shutdowns and power downs occur efficiently • Provide awareness training for bridge-watch crew on seismic and support vessels prior to activities commencing • Undertake visual observations for marine fauna in accordance with Section 7.5 • Record and report all sightings of marine fauna to the HSE Specialist • Provide advice to the CAPL Offshore Representative and Vessel Master (or delegate) regarding delay or shut down seismic source, if required, in accordance with EPBC Policy Statement 2.1 and Section 7.5 of this EP • Preparation of daily, and end of survey marine fauna monitoring reports • Preparation of compliance and sighting reports (for whale interactions) in accordance with EPBC Policy Statement 2.1 (Section 8.4.1.1) • Maintain MFO observation logs, including details of any sightings, soft start procedures, and mitigation actions • Assist HSE Specialist with compliance verification as required • Assist HSE Specialist with incident reporting as required.

Role	Responsibilities
PAM operators	• Undertake visual observations for marine fauna in accordance with Section 7.5 • Record and report all sightings of marine fauna to the Lead MFO • Provide advice to the Lead MFO, CAPL Offshore Representative and Vessel Master (or delegate) regarding delay or shut down seismic source, if required, in accordance with EPBC Policy Statement 2.1 and Section 7.5 of this EP • Maintain PAM observation logs, including details of any sightings, soft start procedures, and mitigation actions.
Vessel crew	• Undertake the 4D MSS in a professional and safe manner with attention to good housekeeping procedures and work practices • Immediately report any incidents to the Vessel Master • Immediately report any environmental incidents or spills to the Vessel Master • During pre start-up for seismic operations, bridge-watch crew on the support vessel/s are to record marine fauna observations in accordance with Section 7.5 of this EP.

8.2.1.3 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, training certification, and/or experience relevant to their role, which will be confirmed through the contractor selection process, audits, and review processes.

The seismic contractor will provide marine crew who are trained and competent to undertake their respective activities on board the vessel. All marine personnel will be qualified in accordance with the International Convention on Standards of Training Certification and Watch Keeping for Seafarers (STCW95).

Only appropriately experienced MFOs will be utilised for the Wheatstone 4D MSS, with at a minimum the Lead MFOs having experience on at least five previous seismic surveys in Australian or New Zealand waters (Table 8-2).

Personnel with specific responsibilities under this EP (refer to Section 8.2.1.2) 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 8-2). Records of attendance at inductions will be maintained as per Section 8.3.2.1.

Table 8-2: Training and competency—4D MSS

Training / competency	Required personnel	Scope
Induction	All relevant personnel	Before commencing activities, all personnel, including contractors, 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

Training / competency	Required personnel	Scope
		implemented to minimise the potential impact on the environment. The induction includes: • awareness of Chevron Corporation's Operational Excellence Policy 530 (appendix a) • an overview of environmental sensitivities, and key impacts and risks from the petroleum activity • roles and responsibilities of vessel crew members • cetacean interaction requirements under Part 8 of the EPBC Regulations 2000, and additional marine fauna separation distances as per requirements of this EP • whale interaction requirements under EPBC Act Policy 2.1, and additional marine fauna interaction requirements as per this EP during seismic acquisition • good waste management and hazardous materials housekeeping requirements • incident reporting requirements (including definitions and reporting pathways) • incident response arrangements.
MFO certification	All MFOs	All MFOs must have completed an MFO (or marine mammal observer) training course. As required by EPBC Policy Statement 2.1, MFOs will be trained in whale identification and behaviour, distance estimation, and be capable of making accurate identifications and observations of whales in Australian waters.
MFO competency	Lead MFO	The Lead MFOs will have had previous experience in: • at least five seismic survey campaigns in Australia or New Zealand • application of EPBC Policy Statement 2.1 Part A, and parts of Part B • establishing communications protocol between MFO and the seismic operator, navigators, and/or gun crew • prepared end of survey compliance and sighting reports.
	MFO	The MFOs will have had previous experience in: • at least two campaigns in Australia or New Zealand.
PAM competency	PAM operator	The PAM operators will have had previous experience in: • at least two campaigns in Australia or New Zealand.
MFO support	Bridge-watch crew	All bridge-watch crew from seismic and support vessel/s must have completed an MFO awareness session facilitated by the Lead MFO. This awareness session includes: • whale observation requirements under the EPBC Policy Statement 2.1 for during seismic operations • additional marine fauna observation requirements as specified within this EP for during seismic operations • sighting process and forms.

8.3 Focus areas and OE expectations

The OE expectations are organised into six focus areas (Figure 8-3). 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 8-3.

Figure 8-3: 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 8-3. Each of these focus areas and common expectations are described in further detail in the following subsections.

Table 8-3: Relevant focus areas and common expectations

Focus area or common expectation	Key processes
Focus area	
Workplace safety and health	• *Managing Safe Work (MSW): ABU Standardised OE Process* (Ref. 39) • *Chevron Marine Standard Non Tankers: Corporate OE Standard* (Ref. 40) • *ABU Hazardous Materials Management Procedure: ABU Standardised OE Procedure* (Ref. 41)
Process safety, reliability and integrity	• OE Information Management: ABU Standardised OE Process (Ref. 42) • *Management of Change for Facilities and Operations: ABU Standardised OE Process* (Ref. 43)
Environment	• *Environmental Stewardship: ABU Standardised OE Process (Ref. 44)* • *Quarantine Procedure Marine Vessels. ABU Standardised OE Process (Ref. 45)*
Stakeholders	• *Stakeholder Engagement and Issues Management: ABU Standardised OE Process* (Ref. 46)
Common expectation	
Risk management	• *ABU OE Risk Management Process* (Ref. 31)
Assurance	• *OE Assurance Corporate Process* (Ref. 47) • *OE Corporate Standard Incident Investigation* (Ref. 49) • *OE Data Reporting Standard (Ref. 50)*

Focus area or common expectation	Key processes
Incident investigation and reporting	• *Incident Investigation and Reporting (II&R) Execution Manual* (Ref. 51)
Emergency management	• *Emergency Management OE Process* (Ref. 52) • OPEP (Ref. 1) • *Operational and Scientific Monitoring Plan* (OSMP) (Ref. 2)

8.3.1 Workforce safety and health

8.3.1.1 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. 39) 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.

The CAPL Wheatstone Platform and Woodside Energy Pluto-A Platform are both located within the OA for the 4D MSS. A SIMOPS Plan will be in place prior to the activity commencing to manage any potential interaction between the 4D MSS and the Wheatstone Platform. Similarly, a COP (or equivalent) will be in place prior to the 4D MSS commencing to manage any potential interaction between the 4D MSS and the Pluto-A Platform. The SIMOPS Plans and/or COPs will contain the following details:

- roles and responsibilities
- communications protocols
- close pass procedures
- hazard management
- emergency response.

The potential for concurrent other petroleum activities was also reviewed (Table 4-21). Engagement (to date) with Woodside Energy has identified that activities associated with the Scarborough trunkline installation are indicatively scheduled to occur at the same time as the 4D MSS, pending environmental approvals for the activities. If this schedule is confirmed prior to the commencement of the 4D MSS, the requirement for a COP (or equivalent) will be reassessed.

If concurrent seismic surveys are scheduled within proximity to each other, these are typically managed via a COP (or equivalent) and time-sharing arrangements. Any COP would include a 40 km separation distance between seismic sources as recommended by BOEM (Ref. 254) and required within Section 7.5. As noted in Section 4.4.5, no concurrent seismic activities overlapping with the 4D MSS OA are currently scheduled, and as such no COP is required. If this information changes prior to the commencement of the 4D MSS, the requirement for a COP (or equivalent) will be reassessed.

Similarly, if ongoing consultation with other petroleum operators indicate that diving activity is likely to occur within 45 km of the FPZ, then a COP (or equivalent) for managing these activities will be developed. Any COP (or equivalent) would include a 45 km separation distance between seismic source and divers as recommended by DMAC (Ref. 253) and required within Section 7.5.

If additional COPs are required to be developed because of ongoing consultation with other operators, or additional SIMOPS Plans are required to be developed because of a change in CAPL activities within the OA, these will be in place at prior to the 4D MSS commencing.

8.3.1.2 Marine

The *Marine Standard Non Tankers: Corporate OE Standard* (Ref. 40) 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 Marine Standard 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.

The key elements of the Marine Standard 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.

8.3.1.3 Hazardous materials

CAPL's *Hazardous Materials Management Procedure* (Ref. 41) 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 8-4.

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 8-4: 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. 53).
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.

8.3.2 Process safety, reliability and integrity

8.3.2.1 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. 42) 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.

Records relevant to the 4D MSS may include:

- this EP
- induction material and attendance records
- compliance register
- inspection records and supporting evidence
- incident reports
- routine environmental reporting
- emissions and discharge data
- relevant log book records (e.g., MFO, vessel, etc.).

8.3.2.2 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 8.3.4.2), the *Management of Change for Facilities and Operations* process (Ref. 43) 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.

For the Wheatstone 4D MSS, the following would trigger an MoC:

- change to the activity scope (e.g., timing, vessel, equipment, acquisition area, etc.)
- changes to knowledge of the receiving environment (e.g., EPBC listed species, Part 13 statutory instruments [i.e., recovery plans, threat abatement

plans, conservation advice, wildlife conservation plans], requirements for AMPs, etc.)

- new objections or claims received from relevant persons that are assessed to have merit
- non-conformances or opportunities for improvement which indicate that control measures may not be managing environmental impacts and risk to ALARP and acceptable levels
- incidents which identify new or increased impacts and risks arising from activities not previously identified in the accepted EP.

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.

8.3.3 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.

8.3.3.1 Environmental stewardship

The Environmental Stewardship process (Ref. 44) 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.

8.3.3.2 Quarantine

The *Quarantine Procedure Marine Vessels* (Ref. 45) 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.

All vessels operating in title areas must comply with applicable Australian biofouling and ballast water requirements to prevent the introduction and spread of marine pests. Regardless of the origin of the vessel or where it will be operating, all vessels must be free from marine pests when mobilised and the contractor must demonstrate the vessel meets low risk rating for biofouling.

As per the *Quarantine Procedure Marine Vessels* (Ref. 45), CAPL undertakes a risk assessment before any vessel is mobilised to title areas to confirm the vessel meets the requirements for approaching and accessing these areas. For this purpose, each vessel contractor submits a completed Marine Vessel Questionnaire with supporting evidence to CAPL for assessment.

This risk assessment will consider the vessel's attributes and history, including wetsides cleaning, application of antifoul coating, and recent transit history, including time in known high-risk waters.

If the vessel's history is unknown or if there is a moderate risk of IMP presence, additional actions must be undertaken. These action items (which may include requirements such as dry-dock, hull cleaning, etc.) will be issued to the contractor to implement.

The contractor must also submit the vessel details to the Vessel Check online risk assessment tool (https://www.vessel-check.com/) and provide CAPL with a copy of the resulting Risk Assessment Report demonstrating the vessel has achieved low risk rating. Only once a vessel has met the requirements of the *Quarantine Procedure Marine Vessels* (Ref. 45), will CAPL issue a Vessel Mobilisation Certificate.

8.3.4 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. 46) 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.

8.3.4.1 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 8-5). 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 fishery licence holder, an independent third-party will be engaged at this time to assess the claim. The third-party will be appointed with the agreement of both CAPL and the fishery licence holder at the time (and therefore specific qualifications and/or experience requirements for this independent third-party are not defined within this EP).

If required to be appointed, the third-party will be provided with details regarding the adjustment protocol (Table 8-5), the claim, and any supporting evidence. The independent third-party will provide an assessment of the merit of the claim and a decision on validity of the claim. The decision by the independent third-party will be considered binding on CAPL and the fishery licence holder.

Table 8-5: Commercial fisheries adjustment protocol

Claim type	Considerations
Temporary loss of catch	• 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	• 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

Claim type	Considerations
	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 costs that are additional to the costs that would have been incurred to catch the fish "but for" the relocation • 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	• 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.

8.3.4.2 Ongoing consultation with relevant persons

In accordance with regulation 14(9) of the OPGGS(E)R, CAPL will undertake ongoing consultation for this petroleum activity with relevant authorities and other relevant interested persons or organisations for this petroleum activity as described in Table 8-6.

Through co-design of consultation, CAPL will agree processes for ongoing consultation with relevant persons. This may include consultation on the ongoing environmental performance of the petroleum activity and review of applicable control measures with the relevant persons. Engagement agreements, information on grants and social benefit investments (e.g. funding for ranger programs and training opportunities to support CAPL's activities), and consultation plans with relevant persons are included in the sensitive information report. Records for ongoing consultation with relevant persons will be recorded and maintained in CAPL's online tracking engagements system.

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 8.3.2.2.

If a new relevant person is identified during the in-force period of the EP, CAPL will provide sufficient information to that relevant person (as described in Section 6.2.2) and will assess the merits of the objections or claims of that relevant person in accordance with Section 6.3.6 and CAPL's MoC process (Section 8.3.2.2). Notifications to be made in the event of an emergency are detailed in Section 8.3.4.3.

Table 8-6: Notifications and ongoing consultation

Relevant person	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
Relevant persons (that have requested ongoing notifications)	CAPL will provide a pre-start notification confirming the start date of the petroleum activity	At least two weeks before commencing activities	Once, prior to activities commencing
	CAPL will provide notification following completion of the petroleum activity	Within two weeks of completion of activities	Once post activity completion
DNP	Inform DNP once the EP has been accepted by NOPSEMA. Notify DNP via marineparks@awe.gov.au	Following NOPSEMA acceptance of the EP	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
Potentially affected persons	CAPL to advise of any new or significant changes to activities or impacts/risks within the scope of the EP, following an evaluation as per Section 8.3.2.2, that may potentially impact marine users	Prior to new or significant changes to activities or impacts/risks occurring	As required
First Nations people and/or representative bodies	Any new information on cultural values within the EMBA, and subsequent changes to activities or impacts/risks within the scope of the EP, will undergo an MoC evaluation as per Section 8.3.2.2.	Ongoing	Ongoing
	CAPL to advise of any new or significant changes to activities or impacts/risks	Prior to new or significant changes to activities or	As required

Relevant person	Notification or ongoing consultation requirement	Timing	Frequency
	within the scope of the EP, following an evaluation as per Section 8.3.2.2, that may potentially impact the functions, interests and activities of First Nations people and/or representative bodies	impacts/risks occurring	

8.3.4.3 Consultation in the event of an emergency

In the event of an emergency hydrocarbon spill event, CAPL will commence oil spill trajectory modelling using the actual inputs associated with the spill event to predict trajectory, as described in the OPEP (Ref. 1).

Once oil spill trajectory modelling is completed, CAPL will start engaging with potentially affected relevant persons (those considered relevant from Table 6-4, and any additional relevant persons identified under Section 8.3.4.2), plus any others identified from the oil spill trajectory modelling). This engagement will include WAFIC and any potentially affected commercial fisheries as required. The process for reaching out to these relevant persons includes direct contact (phone or email) or indirect contact via the CAPL website.

In the event of other emergency events (e.g. potential reportable incident), CAPL will commence any emergency management as required (and in accordance with Section 8.3.8), and consultation with required departments or agencies will occur as per regulatory requirements (e.g. refer to Table 8-12 for incident reporting requirements)..

CAPL will also notify any relevant persons that requested to be notified in the event of an oil spill or in the event of any other emergency event as identified in Table 6-4, and any additional relevant persons identified under Section 8.3.4.2.

8.3.5 Risk management

The risk management process (Ref. 31) 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. 37) and ISO 31000:2018 *Risk management – Principles and guidelines* (Ref. 36).

This risk management process is summarised in Section 5 of this EP. Additional risk assessments must be undertaken if the MoC process (Section 8.3.2.2) is triggered. Risk assessments are undertaken in accordance with this process.

The *ABU OE Risk Management Process* (Ref. 31) and the *Management of Change for Facilities and Operations* process (Ref. 43) 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.

8.3.6 Assurance

Within the OEMS, assurance is a common expectation that supports the OE objective of each focus area. The *ABU OE Assurance Process* (Ref. 47) 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 non-compliance
- the minimum qualifications and organisational capability to execute this process.

The *ABU OE Assurance Plan* (Ref. 48) is a multi-year plan that documents the CAPL ABU integrated assurance system and associated assurance activities (Figure 8-4). 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).

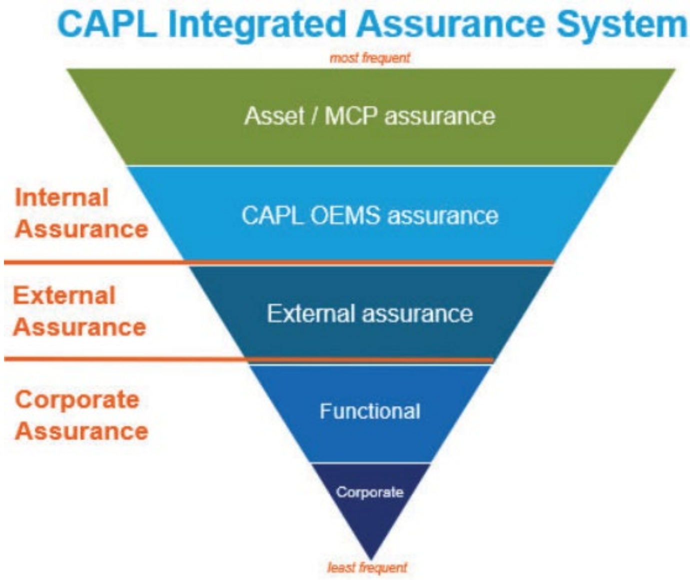


Figure 8-4: ABU integrated assurance system

To support the implementation of the *ABU OE Assurance Process*, CAPL have developed an ABU integrated assurance system (Figure 8-4), 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.

As outlined in Section 8.3.1.2, prior to the 4D MSS commencing, a pre-survey vessel inspection will be undertaken to confirm that vessel management systems are consistent with the requirements in this EP.

Prior to the commencement of the 4D MSS, an assurance register specific to the requirements of this EP will be developed. The HSE Specialist will undertake weekly environment inspections during the 4D MSS. The inspections will be undertaken in accordance with the *ABU OE Assurance Process* (Ref. 47). Any potential non-conformances or opportunities for improvement will be identified, and corrective actions associated with these will be implemented as soon as practicable. Corrective actions will be delegated to the person deemed most appropriate to fulfil the action. Records of inspections will be maintained in accordance with Section 8.3.2.1.

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. Environmental performance during the 4D MSS will be reviewed to ensure that environmental performance standards and environmental performance outcomes are being met, reviewed and where necessary amended to continue to manage the environmental impacts and risks of the petroleum activity to ALARP and acceptable levels.

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 8.4.3).

8.3.6.1 Managing Instances of Potential Nonconformance

The reporting, investigation, and tracking of non-conformances are managed via Chevron's *OE Corporate Standard Incident Investigation* (Ref. 49) and *OE Data Reporting Standard* (Ref. 50). 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 7.

Audit findings and corrective actions are recorded and tracked in a CAPL compliance assurance database for timely closure of actions. As per Section 8.3.6, any corrective action/s identified during a weekly environment inspection is required to be implemented as soon as practicable during the 4D MSS. Audit findings that identify a breach of an environmental performance outcome or environmental performance standard will be reported in accordance with Section 8.4.2.

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 8.3.2.2.

8.3.7 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. 51) 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 8.4.2.

8.3.8 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 7.11 and 7.12, and requirement have not been duplicated here.

8.3.8.1 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. 54) and is consistent with the core aspects presented in the International Maritime Organisation (IMO) equivalent courses.

The ERO comprises the groups listed in Table 8-7; this table also describes the major functions of teams during an emergency.

Figure 8-5 to Figure 8-7 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. 55).

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. 1).

Table 8-7: 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	The IEMT is led by an Incident Commander (IC) and operates out of an on-site emergency command centre.

Team	Description
Management Team (IEMT)	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.

8.3.8.2 Emergency management process

The *Emergency Management OE Process* (Ref. 52) 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. 52) 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. 56).

The OPEP (Ref. 1) 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.

8.3.8.3 Chain of command (emergency response)

A well-delineated EMT chain of command has been established for emergency response (Figure 8-5 to Figure 8-7). 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.

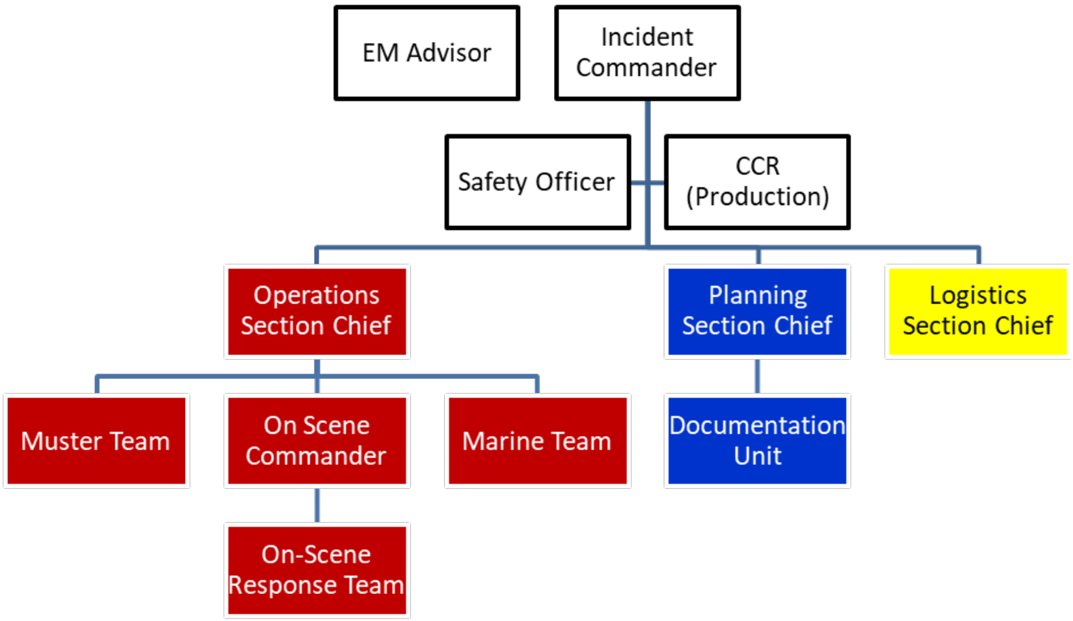


Figure 8-5: Basic installation EMT organisation chart

Figure 8-6: Expanded EMT organisation chart

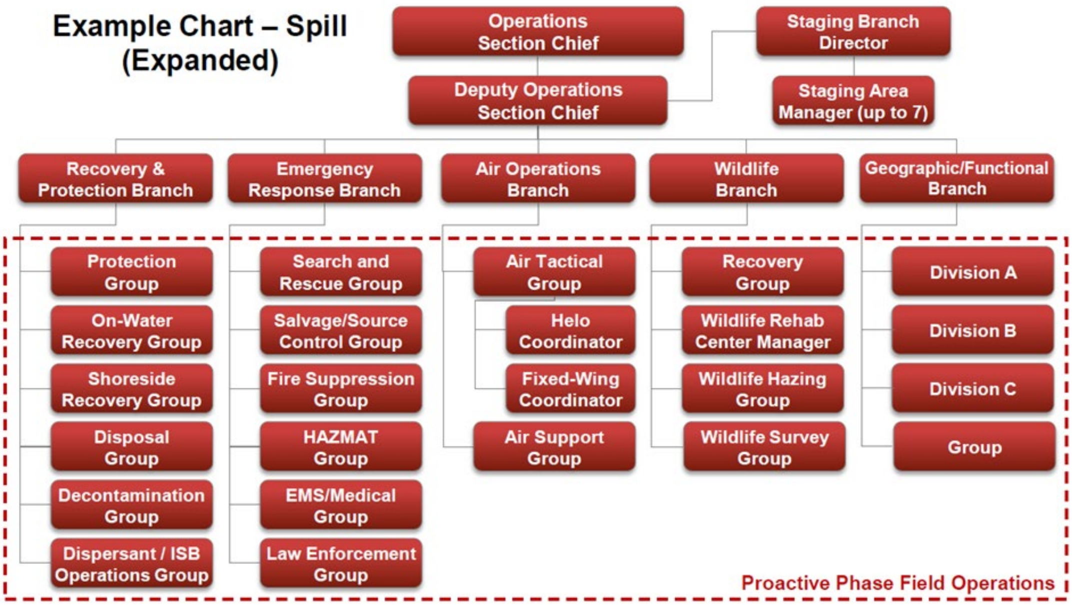


Figure 8-7: Example expanded operations section organisation chart

8.3.8.4 Roles and responsibilities (emergency response)

Table 8-8 provides additional information about the structure of these teams and the key individual roles and responsibilities during emergency response.

Table 8-8: Key roles and responsibilities—emergency response

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

Role	Responsibilities
	• Assists the IC in defining strategic objectives • Assists the IC in providing information to the Level 3 EMT • Compiles and retains documentation
Logistics Section Chief	• Obtains personnel, equipment, materials, and supplies needed to mount and sustain emergency response operations • Provides services necessary to ensure that emergency response operations are carried out safely and efficiently

8.3.8.5 Training and competency (emergency response)

Competencies and training requirements for the EMT, ORT, and other personnel during implementation of the OPEP (Ref. 1) are outlined in Table 8-9. Competency and training records for personnel, including contractors and subcontractors, are maintained.

Table 8-9: Competency and training requirements—emergency response

Role	Summary	Training Standard
Note: Personnel with no specialist emergency response duties should undergo training in line with their responsibilities as indicated below for 'All personnel'.		
All personnel	• Provide basic first response to an incident, including, but not limited to: conducting a quick assessment; making safe; notifying anyone else in danger; and raising the alarm • Complete basic procedures in response to an alarm and evacuate to a muster point (as necessary) • Frequency: every 3 years if not involved in response or drills/exercises	
In addition to the above, personnel responsible for roles with specialist oil spill response duties should undergo further training and practice in line with the responsibilities set out below. Training is provided to maintain the capability to respond to all hazards in line with the Incident Command System implemented by CAPL.		
Emergency Management Teams (EMTs)		
PEMT Incident Commander	• Selected Perth based personnel, would typically with a manager or senior manager role within CAPL • Competencies: overall management of emergency response operations and ensure operations are performed safely, effectively, and efficiently. Commands the EMT • Frequency: once a year (maintenance of competencies may be through response or training/drills/exercises)	• ICS-100 Introduction to the Incident Command System • ICS-200 Basic Incident Command System training • ICS-220 Initial Response Team • ICS-300 Intermediate Incident Command System Training (PEMT members only) • Oil Spill Awareness Training
PEMT Command and General Staff	• Selected Perth based personnel, typically a manager, or personnel with skills and knowledge appropriate to the function • Competencies: provides strategic direction, internal	• ICS-100 Introduction to the Incident Command System • ICS-200 Basic Incident Command System training • ICS-220 Initial Response Team

Role	Summary	Training Standard
	planning, logistics, and operational support. Operates from the emergency command centre and supports the IC who is responsible for the overall control of the incident • Frequency: once a year (maintenance of competencies may be through response or training/drills/exercises)	• ICS-300 Intermediate Incident Command System Training (PEMT members only) • Oil Spill Awareness Training

8.3.8.6 Oil spill exercise schedule

The CAPL *Oil Spill Response Multi-Year Exercise and Drill Schedule* (Ref. 57) 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. 57) outlines the proposed testing arrangements to be completed, including the exercise types (Table 8-10) and proposed level of response to be tested (Table 8-11) that may be used to meet the defined objectives. A minimum of one test for each level will be conducted each year.

Table 8-10: Exercise types

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

Table 8-11: Exercise levels

Level	Details
Level 1 – ORT	• 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	• Exercises may include the participation of an ORT and may be held in conjunction with a Level 3 EMT exercise • Usual duration – one to two hours • Designed to evaluate a Level 2 EMT's ability to notify and activate team members, set up a Level 2 EMT emergency command centre, and implement the Gorgon Emergency Management System as it applies to Level 2 EMTs
Level 3 – EMT	• Each exercise may include the participation of a Level 2 EMT and/or ORT • Usual duration – three to six hours • Designed to evaluate the EMT's ability to notify and activate team members, transfer command to a Level 3 EMT Emergency Command Centre and implement the Gorgon Emergency Management System as it applies to incident escalation

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

Response arrangements as detailed in the OPEP (Ref. 1) 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

8.4 Environmental monitoring and reporting

8.4.1 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 7 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. 2), which is identified as a control measure in Section 7.12 and Section 7.13.4. 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.

8.4.1.1 Marine fauna observations

The MFO contractor will develop a Marine Fauna Observer Operations Plan (or equivalent) and submit this to CAPL for review. The Marine Fauna Observer Operations Plan (or equivalent) will be in place prior to the commencement of the 4D MSS. The purpose of this plan is to describe the following:

- MFO responsibilities
- marine fauna observation requirements related to managing the impacts of underwater sound from the seismic sound source, including:
  - whale interaction and management requirements in accordance with EPBC Policy Statement 2.1 Standard Management Procedures, and any Additional Management Procedures adopted for use within this EP (Section 7.5)
  - marine turtles and Whale Shark interaction and management requirements in accordance with any control measures adopted for use within this EP (Section 7.5)
  - any marine fauna environmental performance standards and environmental performance outcomes defined within Section 7.5 of this EP
- awareness of the marine fauna interaction and action requirements related to other aspects (e.g., vessel strike from physical presence [Section 7.2], underwater sound from field support operations [Section 7.6]); noting that observations and records for these aspects are the responsibility of the vessel crew/s
- identify relevant species which could be expected to occur within the OA
- observation process
- mitigation actions
- communications protocol with vessel crew
- recording requirements[40] (i.e., use of the 'Cetacean Sightings Application' software, or equivalent data schema)
- reporting requirements[40], including:
  - preparation of daily reports during the 4D MSS
  - preparation of the compliance and sighting report as required under Standard Management Procedure A.4 of EPBC Policy Statement 2.1 following completion of the 4D MSS
  - preparation of a final marine fauna observation report following completion of the 4D MSS for submission to CAPL.

[40] Recording and reporting of marine fauna observations is to be consistent with the preferred approach as described in NOPSEMA’s *Recording and reporting MMO data* bulletin (Ref. 296).

8.4.2 Incident reporting

Environmental incidents will be reported by CAPL in accordance with Table 8-12.

Table 8-12: Incident reporting

<table>
<tr><th colspan="2">Recordable Incident reporting – Regulation 26B</th></tr>
<tr><td colspan="2">Legislative definition of ‘recordable incident’:
‘Recordable incident, for an activity, means a breach of an environmental performance outcome or environmental performance standard, in the environment plan that applies to the activity, that is not a reportable incident’
Recordable incidents are breaches of the environmental performance outcomes and standards described in Section 5.7.</td></tr>
<tr><th>Reporting requirements</th><th>Report to / Timing</th></tr>
<tr><td>Written notification to NOPSEMA by the 15th of each month
As a minimum, the written incident report must describe:
• the incidents and all material facts and circumstances concerning the incidents
• any actions taken to avoid or mitigate any adverse environmental impacts
• any corrective actions already taken, or that may be taken, to prevent a repeat of similar incidents.
If no recordable incidents occur during the reporting month, a ‘nil report’ will be submitted.</td><td>Submit written report to NOPSEMA by the 15th of each month</td></tr>
<tr><th colspan="2">Reportable Incident reporting – Regulations 26, 26A, and 26AA</th></tr>
<tr><td colspan="2">Legislative definition of ‘reportable incident’:
‘Reportable incident, for an activity means an incident relating to an activity that has caused, or has the potential to cause, moderate to significant environmental damage’.
Therefore, in alignment with Chevron Corporation’s Integrated Risk Prioritization Matrix (Table 5-1), ‘reportable incidents’ under this EP include those events (not planned activities) that have been risk assessed within Section 7 as having a consequence level between Moderate (4) and Catastrophic (1). In accordance with this definition, the reportable incidents with the potential to cause moderate to significant environmental damage identified under this EP are:
• introduction of an IMP (Section 7.7)
• unplanned release from a vessel collision event (Section 7.12).
Incident reporting is assessed on a case-by-case basis to determine if they trigger a reportable incident as defined by the OPGGS(E)R and this EP. Other incidents that may be considered reportable incidents include:
• loss of equipment resulting in damage or harm to the environment
• death or injury to individual(s) from an EPBC Act listed species
• an unplanned event within the Commonwealth Montebello Marine Park.</td></tr>
<tr><th>Reporting requirements</th><th>Report to</th></tr>
<tr><td>Verbal or written notification must be undertaken within two hours of the incident or as soon as practicable. This information is required:
• the incident and all material facts and circumstances known at the time
• any actions taken to avoid or mitigate any adverse environmental impacts.</td><td>Report verbally to NOPSEMA within two hours or as soon as practicable and provide written record of notification by email.
Phone: (08) 6461 7090
Email: submissions@nopsema.gov.au</td></tr>
</table>

Verbal notifications must be followed by a written report as soon as practicable, and not later than three days following the incident. At a minimum, the written incident report will include: • the incident and all material facts and circumstances • actions taken to avoid or mitigate any adverse environmental impacts • any corrective actions already taken, or that may be taken, to prevent a recurrence. If the initial notification of the reportable incident was verbal, this information must be included in the written report.	Written report to be provided to: • NOPSEMA: submissions@nopsema.gov.au • National Offshore Petroleum Titles Authority: info@nopta.gov.au
Additional Reporting Requirements	
Reporting requirements	**Report to**
An oil/gas pollution incident that occurs within a marine park or is likely to impact on a marine park. The notification should include: • titleholder details • time and location of the incident (including name of marine park likely to be affected) • proposed response arrangements as per the OPEP (e.g., dispersant, containment, etc.) • confirmation of providing access to relevant monitoring and evaluation reports when available • contact details for the response coordinator.	Report verbally to the DNP (24-hour) Marine Duty Officer as soon as practicable, and also provide a follow-up email. Phone: 0419 293 465 Email: marine.compliance@environment.gov.au
Death or injury to individual(s) from an EPBC Act Listed Species as a result of the petroleum activity	Report injury to or mortality of EPBC Act Listed Threatened or Migratory species within seven business days of observation to DCCEEW or equivalent: • Phone: +61 2 6274 1111 • Email: EPBC.Permits@environment.gov.au
Vessel collision with marine mammals (whales)	Reported as soon as practicable. https://data.marinemammals.gov.au/report/shipstrike
Presence of any suspected IMP or disease within 24 hours	DPIRD: • Email: biosecurity@fish.wa.gov.au • Phone: FishWatch 24-hour hotline: 1800 815 507
Unplanned release that is likely to impact land or water within Western Australian State jurisdiction	Reported as soon as practicable. petroleum.environment@dmirs.wa.gov.au
	Report verbally to the DoT MEER Duty Officer within two hours, and also provide a follow-up email with a POLREP attached. Phone: 08 948 9924

8.4.3 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 8-13. Routine notifications required by Regulations 29 and 30 of the OPGGS(E)R and also included in Table 8-13.

Table 8-13: 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
Compliance and sighting report	A report on the conduct of the survey, and any whale interactions, as per the requirements of Standard Management Procedure A.4 of EPBC Policy Statement 2.1. The report should include: • location, date, and start time of the survey • name, qualifications, and experience of any MFOs involved in the survey • location, times, and reasons when observations were hampered by poor visibility or high winds • location and time of any start-up delays, power downs or stop work procedures instigated as a result of whale sightings • location, time, and distance of any whale sighting including species where possible • date and time of survey completion.	DCCEEW sightingsdata@aad.gov.au	Within two months of survey completion
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
Notification of start of activity	CAPL must notify DNP at least 10 days before commencement of the activity within an AMP. The notification should include: • titleholder details	DNP: marineparks@environment.gov.au	Once prior to activity commencement within an AMP

Reporting requirement	Description	Reporting to	Timing
	• contact details for a titleholder representative • details of the OA and overlap with an AMP • name and IMO vessel number of vessel/s entering an AMP • type and duration of activity • link to activity summary on NOPSEMA website.		
Notification of start of activity	CAPL will provide DMIRS a pre-start notification confirming the start date of the proposed activity	DMIRS: Petroleum.environment@dmirs.wa.gov.au	Once prior to activity commencement
Notification of conclusion of activity	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
Notification of conclusion of activity	CAPL must notify DNP following completion of the activity within an AMP.	DNP: marineparks@environment.gov.au	Once post to activity completion within an AMP
Notification of conclusion of activity	CAPL must notify DMIRS following completion of the activity	DMIRS: Petroleum.environment@dmirs.wa.gov.au	Once post activity completion

8.5 Environment Plan review

If required, any revisions and/or resubmission of this EP to NOPSEMA, in accordance with Regulation 17 of the OPGGS(E)R, will be undertaken in accordance with the OEMS, and particularly the MoC process (Section 8.3.2.2).

9 abbreviations and definitions

Table 9-1 defines the acronyms and abbreviations used in this document.

Table 9-1: 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 Institute
API gravity	A specific gravity scale developed by the API
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
DAFF	(Commonwealth) Department of Agriculture, Fisheries and Forestry
DCCEEW	(Commonwealth) Department of Climate Change, Energy, the Environment and Water
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

Acronym/ Abbreviation	Definition
DP	Dynamic positioning
DPIRD	(Western Australia) Department of Primary Industries and Regional Development
EEA	Environmental exposure area
EIS	Environmental impact statement
EMBA	Environment that may be affected
EMT	Emergency Management Team
EP	Environment Plan
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
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
IMMR	Inspection, monitoring, maintenance, and repairs
IMR	Inspection, maintenance, and repairs
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

Acronym/ Abbreviation	Definition
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
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
MSS	Marine seismic survey
MSW	Managing safe work
N/A	Not applicable
NEBA	Net environmental benefit analysis
NEPA	National Environmental Protection Measure
NERA	National Energy Resources Australia
NMFS	National Marine Fisheries Service
NOAA	(United States) National Oceanic and Atmospheric Administration
NOPIMS	National Offshore Petroleum Information Management System
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

Acronym/ Abbreviation	Definition
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
OPEP	Oil Pollution Emergency Plan
OPGGS Act	*Offshore Petroleum and Greenhouse Gas Storage Act 2006* (Cth)
OPGGS(E)R	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Cth)
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
RRKAC	Robe River Kuruma Aboriginal Corporation
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

Acronym/ Abbreviation	Definition
SRD	Streamer recovery device
TEC	Threatened ecological community
TTS	Temporary threshold shift
UK	United Kingdom
VHF	Very high frequency radio
WA	Western Australia
WAC	Wirrawandi Aboriginal Corporation
WAFIC	Western Australian Fisheries Industry Council
YMAC	Yamatji Marlpa Aboriginal Corporation

10 references

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

Table 10-1: References

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appendix a operational excellence—policy 530

policy 530

operational excellence: achieving world-class performance

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

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

leadership and OE culture

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

focus areas and OE expectations

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

management system cycle

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

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

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

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

Environment: We protect the environment through responsible design, development, operations and asset retirement.

Efficiency: We use energy and resources efficiently to continually improve and drive value.

Security: We protect personnel, facilities, information, systems, business operations and our reputation. We proactively identify security risks, develop personnel and sustainable programs to mitigate those risks, and continually evaluate the effectiveness of these efforts.

Stakeholders: We engage stakeholders to foster trust, build relationships, and promote two-way dialogue to manage potential impacts and create business opportunities. We work with our stakeholders in a socially responsible and ethical manner, consistent with our respect for human rights, to create a safer, more inclusive business environment. We also work with our partners to responsibly manage Chevron's non-operated joint venture partnerships and third-party aviation and marine activities.

There are specific OE expectations which need to be met under each focus area. Additional expectations apply to all focus areas and address legal, regulatory and OE compliance; risk management; assurance; competency; learning; human performance; technology; product stewardship; contractor OE management; incident investigation and reporting; and emergency management.

Through disciplined application of the OEMS, we integrate OE processes, standards, procedures and behaviours into our daily operations. While leaders are responsible for managing the OEMS and enabling OE performance, every individual in Chevron's workforce is accountable for complying with the principles of 'Do it safely or not at all' and 'There is always time to do it right'.

Line management has the primary responsibility for complying with this policy and applicable legal requirements within their respective functions and authority limits. Line management will communicate this policy to their respective employees and will establish policies, processes, programs and standards consistent with expectations of the OEMS.

Employees are responsible for understanding the risks that they manage and the safeguards that need to be in place to mitigate those risks. Employees are responsible for taking action consistent with all Company policies, and laws applicable to their assigned duties and responsibilities. Accordingly, employees who are unsure of the legal or regulatory implications of their actions are responsible for seeking management or supervisory guidance.

M Hatfield

Mark Hatfield
Managing Director, Australasia Business Unit

the human energy company™

appendix b protected matters search reports

Australian Government
Department of Climate Change, Energy, the Environment and Water

Operational Area

EPBC Act Protected Matters Report

This report provides general guidance on matters of national environmental significance and other matters protected by the EPBC Act in the area you have selected. Please see the caveat for interpretation of information provided here.

Report created: 28-Mar-2023

Summary

Matters of National Environment 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 (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	24
Listed Migratory Species:	38

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 https://www.dcceew.gov.au/parks-heritage/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 Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	69
Whales and Other Cetaceans:	28
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	1
Habitat Critical to the Survival of Marine Turtles:	1

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	43
Key Ecological Features (Marine):	2
Biologically Important Areas:	8
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name
EEZ and Territorial Sea

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
FISH		
Thunnus maccoyii Southern Bluefin Tuna [69402]	Conservation Dependent	Breeding known to occur within area
MAMMAL		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
REPTILE		
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat likely to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
SHARK		

Scientific Name	Threatened Category	Presence Text
Carcharias taurus (west coast population)		
Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat likely to occur within area
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Pristis clavata		
Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis		
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area
Pristis zijsron		
Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sphyrna lewini		
Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
Anous stolidus		
Common Noddy [825]		Species or species habitat may occur within area
Calonectris leucomelas		
Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel		
Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor		
Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Macronectes giganteus		
Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Phaethon lepturus		
White-tailed Tropicbird [1014]		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

Scientific Name	Threatened Category	Presence Text
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
Megaptera novaeangliae Humpback Whale [38]		Breeding known to occur within area
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat likely to occur within area
Mobula birostris as Manta birostris Giant Manta Ray [90034]		Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sousa sahulensis as Sousa chinensis Australian Humpback Dolphin [87942]		Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species

[Resource Information]

Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area overfly marine area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine 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
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Fish		
Acentronura larsonae Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys latispinosus Muiron Island Pipefish [66196]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Doryrhamphus multiannulatus Many-banded Pipefish [66717]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Phoxocampus belcheri Black Rock Pipefish [66719]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Reptile		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Aipysurus tenuis Brown-lined Seasnake [1121]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Chitulia ornata as Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [87377]		Species or species habitat may 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

Scientific Name	Threatened Category	Presence Text
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Leioselasma czeblukovi as Hydrophis czeblukovi Fine-spined Seasnake, Geometrical Seasnake [87374]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and Other Cetaceans

[Resource Information]

Current Scientific Name	Status	Type of Presence
Mammal		
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
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia sima as Kogia simus Dwarf Sperm Whale [85043]		Species or species habitat may occur within area
Lagenodelphis hosei Fraser's Dolphin, Sarawak Dolphin [41]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]		Breeding known to occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Orcaella heinsohni as Orcaella brevirostris Australian Snubfin Dolphin [81322]		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 sahulensis as Sousa chinensis Australian Humpback Dolphin [87942]		Species or species habitat may occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat 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]

Park Name	Zone & IUCN Categories
Montebello	Multiple Use Zone (IUCN VI)

Habitat Critical to the Survival of Marine Turtles

Scientific Name	Behaviour	Presence
Aug - Sep		
Natator depressus Flatback Turtle [59257]	Nesting	Known to occur

Extra Information

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Project Highclere Cable Lay and Operation	2022/09203		Completed
Controlled action			
Construct and operate LNG & domestic gas plant including onshore and offshore facilities - Wheatston	2008/4469	Controlled Action	Post-Approval
Echo-Yodel Production Wells	2000/11	Controlled Action	Post-Approval
Equus Gas Fields Development Project, Carnarvon Basin	2012/6301	Controlled Action	Completed
Gorgon Gas Development	2003/1294	Controlled Action	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Gorgon Gas Development 4th Train Proposal	2011/5942	Controlled Action	Post-Approval
Pluto Gas Project	2005/2258	Controlled Action	Completed
Pluto Gas Project Including Site B	2006/2968	Controlled Action	Post-Approval
Not controlled action			
Echo A Development WA-23-L, WA-24-L	2005/2042	Not Controlled Action	Completed
Exploration of appraisal wells	2006/3065	Not Controlled Action	Completed
Project Highclere Geophysical Survey	2021/9023	Not Controlled Action	Completed
Telstra North Rankin Spur Fibre Optic Cable	2016/7836	Not Controlled Action	Completed
To construct and operate an offshore submarine fibre optic cable, WA	2014/7373	Not Controlled Action	Completed
Western Flank Gas Development	2005/2464	Not Controlled Action	Completed
Wheatstone 3D seismic survey, 70km north of Barrow Island	2004/1761	Not Controlled Action	Completed
Not controlled action (particular manner)			
'Tourmaline' 2D marine seismic survey, permit areas WA-323-P, WA-330-P and WA-32	2005/2282	Not Controlled Action (Particular Manner)	Post-Approval
"Leanne" offshore 3D seismic exploration, WA-356-P	2005/1938	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey in Permit Areas WA-15-R, WA-18-R, WA-205-P, WA-253-P, WA-267-P and WA-268-P	2003/1271	Not Controlled Action (Particular Manner)	Post-Approval
3D seismic survey	2006/2715	Not Controlled Action (Particular Manner)	Post-Approval
Aperio 3D Marine Seismic Survey, WA	2012/6648	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Balnaves Condensate Field Development	2011/6188	Not Controlled Action (Particular Manner)	Post-Approval
Cable Seismic Exploration Permit areas WA-323-P and WA-330-P	2008/4227	Not Controlled Action (Particular Manner)	Post-Approval
CGGVERITAS 2010 2D Seismic Survey	2010/5714	Not Controlled Action (Particular Manner)	Post-Approval
Cue Seismic Survey within WA-359-P, WA-361-P and WA-360-P	2007/3647	Not Controlled Action (Particular Manner)	Post-Approval
DAVROS MC 3D marine seismic survey northwaet of Dampier, WA	2013/7092	Not Controlled Action (Particular Manner)	Post-Approval
Deep Water Northwest Shelf 2D Seismic Survey	2007/3260	Not Controlled Action (Particular Manner)	Post-Approval
Demeter 3D Seismic Survey, off Dampier, WA	2002/900	Not Controlled Action (Particular Manner)	Post-Approval
Drilling 35-40 offshore exploration wells in deep water	2008/4461	Not Controlled Action (Particular Manner)	Post-Approval
Foxhound 3D Non-Exclusive Marine Seismic Survey	2009/4703	Not Controlled Action (Particular Manner)	Post-Approval
Greater Western Flank Phase 1 gas Development	2011/5980	Not Controlled Action (Particular Manner)	Post-Approval
Harmony 3D Marine Seismic Survey	2012/6699	Not Controlled Action (Particular Manner)	Post-Approval
Julimar Brunello Gas Development Project	2011/5936	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Klimt 2D Marine Seismic Survey	2007/3856	Not Controlled Action (Particular Manner)	Post-Approval
Moosehead 2D seismic survey within permit WA-192-P	2005/2167	Not Controlled Action (Particular Manner)	Post-Approval
Osprey and Dionysus Marine Seismic Survey	2011/6215	Not Controlled Action (Particular Manner)	Post-Approval
Rose 3D Seismic Program	2008/4239	Not Controlled Action (Particular Manner)	Post-Approval
Santos Winchester three dimensional seismic survey - WA-323-P & WA-330-P	2011/6107	Not Controlled Action (Particular Manner)	Post-Approval
West Panaeus 3D seismic survey	2006/3141	Not Controlled Action (Particular Manner)	Post-Approval
Westralia SPAN Marine Seismic Survey, WA & NT	2012/6463	Not Controlled Action (Particular Manner)	Post-Approval
Wheatstone 3D MAZ Marine Seismic Survey	2011/6058	Not Controlled Action (Particular Manner)	Post-Approval
Wheatstone Iago Appraisal Well Drilling	2008/4134	Not Controlled Action (Particular Manner)	Post-Approval
Wheatstone Iago Appraisal Well Drilling	2007/3941	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
Rose 3D Seismic acquisition survey	2008/4220	Referral Decision	Completed

Key Ecological Features [Resource Information]

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

Name	Region
Ancient coastline at 125 m depth contour	North-west
Continental Slope Demersal Fish Communities	North-west

Biologically Important Areas

Scientific Name	Behaviour	Presence
Marine Turtles		
Chelonia mydas		
Green Turtle [1765]	Internesting buffer	Known to occur
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Internesting buffer	Known to occur
Natator depressus		
Flatback Turtle [59257]	Internesting buffer	Known to occur
Seabirds		
Ardenna pacifica		
Wedge-tailed Shearwater [84292]	Breeding	Known to occur
Sharks		
Rhincodon typus		
Whale Shark [66680]	Foraging	Known to occur
Whales		
Balaenoptera musculus brevicauda		
Pygmy Blue Whale [81317]	Distribution	Known to occur
Balaenoptera musculus brevicauda		
Pygmy Blue Whale [81317]	Migration	Known to occur
Megaptera novaeangliae		
Humpback Whale [38]	Migration (north and south)	Known to occur

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and 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

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

Where little information is available for a 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 detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

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. Please see the caveat for interpretation of information provided here.

Report created: 28-Mar-2023

Summary

Matters of National Environment 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 (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	24
Listed Migratory Species:	39

Other Matters Protected by the EPBC Act

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

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at https://www.dcceew.gov.au/parks-heritage/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 Lands:	None
Commonwealth Heritage Places:	None
Listed Marine Species:	70
Whales and Other Cetaceans:	28
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	1
Habitat Critical to the Survival of Marine Turtles:	3

Extra Information

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

State and Territory Reserves:	None
Regional Forest Agreements:	None
Nationally Important Wetlands:	None
EPBC Act Referrals:	52
Key Ecological Features (Marine):	2
Biologically Important Areas:	8
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name
EEZ and Territorial Sea

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
FISH		

Scientific Name	Threatened Category	Presence Text
Thunnus maccoyii Southern Bluefin Tuna [69402]	Conservation Dependent	Breeding known to occur within area
MAMMAL		
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
REPTILE		
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat likely to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
SHARK		

Scientific Name	Threatened Category	Presence Text
Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sphyrna lewini Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

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

Scientific Name	Threatened Category	Presence Text
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
Phaethon lepturus White-tailed Tropicbird [1014]		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

Scientific Name	Threatened Category	Presence Text
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Dugong dugon Dugong [28]		Species or species habitat likely to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]		Breeding known to occur within area
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat likely to occur within area
Mobula birostris as Manta birostris Giant Manta Ray [90034]		Species or species habitat likely to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat may occur within area
Pristis zijsron Green Sawfish, Dindagubba, Narrowsnout Sawfish [68442]	Vulnerable	Species or species habitat known to occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Sousa sahulensis as Sousa chinensis Australian Humpback Dolphin [87942]		Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Anous stolidus Common Noddy [825]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat may occur within area overfly marine area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
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
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Phaethon lepturus fulvus Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
Fish		
Acentronura larsonae Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Choeroichthys latispinosus Muiron Island Pipefish [66196]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys flavofasciatus Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Cosmocampus banneri Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Doryrhamphus multiannulatus Many-banded Pipefish [66717]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area
Hippocampus spinosissimus Hedgehog Seahorse [66239]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Phoxocampus belcheri Black Rock Pipefish [66719]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammal		
Dugong dugon Dugong [28]		Species or species habitat likely to occur within area
Reptile		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Aipysurus tenuis Brown-lined Seasnake [1121]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area
Chitulia ornata as Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [87377]		Species or species habitat may occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat known to occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Leioselasma czeblukovi as Hydrophis czeblukovi Fine-spined Seasnake, Geometrical Seasnake [87374]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Congregation or aggregation known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and Other Cetaceans [Resource Information]

Current Scientific Name	Status	Type of Presence
Mammal		
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Balaenoptera borealis Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia sima as Kogia simus Dwarf Sperm Whale [85043]		Species or species habitat may occur within area
Lagenodelphis hosei Fraser's Dolphin, Sarawak Dolphin [41]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Megaptera novaeangliae Humpback Whale [38]		Breeding known to occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Orcaella heinsohni as Orcaella brevirostris Australian Snubfin Dolphin [81322]		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 sahulensis as Sousa chinensis Australian Humpback Dolphin [87942]		Species or species habitat may occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat may occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat likely to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Park Name	Zone & IUCN Categories
Montebello	Multiple Use Zone (IUCN VI)

Habitat Critical to the Survival of Marine Turtles

Scientific Name	Behaviour	Presence
Aug - Sep		
Natator depressus Flatback Turtle [59257]	Nesting	Known to occur
Dec - Jan		
Chelonia mydas Green Turtle [1765]	Nesting	Known to occur
Nov - May		
Eretmochelys imbricata Hawksbill Turtle [1766]	Nesting	Known to occur

Extra Information

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Project Highclere Cable Lay and Operation	2022/09203		Completed
Controlled action			
Construct and operate LNG & domestic gas plant including onshore and offshore facilities - Wheatston	2008/4469	Controlled Action	Post-Approval
Echo-Yodel Production Wells	2000/11	Controlled Action	Post-Approval
Equus Gas Fields Development Project, Carnarvon Basin	2012/6301	Controlled Action	Completed
Gorgon Gas Development	2003/1294	Controlled Action	Post-Approval
Gorgon Gas Development 4th Train Proposal	2011/5942	Controlled Action	Post-Approval
Pluto Gas Project	2005/2258	Controlled Action	Completed
Pluto Gas Project Including Site B	2006/2968	Controlled Action	Post-Approval
Not controlled action			
Construction and operation of an unmanned sea platform and connecting pipeline to Varanus Island for	2004/1703	Not Controlled Action	Completed
Development of Halyard Field off the west coast of WA	2010/5611	Not Controlled Action	Completed
Echo A Development WA-23-L, WA-24-L	2005/2042	Not Controlled Action	Completed
Exploration of appraisal wells	2006/3065	Not Controlled Action	Completed
Project Highclere Geophysical Survey	2021/9023	Not Controlled Action	Completed
Telstra North Rankin Spur Fibre Optic Cable	2016/7836	Not Controlled Action	Completed
To construct and operate an offshore submarine fibre optic	2014/7373	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
cable, WA			
Western Flank Gas Development	2005/2464	Not Controlled Action	Completed
Wheatstone 3D seismic survey, 70km north of Barrow Island	2004/1761	Not Controlled Action	Completed
Not controlled action (particular manner)			
'Tourmaline' 2D marine seismic survey, permit areas WA-323-P, WA-330-P and WA-32	2005/2282	Not Controlled Action (Particular Manner)	Post-Approval
"Leanne" offshore 3D seismic exploration, WA-356-P	2005/1938	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey in Permit Areas WA-15-R, WA-18-R, WA-205-P, WA-253-P, WA-267-P and WA-268-P	2003/1271	Not Controlled Action (Particular Manner)	Post-Approval
3D seismic survey	2006/2715	Not Controlled Action (Particular Manner)	Post-Approval
Aperio 3D Marine Seismic Survey, WA	2012/6648	Not Controlled Action (Particular Manner)	Post-Approval
Artemis-1 Drilling Program (WA-360-P)	2010/5432	Not Controlled Action (Particular Manner)	Post-Approval
Balnaves Condensate Field Development	2011/6188	Not Controlled Action (Particular Manner)	Post-Approval
Cable Seismic Exploration Permit areas WA-323-P and WA-330-P	2008/4227	Not Controlled Action (Particular Manner)	Post-Approval
CGGVERITAS 2010 2D Seismic Survey	2010/5714	Not Controlled Action (Particular Manner)	Post-Approval
Cue Seismic Survey within WA-359-P, WA-361-P and WA-360-P	2007/3647	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
DAVROS MC 3D marine seismic survey northwaet of Dampier, WA	2013/7092	Not Controlled Action (Particular Manner)	Post-Approval
Deep Water Northwest Shelf 2D Seismic Survey	2007/3260	Not Controlled Action (Particular Manner)	Post-Approval
Demeter 3D Seismic Survey, off Dampier, WA	2002/900	Not Controlled Action (Particular Manner)	Post-Approval
Drilling 35-40 offshore exploration wells in deep water	2008/4461	Not Controlled Action (Particular Manner)	Post-Approval
Exploration drilling of Zeus-1 well	2008/4351	Not Controlled Action (Particular Manner)	Post-Approval
Foxhound 3D Non-Exclusive Marine Seismic Survey	2009/4703	Not Controlled Action (Particular Manner)	Post-Approval
Greater Western Flank Phase 1 gas Development	2011/5980	Not Controlled Action (Particular Manner)	Post-Approval
Harmony 3D Marine Seismic Survey	2012/6699	Not Controlled Action (Particular Manner)	Post-Approval
John Ross & Rosella Off Bottom Cable Seismic Exploration Program	2008/3966	Not Controlled Action (Particular Manner)	Post-Approval
Julimar Brunello Gas Development Project	2011/5936	Not Controlled Action (Particular Manner)	Post-Approval
Klimt 2D Marine Seismic Survey	2007/3856	Not Controlled Action (Particular Manner)	Post-Approval
Moosehead 2D seismic survey within permit WA-192-P	2005/2167	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Osprey and Dionysus Marine Seismic Survey	2011/6215	Not Controlled Action (Particular Manner)	Post-Approval
Pomodoro 3D Marine Seismic Survey in WA-426-P and WA-427-P	2010/5472	Not Controlled Action (Particular Manner)	Post-Approval
Rose 3D Seismic Program	2008/4239	Not Controlled Action (Particular Manner)	Post-Approval
Santos Winchester three dimensional seismic survey - WA-323-P & WA-330-P	2011/6107	Not Controlled Action (Particular Manner)	Post-Approval
Triton 3D Marine Seismic Survey, WA-2-R and WA-3-R	2006/2609	Not Controlled Action (Particular Manner)	Post-Approval
West Anchor 3D Marine Seismic Survey	2008/4507	Not Controlled Action (Particular Manner)	Post-Approval
West Panaeus 3D seismic survey	2006/3141	Not Controlled Action (Particular Manner)	Post-Approval
Westralia SPAN Marine Seismic Survey, WA & NT	2012/6463	Not Controlled Action (Particular Manner)	Post-Approval
Wheatstone 3D MAZ Marine Seismic Survey	2011/6058	Not Controlled Action (Particular Manner)	Post-Approval
Wheatstone Iago Appraisal Well Drilling	2007/3941	Not Controlled Action (Particular Manner)	Post-Approval
Wheatstone Iago Appraisal Well Drilling	2008/4134	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			

Title of referral	Reference	Referral Outcome	Assessment Status
Referral decision			
3D Seismic Survey	2008/4219	Referral Decision	Completed
Rose 3D Seismic acquisition survey	2008/4220	Referral Decision	Completed

Key Ecological Features [Resource Information]

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

Name	Region
Ancient coastline at 125 m depth contour	North-west
Continental Slope Demersal Fish Communities	North-west

Biologically Important Areas

Scientific Name	Behaviour	Presence
Marine Turtles		
Chelonia mydas Green Turtle [1765]	Internesting buffer	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Internesting buffer	Known to occur
Natator depressus Flatback Turtle [59257]	Internesting buffer	Known to occur
Seabirds		
Ardenna pacifica Wedge-tailed Shearwater [84292]	Breeding	Known to occur
Sharks		
Rhincodon typus Whale Shark [66680]	Foraging	Known to occur
Whales		
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Distribution	Known to occur
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Migration	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Migration (north and	Known to occur

Scientific Name	Behaviour	Presence
	south)	

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and 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

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

Where little information is available for a 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 detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

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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Hydrocarbon Ecological and Social EMBAs

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. Please see the caveat for interpretation of information provided here.

Report created: 28-Mar-2023

Summary

Matters of National Environment 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 (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	1
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	47
Listed Migratory Species:	62

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 https://www.dcceew.gov.au/parks-heritage/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 Lands:	4
Commonwealth Heritage Places:	2
Listed Marine Species:	102
Whales and Other Cetaceans:	30
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	4
Habitat Critical to the Survival of Marine Turtles:	4

Extra Information

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

State and Territory Reserves:	15
Regional Forest Agreements:	None
Nationally Important Wetlands:	1
EPBC Act Referrals:	183
Key Ecological Features (Marine):	6
Biologically Important Areas:	34
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

World Heritage Properties

[Resource Information]

Name	State	Legal Status
The Ningaloo Coast	WA	Declared property

National Heritage Places

[Resource Information]

Name	State	Legal Status
Natural		
The Ningaloo Coast	WA	Listed place

Commonwealth Marine Area

[Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside a Commonwealth Marine Area but which has, may have or is likely to have a significant impact on the environment in the Commonwealth Marine Area.

Feature Name
EEZ and Territorial Sea

Listed Threatened Species

[Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
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
Charadrius leschenaultii		
Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Erythrotriorchis radiatus		
Red Goshawk [942]	Vulnerable	Species or species habitat may occur within area
Falco hypoleucos		
Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica menzbieri		
Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Critically Endangered	Species or species habitat known to occur within area
Macronectes giganteus		
Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Malurus leucopterus edouardi		
White-winged Fairy-wren (Barrow Island), Barrow Island Black-and-white Fairy-wren [26194]	Vulnerable	Species or species habitat likely to occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pezoporus occidentalis		
Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Phaethon lepturus fulvus		
Christmas Island White-tailed Tropicbird, Golden Bosunbird [26021]	Endangered	Species or species habitat may occur within area
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	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Thalassarche impavida		
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Species or species habitat may occur within area
FISH		
Milyeringa veritas		
Cape Range Cave Gudgeon, 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
Thunnus maccoyii		
Southern Bluefin Tuna [69402]	Conservation Dependent	Breeding known to occur within area
MAMMAL		
Balaenoptera borealis		
Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus		
Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Bettongia lesueur Barrow and Boodie Islands subspecies		
Boodie, Burrowing Bettong (Barrow and Boodie Islands) [88021]	Vulnerable	Species or species habitat known to occur within area
Dasyurus hallucatus		
Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat may occur within area
Eubalaena australis		
Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Isoodon auratus barrowensis		
Golden Bandicoot (Barrow Island) [66666]	Vulnerable	Species or species habitat known to occur within area
Lagorchestes conspicillatus conspicillatus		
Spectacled Hare-wallaby (Barrow Island) [66661]	Vulnerable	Species or species habitat known to occur within area
Lagorchestes hirsutus Central Australian subspecies		
Mala, Rufous Hare-Wallaby (Central Australia) [88019]	Endangered	Translocated population known to occur within area
Macroderma gigas		
Ghost Bat [174]	Vulnerable	Species or species habitat likely to occur within area
Osphranter robustus isabellinus		
Barrow Island Wallaroo, Barrow Island Euro [89262]	Vulnerable	Species or species habitat likely to occur within area
Petrogale lateralis lateralis		
Black-flanked Rock-wallaby, Moororong, Black-footed Rock Wallaby [66647]	Endangered	Species or species habitat known to occur within area
Rhinonicteris aurantia (Pilbara form)		
Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat known to occur within area
REPTILE		
Aipysurus apraefrontalis		
Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus foliosquama		
Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Ctenotus zastictus		
Hamelin Ctenotus [25570]	Vulnerable	Species or species habitat known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
SHARK		
Carcharias taurus (west coast population)		
Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Pristis clavata		
Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis		
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat likely 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
Sphyrna lewini		
Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat known to occur within area

Listed Migratory Species

[Resource Information]

Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
Anous stolidus		
Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus		
Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes		
Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area
Ardenna pacifica		
Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Calonectris leucomelas		
Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel		
Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor		
Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Hydroprogne caspia		
Caspian Tern [808]		Breeding known to occur within area
Macronectes giganteus		
Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Onychoprion anaethetus		
Bridled Tern [82845]		Breeding known to occur within area
Phaethon lepturus		
White-tailed Tropicbird [1014]		Species or species habitat known to occur within area
Sterna dougallii		
Roseate Tern [817]		Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Sternula albifrons Little Tern [82849]		Species or species habitat may occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	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
Migratory Marine Species		
Anoxypristis cuspidata Narrow Sawfish, Knifetooth Sawfish [68448]		Species or species habitat known to occur within area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	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

Scientific Name	Threatened Category	Presence Text
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	Species or species habitat known to occur within area
Dugong dugon Dugong [28]		Breeding known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Eubalaena australis as Balaena glacialis australis Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus Longfin Mako [82947]		Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]		Breeding known to occur within area
Mobula alfredi as Manta alfredi Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat known to occur within area
Mobula birostris as Manta birostris Giant Manta Ray [90034]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat likely 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 sahulensis as Sousa chinensis Australian Humpback Dolphin [87942]		Species or species habitat known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area
Calidris canutus Red Knot, Knot [855]	Endangered	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Charadrius 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
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Thalasseus bergii Greater Crested Tern [83000]		Breeding known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands [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.

Commonwealth Land Name	State
Defence	
Defence - EXMOUTH VLF TRANSMITTER STATION [50122]	WA
Defence - EXMOUTH VLF TRANSMITTER STATION [50123]	WA
Defence - LEARMONTH RADAR SITE - VLAMING HEAD EXMOUTH [50001]	WA
Unknown	
Commonwealth Land - [52236]	WA

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Natural		
Learmonth Air Weapons Range Facility	WA	Listed place
Ningaloo Marine Area - Commonwealth Waters	WA	Listed place

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Ardenna carneipes as Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area
Ardenna pacifica as Puffinus pacificus Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine 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 overfly marine area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat known to occur within area overfly marine 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 overfly marine area
Chroicocephalus novaehollandiae as Larus novaehollandiae Silver Gull [82326]		Breeding known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat known to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area
Glareola maldivarum Oriental Pratincole [840]		Species or species habitat may occur within area overfly marine area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundo rustica Barn Swallow [662]		Species or species habitat may occur within area overfly marine area
Hydroprogne caspia as Sterna caspia Caspian Tern [808]		Breeding known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]		Species or species habitat may occur within area overfly marine area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area
Motacilla cinerea Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Onychoprion anaethetus as Sterna anaethetus Bridled Tern [82845]		Breeding known to occur within area
Onychoprion fuscatus as Sterna fuscata Sooty Tern [90682]		Breeding known to occur within area
Pandion haliaetus Osprey [952]		Breeding known to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Phaethon lepturus fulvus		
Christmas Island White-tailed Tropicbird, Golden Bosunbird [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 as Rostratula benghalensis (sensu lato)		
Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area
Sterna dougallii		
Roseate Tern [817]		Breeding known to occur within area
Sternula albifrons as Sterna albifrons		
Little Tern [82849]		Species or species habitat may occur within area
Sternula nereis as Sterna nereis		
Fairy Tern [82949]		Breeding known to occur within area
Thalassarche carteri		
Indian Yellow-nosed Albatross [64464]	Vulnerable	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
Thalasseus bengalensis as Sterna bengalensis		
Lesser Crested Tern [66546]		Breeding known to occur within area
Thalasseus bergii as Sterna 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 overfly marine area
Fish		

Scientific Name	Threatened Category	Presence Text
Acentronura larsonae		
Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
Bulbonaricus brauni		
Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within area
Campichthys tricarinatus		
Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma		
Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys latispinosus		
Muiron Island Pipefish [66196]		Species or species habitat may occur within area
Choeroichthys suillus		
Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Corythoichthys flavofasciatus		
Reticulate Pipefish, Yellow-banded Pipefish, Network Pipefish [66200]		Species or species habitat may occur within area
Cosmocampus banneri		
Roughridge Pipefish [66206]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus		
Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus excisus		
Bluestripe Pipefish, Indian Blue-stripe Pipefish, Pacific Blue-stripe Pipefish [66211]		Species or species habitat may occur within area
Doryrhamphus janssi		
Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Doryrhamphus multiannulatus Many-banded Pipefish [66717]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
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 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

Scientific Name	Threatened Category	Presence Text
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
Mammal		
Dugong dugon Dugong [28]		Breeding known to occur within area
Reptile		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Aipysurus tenuis Brown-lined Seasnake [1121]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Chitulia ornata as Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [87377]		Species or species habitat may occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Hydrelaps darwiniensis Black-ringed Seasnake [1100]		Species or species habitat may occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Hydrophis macdowelli as Hydrophis mcdowelli Small-headed Seasnake [75601]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Leioselasma czeblukovi as Hydrophis czeblukovi		
Fine-spined Seasnake, Geometrical Seasnake [87374]		Species or species habitat may occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Pelamis platurus		
Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and Other Cetaceans

[Resource Information]

Current Scientific Name	Status	Type of Presence
Mammal		
Balaenoptera acutorostrata		
Minke Whale [33]		Species or species habitat may occur within area
Balaenoptera bonaerensis		
Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area
Balaenoptera borealis		
Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera edeni		
Bryde's Whale [35]		Species or species habitat likely to occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Migration route known to occur within area
Balaenoptera physalus		
Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Delphinus delphis		
Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis		
Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Feresa attenuata		
Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus		
Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Grampus griseus		
Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps		
Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia sima as Kogia simus		
Dwarf Sperm Whale [85043]		Species or species habitat may occur within area
Lagenodelphis hosei		
Fraser's Dolphin, Sarawak Dolphin [41]		Species or species habitat may occur within area
Megaptera novaeangliae		
Humpback Whale [38]		Breeding known to occur within area
Mesoplodon densirostris		
Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Orcaella heinsohni as Orcaella brevirostris		
Australian Snubfin Dolphin [81322]		Species or species habitat likely to occur within area
Orcinus orca		
Killer Whale, Orca [46]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
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 sahulensis as Sousa chinensis Australian Humpback Dolphin [87942]		Species or species habitat known to occur within area
Stenella attenuata Spotted Dolphin, Pantropical Spotted Dolphin [51]		Species or species habitat may occur within area
Stenella coeruleoalba Striped Dolphin, Euphrosyne Dolphin [52]		Species or species habitat may occur within area
Stenella longirostris Long-snouted Spinner Dolphin [29]		Species or species habitat may occur within area
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Australian Marine Parks [Resource Information]

Park Name	Zone & IUCN Categories
Gascoyne	Habitat Protection Zone (IUCN IV)
Gascoyne	Multiple Use Zone (IUCN VI)
Montebello	Multiple Use Zone (IUCN VI)
Ningaloo	Recreational Use Zone (IUCN IV)

Habitat Critical to the Survival of Marine Turtles

Scientific Name	Behaviour	Presence
Aug - Sep		
Natator depressus Flatback Turtle [59257]	Nesting	Known to occur
Dec - Jan		
Chelonia mydas Green Turtle [1765]	Nesting	Known to occur
Nov-Feb		
Caretta caretta Loggerhead Turtle [1763]	Nesting	Known to occur
Nov - May		
Eretmochelys imbricata Hawksbill Turtle [1766]	Nesting	Known to occur

Extra Information

State and Territory Reserves [Resource Information]

Protected Area Name	Reserve Type	State
Barrow Island	Nature Reserve	WA
Barrow Island	Marine Management Area	WA
Barrow Island	Marine Park	WA
Boodie, Double Middle Islands	Nature Reserve	WA

Protected Area Name	Reserve Type	State
Cape Range	National Park	WA
Jurabi Coastal Park	5(1)(h) Reserve	WA
Lowendal Islands	Nature Reserve	WA
Montebello Islands	Conservation Park	WA
Montebello Islands	Conservation Park	WA
Montebello Islands	Marine Park	WA
Muiron Islands	Nature Reserve	WA
Muiron Islands	Marine Management Area	WA
Ningaloo	Marine Park	WA
Unnamed WA40828	5(1)(h) Reserve	WA
Unnamed WA41080	5(1)(h) Reserve	WA

Nationally Important Wetlands

[Resource Information]

Wetland Name	State
Cape Range Subterranean Waterways	WA

EPBC Act Referrals

[Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Browse to North West Shelf Development, Indian Ocean, WA	2018/8319		Approval
Project Highclere Cable Lay and Operation	2022/09203		Completed
Action clearly unacceptable			
Highlands 3D Marine Seismic Survey	2012/6680	Action Clearly Unacceptable	Completed
Controlled action			
'Van Gogh' Petroleum Field Development	2007/3213	Controlled Action	Post-Approval
Construct and operate LNG & domestic gas plant including onshore and offshore facilities - Wheatston	2008/4469	Controlled Action	Post-Approval
Develop Jansz-Io deepwater gas field in Permit Areas WA-18-R, WA-25-R and WA-26-	2005/2184	Controlled Action	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Development of Angel gas and condensate field, North West Shelf	2004/1805	Controlled Action	Post-Approval
Development of Browse Basin Gas Fields (Upstream)	2008/4111	Controlled Action	Completed
Development of Coniston/Novara fields within the Exmouth Sub-basin	2011/5995	Controlled Action	Post-Approval
Development of Stybarrow petroleum field incl drilling and facility installation	2004/1469	Controlled Action	Post-Approval
Echo-Yodel Production Wells	2000/11	Controlled Action	Post-Approval
Enfield full field development	2001/257	Controlled Action	Post-Approval
Equus Gas Fields Development Project, Carnarvon Basin	2012/6301	Controlled Action	Completed
Gorgon Gas Development	2003/1294	Controlled Action	Post-Approval
Gorgon Gas Development 4th Train Proposal	2011/5942	Controlled Action	Post-Approval
Gorgon Gas Revised Development	2008/4178	Controlled Action	Post-Approval
Greater Enfield (Vincent) Development	2005/2110	Controlled Action	Post-Approval
Greater Gorgon Development - Optical Fibre Cable, Mainland to Barrow Island	2005/2141	Controlled Action	Completed
Light Crude Oil Production	2001/365	Controlled Action	Post-Approval
Ningaloo Lighthouse Development, 17km north west Exmouth, Western Australia	2020/8693	Controlled Action	Assessment Approach
Pluto Gas Project	2005/2258	Controlled Action	Completed
Pluto Gas Project Including Site B	2006/2968	Controlled Action	Post-Approval
Pyrenees Oil Fields Development	2005/2034	Controlled Action	Post-Approval
Simpson Development	2000/59	Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Simpson Oil Field Development	2001/227	Controlled Action	Post-Approval
The Scarborough Project - FLNG & assoc subsea infrastructure, Carnarvon Basin	2013/6811	Controlled Action	Post-Approval
Vincent Appraisal Well	2000/22	Controlled Action	Post-Approval
Yardie Creek Road Realignment Project	2021/8967	Controlled Action	Assessment Approach
Not controlled action			
'Goodwyn A' Low Pressure Train Project	2003/914	Not Controlled Action	Completed
'Van Gogh' Oil Appraisal Drilling Program, Exploration Permit Area WA-155-P(1)	2006/3148	Not Controlled Action	Completed
Barrow Island 2D Seismic survey	2006/2667	Not Controlled Action	Completed
Bollinger 2D Seismic Survey 200km North of North West Cape WA	2004/1868	Not Controlled Action	Completed
Bultaco-2, Laverda-2, Laverda-3 and Montesa-2 Appraisal Wells	2000/103	Not Controlled Action	Completed
Carnarvon 3D Marine Seismic Survey	2004/1890	Not Controlled Action	Completed
Cazadores 2D seismic survey	2004/1720	Not Controlled Action	Completed
Construction and operation of an unmanned sea platform and connecting pipeline to Varanus Island for	2004/1703	Not Controlled Action	Completed
Controlled Source Electromagnetic Survey	2007/3262	Not Controlled Action	Completed
Development of Halyard Field off the west coast of WA	2010/5611	Not Controlled Action	Completed
Development of Mutineer and Exeter petroleum fields for oil production, Permit	2003/1033	Not Controlled Action	Completed
Drilling of an exploration well Gats-1 in Permit Area WA-261-P	2004/1701	Not Controlled Action	Completed
Eagle-1 Exploration Drilling, North West Shelf, WA	2019/8578	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Echo A Development WA-23-L, WA-24-L	2005/2042	Not Controlled Action	Completed
Exploration drilling well WA-155-P(1)	2003/971	Not Controlled Action	Completed
Exploration of appraisal wells	2006/3065	Not Controlled Action	Completed
Exploration Well in Permit Area WA-155-P(1)	2002/759	Not Controlled Action	Completed
Exploratory drilling in permit area WA-225-P	2001/490	Not Controlled Action	Completed
Extension of Simpson Oil Platforms & Wells	2002/685	Not Controlled Action	Completed
HCA05X Macedon Experimental Survey	2004/1926	Not Controlled Action	Completed
Hess Exploration Drilling Programme	2007/3566	Not Controlled Action	Completed
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed
Infill Production Well (Griffin-9)	2001/417	Not Controlled Action	Completed
Jansz-2 and 3 Appraisal Wells	2002/754	Not Controlled Action	Completed
Klammer 2D Seismic Survey	2002/868	Not Controlled Action	Completed
Maia-Gaea Exploration wells	2000/17	Not Controlled Action	Completed
Montesa-1 and Bultaco-1 Exploration Wells	2000/102	Not Controlled Action	Completed
North Rankin B gas compression facility	2005/2500	Not Controlled Action	Completed
Pipeline System Modifications Project	2000/3	Not Controlled Action	Completed
Project Highclere Geophysical Survey	2021/9023	Not Controlled Action	Completed
Searipple gas and condensate field development	2000/89	Not Controlled Action	Completed
Spool Base Facility	2001/263	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Subsea Gas Pipeline From Stybarrow Field to Griffin Venture Gas Export Pipeline	2005/2033	Not Controlled Action	Completed
sub-sea tieback of Perseus field wells	2004/1326	Not Controlled Action	Completed
Telstra North Rankin Spur Fibre Optic Cable	2016/7836	Not Controlled Action	Completed
To construct and operate an offshore submarine fibre optic cable, WA	2014/7373	Not Controlled Action	Completed
Wanda Offshore Research Project, 80 km north-east of Exmouth, WA	2018/8293	Not Controlled Action	Completed
Western Flank Gas Development	2005/2464	Not Controlled Action	Completed
Wheatstone 3D seismic survey, 70km north of Barrow Island	2004/1761	Not Controlled Action	Completed
Not controlled action (particular manner)			
'Kate' 3D marine seismic survey, exploration permits WA-320-P and WA-345-P, 60km	2005/2037	Not Controlled Action (Particular Manner)	Post-Approval
'Tourmaline' 2D marine seismic survey, permit areas WA-323-P, WA-330-P and WA-32	2005/2282	Not Controlled Action (Particular Manner)	Post-Approval
"Leanne" offshore 3D seismic exploration, WA-356-P	2005/1938	Not Controlled Action (Particular Manner)	Post-Approval
2D and 3D seismic surveys	2005/2151	Not Controlled Action (Particular Manner)	Post-Approval
2D marine seismic survey	2012/6296	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Survey	2005/2146	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Survey Permit Area WA-352-P	2008/4628	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
2D seismic survey within permit WA-291	2007/3265	Not Controlled Action (Particular Manner)	Post-Approval
3D marine seismic survey	2008/4281	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey (WA-482-P, WA-363-P), WA	2013/6761	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey in Permit Areas WA-15-R, WA-18-R, WA-205-P, WA-253-P, WA-267-P and WA-268-P	2003/1271	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Survey in WA 457-P & WA 458-P, North West Shelf, offshore WA	2013/6862	Not Controlled Action (Particular Manner)	Post-Approval
3D marine seismic survey over petroleum title WA-268-P	2007/3458	Not Controlled Action (Particular Manner)	Post-Approval
3D Marine Seismic Surveys - Contos CT-13 & Supertubes CT-13, offshore WA	2013/6901	Not Controlled Action (Particular Manner)	Post-Approval
3D seismic survey	2006/2715	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey, WA	2008/4428	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey in the Carnarvon Bsin on the North West Shelf	2002/778	Not Controlled Action (Particular Manner)	Post-Approval
3D sesmic survey	2006/2781	Not Controlled Action (Particular Manner)	Post-Approval
Agrippina 3D Seismic Marine Survey	2009/5212	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Apache Northwest Shelf Van Gogh Field Appraisal Drilling Program	2007/3495	Not Controlled Action (Particular Manner)	Post-Approval
Aperio 3D Marine Seismic Survey, WA	2012/6648	Not Controlled Action (Particular Manner)	Post-Approval
Artemis-1 Drilling Program (WA-360-P)	2010/5432	Not Controlled Action (Particular Manner)	Post-Approval
Babylon 3D Marine Seismic Survey, Commonwealth Waters, nr Exmouth WA	2013/7081	Not Controlled Action (Particular Manner)	Post-Approval
Balnaves Condensate Field Development	2011/6188	Not Controlled Action (Particular Manner)	Post-Approval
Bonaventure 3D seismic survey	2006/2514	Not Controlled Action (Particular Manner)	Post-Approval
Cable Seismic Exploration Permit areas WA-323-P and WA-330-P	2008/4227	Not Controlled Action (Particular Manner)	Post-Approval
CGGVERITAS 2010 2D Seismic Survey	2010/5714	Not Controlled Action (Particular Manner)	Post-Approval
Charon 3D Marine Seismic Survey	2007/3477	Not Controlled Action (Particular Manner)	Post-Approval
Consturction & operation of the Varanus Island kitchen & mess cyclone refuge building, compression p	2013/6952	Not Controlled Action (Particular Manner)	Post-Approval
Coverack Marine Seismic Survey	2001/399	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Cue Seismic Survey within WA-359-P, WA-361-P and WA-360-P	2007/3647	Not Controlled Action (Particular Manner)	Post-Approval
CVG 3D Marine Seismic Survey	2012/6654	Not Controlled Action (Particular Manner)	Post-Approval
DAVROS MC 3D marine seismic survey northwaet of Dampier, WA	2013/7092	Not Controlled Action (Particular Manner)	Post-Approval
Decommissioning of the Legendre facilities	2010/5681	Not Controlled Action (Particular Manner)	Post-Approval
Deep Water Drilling Program	2010/5532	Not Controlled Action (Particular Manner)	Post-Approval
Deep Water Northwest Shelf 2D Seismic Survey	2007/3260	Not Controlled Action (Particular Manner)	Post-Approval
Demeter 3D Seismic Survey, off Dampier, WA	2002/900	Not Controlled Action (Particular Manner)	Post-Approval
Draeck 3D Marine Seismic Survey, WA-205-P	2006/3067	Not Controlled Action (Particular Manner)	Post-Approval
Drilling 35-40 offshore exploration wells in deep water	2008/4461	Not Controlled Action (Particular Manner)	Post-Approval
Earthworks for kitchen/mess, cyclone refuge building & Compression Plant, Varanus Island	2013/6900	Not Controlled Action (Particular Manner)	Post-Approval
Eendracht Multi-Client 3D Marine Seismic Survey	2009/4749	Not Controlled Action (Particular Manner)	Post-Approval
Effect of marine seismic sounds to demersal fish and pearl oysters, north-west WA	2018/8169	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Enfield M3 & Vincent 4D Marine Seismic Surveys	2008/3981	Not Controlled Action (Particular Manner)	Completed
Enfield M3 4D, Vincent 4D & 4D Line Test Marine Seismic Surveys	2008/4122	Not Controlled Action (Particular Manner)	Post-Approval
Enfield M4 4D Marine Seismic Survey	2008/4558	Not Controlled Action (Particular Manner)	Post-Approval
Enfield oilfield 3D Seismic Survey	2006/3132	Not Controlled Action (Particular Manner)	Post-Approval
Exmouth West 2D Marine Seismic Survey	2008/4132	Not Controlled Action (Particular Manner)	Post-Approval
Exploration drilling of Zeus-1 well	2008/4351	Not Controlled Action (Particular Manner)	Post-Approval
Fletcher-Finucane Development, WA26-L and WA191-P	2011/6123	Not Controlled Action (Particular Manner)	Post-Approval
Foxhound 3D Non-Exclusive Marine Seismic Survey	2009/4703	Not Controlled Action (Particular Manner)	Post-Approval
Gazelle 3D Marine Seismic Survey in WA-399-P and WA-42-L	2010/5570	Not Controlled Action (Particular Manner)	Post-Approval
Geco Eagle 3D Marine Seismic Survey	2008/3958	Not Controlled Action (Particular Manner)	Post-Approval
Glencoe 3D Marine Seismic Survey WA-390-P	2007/3684	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Greater Western Flank Phase 1 gas Development	2011/5980	Not Controlled Action (Particular Manner)	Post-Approval
Grimalkin 3D Seismic Survey	2008/4523	Not Controlled Action (Particular Manner)	Post-Approval
Guacamole 2D Marine Seismic Survey	2008/4381	Not Controlled Action (Particular Manner)	Post-Approval
Harmony 3D Marine Seismic Survey	2012/6699	Not Controlled Action (Particular Manner)	Post-Approval
Harpy 1 exploration well	2001/183	Not Controlled Action (Particular Manner)	Post-Approval
Honeycombs MC3D Marine Seismic Survey	2012/6368	Not Controlled Action (Particular Manner)	Post-Approval
Huzzas MC3D Marine Seismic Survey (HZ-13) Carnarvon Basin, offshore WA	2013/7003	Not Controlled Action (Particular Manner)	Post-Approval
Huzzas phase 2 marine seismic survey, Exmouth Plateau, Northern Carnarvon Basin, WA	2013/7093	Not Controlled Action (Particular Manner)	Post-Approval
John Ross & Rosella Off Bottom Cable Seismic Exploration Program	2008/3966	Not Controlled Action (Particular Manner)	Post-Approval
Judo Marine 3D Seismic Survey within and adjacent to WA-412-P	2008/4630	Not Controlled Action (Particular Manner)	Post-Approval
Judo Marine 3D Seismic Survey within and adjacent to WA-412-P	2009/4801	Not Controlled Action (Particular Manner)	Post-Approval
Julimar Brunello Gas Development Project	2011/5936	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Klimt 2D Marine Seismic Survey	2007/3856	Not Controlled Action (Particular Manner)	Post-Approval
Laverda 3D Marine Seismic Survey and Vincent M1 4D Marine Seismic Survey	2010/5415	Not Controlled Action (Particular Manner)	Post-Approval
Leopard 2D marine seismic survey	2005/2290	Not Controlled Action (Particular Manner)	Post-Approval
Lion 2D Marine Seismic Survey	2007/3777	Not Controlled Action (Particular Manner)	Post-Approval
Macedon Gas Field Development	2008/4605	Not Controlled Action (Particular Manner)	Post-Approval
Marine reconnaissance survey	2008/4466	Not Controlled Action (Particular Manner)	Post-Approval
Moosehead 2D seismic survey within permit WA-192-P	2005/2167	Not Controlled Action (Particular Manner)	Post-Approval
Munmorah 2D seismic survey within permits WA-308/9-P	2003/970	Not Controlled Action (Particular Manner)	Post-Approval
Ocean Bottom Cable Seismic Program, WA-264-P	2007/3844	Not Controlled Action (Particular Manner)	Post-Approval
Ocean Bottom Cable Seismic Survey	2005/2017	Not Controlled Action (Particular Manner)	Post-Approval
Offshore Drilling Campaign	2011/5830	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Orcus 3D Marine Seismic Survey in WA-450-P	2010/5723	Not Controlled Action (Particular Manner)	Post-Approval
Osprey and Dionysus Marine Seismic Survey	2011/6215	Not Controlled Action (Particular Manner)	Post-Approval
Palta-1 exploration well in Petroleum Permit Area WA-384-P	2011/5871	Not Controlled Action (Particular Manner)	Post-Approval
Pomodoro 3D Marine Seismic Survey in WA-426-P and WA-427-P	2010/5472	Not Controlled Action (Particular Manner)	Post-Approval
Pyrenees 4D Marine Seismic Monitor Survey, HCA12A	2012/6579	Not Controlled Action (Particular Manner)	Post-Approval
Pyrenees-Macedon 3D marine seismic survey	2005/2325	Not Controlled Action (Particular Manner)	Post-Approval
Reindeer gas reservior development, Devil Creek, Carnarvon Basin - WA	2007/3917	Not Controlled Action (Particular Manner)	Post-Approval
Rose 3D Seismic Program	2008/4239	Not Controlled Action (Particular Manner)	Post-Approval
Rydal-1 Petroleum Exploration Well, WA	2012/6522	Not Controlled Action (Particular Manner)	Post-Approval
Salsa 3D Marine Seismic Survey	2010/5629	Not Controlled Action (Particular Manner)	Post-Approval
Santos Winchester three dimensional seismic survey - WA-323-P & WA-330-P	2011/6107	Not Controlled Action (Particular Manner)	Post-Approval
Skorpion Marine Seismic Survey WA	2001/416	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Sovereign 3D Marine Seismic Survey	2011/5861	Not Controlled Action (Particular Manner)	Post-Approval
Stag 4D & Reindeer MAZ Marine Seismic Surveys, WA	2013/7080	Not Controlled Action (Particular Manner)	Post-Approval
Stag Off-bottom Cable Seismic Survey	2007/3696	Not Controlled Action (Particular Manner)	Post-Approval
Stybarrow 4D Marine Seismic Survey	2011/5810	Not Controlled Action (Particular Manner)	Post-Approval
Stybarrow Baseline 4D marine seismic survey	2008/4530	Not Controlled Action (Particular Manner)	Post-Approval
Tantabiddi Boat Ramp Sand Bypassing	2015/7411	Not Controlled Action (Particular Manner)	Post-Approval
Tidepole Maz 3D Seismic Survey Campaign	2007/3706	Not Controlled Action (Particular Manner)	Post-Approval
Tortilla 2D Seismic Survey, WA	2011/6110	Not Controlled Action (Particular Manner)	Post-Approval
Triton 3D Marine Seismic Survey, WA-2-R and WA-3-R	2006/2609	Not Controlled Action (Particular Manner)	Post-Approval
Undertake a 3D marine seismic survey	2010/5695	Not Controlled Action (Particular Manner)	Post-Approval
Undertake a three dimensional marine seismic survey	2010/5679	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Undertake a three dimensional marine seismic survey	2010/5715	Not Controlled Action (Particular Manner)	Post-Approval
Vincent M1 and Enfield M5 4D Marine Seismic Survey	2010/5720	Not Controlled Action (Particular Manner)	Post-Approval
Warramunga Non-Inclusive 3D Seismic Survey	2008/4553	Not Controlled Action (Particular Manner)	Post-Approval
West Anchor 3D Marine Seismic Survey	2008/4507	Not Controlled Action (Particular Manner)	Post-Approval
West Panaeus 3D seismic survey	2006/3141	Not Controlled Action (Particular Manner)	Post-Approval
Westralia SPAN Marine Seismic Survey, WA & NT	2012/6463	Not Controlled Action (Particular Manner)	Post-Approval
Wheatstone 3D MAZ Marine Seismic Survey	2011/6058	Not Controlled Action (Particular Manner)	Post-Approval
Wheatstone Iago Appraisal Well Drilling	2007/3941	Not Controlled Action (Particular Manner)	Post-Approval
Wheatstone Iago Appraisal Well Drilling	2008/4134	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
3D Seismic Survey	2008/4219	Referral Decision	Completed
Bianchi 3D Marine Seismic Survey, Carnavon Basin, WA	2013/7078	Referral Decision	Completed
CVG 3D Marine Seismic Survey	2012/6270	Referral Decision	Completed
Enfield 4D Marine Seismic Surveys, Production Permit WA-28-L	2005/2370	Referral Decision	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Referral decision			
Rose 3D Seismic acquisition survey	2008/4220	Referral Decision	Completed
Stybarrow Baseline 4D Marine Seismic Survey (Permit Areas WA-255-P, WA-32-L, WA-	2008/4165	Referral Decision	Completed
Two Dimensional Transition Zone Seismic Survey - TP/7 (R1)	2010/5507	Referral Decision	Completed
Varanus Island Compression Project	2012/6698	Referral Decision	Completed

Key Ecological Features [Resource Information]

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

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

Biologically Important Areas

Scientific Name	Behaviour	Presence
Dugong		
Dugong dugon Dugong [28]	Breeding	Known to occur
Dugong dugon Dugong [28]	Calving	Known to occur
Dugong dugon Dugong [28]	Foraging (high density seagrass beds)	Known to occur
Dugong dugon Dugong [28]	Nursing	Known to occur

Scientific Name	Behaviour	Presence
Marine Turtles		
Caretta caretta Loggerhead Turtle [1763]	Internesting buffer	Known to occur
Caretta caretta Loggerhead Turtle [1763]	Nesting	Known to occur
Chelonia mydas Green Turtle [1765]	Aggregation	Known to occur
Chelonia mydas Green Turtle [1765]	Basking	Known to occur
Chelonia mydas Green Turtle [1765]	Foraging	Known to occur
Chelonia mydas Green Turtle [1765]	Internesting	Known to occur
Chelonia mydas Green Turtle [1765]	Internesting buffer	Known to occur
Chelonia mydas Green Turtle [1765]	Mating	Known to occur
Chelonia mydas Green Turtle [1765]	Nesting	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Foraging	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Internesting	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Internesting buffer	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Mating	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Nesting	Known to occur

Scientific Name	Behaviour	Presence
Natator depressus Flatback Turtle [59257]	Aggregation	Known to occur
Natator depressus Flatback Turtle [59257]	Foraging	Known to occur
Natator depressus Flatback Turtle [59257]	Internesting	Known to occur
Natator depressus Flatback Turtle [59257]	Internesting buffer	Known to occur
Natator depressus Flatback Turtle [59257]	Mating	Known to occur
Natator depressus Flatback Turtle [59257]	Nesting	Known to occur
Seabirds		
Ardenna pacifica Wedge-tailed Shearwater [84292]	Breeding	Known to occur
Sterna dougallii Roseate Tern [817]	Breeding	Known to occur
Sternula nereis Fairy Tern [82949]	Breeding	Known to occur
Thalasseus bengalensis Lesser Crested Tern [66546]	Breeding	Known to occur
Sharks		
Rhincodon typus Whale Shark [66680]	Foraging	Known to occur
Rhincodon typus Whale Shark [66680]	Foraging (high density prey)	Known to occur
Whales		
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Distribution	Known to occur

Scientific Name	Behaviour	Presence
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Foraging	Known to occur
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Migration	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Migration (north and south)	Known to occur

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and 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

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

Where little information is available for a 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 detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

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. Please see the caveat for interpretation of information provided here.

Report created: 27-Jun-2023

Summary

Matters of National Environment 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 (Ramsar	None
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	None
Listed Threatened Ecological Communities:	None
Listed Threatened Species:	41
Listed Migratory Species:	54

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 https://www.dcceew.gov.au/parks-heritage/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 Lands:	3
Commonwealth Heritage Places:	1
Listed Marine Species:	90
Whales and Other Cetaceans:	16
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	4

Extra Information

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

State and Territory Reserves:	5
Regional Forest Agreements:	None
Nationally Important Wetlands:	1
EPBC Act Referrals:	11
Key Ecological Features (Marine):	None
Biologically Important Areas:	28
Bioregional Assessments:	None
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

World Heritage Properties [Resource Information]

Name	State	Legal Status
The Ningaloo Coast	WA	Declared property

National Heritage Places [Resource Information]

Name	State	Legal Status
Natural		
The Ningaloo Coast	WA	Listed place

Listed Threatened Species [Resource Information]

Status of Conservation Dependent and Extinct are not MNES under the EPBC Act.
Number is the current name ID.

Scientific Name	Threatened Category	Presence Text
BIRD		
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
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat may occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Limosa lapponica menzbieri Northern Siberian Bar-tailed Godwit, Russkoye Bar-tailed Godwit [86432]	Critically Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
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 known to occur within area
Pezoporus occidentalis		
Night Parrot [59350]	Endangered	Species or species habitat may occur within area
Pterodroma mollis		
Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Rostratula australis		
Australian Painted Snipe [77037]	Endangered	Species or species habitat 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	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
FISH		
Milyeringa veritas		
Cape Range Cave Gudgeon, 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
Thunnus maccoyii		
Southern Bluefin Tuna [69402]	Conservation Dependent	Species or species habitat likely to occur within area
MAMMAL		

Scientific Name	Threatened Category	Presence Text
Balaenoptera borealis		
Sei Whale [34]	Vulnerable	Species or species habitat likely to occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus		
Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Bettongia lesueur Barrow and Boodie Islands subspecies		
Boodie, Burrowing Bettong (Barrow and Boodie Islands) [88021]	Vulnerable	Translocated population known to occur within area
Dasyurus hallucatus		
Northern Quoll, Digul [Gogo-Yimidir], Wijingadda [Dambimangari], Wiminji [Martu] [331]	Endangered	Species or species habitat may occur within area
Eubalaena australis		
Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Isoodon auratus barrowensis		
Golden Bandicoot (Barrow Island) [66666]	Vulnerable	Species or species habitat known to occur within area
Macroderma gigas		
Ghost Bat [174]	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
Rhinonicteris aurantia (Pilbara form)		
Pilbara Leaf-nosed Bat [82790]	Vulnerable	Species or species habitat may occur within area
REPTILE		
Aipysurus apraefrontalis		
Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
SHARK		
Carcharias taurus (west coast population) Grey Nurse Shark (west coast population) [68752]	Vulnerable	Species or species habitat known to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Pristis clavata Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat likely 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
Sphyrna lewini Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat likely to occur within area

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat may occur within area
Ardenna pacifica Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Hydroprogne caspia Caspian Tern [808]		Breeding known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Sterna dougallii Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
Sternula albifrons		
Little Tern [82849]		Species or species habitat may occur within area
Thalassarche carteri		
Indian Yellow-nosed Albatross [64464]	Vulnerable	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
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 may occur within area
Balaenoptera musculus		
Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus		
Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Carcharhinus longimanus		
Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Species or species habitat known to occur within area
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Dugong dugon		
Dugong [28]		Breeding known to occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Eubalaena australis as Balaena glacialis australis		
Southern Right Whale [40]	Endangered	Species or species habitat likely to occur within area
Lamna nasus		
Porbeagle, Mackerel Shark [83288]		Species or species habitat may occur within area
Megaptera novaeangliae		
Humpback Whale [38]		Breeding known to occur within area
Mobula alfredi as Manta alfredi		
Reef Manta Ray, Coastal Manta Ray [90033]		Species or species habitat known to occur within area
Mobula birostris as Manta birostris		
Giant Manta Ray [90034]		Species or species habitat known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Orcaella heinsohni		
Australian Snubfin Dolphin [81322]		Species or species habitat likely to occur within area
Orcinus orca		
Killer Whale, Orca [46]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Pristis clavata		
Dwarf Sawfish, Queensland Sawfish [68447]	Vulnerable	Species or species habitat known to occur within area
Pristis pristis		
Freshwater Sawfish, Largetooth Sawfish, River Sawfish, Leichhardt's Sawfish, Northern Sawfish [60756]	Vulnerable	Species or species habitat likely 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 sahulensis as Sousa chinensis		
Australian Humpback Dolphin [87942]		Species or species habitat known to occur within area
Tursiops aduncus (Arafura/Timor Sea populations)		
Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area
Migratory Terrestrial Species		
Hirundo rustica		
Barn Swallow [662]		Species or species habitat may occur within area
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat known to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
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 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
Glareola maldivarum		
Oriental Pratincole [840]		Species or species habitat may occur within area
Limosa lapponica		
Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pandion haliaetus		
Osprey [952]		Breeding known to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area

Other Matters Protected by the EPBC Act

Commonwealth Lands [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.

Commonwealth Land Name	State
Defence	
Defence - EXMOUTH VLF TRANSMITTER STATION [50123]	WA
Defence - LEARMONTH - AIR WEAPONS RANGE [50193]	WA
Unknown	
Commonwealth Land - [52236]	WA

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Natural		
Learmonth Air Weapons Range Facility	WA	Listed place

Listed Marine Species [Resource Information]

Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area
Ardenna carneipes as Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat may occur within area
Ardenna pacifica as Puffinus pacificus Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine 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 overfly marine area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area overfly marine area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Chalcites osculans as Chrysococcyx osculans Black-eared Cuckoo [83425]		Species or species habitat likely to occur within area overfly marine 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 overfly marine area
Chroicocephalus novaehollandiae as Larus novaehollandiae Silver Gull [82326]		Breeding known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Glareola maldivarum		
Oriental Pratincole [840]		Species or species habitat may occur within area overfly marine area
Haliaeetus leucogaster		
White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area
Hirundo rustica		
Barn Swallow [662]		Species or species habitat may occur within area overfly marine area
Hydroprogne caspia as Sterna caspia		
Caspian Tern [808]		Breeding known to occur within area
Limosa lapponica		
Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Macronectes giganteus		
Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Merops ornatus		
Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area
Motacilla cinerea		
Grey Wagtail [642]		Species or species habitat may occur within area overfly marine area
Motacilla flava		
Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area
Numenius madagascariensis		
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Onychoprion fuscatus as Sterna fuscata		
Sooty Tern [90682]		Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Pandion haliaetus		
Osprey [952]		Breeding known to occur within area
Phaethon lepturus		
White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Pterodroma mollis		
Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Rostratula australis as Rostratula benghalensis (sensu lato)		
Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area
Sterna dougallii		
Roseate Tern [817]		Foraging, feeding or related behaviour likely to occur within area
Sternula albifrons as Sterna albifrons		
Little Tern [82849]		Species or species habitat may occur within area
Sternula nereis as Sterna nereis		
Fairy Tern [82949]		Breeding known to occur within area
Thalassarche carteri		
Indian Yellow-nosed Albatross [64464]	Vulnerable	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
Thalasseus bengalensis as Sterna bengalensis		
Lesser Crested Tern [66546]		Breeding known to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]		Species or species habitat likely to occur within area overfly marine area
Fish		

Scientific Name	Threatened Category	Presence Text
Acentronura larsonae Helen's Pygmy Pipehorse [66186]		Species or species habitat may occur within area
Bulbonaricus brauni Braun's Pughead Pipefish, Pug-headed Pipefish [66189]		Species or species habitat may occur within area
Campichthys tricarinatus Three-keel Pipefish [66192]		Species or species habitat may occur within area
Choeroichthys brachysoma Pacific Short-bodied Pipefish, Short-bodied Pipefish [66194]		Species or species habitat may occur within area
Choeroichthys latispinosus Muiron Island Pipefish [66196]		Species or species habitat may occur within area
Choeroichthys suillus Pig-snouted Pipefish [66198]		Species or species habitat may occur within area
Doryrhamphus dactyliophorus Banded Pipefish, Ringed Pipefish [66210]		Species or species habitat may occur within area
Doryrhamphus janssi Cleaner Pipefish, Janss' Pipefish [66212]		Species or species habitat may occur within area
Doryrhamphus multiannulatus Many-banded Pipefish [66717]		Species or species habitat may occur within area
Doryrhamphus negrosensis Flagtail Pipefish, Masthead Island Pipefish [66213]		Species or species habitat may occur within area
Festucalex scalaris Ladder Pipefish [66216]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Halicampus brocki Brock's Pipefish [66219]		Species or species habitat may occur within area
Halicampus grayi Mud Pipefish, Gray's Pipefish [66221]		Species or species habitat may occur within area
Halicampus nitidus Glittering Pipefish [66224]		Species or species habitat may occur within area
Halicampus spinirostris Spiny-snout Pipefish [66225]		Species or species habitat may occur within area
Haliichthys taeniophorus Ribboned Pipehorse, Ribboned Seadragon [66226]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus angustus Western Spiny Seahorse, Narrow-bellied Seahorse [66234]		Species or species habitat may occur within area
Hippocampus histrix Spiny Seahorse, Thorny Seahorse [66236]		Species or species habitat may occur within area
Hippocampus kuda Spotted Seahorse, Yellow Seahorse [66237]		Species or species habitat may occur within area
Hippocampus planifrons Flat-face Seahorse [66238]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Hippocampus trimaculatus Three-spot Seahorse, Low-crowned Seahorse, Flat-faced Seahorse [66720]		Species or species habitat may occur within area
Micrognathus micronotopterus Tidepool Pipefish [66255]		Species or species habitat may occur within area
Phoxocampus belcheri Black Rock Pipefish [66719]		Species or species habitat may occur within area
Solegnathus hardwickii Pallid Pipehorse, Hardwick's Pipehorse [66272]		Species or species habitat may occur within area
Solegnathus lettiensis Gunther's Pipehorse, Indonesian Pipefish [66273]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area
Trachyrhamphus bicoarctatus Bentstick Pipefish, Bend Stick Pipefish, Short-tailed Pipefish [66280]		Species or species habitat may occur within area
Trachyrhamphus longirostris Straightstick Pipefish, Long-nosed Pipefish, Straight Stick Pipefish [66281]		Species or species habitat may occur within area
Mammal		
Dugong dugon Dugong [28]		Breeding known to occur within area
Reptile		
Acalyptophis peronii Horned Seasnake [1114]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Aipysurus apraefrontalis Short-nosed Seasnake [1115]	Critically Endangered	Species or species habitat likely to occur within area
Aipysurus duboisii Dubois' Seasnake [1116]		Species or species habitat may occur within area
Aipysurus eydouxii Spine-tailed Seasnake [1117]		Species or species habitat may occur within area
Aipysurus foliosquama Leaf-scaled Seasnake [1118]	Critically Endangered	Species or species habitat known to occur within area
Aipysurus laevis Olive Seasnake [1120]		Species or species habitat may occur within area
Astrotia stokesii Stokes' Seasnake [1122]		Species or species habitat may occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Breeding known to occur within area
Chitulia ornata as Hydrophis ornatus Spotted Seasnake, Ornate Reef Seasnake [87377]		Species or species habitat may occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat known to occur within area
Disteira kingii Spectacled Seasnake [1123]		Species or species habitat may occur within area
Disteira major Olive-headed Seasnake [1124]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Emydocephalus annulatus Turtle-headed Seasnake [1125]		Species or species habitat may occur within area
Ephalophis greyi North-western Mangrove Seasnake [1127]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Breeding known to occur within area
Hydrophis elegans Elegant Seasnake [1104]		Species or species habitat may occur within area
Leioselasma czeblukovi as Hydrophis czeblukovi Fine-spined Seasnake, Geometrical Seasnake [87374]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Breeding known to occur within area
Pelamis platurus Yellow-bellied Seasnake [1091]		Species or species habitat may occur within area

Whales and Other Cetaceans

[Resource Information]

Current Scientific Name	Status	Type of Presence
Mammal		
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 may occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Species or species habitat likely to occur within area
Delphinus delphis Common 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
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]		Breeding known to occur within area
Orcaella heinsohni Australian Snubfin Dolphin [81322]		Species or species habitat likely to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat may occur within area
Sousa sahulensis Australian Humpback Dolphin [87942]		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
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area
Tursiops aduncus (Arafura/Timor Sea populations) Spotted Bottlenose Dolphin (Arafura/Timor Sea populations) [78900]		Species or species habitat known to occur within area

Current Scientific Name	Status	Type of Presence
Tursiops truncatus s. str.		
Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Habitat Critical to the Survival of Marine Turtles

Scientific Name	Behaviour	Presence
Aug - Sep		
Natator depressus		
Flatback Turtle [59257]	Nesting	Known to occur
Dec - Jan		
Chelonia mydas		
Green Turtle [1765]	Nesting	Known to occur
Nov-Feb		
Caretta caretta		
Loggerhead Turtle [1763]	Nesting	Known to occur
Nov - May		
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Nesting	Known to occur

Extra Information

State and Territory Reserves [Resource Information]

Protected Area Name	Reserve Type	State
Barrow Island	Marine Management Area	WA
Boodie, Double Middle Islands	Nature Reserve	WA
Cape Range	National Park	WA
Ningaloo	Marine Park	WA
Thevenard Island	Nature Reserve	WA

Nationally Important Wetlands [Resource Information]

Wetland Name	State
Cape Range Subterranean Waterways	WA

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Construct and operate LNG & domestic gas plant including onshore and offshore facilities - Wheatston	2008/4469	Controlled Action	Post-Approval
Gorgon Gas Development	2003/1294	Controlled Action	Post-Approval
Gorgon Gas Development 4th Train Proposal	2011/5942	Controlled Action	Post-Approval
Not controlled action			
HCA05X Macedon Experimental Survey	2004/1926	Not Controlled Action	Completed
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed
Spool Base Facility	2001/263	Not Controlled Action	Completed
Thevenard Island Retirement Project	2015/7423	Not Controlled Action	Completed
Not controlled action (particular manner)			
2D and 3D seismic surveys	2005/2151	Not Controlled Action (Particular Manner)	Post-Approval
Huzzas phase 2 marine seismic survey, Exmouth Plateau, Northern Carnarvon Basin, WA	2013/7093	Not Controlled Action (Particular Manner)	Post-Approval
Ocean Bottom Cable Seismic Survey	2005/2017	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
Two Dimensional Transition Zone Seismic Survey - TP/7 (R1)	2010/5507	Referral Decision	Completed

Biologically Important Areas

Scientific Name	Behaviour	Presence
Dugong		
Dugong dugon		
Dugong [28]	Breeding	Known to occur
Dugong dugon		
Dugong [28]	Calving	Known to occur

Scientific Name	Behaviour	Presence
Dugong dugon Dugong [28]	Foraging (high density seagrass beds)	Known to occur
Dugong dugon Dugong [28]	Nursing	Known to occur
Marine Turtles		
Caretta caretta Loggerhead Turtle [1763]	Internesting buffer	Known to occur
Caretta caretta Loggerhead Turtle [1763]	Nesting	Known to occur
Chelonia mydas Green Turtle [1765]	Basking	Known to occur
Chelonia mydas Green Turtle [1765]	Foraging	Known to occur
Chelonia mydas Green Turtle [1765]	Internesting	Known to occur
Chelonia mydas Green Turtle [1765]	Internesting buffer	Known to occur
Chelonia mydas Green Turtle [1765]	Mating	Known to occur
Chelonia mydas Green Turtle [1765]	Nesting	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Foraging	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Internesting buffer	Known to occur
Eretmochelys imbricata Hawksbill Turtle [1766]	Mating	Known to occur

Scientific Name	Behaviour	Presence
Eretmochelys imbricata Hawksbill Turtle [1766]	Nesting	Known to occur
Natator depressus Flatback Turtle [59257]	Foraging	Known to occur
Natator depressus Flatback Turtle [59257]	Internesting buffer	Known to occur
Natator depressus Flatback Turtle [59257]	Mating	Known to occur
Natator depressus Flatback Turtle [59257]	Nesting	Known to occur
Seabirds		
Ardenna pacifica Wedge-tailed Shearwater [84292]	Breeding	Known to occur
Sterna dougallii Roseate Tern [817]	Breeding	Known to occur
Sternula nereis Fairy Tern [82949]	Breeding	Known to occur
Thalasseus bengalensis Lesser Crested Tern [66546]	Breeding	Known to occur
Sharks		
Rhincodon typus Whale Shark [66680]	Foraging (high density prey)	Known to occur
Whales		
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Distribution	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Migration (north and south)	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Resting	Known to occur

Caveat

1 PURPOSE

This report is designed to assist in identifying the location of matters of national environmental significance (MNES) and other matters protected by the Environment Protection and Biodiversity Conservation Act 1999 (Cth) (EPBC Act) which may be relevant in determining obligations and requirements under the EPBC Act.

The report contains the mapped locations of:

- World and National Heritage properties;
- Wetlands of International and National Importance;
- Commonwealth and State/Territory reserves;
- distribution of listed threatened, migratory and marine species;
- listed threatened ecological communities; and
- other information that may be useful as an indicator of potential habitat value.

2 DISCLAIMER

This report is not intended to be exhaustive and should only be relied upon as a general guide as mapped data is not available for all species or ecological communities listed under the EPBC Act (see below). Persons seeking to use the information contained in this report to inform the referral of a proposed action under the EPBC Act should consider the limitations noted below and whether additional information is required to determine the existence and location of MNES and other protected matters.

Where data are available to inform the mapping of protected species, the presence type (e.g. known, likely or may occur) that can be determined from the data is indicated in general terms. It is the responsibility of any person using or relying on the information in this report to ensure that it is suitable for the circumstances of any proposed use. The Commonwealth cannot accept responsibility for the consequences of any use of the report or any part thereof. To the maximum extent allowed under governing law, the Commonwealth will not be liable for any loss or damage that may be occasioned directly or indirectly through the use of, or reliance

3 DATA SOURCES

Threatened ecological communities

For threatened ecological communities where the distribution is well known, maps are generated based on information contained in recovery plans, State vegetation maps and 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

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

Where little information is available for a 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 detailed distribution mapping methods are used to update these distributions

4 LIMITATIONS

The following species and ecological communities have not been mapped and do not appear in this report:

- threatened species listed as extinct or considered vagrants;
- some recently listed species and ecological communities;
- some listed migratory and listed marine species, which are not listed as threatened species; and
- migratory species that are very widespread, vagrant, or only occur in Australia in small numbers.

The following groups have been mapped, but may not cover the complete distribution of the species:

- listed migratory and/or listed marine seabirds, which are not listed as threatened, have only been mapped for recorded
- seals which have only been mapped for breeding sites near the Australian continent

The breeding sites may be important for the protection of the Commonwealth Marine environment.

Refer to the metadata for the feature group (using the Resource Information link) for the currency of the information.

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 c consultation material

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 km^2 while the operational area associated with the survey will be about 3,700km^2. 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.

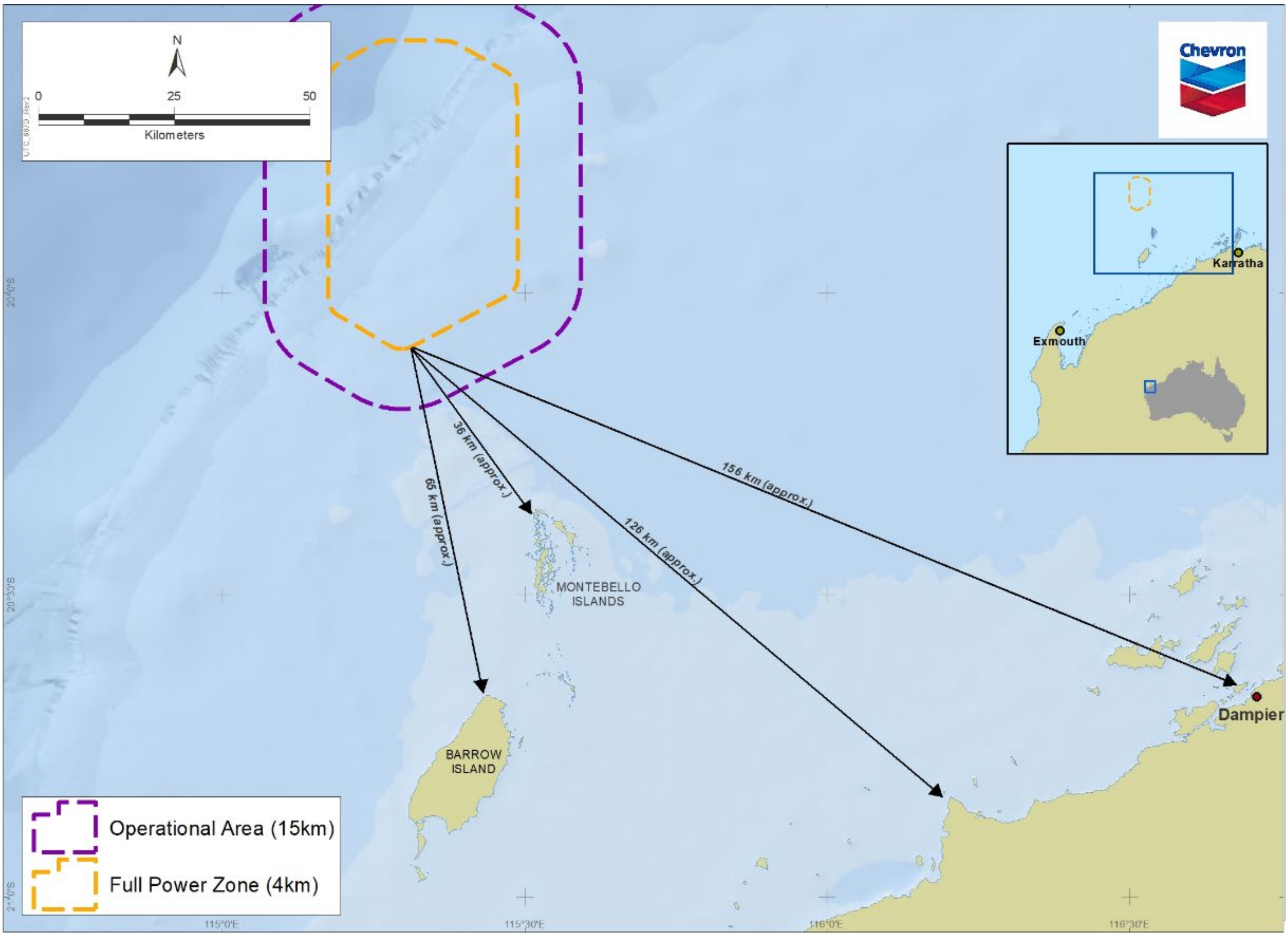
Further details will be provided in the Environment Plan and will incorporate feedback generated during the consultation process.

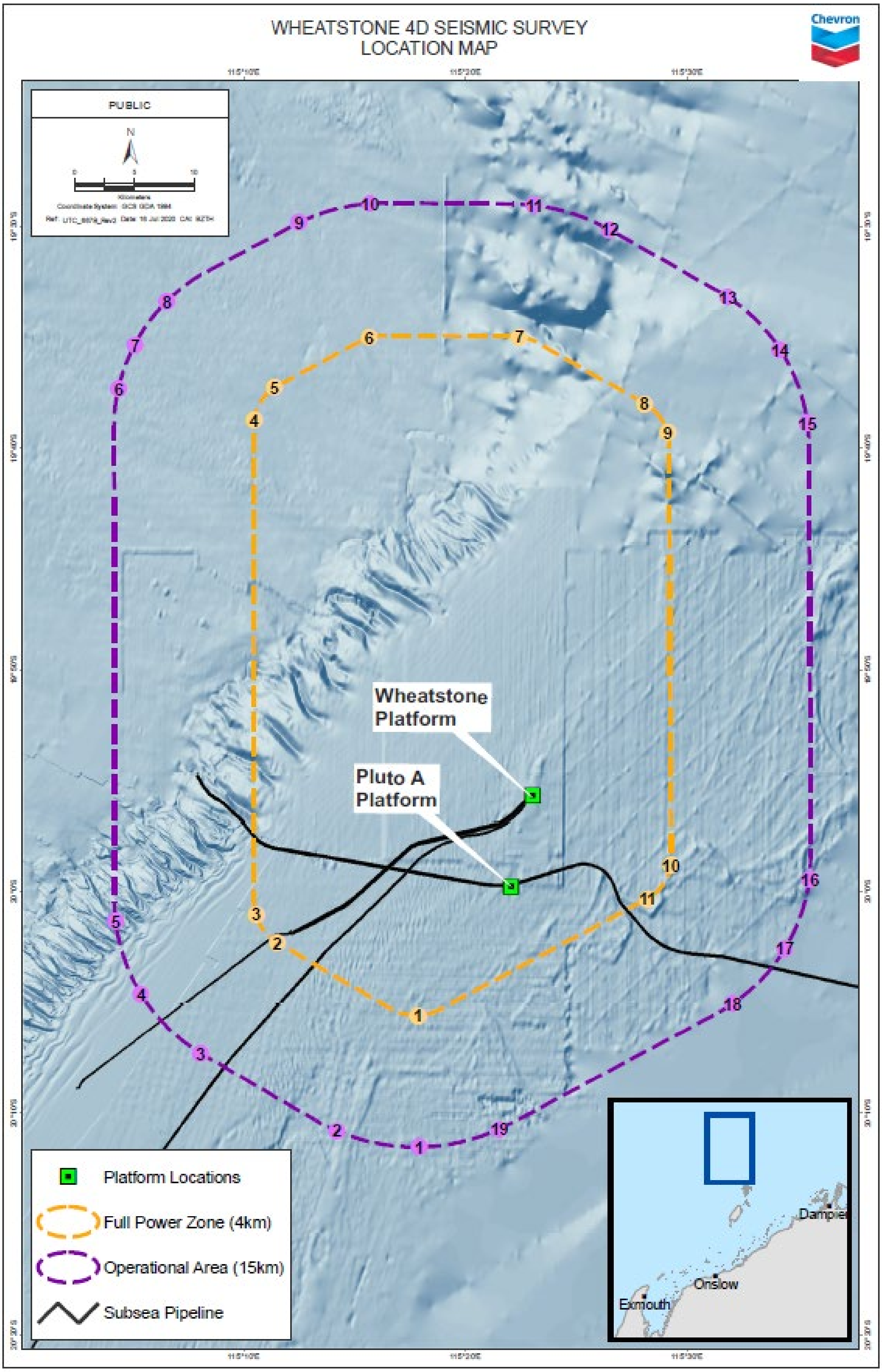
Summary of key impacts/risks and proposed controls

Potential Impact or Risk	Proposed Control
Planned Activities	
Interests of relevant stakeholders: • Defence activities • Petroleum operations and exploration • Shipping • Diving	• 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	• 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	• 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	• 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	• Marine discharges managed as per legislative requirements.
Vessel interaction	• 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	• 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	• 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	• Vessels assessed and managed as appropriate to prevent the introduction of marine pests. • Compliance with Australian ballast water and biosecurity requirements and guidance.
Other	• 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

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

wheatstone 4D-seismic survey

relevant persons information sheet
january 2023

overview
Chevron Australia aims to conduct a 4D-seismic survey over the Wheatstone and Iago gas fields, located offshore Western Australia.

The proposed survey is part of standard reservoir management practice and use conventional seismic survey equipment and methodology. It will serve as a “timelapse” measurement and will be compared to data acquired in 2011/2012 to help Chevron Australia understand how the Wheatstone and Iago reservoirs are performing.

location and water depths
The survey will be conducted within the WA-46-L, WA-47-L, WA-48-L petroleum permits and surrounding permits located approximately 150 kilometres north-west of Dampier at depths from 80 to 1,140 metres. At its closest point the survey will be approximately 37 kilometres from the Montebello Islands.

The survey area is approximately 1,644 square kilometres while the operational area is approximately 3,730 square kilometres. See Figures 1 and 2.

schedule and duration
The survey is expected to start in late 2023 or early 2024, subject to approvals, contracting and vessel availability. The project is estimated to take about 75 days depending on weather conditions.

activity overview
Seismic surveys use sound energy to capture data to develop an accurate and high-quality image of geological features.

A seismic vessel will traverse a series of ‘sail lines’ within the operational area at around 8 kilometres per hour.

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, capture the returning sound waves and record the data that is later interpreted by geoscientists.

The seismic vessel will tow up to 14 streamers at lengths of up to 7 kilometres and depths of up to 25 metres; and 2 source arrays of approximately 4,130 cubic inches at a depth of 5-8 metres.

It will be supported by vessels and a helicopter.

environmental impact

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

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 in Table 1 and additional control measures identified during consultation with relevant persons and the public comment period will be considered for inclusion.

EMBA: environment that may be affected

4D seismic surveys have the potential for environment interactions, known as 'aspects'.

All planned aspects can result in environmental impacts and changes to the environment, and may present environmental risks within the operational area, with the exception of underwater sound emission, which can extend approximately 51 kilometres from the hydrophones.

Unplanned releases and events may occur while conducting activities.

If an emergency condition occurs, the size of the 'environment that may be affected', also known as an 'EMBA', could increase.

The EMBA is based on the emergency condition's worst case environmental scenario, which in this case is an unplanned spill event from a vessel collision.

The EMBA has been defined through combining 300 simulations of vessel collisions under three different hydrological and meteorological conditions.

Control measures to prevent this event are in place, but Chevron Australia is required to assess this highly unlikely scenario.

In this scenario, cultural, ecological and social values and sensitivities may be exposed to hydrocarbons. These are considered environmental risks because they are not planned to occur.

Table 1 lists the environmental impacts, risks and control measures and Figures 1, 2 and 3 show the location of the survey and the EMBA.

approvals process

Petroleum activities in Commonwealth waters are regulated by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA). Before petroleum activities can take place, Chevron Australia must develop an Environment Plan which will be assessed by NOPSEMA in accordance with the requirements of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations (2009). These regulations require Chevron Australia to consult with relevant persons whose functions, interests and activities may be affected by the petroleum activity.

The Environment Plan will describe the environment in which the petroleum activity takes place, an assessment of the potential environmental impacts and risks arising from the activity, and the identification of control measures to manage environmental impacts and risks to acceptable levels that are as low as reasonably practicable.

The environment plan outlines how Chevron Australia has engaged with 'relevant persons', whose interests, functions, and activities may be affected and how their feedback has been considered and addressed.

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

Chevron Australia welcomes feedback from relevant persons prior to the public comment period to ensure feedback is incorporated into the draft environment plan before it is submitted to

NOPSEMA and advertised on NOPSEMA's website.

commercial fishing

Chevron Australia recognises the commercial fishing sector as an important and relevant group whose members may have interests, functions, and activities that could be affected by the seismic survey. We are committed to engaging early and working proactively with the commercial fishing sector and the Western Australian Fishing Industry Council.

diving

It is highly unlikely seismic noise would be detectable to the human ear but as the survey will be conducted about 37 kilometres from the Montebello Islands, at its closest point, relevant commercial charters, tour operators and the WA Charter Boat Owners and Operators Association will be informed and consulted.

other relevant persons

Chevron Australia also recognises the interests, functions, and activities of other relevant persons that may be affected by the surveying.

Chevron Australia is committed to engaging early and working proactively with relevant persons and will keep informed and provide responses to any relevant person that identifies an interest in the planned seismic survey.

communications with marine users

Seismic vessels will operate within the operational area and marine notices will be issued before work starts to notify other mariners that access to the operational area may be limited. This will include a temporary 500-metre exclusion zone around the primary vessel and streamers during seismic operations.

Updates will be provided on vessel movements and activities to meet relevant persons' needs. On-the-water communications and cooperation is a Chevron Australia priority.

We 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 before starting the survey.

your feedback

We are committed to engaging with Traditional Owners and Custodians, commercial fishers, recreational groups and other relevant individuals and organisations, as required by regulation.

We are seeking your feedback if you consider your functions, interests or activities may be affected based on the information outlined in Table 1. Let us know if you consider there are any control measures we could implement to eliminate, reduce or avoid an effect.

You can contact us at:

- 1800 225 195
- feedback@chevron.com

If a relevant person asks that their feedback be treated as confidential, Chevron Australia will make this known to NOPSEMA and the information will be kept confidential.

what's next

Your feedback during the consultation period will be considered and incorporated into the environment plan.

We commit to keeping you informed and providing responses to any relevant person who so requests.

privacy notice

If you choose to provide feedback on this proposal, Chevron Australia will collect your name and contact details, in addition to your comments, for the purposes of maintaining contact with you and inclusion of your feedback in our submission to NOPSEMA. Provision of this information is purely voluntary, however if you choose not to provide it, we may not be able to contact you in the future regarding your submission. Chevron may transfer your information to NOPSEMA, if required and if you do not identify it as sensitive, and to other Chevron affiliates including our head office based in the United States. For further information regarding how we protect your personal information, and your rights, please refer to our privacy notice at https://australia.chevron.com/privacy.

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Table 1. Summary of impacts, risks and key proposed controls

Aspect	Potential interaction (impacts/risks)	Proposed Control
Planned Activities		
Physical presence of supporting vessels and towed equipment from the seismic vessel within the Operational Area (OA)	• Presence of supporting vessels and towed equipment from the seismic vessel within the OA has the potential to interact and disrupt other marine users and marine fauna.	• Relevant parties will be advised of the commencement and expected completion dates of the activity and any relevant Safe Navigation Area information prior to commencing the survey activity • Marine safety information to be issued via AUSCOAST and/or Notice to Mariners (where required) prior to commencing the survey activity • Vessels will meet the crew competency, navigation equipment, and radar requirements of *Chevron Australia's Marine, Safety Reliability and Efficiency (MSRE) process* • Lookahead updates will be provided to operators, and where requested to other on-the-water relevant parties, for the duration of the seismic survey • In accordance with EPBC Regulations 2000 – Part 8 Division 8.1 – Interacting with cetaceans, vessels will implement caution and no approach zones, where practicable • Vessels will implement a separation distance and limit speeds when marine fauna is identified, where practicable.
Air emissions	• Combustion of fuel from vessels and helicopters within the OA during seismic survey may result in a localised and temporary reduction in air quality and contribution to the reduction of the global atmospheric carbon budget	• Reduced sulfur content fuel will be used when available • Vessels will comply with the requirements of Marine Order 97 (MARPOL 73/78 Annex VI) in relation to air pollution
Light emissions	• Navigation and operational lighting from vessels within the OA may result in a localised and temporary change in ambient light • Change in ambient light may result in a temporary attractant for light-sensitive species	• Vessels will meet lighting requirements of the MSRE process • Seismic and support vessels working at night will be required to reduce lighting to the minimum required for safe operations

Table 1. Summary of impacts, risks and key proposed controls

Aspect	Potential interaction (impacts/risks)	Proposed Control

Underwater sound—seismic acquisition	• Seismic acquisition within the OA may result in localised and temporary change in ambient underwater sound
	• Change in ambient sound may result in behavioural disturbance, injury or auditory impairment to marine fauna
	• Change in ambient sound may result in injury or auditory impairment to humans
		• Technical audit will confirm that the seismic source is consistent with the specifications used in the EP
		• In accordance with EPBC Act Policy Statement 2.1 – interaction between offshore seismic exploration and whales, the following will be implemented:
		    o precaution zones
		    o standard procedures during the seismic survey
		    o a dedicated marine fauna observer will be on-duty during all active operations
		    o supplementary marine fauna observations from support vessel, where practicable
		    o night and low visibility procedures
		    o marine fauna observations from the seismic vessel will include marine turtles and Whale Sharks during seismic survey
		    o shutdown and pre-start-up visual observation procedures for marine turtles and Whale Sharks will be implemented
		• Consultation and management of activities will be consistent with relevant codes and standards
		• Concurrent operations plan will be implemented, if required.

Underwater sound—support vessels and helicopter operations	• Vessels or helicopter operations within the OA may result in localised and temporary change in ambient underwater sound
	• Change in ambient sound may result in behavioural disturbance, injury or auditory impairment to marine fauna
		• In accordance with EPBC Regulations 2000 – Part 8 Division 8.1 – Interacting with cetaceans:
		    o vessels will implement caution and no approach zones
		    o helicopters will not operate at a height lower than 1650 feet or within 500 m of a cetacean, where practicable
		    o helicopters will not approach a cetacean from head on

Table 1. Summary of impacts, risks and key proposed controls

Aspect	Potential interaction (impacts/risks)	Proposed Control
Planned discharges—vessel operations	• Planned discharges from vessel operations may result in localised and temporary change in water quality • Change in ambient water quality may result in changes to predator-prey dynamics	• Vessels will comply with the requirements of Marine Order 96 (MARPOL 73/78 Annex IV) in relation to sewage discharge • Vessels will comply with the requirements of Marine Order 95 (MARPOL 73/78 Annex V) in relation to food waste discharge • Vessels will comply with the requirements of Marine Order 91 (MARPOL 73/78 Annex I) in relation to oily bilge water discharges • No planned discharges from vessels within Australian Marine Parks
Unplanned Activities		
Invasive marine pests	• Planned discharged of ballast water or the presence of biofouling on vessels may have the potential to result in the introduction of an invasive marine pest	• Vessels will meet the requirements of the Chevron Australia's Quarantine Procedure for Marine Vessels • Ballast water exchanges will be managed in accordance with the Australian Ballast Water Management Requirements • Vessels greater than 400 GT with an antifoul coating are to maintain an up to date international antifouling coating certification in accordance with the Protection of the Sea (Harmful Anti-fouling Systems) Act 2006 and/or relevant codes and standards • Where required, vessel pre-arrival information will be reported through the Maritime Arrivals Reporting System as per the Commonwealth Biosecurity Act 2015.
Release of waste	• Vessel operations activities may result in an unplanned release of waste to environment causing marine pollution	• Vessels will comply with the requirements of Marine Order 95 (MARPOL 73/78 Annex V) in relation to managing waste (garbage) offshore.
Loss of equipment	• Unplanned release of seismic equipment (seismic source and/or streamers) to the environment may result in disruption to other marine users from temporary navigation hazards and alteration of marine habitats arising from seabed disturbance	• Operating procedures for streamer deployment, operations, and retrieval will be implemented • In the event of a loss of equipment that results in a navigational hazard, marine users within the vicinity will be notified • Lost equipment will be retrieved, where safe and practicable to do so

Table 1. Summary of impacts, risks and key proposed controls

Aspect	Potential interaction (impacts/risks)	Proposed Control
Loss of containment	• Unplanned release of hazardous material to the environment may result in indirect impacts to fauna arising from chemical toxicity	• Vessels will meet the requirements of *Chevron Australia's MSRE process*, including the pre-mobilisation inspections of equipment, couplings and secondary containment availability and refuelling/bunkering process • Vessels will comply with the requirements of Marine Order 91 (MARPOL 73/78 Annex I) in relation to having an approved Ship Oil Pollution Emergency Plan in place.
Vessel collision event	• A vessel collision event may occur as a result of a loss of Dynamic Positioning, navigational error or floundering due to weather. • The potential environmental impacts associated with hydrocarbon exposures from a vessel collision event may result in marine pollution, smothering of subtidal and intertidal habitats, indirect impacts to fisheries, reduction in amenity (resulting in impacts to tourism and recreation) and changes to values and sensitivities of marine protected areas.	• Vessels will meet the crew competency, navigation equipment, and radar requirements of *Chevron Australia's MSRE process* • Notification to relevant agencies of activities and vessel movements to allow them to send warnings and/or notices to mariners prior to commencing activity • Where required, a simultaneous operation plan and/or concurrent operations plan will develop and implement before commencing the activity • Vessels will comply with the requirements of Marine Order 91 (MARPOL 73/78 Annex I) in relation to having an approved Ship Oil Pollution Emergency Plan in place • Emergency response will be implemented in accordance with the response arrangements and strategies detailed in Chevron Australia's Oil Pollution Emergency Plan • Where required, operational and scientific monitoring will be undertaken in accordance with Chevron Australia's Operational and Scientific Monitoring Plan.
Emergency response		
Ground disturbance – shoreline spill response	• In the event of a worst-case spill event, if shoreline is impacted, implementing shoreline clean-up techniques involves people and equipment, which may disturb shoreline habitat with subsequent impacts to fauna.	• Where required, operational and scientific monitoring will be undertaken in accordance with Chevron Australia's Operational and Scientific Monitoring Plan.
Physical presence—oiled wildlife response	• In the event of a worst-case spill event, if fauna is affected, the handling and treating of marine fauna will result in personnel interacting with marine fauna.	• Where required, operational and scientific monitoring will be undertaken in accordance with Chevron Australia's Operational and Scientific Monitoring Plan.

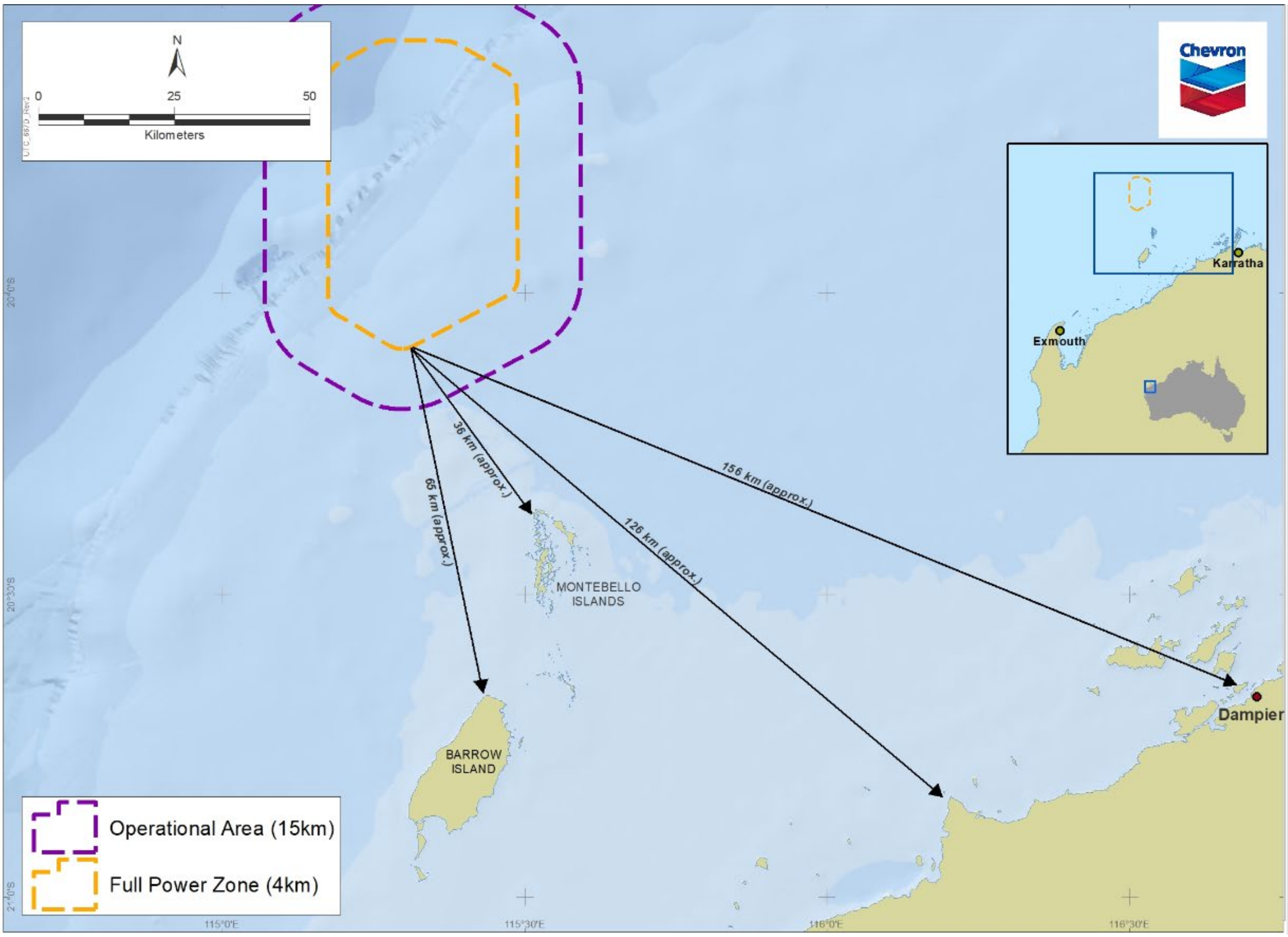


Figure 1. Location of the seismic survey

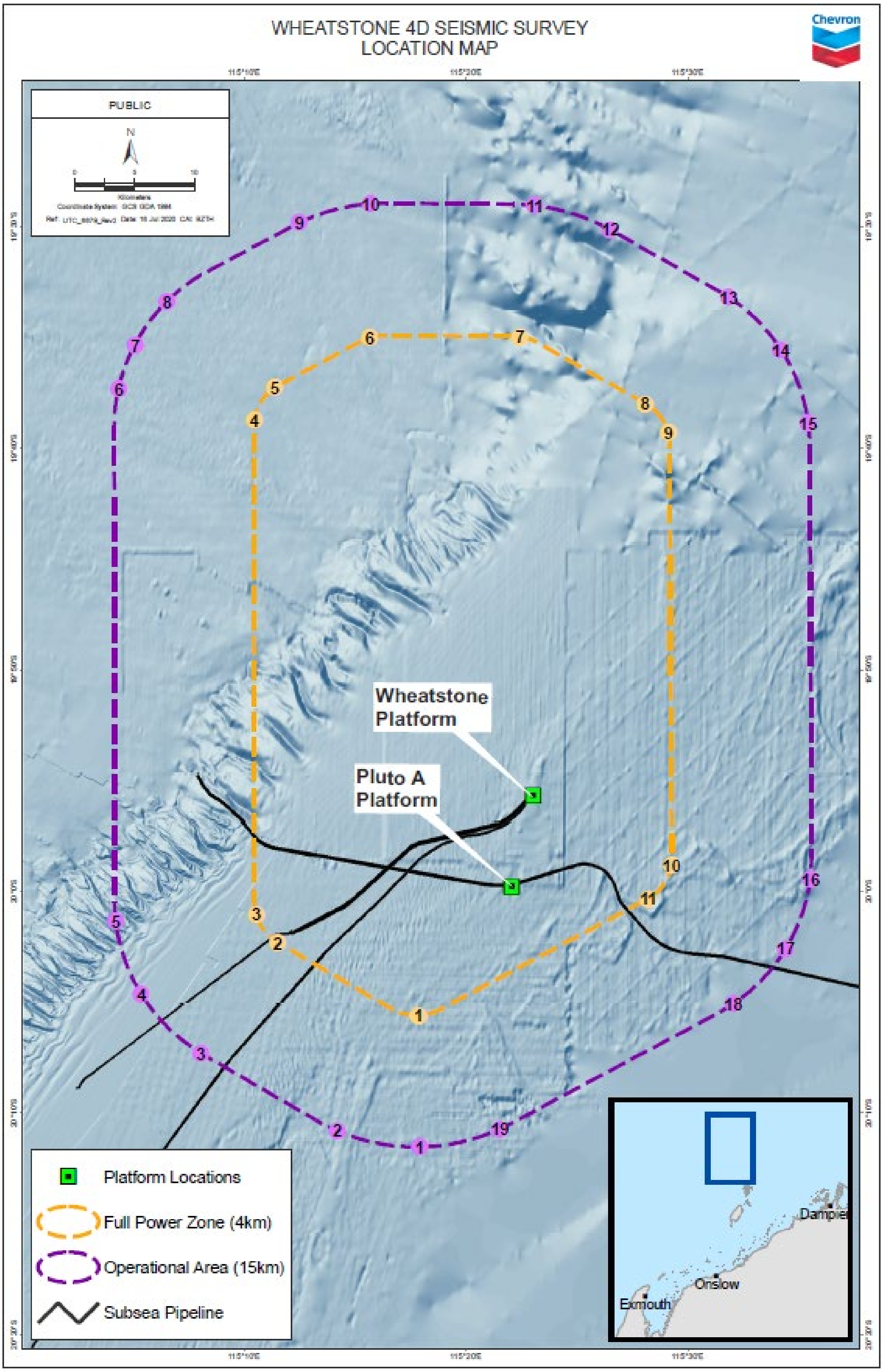


Figure 2. Areas identified in the seismic survey

NOTE: Refer to next page (Table 2) for coordinates and depths of locations indicated in map above

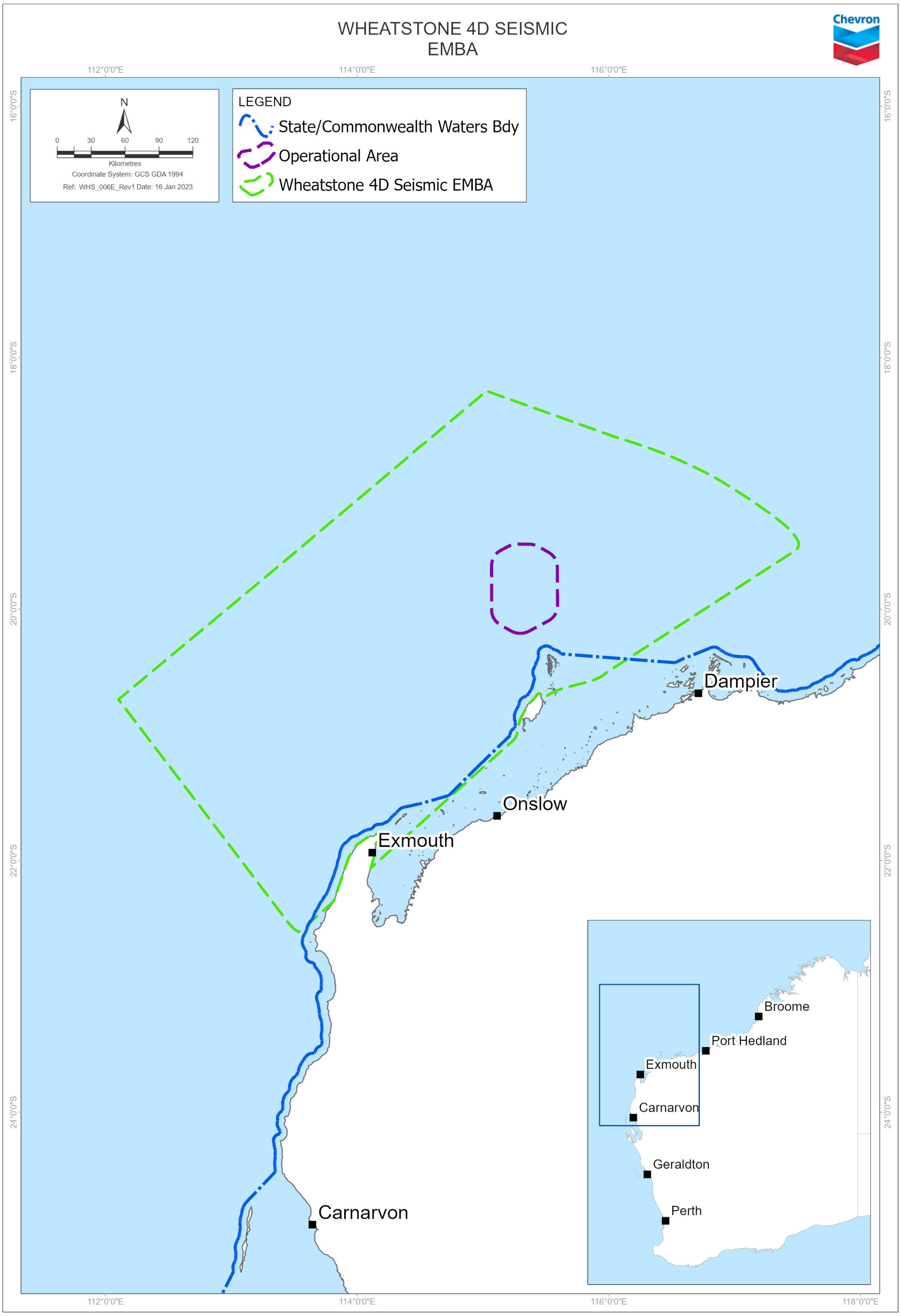


Figure 3. Environment that may be affected

Table 2. Coordinates and depths of the seismic survey areas

Point ID	Latitude *(GDA94)*	Longitude *(GDA94)*	Water depth (m)
Acquisition area			
1	-20.05696	115.2963	82
2	-20.00816	115.2127	151
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

Point ID	Latitude *(GDA94)*	Longitude *(GDA94)*	Water depth (m)
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

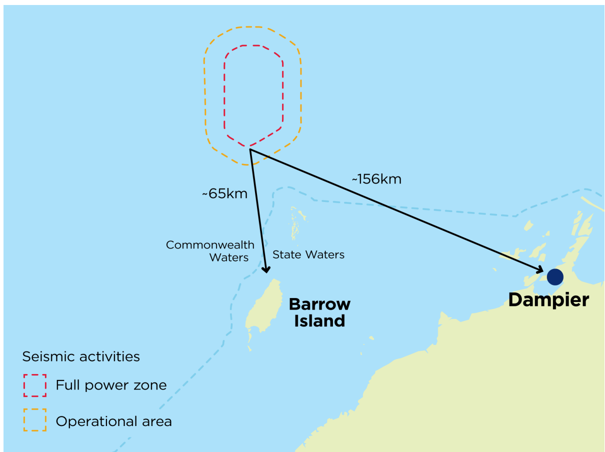
relevant persons information

wheatstone 4D-seismic survey

Chevron Australia aims to conduct a 4D-seismic survey over the Wheatstone and Iago gas fields, located offshore Western Australia.

The proposed survey is part of standard reservoir management practice and use conventional seismic survey equipment and methodology. It will serve as a “timelapse” measurement and will be compared to data acquired in 2011/2012 to help Chevron Australia understand how the Wheatstone and Iago reservoirs are performing.

location and water depth



The survey will be conducted within the WA-46-L, WA-47-L, WA-48-L petroleum permits and surrounding permits located approximately 150 kilometres north-west of Dampier at depths from 80 to 1,140 metres. At its closest point the survey will be approximately 37 kilometres from the Montebello Islands.

The survey area is approximately 1,644 square kilometres while the operational area is approximately 3,730 square kilometres. See figures 1 and 2.

Jump to detailed maps below

schedule and duration

The survey is expected to start in late 2023 or early 2024, subject to approvals, contracting and vessel availability. The project is estimated to take about 75 days depending on weather conditions.

activity overview

Seismic surveys use sound energy to capture data to develop an accurate and high-quality image of geological features.

A seismic vessel will traverse a series of ‘sail lines’ within the operational area at around 8 kilometres per hour.

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, capture the returning sound waves and record the data that is later interpreted by geoscientists.

The seismic vessel will tow up to 14 streamers at lengths of up to 7 kilometres and depths of up to 25 metres; and 2 source arrays of approximately 4,130 cubic inches at a depth of 5-8 metres.

It will be supported by vessels and a helicopter.

environmental impact

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

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 in Table 1 and additional control measures identified during consultation with relevant persons and the public comment period will be considered for inclusion.

EMBA – environment that may be affected

4D seismic surveys have the potential for environment interactions, known as ‘aspects’.

All planned aspects can result in environmental impacts and changes to the environment, and may present environmental risks within the operational area, with the exception of underwater sound emission, which can extend approximately 51 kilometres from the hydrophones.

Unplanned releases and events may occur while conducting activities.

If an emergency condition occurs, the size of the 'environment that may be affected', also known as an 'EMBA', could increase.

The EMBA is based on the emergency condition's worst case environmental scenario, which in this case is an unplanned spill event from a vessel collision.

The EMBA has been defined through combining 300 simulations of vessel collisions under three different hydrological and meteorological conditions.

Control measures to prevent this event are in place, but Chevron Australia is required to assess this highly unlikely scenario.

In this scenario, cultural, ecological and social values and sensitivities may be exposed to hydrocarbons. These are considered environmental risks because they are not planned to occur.

Table 1 lists the environmental impacts, risks and control measures and Figures 1, 2 and 3 show the location of the survey and the EMBA.

approvals process

Petroleum activities in Commonwealth waters are regulated by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA). Before petroleum activities can take place, Chevron Australia must develop an Environment Plan which will be assessed by NOPSEMA in accordance with the requirements of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations (2009). These regulations require Chevron Australia to consult with relevant persons whose functions, interests and activities may be affected by the petroleum activity.

The Environment Plan will describe the environment in which the petroleum activity takes place, an assessment of the potential environmental impacts and risks arising from the activity, and the identification of control measures to manage environmental impacts and risks to acceptable levels that are as low as reasonably practicable. The environment plan outlines how Chevron Australia has engaged with 'relevant persons', whose interests, functions, and activities may be affected and how their feedback has been considered and addressed.

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

Chevron Australia welcomes feedback from relevant persons prior to the public comment period to ensure feedback is incorporated into the draft environment plan before it is submitted to NOPSEMA and advertised on NOPSEMA's website.

commercial fishing

Chevron Australia recognises the commercial fishing sector as an important and relevant group whose members may have interests, functions, and activities that could be affected by the seismic survey. We are committed to engaging early and working proactively with the commercial fishing sector and the Western Australian Fishing Industry Council.

diving

It is highly unlikely seismic noise would be detectable to the human ear but as the survey will be conducted about 37 kilometres from the Montebello Islands, at its closest point, relevant commercial charters, tour operators and the WA Charter Boat Owners and Operators Association will be informed and consulted.

communications with marine users

Seismic vessels will operate within the operational area and marine notices will be issued before work starts to notify other mariners that access to the operational area may be limited. This will include a temporary 500-metre exclusion zone around the primary vessel and streamers during seismic operations.

Updates will be provided on vessel movements and activities to meet relevant persons' needs. On-the-water communications and cooperation is a Chevron Australia priority.

We 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 before starting the survey.

other relevant persons

Chevron Australia also recognises the interests, functions, and activities of other relevant persons that may be affected by the surveying.

Chevron Australia is committed to engaging early and working proactively with relevant persons and will keep informed and provide responses to any relevant person that identifies an interest in the planned seismic survey.

impacts, risks and proposed controls

Summary of impacts/risks and key proposed controls – view Table 1.

your feedback

We are committed to engaging with Traditional Owners and Custodians, commercial fishers, recreational groups and other relevant individuals and organisations, as required by regulation.

We are seeking your feedback if you consider your **functions**, **interests** or **activities** may be affected based on the information outlined in table 1.

Let us know if you consider there are any control measures we could implement to eliminate, reduce or avoid an effect.

You can contact us tollfree at **1800 225 195** or leave feedback online below.

If a relevant person asks that their feedback be treated as confidential, Chevron Australia will make this known to NOPSEMA and the information will be kept confidential.

To begin providing feedback for **Wheatstone 4D Seismic**, select a feedback category

what's next

Your feedback during the consultation period will be considered and incorporated into the environment plan.

We commit to keeping you informed and providing responses to any relevant person who so requests.

privacy notice

If you choose to provide feedback on this proposal, Chevron Australia will collect your name and contact details, in addition to your comments, for the purposes of maintaining contact with you and inclusion of your feedback in our submission to NOPSEMA. Provision of this information is purely voluntary, however if you choose not to provide it, we may not be able to contact you in the future regarding your submission. Chevron may transfer your information to NOPSEMA, if required and if you do not identify it as sensitive, and to other Chevron affiliates including our head office based in the United States. For further information regarding how we protect your personal information, and your rights, please refer to our privacy notice.

further information

detailed maps and tables

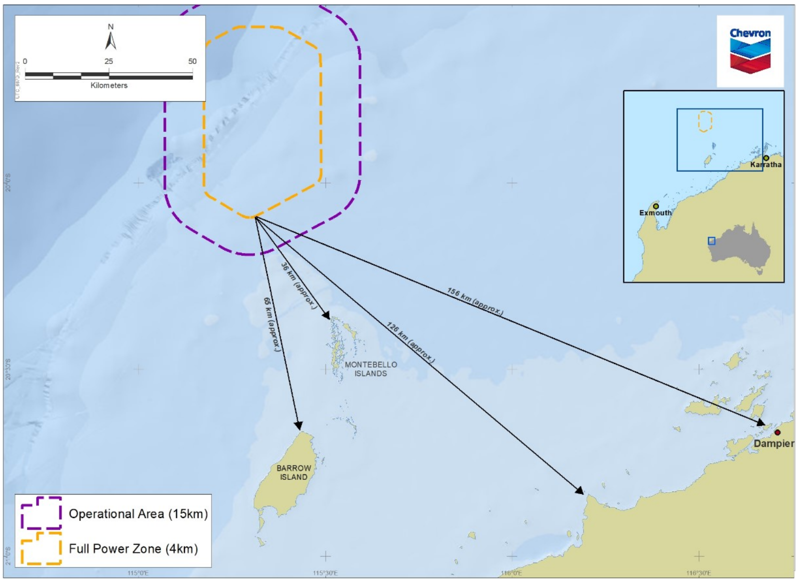


Figure 1. Location of the seismic survey.

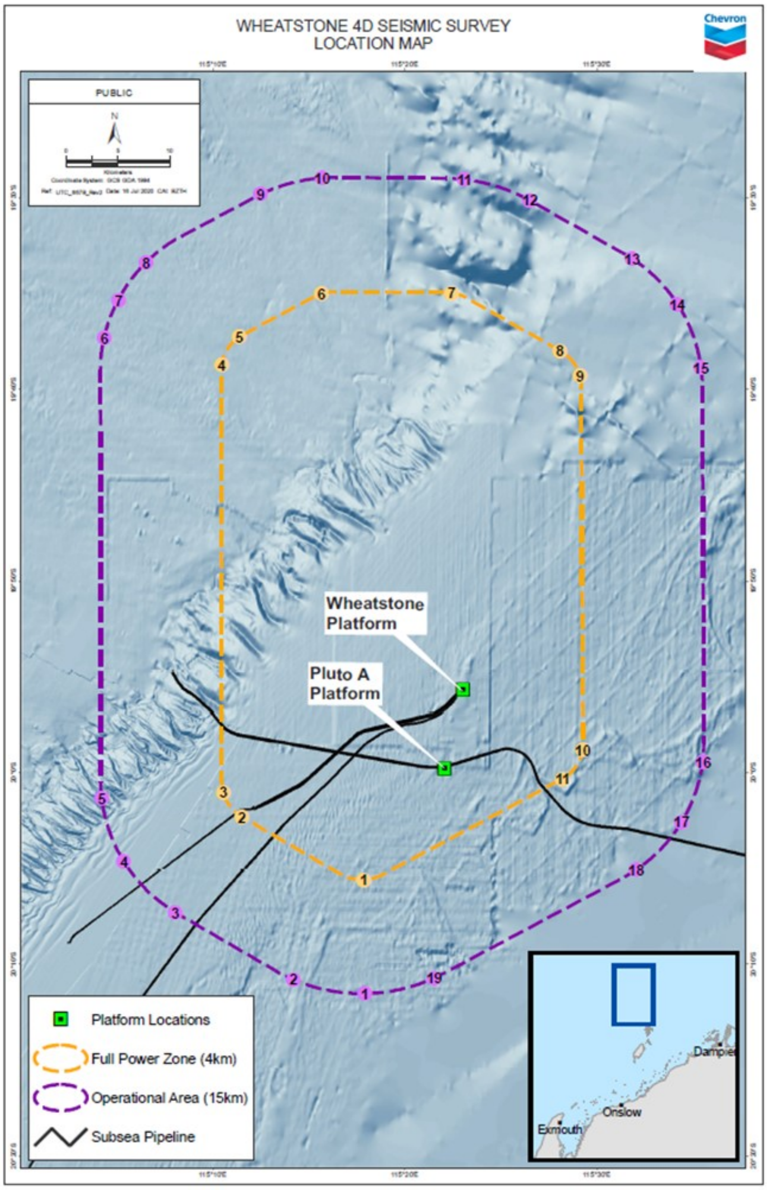


Figure 2. Areas identified in the seismic survey. Refer to Table 2 for coordinates and depths of locations indicated in map above

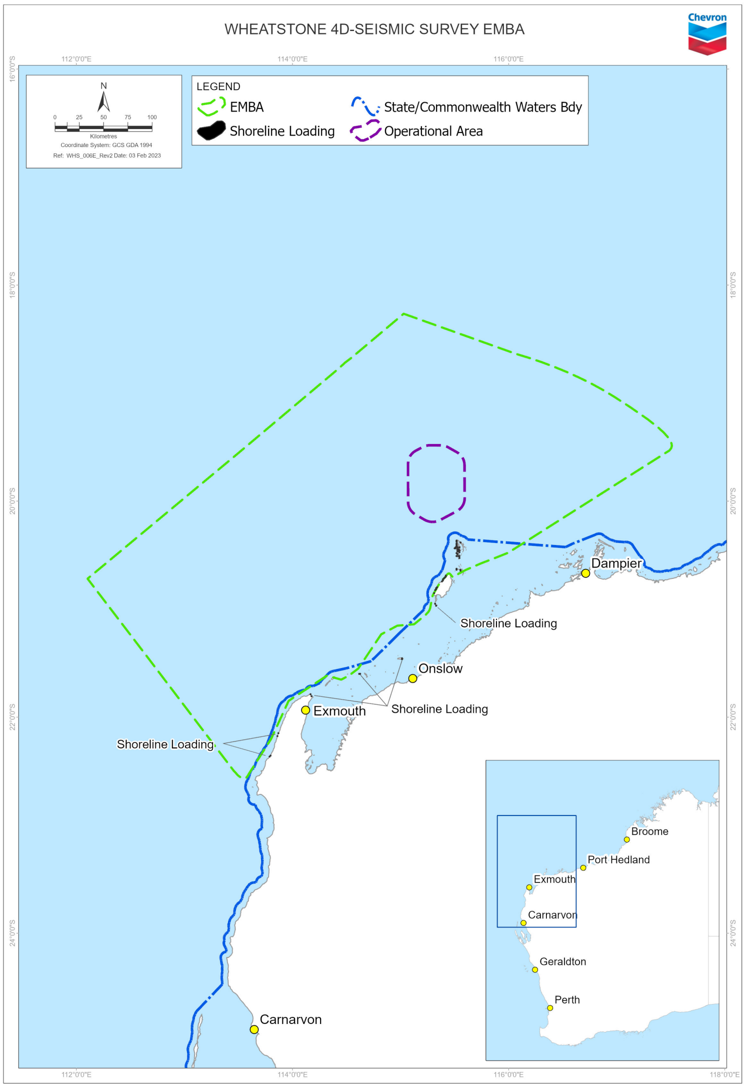


Figure 3: Environment that may be affected.

Table 1: Summary of impacts/risks and key proposed controls – view here.

Table 2: Coordinates and depths of the seismic survey areas – view here.

Table 1: Summary of impacts/risks and key proposed controls

Aspect	Potential Interaction (impacts/risks)	Proposed control measures
Planned activities		
Physical presence of supporting vessels and towed equipment from the seismic vessel within the Operational Area (OA)	• Presence of supporting vessels and towed equipment from the seismic vessel within the OA has the potential to interact and disrupt other marine users and marine fauna.	• Relevant parties will be advised of the commencement and expected completion dates of the activity and any relevant Safe Navigation Area information prior to commencing the survey activity • Marine safety information to be issued via AUSCOAST and/or Notice to Mariners (where required) prior to commencing the survey activity • Vessels will meet the crew competency, navigation equipment, and radar requirements of *Chevron Australia's Marine, Safety Reliability and Efficiency (MSRE) process* • Lookahead updates will be provided to operators, and where requested to other on-the-water relevant parties, for the duration of the seismic survey • In accordance with EPBC Regulations 2000 – Part 8 Division 8.1 – Interacting with cetaceans, vessels will implement caution and no approach zones, where practicable • Vessels will implement a separation distance and limit speeds when marine fauna is identified, where practicable.
Air emissions	• Combustion of fuel from vessels and helicopters within the OA during seismic survey may result in a localised and temporary reduction in air quality and contribution to the reduction of the global atmospheric carbon budget	• Reduced sulfur content fuel will be used when available • Vessels will comply with the requirements of Marine Order 97 (MARPOL 73/78 Annex VI) in relation to air pollution
Light emissions	• Navigation and operational lighting from vessels within the OA may result in a localised and temporary change in ambient light • Change in ambient light may result in a temporary attractant for light-sensitive species	• Vessels will meet lighting requirements of the MSRE process • Seismic and support vessels working at night will be required to reduce lighting to the minimum required for safe operations

Underwater sound—seismic acquisition	• Seismic acquisition within the OA may result in localised and temporary change in ambient underwater sound
	• Change in ambient sound may result in behavioural disturbance, injury or auditory impairment to marine fauna
	• Change in ambient sound may result in injury or auditory impairment to humans
		• Technical audit will confirm that the seismic source is consistent with the specifications used in the EP
		• In accordance with EPBC Act Policy Statement 2.1 – interaction between offshore seismic exploration and whales, the following will be implemented:
		  ○ precaution zones
		  ○ standard procedures during the seismic survey
		  ○ a dedicated marine fauna observer will be on-duty during all active operations
		  ○ supplementary marine fauna observations from support vessel, where practicable
		  ○ night and low visibility procedures
		  ○ marine fauna observations from the seismic vessel will include marine turtles and Whale Sharks during seismic survey
		  ○ shutdown and pre-start-up visual observation procedures for marine turtles and Whale Sharks will be implemented
		• Consultation and management of activities will be consistent with relevant codes and standards
		• Concurrent operations plan will be implemented, if required.

Underwater sound—support vessels and helicopter operations	• Vessels or helicopter operations within the OA may result in localised and temporary change in ambient underwater sound
	• Change in ambient sound may result in behavioural disturbance, injury or auditory impairment to marine fauna
		• In accordance with EPBC Regulations 2000 – Part 8 Division 8.1 – Interacting with cetaceans:
		  ○ vessels will implement caution and no approach zones
		  ○ helicopters will not operate at a height lower than 1650 feet or within 500 m of a cetacean, where practicable
		  ○ helicopters will not approach a cetacean from head on

Planned discharges—vessel operations	• Planned discharges from vessel operations may result in localised and temporary change in water quality • Change in ambient water quality may result in changes to predator-prey dynamics	• Vessels will comply with the requirements of Marine Order 96 (MARPOL 73/78 Annex IV) in relation to sewage discharge • Vessels will comply with the requirements of Marine Order 95 (MARPOL 73/78 Annex V) in relation to food waste discharge • Vessels will comply with the requirements of Marine Order 91 (MARPOL 73/78 Annex I) in relation to oily bilge water discharges • No planned discharges from vessels within Australian Marine Parks
Unplanned activities		

Aspect	Potential Interaction (impacts/risks)	Proposed control measures
Invasive marine pests	• Planned discharged of ballast water or the presence of biofouling on vessels may have the potential to result in the introduction of an invasive marine pest	• Vessels will meet the requirements of the Chevron Australia's Quarantine Procedure for Marine Vessels • Ballast water exchanges will be managed in accordance with the Australian Ballast Water Management Requirements • Vessels greater than 400 GT with an antifoul coating are to maintain an up to date international antifouling coating certification in accordance with the Protection of the Sea (Harmful Anti-fouling Systems) Act 2006 and/or relevant codes and standards • Where required, vessel pre-arrival information will be reported through the Maritime Arrivals Reporting System as per the Commonwealth Biosecurity Act 2015.
Release of waste	• Vessel operations activities may result in an unplanned release of waste to environment causing marine pollution	• Vessels will comply with the requirements of Marine Order 95 (MARPOL 73/78 Annex V) in relation to managing waste (garbage) offshore.
Loss of equipment	• Unplanned release of seismic equipment (seismic source and/or streamers) to the environment may result in disruption to other marine users from temporary navigation hazards and alteration of marine habitats arising from seabed disturbance	• Operating procedures for streamer deployment, operations, and retrieval will be implemented • In the event of a loss of equipment that results in a navigational hazard, marine users within the vicinity will be notified • Lost equipment will be retrieved, where safe and practicable to do so
Loss of containment	• Unplanned release of hazardous material to the environment may result in indirect impacts to fauna arising from chemical toxicity	• Vessels will meet the requirements of *Chevron Australia's MSRE process*, including the pre-mobilisation inspections of equipment, couplings and secondary containment availability and refuelling/bunkering process • Vessels will comply with the requirements of Marine Order 91 (MARPOL 73/78 Annex I) in relation to having an approved Ship Oil Pollution Emergency Plan in place.
Vessel collision event	• A vessel collision event may occur as a result of a loss of Dynamic Positioning, navigational error or floundering due to weather. • The potential environmental impacts associated with hydrocarbon exposures from a vessel collision event may result in marine pollution, smothering of subtidal and intertidal habitats, indirect impacts to fisheries, reduction in amenity (resulting in impacts to tourism and recreation) and changes to values and sensitivities of marine protected areas.	• Vessels will meet the crew competency, navigation equipment, and radar requirements of *Chevron Australia's MSRE process* • Notification to relevant agencies of activities and vessel movements to allow them to send warnings and/or notices to mariners prior to commencing activity • Where required, a simultaneous operation plan and/or concurrent operations plan will develop and implement before commencing the activity • Vessels will comply with the requirements of Marine Order 91 (MARPOL 73/78 Annex I) in relation to having an approved Ship Oil Pollution Emergency Plan in place • Emergency response will be implemented in accordance with the response arrangements and strategies detailed in Chevron Australia's Oil Pollution Emergency Plan • Where required, operational and scientific monitoring will be undertaken in accordance with Chevron Australia's Operational and Scientific Monitoring Plan.
Emergency response		
Ground disturbance – shoreline spill response	• In the event of a worst-case spill event, if shoreline is impacted, implementing shoreline clean-up techniques involves people and equipment, which may disturb shoreline habitat with subsequent impacts to fauna.	• Where required, operational and scientific monitoring will be undertaken in accordance with Chevron Australia's Operational and Scientific Monitoring Plan.
Physical presence—oiled wildlife response	• In the event of a worst-case spill event, if fauna is affected, the handling and treating of marine fauna will result in personnel interacting with marine fauna.	• Where required, operational and scientific monitoring will be undertaken in accordance with Chevron Australia's Operational and Scientific Monitoring Plan.

Table 2. Coordinates and depths of the seismic survey areas

Point ID	Latitude *(GDA94)*	Longitude *(GDA94)*	Water depth (m)
Acquisition area			
1	-20.05696	115.2963	82
2	-20.00816	115.2127	151
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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
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6	-19.58402	115.261	1108
7	-19.58327	115.3739	898
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10	-19.98007	115.4877	67
11	-20.00561	115.4702	61

Point ID	Latitude *(GDA94)*	Longitude *(GDA94)*	Water depth (m)
Operational area			
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8	-19.55729	115.1087	1245
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10	-19.48324	115.2619	1208
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13	-19.55349	115.5307	358
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16	-19.99043	115.5923	80
17	-20.04325	115.5738	75
18	-20.08456	115.5343	67
19	-20.17893	115.3588	49

resources

Consultation in the course of preparing an environment plan – NOPSEMA

Environment plan content requirements – NOPSEMA

Environmental requirements – NOPSEMA

Offshore Petroleum Greenhouse Gas Storage (Environment) Regulations

NOPSEMA Assessment Process Environment Plans

Chevron Operational Excellence Management System (OEMS)

appendix d summary of relevant persons consultation

Table D-1: Summary of relevant persons objections/claims and titleholder response

Relevant Person	Interaction Date	Record ID	Method	Summary	Assessment of Objection/Claim	Changes made to EP in response to consultation
Apache Fishing Charters	04/05/2023	CN-000383	Email	CAPL advised the Apache Fishing Charters had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the Apache Fishing Charters that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (see Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Apache Fishing Charters functions, interests or activities. No changes required.
Aquaculture Council of WA	10/01/2023	CN-000106	Email	CAPL advised the Aquaculture Council of Western Australia (ACWA) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL suggested they coordinate a phone call to discuss and agree on the communication protocols and to consult on the current Environment Plans. ACWA would be pleased to meet with CAPL, and a meeting was organised.	In consultation in the course of preparing the EP, Aquaculture Council of WA has provided no objection or claim in response to the proposed activity CAPL reached out to the additional contacts provided by Aquaculture Council of WA. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future (Section 8.3.4.1)	CAPL considers the measures and controls in the EP address Aquaculture Council of WA's functions, interests or activities. No changes required.
	09/02/2023	OC-000296	Virtual Meeting	CAPL spoke with a representative from the Aquaculture Council of WA (ACWA) to provide an overview of CAPL's new approach to consultation along with an update on CAPL's Environment Plans. CAPL were asked to present the same information to the ACWA board.		
	21/04/2023	OC-000307	Face-to-face	CAPL presented on the current activities and consultation process to the Aquaculture Council of WA (ACWA) board. ACWA mentioned various areas that their members may be interested and concerned about. The ACWA was appreciative of CAPL's approach and will revert back to CAPL with any questions they may have.		

Relevant Person	Interaction Date	Record ID	Method	Summary	Assessment of Objection/Claim	Changes made to EP in response to consultation
	01/05/2023	OC-000424	Email	CAPL thanked the Aquaculture Council of WA (ACWA) for their support and engagement in the preparation of the Environment Plan. CAPL advised that if the ACWA had any objections or questions about the activity before CAPL submitted the Environment Plan to NOPSEMA, CAPL welcomed them. ACWA confirmed CAPL's activity information was presented at the board meeting and there were no concerns raised but noted there are some operators in the vicinity that may be relevant and asked what licences CAPL has engaged directly. CAPL confirmed they have engaged WAFIC and asked ACWA to identify additional contacts CAPL should contact.		
	04/05/2023	OC-000455	Email	ACWA identified additional relevant persons CAPL should engage with regarding their Environment Plans. ACWA thanked CAPL for getting in touch. CAPL engaged with ACWA and acknowledged their intentions to contact the referenced relevant persons and thanked ACWA for their assistance. ACWA shared CAPLs written notice on the activity to Maxima Pearling on CAPL's behalf for introduction.		
Archipelago Adventures	04/05/2023	CN-000384	Email	CAPL advised the Archipelago Adventures had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Archipelago Adventures that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (see Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Archipelago Adventure's functions, interests or activities. No changes required.

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Ashburton Anglers	08/05/2023	CN-000400	Email	CAPL engaged with Ashburton Anglers as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity through a written notice factsheet and provided a link to their website for further information regarding the activity. CAPL notified Ashburton Anglers that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (see Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Ashburton Angler's functions, interests or activities. No changes required.
Australian Communications and Media Authority (ACMA)	23/08/2022	CN-000505	Email	CAPL advised that Australian Communications and Media Authority (ACMA) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and a link to their website for further information regarding the activity. CAPL notified ACMA that they welcome meaningful feedback. ACMA acknowledged receipt of email and notified CAPL that there are submarine cables in the vicinity of the proposed survey. The cables in proximity are the North West Cable System owned by Vocus and the North West Fibre Optic Cable Network owned by Telstra. ACMA advised CAPL should ensure cable operators are notified.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (see Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address ACMA's functions, interests or activities. No changes required.
	05/09/2022	OC-000463	Email	CAPL reached out to ACMA to determine the location of the subsea cables and also asked if seismic survey's will have an impact on subsea cables. ACMA confirmed that the NWS area has two existing subsea cables and that maps were available from the Australian Hydrographic Office. ACMA informed CAPL that Vocus had recently		

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				acquired a permit to install in that area. ACMA advised CAPL to contact the cable operators.		
	08/05/2023	CN-000402	Email	CAPL re-advised the Australian Communications and Media Authority (ACMA) that they had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified ACMA that they welcome meaningful feedback.		
Australian Conservation Foundation (ACF)	31/03/2023	CN-000163	Email	CAPL used webform to request the contact email in order to supply Environment Plan information to the Australian Conservation Foundation (ACF). CAPL responded to the email sent by ACF and advised that the ACF had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified ACF that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (see Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address ACF's functions, interests or activities. No changes required.
Australian Council of Prawn Fisheries (ACPF) Ltd.	04/05/2023	CN-000388	Email	CAPL advised the Australian Council of Prawn Fisheries (ACPF) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the ACPF that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (see Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address ACPF's functions, interests or activities. No changes required.

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Australian Fisheries Management Authority (AFMA)	08/06/2021	CN-000459	Email	CAPL advised that Australian Fisheries Management Authority (AFMA) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and notified AFMA that they welcome meaningful feedback. AFMA acknowledged receipt of email and recommended that CAPL contact relevant fishing industry associations directly. CAPL acknowledged AFMAs advice and confirmed they had engaged the appropriate associations.	In consultation in the course of preparing the EP, AFMA has provided no objection or claim in response to the proposed activity CAPL reached out to the additional contacts provided by AFMA. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future (Section 8.3.4.1)	CAPL considers the measures and controls in the EP address AFMA's functions, interests or activities. No changes required.
	15/02/2023	CN-000214	Email	CAPL advised the AFMA had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified AFMA that they welcome meaningful feedback. AFMA provided other relevant industry associations CAPL should consult with, CAPL confirmed they have been engaging with WAFIC closely and subsequently have reach out to the Northern Prawn Fishery and Commonwealth Fishery Association (CFA).		
Australian Hydrographic Office (AHO)	08/05/2023	CN-000416	Email	CAPL advised the Australian Hydrographic Office (AHO) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the AHO that they welcome meaningful feedback. AHO acknowledged receipt of email and notified CAPL that the data supplied will now be registered, assessed, prioritised and validated in preparation for updating our Navigational Charting products.	In consultation in the course of preparing the EP, AHO has provided no objection or claim in response to the proposed activity. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future (Section 8.3.4.1)	As referenced in Section 7, CAPL will notify the AHO no less than four weeks before commencing activity. CAPL considers the measures and controls in the EP address AHO's functions, interests or activities. No additional EP controls are required.

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Australian Institute of Marine Science (AIMS)	04/05/2023	CN-000387	Email	CAPL advised the Australian Institute of Marine Science (AIMS) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified AIMS that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (see Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address AIMS's functions, interests or activities. No changes required.
Australian Marine Conservation Society (AMCS)	10/02/2023	CN-000226	Email	CAPL advised the Australian Marine Conservation Society (AMCS) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the AMCS that they welcome meaningful feedback. CAPL followed up with AMCS to ensure they received the formal notification regarding CAPL's activity.	In consultation in the course of preparing the EP, AMCS has provided no objection or claim in response to the proposed activity CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address AMCS's functions, interests or activities. No changes required.
	27/03/2023	OC-000160	Phone	CAPL called AMCS to confirm receipt of formal notifications for CAPL's Environment Plan and proposed activity. AMCS confirmed they will reach out to CAPL if they have any comments or concerns.		
Australian Marine Oil Spill Response Centre (AMOSC)	04/05/2023	CN-000385	Email	CAPL advised the Australian Maine Oil Spill Response Centre (AMOSC) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified AMOSC that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation	CAPL considers the measures and controls in the EP address AMOSC's functions, interests or activities. No additional EP controls are required.

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					(Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future. CAPL will notify AMOSC in the event of an emergency as per their request.	
Australian Maritime Safety Authority (AMSA)	09/06/2021	CN-000458	Email	CAPL advised that The Australian Maritime Safety Authority (AMSA) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and notified AMSA that they welcome meaningful feedback. AMSA advise CAPL on necessary procedures to adhere to such as: • CAPL will ensure timely and relevant maritime safety information (MSI) by contacting AHO no less than four weeks before operations commence with details relevant to operations. AHO will then ensure vessels receive information of the activities, • CAPL is required to contact AMSA's Joint Rescue Coordination Centre (JRCC) by email so they can promulgate radio-navigation warnings at least 24-48 hours before operations commence, • CAPL to keep both sectors updated on activity progress and any changes to activity operations, • CAPL to comply with International Rules for Preventing Collisions at Sea and to obtain vessel traffic data for the operational area (AIS). CAPL responded and acknowledged AMSA's requirements and committed to continued consultation with AMSA and relevant parties.	In consultation in the course of preparing the EP, AMSA has provided no objection or claim in response to the proposed activity. AMSA have requested to be included in ongoing consultation. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	As referenced in EPS Section 7 and detailed in Table 8-5, CAPL will notify the AMSA and AHO no less than four weeks before commencing activity. CAPL considers the measures and controls in the EP address AMSA functions, interests or activities. No additional EP controls are required.
	15/02/2023	CN-000537	Email	CAPL advised AMSA that they had been identified as a relevant person with functions, interests or		

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				activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified AMSA that they welcome meaningful feedback. AMSA requested the ArcGIS shapefiles of the activity so AMSA GIS team can map the area and overlay their AIS data. CAPL provided the requested data.		
Australian Southern Bluefin Tuna Industry Association (ASBTIA)	19/05/2022	OC-000071	Email	CAPL requested information as to who the correct person is to send information to at Australian Southern Bluefin Tuna Association (ASBTIA). ASBTIA requested they be removed from the ongoing consultation due to them not having a direct interest in the location of the activity. ASBTIA expect that all activities are done in a responsible manner so as to prevent accidental discharge of hydrocarbons or chemicals into the marine environment and that any potential oil spill or loss of well control be appropriately and rapidly dealt with.	In consultation in the course of preparing the EP, ASBTIA has provided no objection or claim in response to the proposed activity ASBTIA has requested to be removed from CAPL's ongoing consultation. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address ASBTIA's functions, interests or activities. No additional EP controls are required.
	10/03/2023	CN-000404	Email	CAPL re-engaged ASBTIA with the updated and additional information regarding the activity and sought confirmation that ASBTIA would still like to be removed from the consultation list. No response was received.		
Baiyungu Aboriginal Corporation (BAC)	09/02/2023	CN-000321	Email	CAPL advised that the Baiyungu Aboriginal Corporation (BAC) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified BAC that they welcome meaningful feedback.	In consultation in the course of preparing the EP, BAC has provided no objection or claim in response to the proposed activity. BAC have requested to be included in ongoing consultation and in the event of an emergency they be	As referenced in EPS Section 7 and detailed in Table 8-5, CAPL will provide BAC ongoing consultation of the activity milestones as per their request. CAPL will also notify BAC in the event of an emergency as per their request (see and Section 8.3.4.2)
	22/02/2023	OC-000323	Email	CAPL advised BAC that they had been identified and that. CAPL representatives are interested in speaking to a representative of BAC about CAPL's activities.		

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	13/03/2023	OC-000322	Email	CAPL engaged with BAC to express their gratitude for BACs time and continued partnership. CAPL also confirmed attendance to present to the Directors of Baiyungu.	included in the notification to relevant persons. CAPL is committed to ongoing consultation including working with traditional owners on a broader understanding of sea country and underwater cultural heritage. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future (see Section 8.3.4.1)	CAPL considers the measures and controls in the EP address BAC's functions, interests or activities. No additional EP controls are required.
	15/03/2023	OC-000232	Email	CAPL and BAC organised a meeting for CAPL to present on the upcoming activities along with explore possible opportunities for the Traditional Owners in regards to ranger programs, protection areas and other programs that may have impacts on country. A meeting was organised.		
	30/03/2023	OC-000245	Face-to-face	CAPL met with the BAC Board of Directors at Cardabia Station to present the details of CAPL's upcoming offshore activities and the identified risks and impacts. CAPL requested advice as to whether additional relevant persons not present at the meeting should be informed and consulted with. CAPL sought feedback on areas of significance and cultural values including sea country and underwater cultural heritage. Protecting land and sea country is a significant focus of the BAC and they are interested in collaborating with CAPL to protect it.		
	04/04/2023	OC-000242	Phone	BAC enquired if CAPL have engaged Nganhurra Thanardi Garrbu Aboriginal Corporation (NTGAC), CAPL confirmed they have a meeting with NTGAC organised for September. CAPL reiterated their interest to meet with Baiyungu board again and to maintain momentum on discussions.		

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	02/05/2023	OC-000357	Email	CAPL contacted BAC to confirm they have no specific objections and claims regarding the activity. CAPL reiterated with BAC that this has not just been a one-off engagement and CAPL are committed to ongoing consultation.		
	09/05/2023	OC-000421	Phone	CAPL contacted BAC to confirm they have no specific objections and claims regarding the activity. BAC confirmed that there were no issues or objections with respect to the Environment Plan and look forward to ongoing consultations and discussions.		
	10/05/2023	OC-000525	Email	CAPL advised BAC of the completion of the consultation timeframe regarding CAPL Environment Plans, and provided the following summary: The Baiyungu coastal area, sea country, and adjacent islands are highly valuable to the Baiyungu people. Impact on these areas from a planned or unplanned event may cause harm to the cultural landscape, individuals, and the community. Based on the current activity proposal, BAC, as representatives for the Baiyungu people has not expressed objections to the planned activities discussed in the consultation process. BAC requests CAPL to formalise continued engagement and support in relation to the Environment Plans and related activities to assist in properly performing its duties in advocating for and protecting rights and interests on Baiyungu country, including to inform emergency response planning. CAPL sent through a summary of engagements with BAC for confirmation. BAC advised CAPL that		

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				it is not their role to provide a formal response and advised CAPL to engage with NTGAC.		
	21/06/2023	OC-000562	Virtual Meeting	CAPL met with BAC to discuss ongoing consulting and relationship. BAC advised that they support opportunities to continue to build the relationship between CAPL and BAC and were grateful for receipt of information on the Chevron Community Spirit Grant. BAC advised CAPL that they may wish to also engage with the DBCA who are in partnership with Baiyungu people and have joint management of the Ningaloo Coast. BAC supported CAPLs approach of continuing to engage with NTGAC and BAC on Engagement Plan. CAPL introduced the OPP for future consultation.		
Blue Horizon Charters	04/05/2023	CN-000386	Email	CAPL advised the Blue Horizon Charters had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Blue Horizon Charters that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Blue Horizon Charters functions, interests or activities. No changes required.

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Blue Juice Charters	04/05/2023	CN-000389	Email	CAPL advised the Blue Juice Charters had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Blue Juice Charters that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Blue Juice Charters functions, interests or activities. No changes required.
Blue Lightning Fishing Charters	04/05/2023	CN-000390	Email	CAPL advised that Blue Lightning Fishing Charters had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Blue Lightning Fishing Charters that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Blue Lightning Fishing Charters functions, interests or activities. No changes required.
Bluesun2 Boat Charters	04/05/2023	CN-000391	Email	CAPL advised the Bluesun 2 Boat Charters had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Bluesun 2 Boat Charters that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Bluesun 2 Boat Charters functions, interests or activities. No changes required.

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Boating Industry Association WA	04/05/2023	CN-000392	Email	CAPL advised the Boating Industry Association WA had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Boating Industry Association WA that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Boating Industry Association WA's functions, interests or activities. No changes required.
British Petroleum (BP)	17/02/2023	CN-000209	Email	CAPL advised that British Petroleum (BP) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified BP that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address BP's functions, interests or activities. No changes required.
Buurabalayji Thalanyji Aboriginal Corporation (BTAC)	07/09/2022	OC-000477	Phone	CAPL provided an initial conversation about the new Environment Plan consultation requirements. Buurabalayji Thalanyji Aboriginal Corporation (BTAC) agreed to meet when CAPL had further information to share.	In consultation in the course of preparing the EP, BTAC has provided no objection or claim in response to the proposed activity. BTAC have requested to be included in ongoing consultation and in the event of an emergency they be	As referenced in EPS Section 7 and detailed in Table 8-5, CAPL will provide BTAC ongoing consultation of the activity milestones as per their request. CAPL will also notify BTAC in the event of an emergency as per their request (see and Section 8.3.4.2)
	11/11/2022	OC-000478	Email	CAPL emailed BTAC to request a meeting to discuss the upcoming activities CAPL have and the environmental plan consultation requirement and develop a mutually agreed consultation process. A meeting was organised.		
	17/11/2022	OC-000479	Email	BTAC provided survey results to CAPL that were undertaken.		

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				CAPL sent a follow-up email to BTAC requesting a meeting to discuss the upcoming offshore activities and environmental plan consultation requirements along with to map a path forward in regard to co-design consultation. A meeting was confirmed.	included in the notification to relevant persons. CAPL is committed to ongoing consultation including working with traditional owners on a broader understanding of sea country and underwater cultural heritage. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future (see Section 8.3.4.1)	CAPL considers the measures and controls in the EP address BTAC's functions, interests or activities. No additional EP controls are required.
	13/12/2022	OC-000480	Face-to-face	CAPL met with BTAC to discuss cultural heritage planning for 2023. During the meeting CAPL raised the need to meet and develop a consultation approach for environmental plans. All parties agreed to meet in January 2023 to discuss further.		
	13/01/2023	OC-000249	Face-to-face	CAPL met with the Chair of the BTAC to present an overview of the consultation process for CAPL's upcoming offshore activities. CAPL sought feedback on areas of significance and cultural values including sea country and underwater cultural heritage. CAPL requested advice as to whether additional relevant persons not present at the meeting should be informed and consulted with. BTAC provided details of other relevant persons in neighbouring PBCs.		
	03/02/2023	OC-000481	Face-to-face	CAPL and BTAC held a meeting to discuss the environmental planning consultation requirements of the Commonwealth. During the meeting CAPL provided an overview of the proposed activities and directed BTAC to CAPL's public website for detailed information, including project overviews, potential impacts, and risks. CAPL requested to work with BTAC to co-design the consultation process.		
		CN-000484	Email	CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified BTAC that they welcome meaningful feedback. Correspondence between CAPL and RFF Australia (representing BTAC) in relation to the CAPLs environmental plan consultation process. RFF and CAPL agreed to develop a 'consultation		

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				agreement' and both parties began drafting the agreement in parallel. CAPL provided details on how they have been engaging with other PBCs by engaging with the CEO, then the board. CAPL reiterated they would like to organise a meeting with BTAC for CAPL to present an overview of the upcoming activity.		
	27/02/2023	OB-000482	Email	Response from BTAC stating Thalanyji people consider themselves Relevant Persons in relation to CAPL's planned activities. The letter requests further engagement with CAPL to understand the projects in order to protect Thalanyji interests and in ongoing consultation through an agreed framework. BTAC also requests support from CAPL, to enable BTAC to work with its members and supporting anthropological / ethnographic team to define and articulate Thalanyji values on Sea Country in a manner that could be more clearly understood by the offshore sector, government, and the community.		
	30/03/2023	OC-000538	Email	RFF Australia reached out to CAPL to discuss CAPL's upcoming activities and to organise a meeting.		
	12/04/2023	OC-000483	Face-to-face	CAPL and RFF - representing BTACs interests, met up to discuss the next steps in relation to BTAC providing feedback on CAPLs Environment Plan consultation. BTAC requested the draft statements or principles specifically tailored to BTAC or the Thalanyji people, which CAPL proposes to include in its Environment Plans and a summary of consultation.		
	13/04/2023	OC-000486	Email	Correspondence between CAPL and RFF Australia (representing BTAC) summarising the points of consultation and engagement between CAPL and BTAC, as well as feedback provided by BTAC, that CAPL propose to include in the Environment Plans submission to NOPSEMA. - CAPL first engaged BTAC in November 2022, on the new Commonwealth Environment Plan consultation requirements. CAPL shared the draft consultation process and timeline for		

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				feedback. CAPL had several subsequent conversations with BTAC staff and the BTAC Chair in January 2023, to understand their view on the new requirements, and requested the opportunity to co-design the consultation process. - On 3 February 2023, CAPL notified BTAC of the commencement of the consultation period and provided information on our upcoming offshore activities which may intersect with Thalanyji interests. The twelve-week consultation period is due to conclude on 5 May 2023. - A letter was sent to CAPL from BTAC on Monday 27 February confirming the Thalanyji community holds interests and values within the Environmental Area that might be affected (EMBA). The letter sought ongoing consultation with BTAC, and support by CAPL to that end, in relation to the above Environment Plans and related activities – and requested formalisation of ongoing consultation under a framework to be jointly developed and agreed. - CAPL provided a written response on 10 March 2023 that provided in-principle support for a consultation framework with BTAC. CAPL's response recommended that ongoing consultation under a formalised framework occur in parallel with immediate consultation specific to approval of proposed Environment Plans. - On the 3 March 2023, CAPL and BTAC met to further discuss the Commonwealth Environmental Plan consultation process. During the meeting, the parties discussed CAPL's approach to consultation where BTAC was again invited to provide input on the consultation method and timeline. CAPL representatives also provided an overview of where information can be found about the proposed activities, including the activities overview, risk, and impact assessments. Based on these discussions, CAPL understand that:		

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				- The Thalanyji coastal area, sea country, and adjacent islands are highly valuable to the Thalanyji people. Impact on these areas from a planned or unplanned event may cause harm to the cultural landscape, individuals, and the community. - BTAC requests CAPL to formalise continued engagement and support in relation to the Environment Plans and related activities to assist it properly perform its duties in advocating for and protecting rights and interests in Thalanyji country, including so emergency response plans are well informed. - BTAC expects that CAPL will provide an annual update, or as otherwise requested, to the BTAC board or common law holders of CAPL's activities in the EMBA. - BTAC can at any time make direct representations to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) about the nature of BTAC's interests and values and how they may be affected by CAPL's activities.		
	24/05/2023	OC-000555	Face-to-Face	CAPL met with BTAC to finalise BTAC's formal response to consultation. BTAC agreed to suggested changes by CAPL and requested final copy.		
	26/05/2023	OC-000556	Email	CAPL sent email to BTAC with the final copy of the engagement summary.		
Cape Conservation Group	10/02/2023	CN-000158	Email	CAPL advised the Cape Conservation Group had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Cape Conservation Group that they welcome meaningful feedback.	Cape Conservation Group has expressed their views of not willing to participate in CAPL's consultation process regarding the activity. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL	CAPL considers the measures and controls in the EP address Cape Conservation Group's functions, interests or activities. No changes required.
	17/02/2023	OC-000306	Phone	CAPL spoke with Cape Conservation Group about CAPL's want to engage with them in Exmouth and discuss preferred methods of communication.		

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				Cape Conservation group confirmed they would share CAPL's details.	will consider any feedback if they provide in the future.	
	11/05/2023	OC-000527	Email	CAPL reached out to the Cape Conservation Group to see if they had any feedback they may have on the activity and confirmed that the Cape Conservation Group has not expressed specific concerns or objections to the planned activity. The Cape Conservation Group advised CAPL of their views and informed CAPL of their decision not to participate in the consultation process. CAPL responded to Cape Conservation Group acknowledging their views and that CAPL would be happy to discuss CAPL's activities at any time should they change their minds.		
Cape Immersion Tours	20/02/2023	CN-000208	Email	CAPL advised that Cape Immersion Tours had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Cape Immersion Tours that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Cape Immersion Tour's functions, interests or activities. No changes required.
Care For Hedland Environmental Association	08/02/2023	OC-000140	Email	Care for Hedland identified themselves to CAPL as a relevant person with functions, interests or activities that may be affected by the activity. CAPL organised a meeting with Care for Hedland to provide an overview of their activity and consultation process.	In consultation in the course of preparing the EP, Care For Hedland Environmental Association has provided no objection or claim in	CAPL considers the measures and controls in the EP address Care For Hedland Environmental Association's functions, interests or activities.

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		CN-000100	Email	Upon Care for Hedland self-identifying themselves, CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Care for Hedland that they welcome meaningful feedback. Care for Hedland requested to be included in the consultation process.	response to the proposed activity. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	No changes required.
	22/02/2023	OC-000259	Virtual Meeting	CAPL spoke with Care for Hedland and provided an overview of their current consultation hub and update on their Environment Plan. Care for Hedland nominated themselves as Relevant Person. Care for Hedland have been undergoing a turtle monitoring program over the past 20 years, Care for Hedland would be interested in a collaboration with CAPL with marine turtles being their primary interest. Care for Hedland confirmed they will meet with the committee and revert back with any additional questions they may have for CAPL.		
	11/05/2023	OC-000508	Email	CAPL thanked Care for Hedland for their engagement and support in 2023. CAPL asked if there had been any comments or feedback from the community with respect to CAPL activities. Care for Hedland responded with no specific concerns around CAPL activities, but specified the need to mitigate impacts to marine turtles.		
Carnarvon Chamber of Commerce Inc.	08/02/2023	CN-000229	Email	CAPL advised the Carnarvon Chamber of Commerce had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the Carnarvon Chamber of Commerce that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Carnarvon Chamber of Commerce's functions, interests or activities. No changes required.

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Carnarvon Energy	14/02/2023	CN-000217	Email	CAPL advised that Carnarvon Energy had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Carnarvon Energy that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Carnarvon Energy's functions, interests or activities. No changes required.
Centre for Whale Research Western Australia (CWR)	10/02/2023	CN-000409	Email	CAPL advised the Centre for Whale Research had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the Centre for Whale Research that they welcome meaningful feedback. CAPL followed up to ensure they received the formal notification regarding CAPL's activity.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address CWR's functions, interests or activities. No changes required.
City of Karratha (Pilbara)	19/12/2022	OC-000131	Email	CAPL advised the City of Karratha had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL suggested they coordinate a phone call to discuss and agree on the communication protocols and to consult on the current Environment Plans.	In consultation in the course of preparing the EP, City of Karratha has provided no objection or claim in response to the proposed activity. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL	CAPL considers the measures and controls in the EP address City of Karratha's functions, interests or activities. No changes required.
	31/01/2023	OC-000290	Face-to-face	CAPL met with the City of Karratha to provide an overview of their new approach to consultation along with an update on their Environment Plans. CAPL requested time to speak to the City of Karratha council on their Environment Plans.		

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	01/02/2023	OC-000130	Email	CAPL thanked the City of Karratha for their time and participation regarding CAPL's consultation process. CAPL confirmed they would like the opportunity to present to the Council Briefing. CAPL provided a list of other organisations they are currently consulting and asked if the City of Karratha could provide relevant eNGOs CAPL should proactively engage.	will consider any feedback if they provide in the future.	
	06/02/2023	CN-000369	Email	CAPL advised the City of Karratha had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified City of Karratha that they welcome meaningful feedback.		
	15/02/2023	OC-000135	Email	CAPL engaged with the City of Karratha to discuss the most efficient method to inform the community of CAPL's activities.		
	20/02/2023	OC-000258	Virtual Meeting	CAPL met with the City of Karratha Council. CAPL provided an overview of their new online consultation hub and update on their Environment Plans. The City of Karratha Council complemented the level of detail by CAPL and posed a question on well decommissioning and seismic activities. CAPL informed the City of Karratha Council of the preventative measures that are in place as safeguards. CAPL offered to answer any further questions that may arise.		
		OC-000301	Email	CAPL reached out to the City of Karratha to thank them for their hospitality and to communicate their ongoing commitment to consultation.		
	04/05/2023	OC-000454	Email	CAPL reached out to the City of Karratha to provide any feedback they may have on the activity. CAPL confirmed that the City of Karratha has not expressed specific concerns or objections to the planned activity.		

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Commonwealth Fisheries Association (CFA)	14/03/2023	CN-000192	Email	CAPL advised the Commonwealth Fisheries Association (CFA) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the CFA that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address CFA's functions, interests or activities. No changes required.
Conservation Council of WA (CCWA)	10/02/2023	CN-000225	Email	CAPL advised that the Conservation Council of Western Australia (CCWA) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the CCWA that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address CCWA's functions, interests or activities. No changes required.
	27/03/2023	CN-000159	Phone	CAPL contacted Conservation Council of WA (CCWA) to confirm receipt of formal notification. CCWA confirmed that they would forward on to the appropriate representatives.		
	11/05/2023	OC-000532	Email	CAPL reached out to the CCWA to provide any feedback they may have on the activity. CAPL confirmed that the CCWA has not expressed specific concerns or objections to the planned activity. CCWA advised CAPL of their intention and interest in providing feedback on the Environment Plans and activities. CAPL informed CCWA that consultation had been finalised but, if they could provide their feedback as soon as possible, CAPL would possibly be able to consider the feedback and include it in the Environment Plans. CAPL		

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				welcomed the opportunity to meet with CCWA to discuss ongoing consultation for future activities.		
Coral Bay Progress Association	03/01/2023	OC-000113	Email	The Shire of Carnarvon provided CAPL with a contact at the Coral Bay Progress Association for CAPL to contact. CAPL advised the Coral Bay Progress Association had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL suggested they coordinate a phone call to discuss and agree on the communication protocols and to consult on the current Environment Plans. A meeting was organised.	In consultation in the course of preparing the EP, Coral Bay Progress Association has provided no objection or claim in response to the proposed activity. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Coral Bay Progress Association's functions, interests or activities. No changes required.
	06/02/2023	CN-000114	Email	CAPL advised the Coral Bay Progress Association had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Coral Bay Progress Association that they welcome meaningful feedback.		
	27/02/2023	OC-000265	Phone	CAPL spoke with the representatives from the Coral Bay Progress Association. Coral Bay Progress Association advised that they would discuss the Environment Plans during an internal meeting and revert back to CAPL with any comments or questions.		

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	02/03/2023	OC-000292	Virtual Meeting	CAPL met with the Coral Bay Progress Association to provide an overview of their new approach to consultation along with an update on their Environment Plans.		
	16/03/2023	OC-000068	Phone	CAPL called to follow up their recent meeting to understand whether there was interest in meeting up. Coral Bay Progress Association confirmed that CAPL's Environment Plan information had been shared but there has been no interest in engaging further at this point.		
	10/05/2023	OC-000439	Email	CAPL reached out to the Coral Bay Progress Association to provide any feedback they may have on the activity. CAPL confirmed that the Coral Bay Progress Association has not expressed specific concerns or objections to the planned activity.		
Coral Futures Corporation	04/05/2023	CN-000399	Email	CAPL advised that Coral Futures Corporation had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Coral Futures Corporation that they welcome meaningful feedback. Coral Futures Corporation responded to CAPL and wish to be included in the continuing consultation process regarding the activity. Coral Futures has planned an aquaculture project in the zone of the CAPL's planned activity and seek to understand the potential impacts (if any) and risks that may arise and have potential for impact from CAPL's proposed activity, including air and water quality, seabed habitat, and marine fauna. A meeting was organised.	In consultation in the course of preparing the EP, Coral Futures Corporation has provided no objection or claim in response to the proposed activity. Coral Futures Corporation have requested to be included in ongoing consultation and in the event of an emergency they be included in the notification to relevant persons. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	As referenced in EPS Section 7 and detailed in Table 8-5, CAPL will provide Coral Futures Corporation ongoing consultation of the activity milestones as per their request. CAPL will also notify Coral Futures Corporation in the event of an emergency as per their request (see and Section 8.3.4.2) CAPL considers the measures and controls in the EP address Coral Futures Corporation's functions, interests or activities. No additional EP controls are required.
	11/05/2023	OC-000428	Virtual Meeting	CAPL presented to Coral Futures Corporation who have an aquaculture license in state waters near Dampier to grow coral. Coral Futures Corporation would like to be advised of ongoing activities from CAPL and be included in emergency notifications.		

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Cygnet Bay Pearl Farm	10/05/2023	CN-000441	Email	CAPL advised the Cygnet Bay Pearl Farm had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the Cygnet Bay Pearl Farm that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Cygnet Bay Pearl Farm's functions, interests or activities. No changes required.
Department of Agriculture, Fisheries and Forestry – (DAFF)	15/02/2023	CN-000215	Email	CAPL advised the Department of Agriculture, Fisheries and Forestry (DAFF) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the DAFF that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Department of Agriculture, Fisheries and Forestry - Fishing impacts functions, interests or activities. No changes required.
Department of Biodiversity, Conservation and Attractions (DBCA)	08/06/2021	CN-000466	Email	CAPL advised Department of Biodiversity Conservation and Attractions (DBCA) of the upcoming activity. DBCA advised CAPL of the activities proximity to marine fauna, marine parks and marine management areas. DBCA requested CAPL undertake a risk assessment to determine the likelihood of potential impacts on marine fauna species that are likely to occur within the Project Area, accounting for the scale and biological significance of noise production.	In consultation in the course of preparing the EP, DBCA has provided no objection or claim in response to the proposed activity. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address DBCA's functions, interests or activities. No changes required.

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				DBCA outlined best practices for management of any significant underwater noise with the potential to impact marine fauna. DBCA provided a link to the underwater noise regulations under the EPBC Act. DBCA was happy to engage with CAPL further if they required any additional assistance or advice.		
	24/01/2023	OC-000108	Email	The Shire of Carnarvon provided a contact at the DBCA for CAPL to contact to organise a time to discuss the upcoming activity. CAPL advised that the DBCA had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL suggested they coordinate a phone call to discuss and agree on the communication protocols and to consult on the current Environment Plans. DBCA acknowledged that the location of the activity is relevant to the DBCA. The DBCA advised they added CAPL's information on the activity to the committee's agenda that is scheduled for 2 May 2023. Post this meeting the DBCA will be in contact with CAPL to address likely impacts (if any) to the outstanding universal value of the Ningaloo Coast World Heritage Area.		
	15/02/2023	CN-000109	Email	CAPL advised the DBCA had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified DBCA that they welcome meaningful feedback. Additional contacts within DBCA was provided to CAPL to provide consultation in the area of Ningaloo Coast and Shark Bay World Heritage Areas.		
	24/02/2023	OC-000267	Virtual Meeting	CAPL met with the representatives from the DBCA Exmouth and provided an overview of their new approach to consultation along with an update on their Environment Plans. Discussion focused		

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				around EMBA map and shoreline loading queries. DBCA Exmouth advised CAPL of the importance of engagement with the World Heritage Committees and NOPSEMA guidelines and sensitivities relevant to World Heritage Areas.		
	11/05/2023	OC-000456	Email	CAPL reached out to the DBCA to provide any feedback they may have on the activity. CAPL confirmed that DBCA has not expressed specific concerns or objections to the planned activity. DBCA Exmouth contacted CAPL and notified them that all queries regarding Environment Plans and consultation on proposals should be sent to a separate branch of DBCA. CAPL sent the email to the appropriate inbox DBCA Exmouth pointed CAPL to.		
Department of Climate Change, energy, the Environment and Water – DCCEEW Underwater Cultural Heritage (UCH)	16/05/2023	CN-000547	Email	CAPL advised DCCEEW that they had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and advised that they welcome meaningful feedback. DCCEEW advised CAPL of the requirements regarding Underwater Cultural Heritage (UCH) and its importance to Aboriginal Corporations and people. CAPL acknowledged the email and informed DCCEEW that they are aware and understand the importance of UCH and have been engaging according to ensure they meet the requirements and engage with the appropriate corporations.	In consultation in the course of preparing the EP, DCCEEW UCH has provided no objection or claim in response to the proposed activity. DCCEEW UCH have requested to be included in ongoing consultation. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	As referenced in EPS Section 7 and detailed in Table 8-5, CAPL will notify DCCEEW UCH before commencing the activity. CAPL considers the measures and controls in the EP address DCCEEW UCH's functions, interests or activities. No additional EP controls are required.
Department of Climate Change, Energy, the Environment and Water - Director of National Parks (DNP)	08/06/2021	OB-000468	Email	CAPL advised the Director of National Parks (DNP) that they had been identified as a relevant person with functions, interests or activities that may be affected by the activity. DNP advised CAPL of the regulations of petroleum activities within marine management and park	In consultation in the course of preparing the EP, DNP has provided no further objection or claim in response to the proposed activity.	As referenced in EPS Section 7 and detailed in Table 8-5, CAPL will provide the DNP's ongoing consultation of the activity milestones as per their request.

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				areas. DNP informed CAPL that NOPSEMA has worked closely with Parks Australia to develop and publish the guidance note for titleholders to use which: - identifies and manages all impacts and risks on Australian marine park values (including ecosystem values) to an acceptable level and has considered all options to avoid or reduce them to as low as reasonably practicable. 2 - Clearly demonstrates that the activity will not be inconsistent with the management plan. DNP outlined the importance of the Marne Park Values and outlined there objection and claims: - That the proximity to the Montebello Marine Park and nearby marine parks are clearly identified to enable us to provide feedback on proposed risk management activities. - Detailed consideration given to the: ○ impacts upon the Flatback, Green, Loggerhead and Hawksbill turtles which are present and display behaviours including breeding (on the nearby Montebello Islands), foraging and nesting. ○ impacts upon seabirds that forage within the Marine Park. o impacts upon the Whale Shark, Humpback Whale and Pygmy Blue Whale which are present and include migration and foraging. - Documented approach to engaging with tourism and commercial fishing operators that operate within and nearby the Marine Park. - Documented approach to engaging with the Yamatji Marlpa Corporation who is the Native Title Representative Body for	Director of National Parks have requested to be included in ongoing consultation and when the Environment Plan is published on NOPSEMA's website. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address DNP's functions, interests or activities. No additional EP controls are required.

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				the Pilbara region to understand and manage implications with sea country. Details of the manage implications with sea country. Consideration should clearly detail the use of low power and shut down zones, timing of the activity and detailed adaptive management approaches – with particular attention to managing the risk to migratory, foraging and internesting locations. Additionally, DNP advised CAPL of the necessity of emergency response in the unplanned event of an oil/gas incident. DNP also suggested they may request daily or weekly situation reports, depending on the sale and severity of the incident. DNP advised that they would like to be included in ongoing consultation relating to the project. DNP requests correspondence if the EP is approved at 10 days before works begin and the conclusion of the activity.		
	13/09/2021	OC-000561	Email	CAPL responded to the raised objection and claims from the DCCEEW on behalf of the Director of National Parks (DNP), and confirmed their commitment to notify DNP at least 10 days prior to undertaking the activity and to ongoing consultation.		
	15/02/2023	CN-000194	Email	CAPL advised the Director of National Parks (DNP) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the DNP that they welcome meaningful feedback.		

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Department of Defence (DoD)	14/02/2023	CN-000220	Email	CAPL advised that The Department of Defence (DoD) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the DoD that they welcome meaningful feedback.	In consultation in the course of preparing the EP, DoD has provided no objection or claim in response to the proposed activity. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	As referenced in EPS Section 7 and detailed in Table 8-5, CAPL will notify the AHO no less than four weeks before commencing activity. CAPL considers the measures and controls in the EP address DoD's functions, interests or activities. No additional EP controls are required.
	16/03/2023	OC-000368	Email	Department of Defence replied to CAPL's consultation that the activity areas are located in the North-West Exercise Area (NWXA) and restricted airspace. CAPL was advised that unexploded ordnance (UXO) may be present on and in the seafloor. CAPL must, therefore, inform itself as to the risks associated with conducting activities in the area. The DoD requested CAPL continue liaison with the Australian Hydrographic Service (AHS) for Notices to Mariners (NOTMAR) three weeks prior to the actual commencement of activities. CAPL acknowledged receipt of DoD response. CAPL understands that the activity areas are located in the North-West Exercise Area (NWXA) and have checked where known unexploded ordnance (UXO) are using the UXO map UXO Map (whereisuxo.org.au) and there are no known UXOs present within the proposed operational area's for the activities consulted on, however CAPL note that there may be UXOs present on and in the sea floor. CAPL confirmed they will contact the Australian Hydrographic Service 3-weeks prior to any activities occurring. CAPL requested further clarification and understanding of where the restricted airspace is within the vicinity of the activity areas. DoD responded and attached a map of the restricted airspace.		

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				The DoD added that should CAPL have any additional questions they shouldn't hesitate to get in touch.		
Department of Mines, Industry Regulation and Safety (WA DMIRS)	08/06/2021	CN-000467	Email	CAPL advised DMIRS that they had been identified as a relevant person with functions, interests or activities that may be affected by the activity. DMIRS stated in the correspondence that they would not be the regulating body and the information was missing the below for DMIRS to review the risks and potential impacts of the activity: - details of credible spill scenarios (including trajectory modelling) and response arrangements particularly if relevant to state lands and waters). - commitment for incident reporting to DMIRS for any impacts that are potentially relevant to WA. DMIRS advised CAPL to get in touch if they have any further questions.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address DMIRS functions, interests or activities. No changes required.
	09/05/2023	CN-000510	Email	CAPL advised the Department of Mines, Industry Regulation and Safely (DMIRS) they have been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and advised DMIRS that CAPL welcome meaningful feedback.		
Department of Primary Industries and Regional Development (WA DPIRD): Fisheries	08/05/2023	CN-000453	Email	CAPL advised the Department of Primary Industries and Regional Development (DPIRD) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified DPIRD that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address DPIRD's functions, interests or activities. No changes required.

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Department of Transport (DoT) - Maritime Environmental Emergency Response (MEER) - Marine Pollution (formerly OSRC Unit)	22/06/2021	CN-000462	Email	CAPL engaged with the Department of Transport - Maritime Environmental Emergency Response (DoT) regarding CAPL's activity. DoT advised CAPL that they should be kept updated through ongoing consultation about the activity. .	In consultation in the course of preparing the EP, DoT - Maritime Environmental Emergency Response has provided no objection or claim in response to the proposed activity. Department of Transport (DoT) - Maritime Environmental Emergency Response have requested to be consulted in the event of an emergency event. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	CAPL will notify Department of Transport (DoT) - Maritime Environmental Emergency Response in the event of an emergency as per their request (see and Section 8.3.4.2). CAPL considers the measures and controls in the EP address DoT Maritime Environmental Emergency Response's functions, interests or activities. No additional EP controls are required.
	15/02/2023	CN-000168	Email	CAPL sent a follow up advising the Department of Transport: Maritime Environmental Emergency Response (DoT) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the Department of Transport that they welcome meaningful feedback. DoT notified CAPL that if there is a risk of a spill impacting State waters from the proposed activities that DoT Oil Spill Response Unit is consulted as outlined in the Department of Transport Offshore Petroleum Industry Guidance Note – Marine Oil Pollution: Response and Consultation Arrangements (July 2020).		

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Department of Transport (DoT) - Navigational Safety	23/03/2023	CN-000127	Email	CAPL advised the Department of Transport (DoT) - Navigational Safety had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the Department of Transport (DoT) -Navigational Safety that they welcome meaningful feedback. Department of Transport (DoT) - Navigational Safety acknowledged receipt of email and would like to be involved in consultation regarding the activity.	In consultation in the course of preparing the EP, DoT – Navigational Safety has provided no objection or claim in response to the proposed activity. Department of Transport (DoT) - Navigational Safety have requested to be included in ongoing consultation. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	As referenced in EPS Section 7 and detailed in Table 8-5, CAPL will provide Department of Transport (DoT) - Navigational Safety ongoing consultation of the activity milestones as per their request. CAPL considers the measures and controls in the EP address DoT Navigational Safety's functions, interests or activities. No additional EP controls are required. No additional EP controls are required.
Department of Water & Environmental Regulation (DWER)	15/02/2023	CN-000210	Email	CAPL advised the Department of Water & Environmental Regulation (DWER) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified DWER that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address DWER's functions, interests or activities. No changes required.
Ebb and Flow / Glass Bottom Boats	20/02/2023	CN-000206	Email	CAPL advised Glass Bottom Boats had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive	CAPL considers the measures and controls in the EP address Glass Bottom Boat's functions, interests or activities. No changes required.

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				Glass Bottom Boats that they welcome meaningful feedback.	feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	
Eni Australia	14/02/2023	CN-000190	Email	CAPL advised that Eni Australia had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Eni Australia that they welcome meaningful feedback. Eni Australia responded that they have received the email and have no concerns regarding the activity.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Eni Australia's functions, interests or activities. No changes required.
Environmental Protection Authority	08/05/2023	CN-000431	Email	CAPL advised that the Environmental Protection Authority (EPA) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the EPA that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address EPA's functions, interests or activities. No changes required.
Exmouth Chamber of Commerce and Industry (ECCI)	20/12/2022	OC-000174	Email	CAPL advised the Exmouth Chamber of Commerce and Industry (ECCI) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. ECCI were pleased to hear from CAPL for early consultation and relationship building.	In consultation in the course of preparing the EP, ECCI has provided no objection or	CAPL considers the measures and controls in the EP address ECCI's functions, interests or activities. No changes required.

Relevant Person	Interaction Date	Record ID	Method	Summary	Assessment of Objection/Claim	Changes made to EP in response to consultation
	05/01/2023	OC-000542	Virtual Meeting	CAPL discussed the upcoming Environment Plan consultation for the activity and CAPL's membership with Exmouth Chamber of Commerce and Industry (ECCI) had been identified as a relevant person.	claim in response to the proposed activity. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	
		OC-000172	Email	CAPL thanked the Exmouth Chamber of Commerce and Industry for their time. CAPL requested community engagement group contacts for continued consultation.		
	24/01/2023	OC-000283	Face-to-face	CAPL met with representatives from Exmouth Chamber of Commerce and Industry (ECCI) in Exmouth. ECCI provided advice on local relevant persons that CAPL should be engaging.		
		OC-000171	Email	ECCI in partnership with Tourism WA provided CAPL with contacts for relevant persons within the region as well as sponsorship opportunities to support the community.		
	06/02/2023	CN-000110	Email	CAPL advised that the Exmouth Chamber of Commerce had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the Exmouth Chamber of Commerce and Industry that they welcome meaningful feedback. The Exmouth Chamber of Commerce organised for CAPL's activity information to be sent out via the Exmouth Chamber of Commerce EDM. CAPL notified the Exmouth Chamber of Commerce that they would reach out to St John Ambulance regarding first aid training for local members in preparation for the Eclipse.		
	13/02/2023	OC-000112	Email	CAPL assisted Exmouth Chamber of Commerce with first aid training through CAPL's relationship with St John Ambulance. CAPL passed on the email address and contact details for a local company that can run the first aid classes for ECCI.		

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	23/02/2023	OC-000261	Virtual Meeting	CAPL met with the ECCI to understand potential opportunities for engagement and support.		
	27/02/2023	OC-000299	Phone	CAPL spoke with ECCI about possible sponsorship and engagement opportunities.		
Exmouth Dive & Whalesharks Ningaloo	09/01/2023	OC-000173	Email	CAPL identified Exmouth Dive & Whaleshark Ningaloo as a relevant person with functions, interests or activities that may be affected by the activity and CAPL contacted them to confirm their contact details for consultation.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Exmouth Dive & Whaleshark Ningaloo's functions, interests or activities. No changes required.
	20/02/2023	CN-000204	Email	CAPL re-engaged with Exmouth Dive & Whalesharks Ningaloo had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the Exmouth Dive & Whalesharks Ningaloo that they welcome meaningful feedback.		
Exmouth Gulf Task Force - DWER	13/02/2023	CN-000069	Email	CAPL advised that the Exmouth Gulf Task Force had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the Exmouth Gulf Task Force that they welcome meaningful feedback. Exmouth Gulf Task Force acknowledged receipt of email and that the Exmouth Gulf Taskforce will consider this at the next meeting.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Exmouth Gulf Task Force's functions, interests or activities. No changes required.
Exxon Mobil	14/02/2023	CN-000191	Email	CAPL advised that Exxon Mobil had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Exxon Mobil that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation	CAPL considers the measures and controls in the EP address Exxon Mobil's functions, interests or activities. No changes required.

Relevant Person	Interaction Date	Record ID	Method	Summary	Assessment of Objection/Claim	Changes made to EP in response to consultation
					(Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	
Gascoyne Development Commission	10/01/2023	OC-000104	Email	CAPL advised the Gascoyne Development Commission (GDC) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL suggested they coordinate a phone call to discuss and agree on the communication protocols and to consult on the current Environment Plans. Gascoyne Development Commission would be pleased to meet with CAPL, and a meeting was organised.	In consultation in the course of preparing the EP, Gascoyne Development Commission has provided no objection or claim in response to the proposed activity. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Gascoyne Development Commission's functions, interests or activities. No changes required.
	09/02/2023	CN-000105	Email	CAPL advised that the GDC had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the Gascoyne Development Commission that they welcome meaningful feedback.		
		OC-000297	Virtual Meeting	CAPL met with a representative from the GDC to provide an overview of their new approach to consultation along with an update on their Environment Plans. The Gascoyne Development Commission provided advice on local relevant persons that CAPL should be engaging.		
	23/02/2023	OC-000262	Virtual Meeting	CAPL spoke with the GDC to understand potential engagement opportunities. CAPL provided an overview of current activities and clarified any questions posed by the GDC regarding the EMBA. The GDC recommended engagement with Recfishwest.		
	10/05/2023	OC-000440	Email	CAPL reached out to the GDC to provide any feedback they may have on the activity. CAPL confirmed that the Gascoyne Development Commission has not expressed specific concerns or objections to the planned activity.		

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Gascoyne Junction Community Resource Centre	08/02/2023	CN-000228	Email	CAPL advised that the Gascoyne Junction Community Resource Centre (GJCRC) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the GJCRC that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Gascoyne Junction Community Resource Centre's functions, interests or activities. No changes required.
Greenpeace	10/02/2023	CN-000224	Email	CAPL advised that Greenpeace had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Greenpeace that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Greenpeace's functions, interests or activities. No changes required.
Haysito Holdings Pty.	03/11/2021	CN-000516	Email	CAPL engaged WAFIC to inform relevant persons with functions, interests or activities about CAPL's upcoming activities. Haysito Holdings was identified as a relevant person that may be affected by the activity. CAPL through WAFIC provided an overview of the activity in a factsheet.	In consultation in the course of preparing the EP, Haysito Holdings Pty. provided their objection or claims in response to the proposed activity. CAPL responded to the objections and ensured Haysito Holdings Pty. understood that CAPL was adhering to all regulations to prevent impacts to the marine environment and fauna.	CAPL considers the measures and controls in the EP address Haysito Holdings Pty. functions, interests or activities.
	11/11/2021	OB-000469	Email	CAPL sent out a written notice of their seismic survey through WAFIC to engage with relevant persons. A commercial fisher responded to CAPL with an objection stating that seismic surveys have negatively impacted business, fish stocks and fishing season. CAPL Acknowledged receipt of feedback. CAPL noted that a comprehensive impact and risk		

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				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 verifiable impacted to a commercial extent by the Wheatstone 4D MSS. 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. CAPL acknowledged the fishers concerns and appreciated the feedback and engagement.	CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	
Image Dive and Charters	04/05/2023	CN-000393	Email	CAPL advised that Image Dive and Charters had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Image Dive and Charters that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Image Dive and Charter's functions, interests or activities. No changes required.
International Fund for Animal Welfare (IFAW) - Oceania	10/02/2023	CN-000377	Email	CAPL advised that the International Fund for Animal Welfare had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the International Fund for	In consultation in the course of preparing the EP, IFAW provided their objection or claims in response to the proposed activity. CAPL responded to the objections	CAPL considers the measures and controls in the EP address Karratha & Districts Chamber of Commerce and Industry's functions, interests or activities.

Relevant Person	Interaction Date	Record ID	Method	Summary	Assessment of Objection/Claim	Changes made to EP in response to consultation
				Animal Welfare that they welcome meaningful feedback.	and ensured IFAW understood that CAPL was adhering to all regulations to prevent impacts to the marine environment and fauna. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	No changes required.
	13/03/2023	OB-000380	Email	IFAW emailed CAPL regarding concerns about the impact of oil and gas exploration on the marine environment, particularly in regards to seismic testing and its impacts on whales. IFAW would like to see the development of quieter alternatives to seismic airguns to reduce underwater noise pollution and a moratorium on any further seismic surveying in Biologically Important Areas at times when whales are present in these areas. CAPL thanked IFAW for the email and for highlighting their concerns. CAPL advised that 4D Marine Seismic Surveys (MSS) are undertaken to acquire data that is compared to previously acquired 3D MSS. There are currently no suitable alternatives to an air gun array that would achieve the objectives of the Wheatstone 4D Marine Seismic Survey. With respect to the timing, for a 4D MSS to be successful, acquisition parameters and ambient environmental conditions (e.g. currents, water temperature, swell etc.) 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. The reason for the Wheatstone 4D MSS starting in January rather than November is to limit the overlap with the predicted Pygmy Blue Whale migration timings. CAPL commissioned acoustic modelling for the Wheatstone 4D MSS to inform the environmental risk assessment for the activity and commits to the implementation of EPBC Policy Statement 2.1 - Interaction between offshore seismic exploration and whales. In addition, CAPL will ensure the activity is conducted in a manner that is consistent with management action A.2.3 of the Blue Whale Conservation Management Plan: “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 foraging area".		

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Jadestone Energy	14/02/2023	CN-000189	Email	CAPL advised that Jadestone Energy had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Jadestone Energy that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Jadestone Energy's functions, interests or activities. No changes required.
Karratha & Districts Chamber of Commerce and Industry	22/12/2022	OC-000115	Email	CAPL advised the Karratha and Districts Chamber of Commerce and Industry (KDCCI) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL suggested they coordinate a phone call to discuss and agree on the communication protocols and to consult on the current Environment Plans. KDCCI acknowledged and appreciated CAPL reaching out and a meeting was organised.	In consultation in the course of preparing the EP, Karratha & Districts Chamber of Commerce and Industry has provided no objection or claim in response to the proposed activity. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Karratha & Districts Chamber of Commerce and Industry's functions, interests or activities. No changes required.
	31/01/2023	OC-000288	Face-to-face	CAPL met with KDCCI in Karratha. CAPL provided an overview of their new approach to consultation along with an update on their Environment Plans. KDCCI offered to share CAPL's information sheet with their members.		
	13/02/2023	CN-000410	Email	CAPL advised that KDCCI had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified KDCCI that they welcome meaningful feedback.		
		OC-000304	Phone	CAPL spoke with KDCCI regarding details of CAPL's advert to include in the KDCCI newsletter.		
	22/02/2023	OC-000117	Email	KDCCI advertised CAPL's Environment Plan information sheet in their newsletter.		

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	03/03/2023	OC-000520	Email	KDCCI offered the opportunity for CAPL to present to their board regarding the upcoming activities.		
	16/05/2023	OC-000534	Virtual Meeting	CAPL presented to the KDCCI board on CAPL's upcoming activities. The KDDCI board confirmed CAPL's Environment Plan information was shared via email to their membership on CAPL's behalf in February. No feedback, objections or claims were raised.		
Karratha Tourism and Visitor Centre	08/02/2023	CN-000231	Email	CAPL advised that the Karratha Visitor Centre had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the Karratha Visitor Centre that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Karratha Tourism and Visitor Centre's functions, interests or activities. No changes required.
Kato Energy / Kato NWS Pty Ltd	14/02/2023	CN-000216	Email	CAPL advised that Kato Energy had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Kato Energy that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Kato Energy's functions, interests or activities. No changes required.
Kufpec	14/02/2023	CN-000417	Email	CAPL advised that Kufpec had been identified as a relevant person with functions, interests or activities that may be affected by the activity.	No objection or claim raised regarding the activity impacts or risks.	CAPL considers the measures and controls in the EP address Kufpec's

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				CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Kufpec that they welcome meaningful feedback.	CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	functions, interests or activities. No changes required.
Live Ningaloo	09/01/2023	OC-000181	Email	CAPL advised that Live Ningaloo had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL confirmed contact details for future consultation.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Live Ningaloo's functions, interests or activities. No changes required.
	20/02/2023	CN-000201	Email	CAPL advised Live Ningaloo had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Live Ningaloo that they welcome meaningful feedback.		
	11/05/2023	OC-000444	Email	CAPL reached out to Live Ningaloo to provide any feedback they may have on the activity. CAPL confirmed that Live Ningaloo has not expressed specific concerns or objections to the planned activity.		

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Mackerel Islands & Onslow Beach Resort	20/02/2023	CN-000207	Email	CAPL advised the Mackerel Islands had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the Mackerel Islands that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Mackerel Islands and Onslow Beach Resort's functions, interests or activities. No changes required.
Mahi Mahi Charters	04/05/2023	CN-000394	Email	CAPL advised Mahi Mahi Fishing Charters had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Mahi Mahi Fishing Charters that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Mahi Mahi Charters functions, interests or activities. No changes required.
Maxima Pearling Company	04/05/2023	CN-000430	Email	CAPL advised that Maxima Pearling Company had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the Maxima Pearling Company that they welcome meaningful feedback. A phone call was organised.	In consultation in the course of preparing the EP, Maxima Pearling Company has provided no objection or claim in response to the proposed activity. Maxima Pearling Company have requested to be consulted in the event of an emergency event.	CAPL will notify Maxima Pearling Company in the event of an emergency as per their request (see and Section 8.3.4.2). No additional EP controls are required.
	09/05/2023	OC-000425	Virtual Meeting	CAPL presented to Maxima Pearling in relation to our upcoming offshore activities. Maxima Pearling have Edible Rock Oyster Aquaculture sites at West Lewis Islands, Flying Foam Passage, Withnell Bay and Cossack.		

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				Maxima Pearling have no objections to the activities proposed, but they would like to be notified in the event of an emergency.	CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	
Member for Pilbara	08/02/2023	CN-000122	Email	CAPL advised the Member for Pilbara had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the Member for Pilbara that they welcome meaningful feedback. A meeting was organised.	In consultation in the course of preparing the EP, the Member for Pilbara has provided no objection or claim in response to the proposed activity. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address the Member for Pilbara's functions, interests or activities. No changes required.
	20/02/2023	OC-000257	Virtual Meeting	CAPL met with the Member of the Pilbara. The Member of the Pilbara showed support for CAPL's activities and a keen interest in employment opportunities in the Pilbara.		
	11/05/2023	OC-000506	Email	CAPL thanked the Member of Pilbara for their engagement and support in 2023. CAPL asked if there had been any comments or feedback from the community with respect to CAPL activities and reiterated the opportunity to catch up in the near future to provide the Member of Pilbara with an overview of the extent of CAPL's consultations and how CAPL will continue to build relationships in the Pilbara.		
Member of Legislative Authority - North West Central	08/02/2023	CN-000240	Email	CAPL advised that Member of Legislative Authority (MLA) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the MLA that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider	CAPL considers the measures and controls in the EP address the Member of Legislative Authority's functions, interests or activities. No changes required.
	10/05/2023	OC-000513	Email	CAPL contacted the Member of Legislative Authority (MLA) regarding CAPL's upcoming activities as a relevant person with interests and functions in the region. No response was received		

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				from the MLA, CAPL informed the MLA that if they have any input on the proposed activities to please contact CAPL.	any feedback if they provide in the future.	
Member of Mining and Pastoral Region	19/12/2022	OC-000406	Email	CAPL advised the Representative from the Member for Mining and Pastoral Region had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL requested to organise a meeting to discuss the activity and agree on communication protocols for consultation. A meeting was organised.	In consultation in the course of preparing the EP, the Member of Mining and Pastoral Region has provided no objection or claim in response to the proposed activity. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address the Member of Mining and Pastoral Region's functions, interests or activities. No changes required.
	08/02/2023	CN-000408	Email	CAPL advised the Representative from the Member of Mining and Pastoral Region had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the Representative from the Member of Mining and Pastoral Region that they welcome meaningful feedback.		
	09/02/2023	OC-000298	Virtual Meeting	CAPL met with a representative from the Members for Mining and Pastoral Region to provide an overview of CAPL's new approach to consultation along with an update on CAPL's Environment Plans. The Members for Mining and Pastoral Region provided advice on local relevant persons that CAPL should be engaging. CAPL reached out to the additional contacts advised by the representative from the Members for Mining and Pastoral Region.		
	16/02/2023	OC-000407	Email	CAPL thanked the representative from the Member for Mining and Pastoral Region for the opportunity to speak about CAPL's Environment Plans and to contact CAPL if they have additional questions about the information shared.		
	11/05/2023	OC-000507	Email	CAPL thanked the Member of Mining and Pastoral Region for their engagement and support in 2023. CAPL asked if there had been any comments or feedback from the community with respect to CAPL activities and reiterated the opportunity to		

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				catch up in the near future to provide the Member of Pilbara with an overview of the extent of CAPL's consultations and how CAPL will continue to build relationships in the Pilbara.		
Member of the Public	24/02/2023	CN-000488	Phone	The member of the public called the CAPL 1800 phone number. CAPL returned the call in the afternoon of the 24th of February 2023. The member of the public said the newspaper ad told her to call CAPL and the member of the public did not have any specific concerns related to CAPL's proposed activities.	In consultation in the course of preparing the EP, the Member of the Public has provided no objection or claim in response to the proposed activity. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address the Member of the Public's functions, interests or activities. No changes required.
Minister for Environment (WA)	13/02/2023	CN-000511	Email	CAPL advised that the Minister for Environment had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the Minister for Environment that they welcome meaningful feedback.	In consultation in the course of preparing the EP, Minister for Environment has provided no objection or claim in response to the proposed activity. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	As detailed in Section 8.3.4.1 and in Table 8-5, CAPL will provide a pre-start and completion notification to the Department of Water, Environment and Regulation and also Department of Biodiversity, Conservation and Attraction as per the Minister of Environment's request. CAPL considers the measures and controls in the EP address the Minister for Environment's functions, interests or activities. No additional EP controls are required.
	10/05/2023	OC-000514	Email	CAPL reached out to the Minister of Environment to provide any feedback they may have on the activity. CAPL informed the Minister of Environment that if they have any questions or would like further details on how CAPL has engaged Traditional Owners, Community and Industry through the consultation process to please reach out. The Minister of Environment responded that they request future consultation of planned activities is copied to DWER and DBCA.		

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Montebello Island Safaris	04/05/2023	CN-000395	Email	CAPL advised the Montebello Island Safaris had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the Montebello Island Safaris that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Montebello Island Safaris' functions, interests or activities. No changes required.
Nganhurra Thanardi Garrbu Aboriginal Corporation (NTGAC)	03/02/2023	CN-000319	Email	CAPL advised that the Nganhurra Thanardi Garrbu Aboriginal Corporation (NTGAC) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified NTGAC that they welcome meaningful feedback. A representative for NTGAC contacted CAPL to identify prerequisites to consultation prior to the board meeting with NTGAC. CAPL responded to the request and outlined the overview of CAPL's goals for continued future consultation.	NTGAC representative advised CAPL that the deadline date stated was not communicated to NTGAC and that it would be difficult to give a response on the Environment Plans in three days. NTGAC stated that they are currently under work pressures and deadlines that require substantial attention at this time. NTGAC informed CAPL of their intention to receive environmental advice on the plans for preparation of NTGACs consideration. This will take some time in order to make informed responses to CAPL. NTGAC specified that this response does not mean that NTGAC does not have concerns or objections to the planned activities. NTGAC require further consultation regarding these plans.	As referenced in EPS Section 7 and detailed in Table 8-5, CAPL will provide Nganhurra Thanardi Garrbu Aboriginal Corporation ongoing consultation of the activity milestones as per their request. CAPL will also notify Nganhurra Thanardi Garrbu Aboriginal Corporation in the event of an emergency as per their request (see and Section 8.3.4.2) CAPL considers the measures and controls in the EP address Nganhurra Thanardi Garrbu Aboriginal Corporation's functions, interests or activities. No changes required.
	28/02/2023	OC-000320	Email	CAPL originally engaged NTGAC regarding the Gorgon and Jansz wellhead decommissioning activity. NTGAC contacted CAPL to request additional information. NTGAC offered CAPL to present an overview of their upcoming activities to their board. CAPL engaged with NTGAC with information responding to NTGACs queries and confirmed that they would present to the NTGAC board of Directors. A confirmation of meeting date and attendance ensued.		
	09/03/2023	OC-000563	Face-to-face	CAPL met with NTGAC Board in Carnarvon to present its Environment Plans and discuss unplanned risks and impacts and identify feedback		

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				on areas of significance and cultural values including sea country and underwater cultural heritage. CAPL spent considerable time explaining the approvals process and offered support to NTGAC to engage an independent environmental specialist to review the information sheets for our activities. CAPL requested advice as to whether additional relevant persons not present at the meeting should be informed and consulted with.	NTGAC provided CAPL with a proposed summary of consultation for CAPL's activity that has been agreed upon NTGAC's board "CAPL has made an initial presentation to NTGAC and informed it of a list of activities which CAPL requires feedback on. NTGAC is considering CAPL's information for the activities and will provide feedback in due course." CAPL is committed to ongoing consultation including working with traditional owners on a broader understanding of sea country and underwater cultural heritage and will continue to provide further information in consultation with NTGAC. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	
	13/03/2023	OC-000564	Email	CAPL wrote to NTGAC thanking them for their time and opportunity to present at the NTGAC Board Meeting in Carnarvon on the 9th of March 2023. CAPL reiterated NOPSEMA process and key timeframes for submission, as well as information that CAPL required as part of the consultation process.		
	03/04/2023	OC-000317	Email	CAPL contacted NTGAC to discuss if any objections or claims were raised after their presentation to the Board. CAPL welcomed the opportunity to discuss any further queries and attend future board meetings. NTGAC advised that the board were agreeable to future consultation and meetings with CAPL.		
		OC-000318	Email	NTGAC contacted CAPL to request further information about the Environment Plans and upcoming activities. CAPL responded and provided the requested information.		
	04/04/2023	OC-000243	Email	CAPL accepted invitation from the NTGAC board to meet with the board on September 5 in Exmouth.		
	09/05/2023	OC-000419	Phone	CAPL attempted to call Nganhurra Thanardi Garrbu Aboriginal Corporation. There was no answer so CAPL left a message to call back.		
		OB-000541	Email	CAPL advised Nganhurra Thanardi Garrbu Aboriginal Corporation (NTGAC) that they had tried to contact them by phone and left a voicemail		

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				regarding their last communication in April. CAPL informed NTGAC that they are looking to finalise the Environment plans and noted that they had not received any feedback from NTGAC. CAPL acknowledged the heavy workload NTGAC is facing and wanted to reiterate their intentions to develop a communication protocol with NTGAC moving forward at NTGAC's convenience. CAPL acknowledged the importance of coastal areas, sea country and adjacent Islands as highly valuable to the NTGAC and other Aboriginal Corporations and understand the impact on these areas from planned or unplanned events which may cause harm to the cultural landscape, individuals, and community. CAPL informed NTGAC of their commitment to developing a relationship and participating in ongoing consultations with NTGAC about the activities that are completed offshore. CAPL informed NTGAC that no planned activities will impact the Native Title. CAPL confirmed their attendance for the Board meeting scheduled in September and reiterated their intentions to further discuss and update the Board on the status of the submitted Environment Plans and commencement of activities. CAPL offered to discuss any issues further at NTGACs convenience.		
	21/06/2023	OC-000565	Phone	CAPL contacted NTGAC via YMAC Legal Representative, responding to correspondence received from YMAC in relation to the development of a framework for ongoing consultation. CAPL confirmed desire to meet with NTGAC and YMAC to develop a framework for future consultation YMAC requested CAPL provide initial feedback on the draft provided which was received for review.		

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Ngarluma Aboriginal Corporation RNTBC	14/12/2022	OC-000342	Email	CAPL engaged with Ngarluma Aboriginal Corporation (NAC) as an opportunity to consult on upcoming activities as a relevant person. NAC and CAPL organised a meeting to discuss and gather a more in depth understanding of the activities.	In consultation in the course of preparing the EP, NAC has provided no objection or claim in response to the proposed activity. CAPL is committed to ongoing consultation including working with traditional owners on a broader understanding of sea country and underwater cultural heritage. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future (see Section 8.3.4.1)	As referenced in EPS Section 7 and detailed in Table 8-5, CAPL will provide NAC in ongoing consultation of the activity milestones as per their request. CAPL will also notify NAC in the event of an emergency as per their request (see and Section 8.3.4.2) CAPL considers the measures and controls in the EP address NAC's functions, interests or activities. No changes required.
	02/02/2023	OC-000340	Face-to-face	CAPL met with NAC as an identified relevant person and provided an overview of their activities. NAC suggested CAPL present to their board in February and to reconnect when they are next back in the region.		
	03/02/2023	CN-000343	Email	CAPL advised that the NAC had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified NAC that they welcome meaningful feedback.		
	10/02/2023	OC-000345	Email	CAPL engaged with NAC to set up a meeting to present activities to the NAC board.		
	10/03/2023	OC-000344	Email	CAPL attempted to contact NAC and receive feedback from previous meeting.		
	29/03/2023	OC-000346	Email	CAPL informed NAC of their travel plans and presentation to the board. NAC confirmed time and date and gave CAPL additional information for CAPLs process and procedures.		
	04/04/2023	OC-000241	Phone	CAPL contacted NAC to confirm attendance at the Board Meeting scheduled in April to discuss CAPL's upcoming activity. CAPL requested NAC to provide names of meeting attendees.		
	26/04/2023	OC-000355	Face-to-face	CAPL presented to NAC on upcoming EP development. CAPL sought feedback on areas of significance and cultural values including sea country and underwater cultural heritage. CAPL requested advice as to whether additional relevant persons not present at the meeting should be informed and consulted with.		
	27/04/2023	OC-000530	Email	CAPL contacted Ngarluma RNTBC regarding feedback following the board meeting. CAPL		

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				identified the importance of Ngarluma RNTBC values and sensitivities and thanked the board for the opportunity to engage. CAPL listed and outlined the important take aways from the meeting and informed Ngarluma RNTBC to identify any missing information. CAPL requested another meeting to discuss other opportunities.		
Ngarluma Yindjibarndi Foundation Ltd (NYFL)	12/12/2022	OC-000331	Email	CAPL advised that the Ngarluma Yindjibarndi Foundation Ltd (NYFL) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activities and NYFL was interested in connecting with CAPL and setting up a meeting.	In consultation in the course of preparing the EP, NYFL has provided no objection or claim in response to the proposed activity. CAPL is committed to ongoing consultation including working with traditional owners on a broader understanding of sea country and underwater cultural heritage. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future (see Section 8.3.4.1)	As referenced in EPS Section 7 and detailed in Table 8-5, CAPL will provide NYFL in ongoing consultation of the activity milestones as per their request. CAPL will also notify NYFL in the event of an emergency as per their request (see and Section 8.3.4.2) CAPL considers the measures and controls in the EP address NYFL's functions, interests or activities. No changes required.
	11/01/2023	OC-000333	Email	CAPL engaged with NYFL to organise a meeting with the board to discuss CAPLs activities and answer any questions NYFL may have.		
	25/01/2023	OC-000422	Phone	CAPL attempted to call NYFL but received an automated message that the office is unattended.		
		OC-000335	Phone	NYFL advised CAPL that they were interested in CAPL spending time in the region and experience what industry contributions and funding can achieve. NYFL requested or more basic information sheet outlining CAPLs activities for their board meeting.		
	03/02/2023	CN-000332	Email	CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified NYFL that they welcome meaningful feedback.		
	15/02/2023	OC-000334	Email	CAPL communicated their planned agenda for the meeting. NYFL responded with additional requests to be added to the agenda which were included.		
	08/03/2023	OC-000535	Virtual Meeting	CAPL met with NYFL to discuss the upcoming activities and to further understand areas of significance and cultural values including sea country and underwater cultural heritage.		

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				CAPL requested advice as to whether additional relevant persons not present at the meeting should be informed and consulted with.		
	06/04/2023	OC-000252	Email	NYFL is pleased to hear CAPL's appetite to strengthen the relationship and likewise NYFL sees the relationship with CAPL as an opportunity to set a new standard for consultation and stakeholder engagement, and in turn, create a more meaningful relationship between CAPL and the NYFL membership, and Ieramugadu community. NYFL confirmed the below - NYFL Directors noted that "People from the land speak for and care about the marine animals", even if they are far out to sea - Discussed the nature of many traditional narratives have origins and connection to the seascape, and that impacts to the seascape can have cultural repercussions. - Discussed that TO communities are rarely able to verify proponent management approaches to the seascape environment, including marine fauna, given it's not an observable environment - Discussed the interconnectedness of the cultural landscape, whereby TOs from the western Pilbara are held to account by other Nyambali (Cultural bosses) when proponents impact land and sea. The cultural responsibilities transcend Native Title and other boundaries.		
	09/05/2023	OC-000420	Phone	CAPL left as message for NYFL to call back in regard to CAPL's Environment Plans.		
	12/05/2023	OC-000429	Phone	CAPL and NYFL discussed opportunities for developing the relationship between the two organisations.		

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				NYFL confirmed that there were no further comments to add to their response to CAPL's submission as detailed in interaction log OC-000252.		
	15/05/2023	OC-000524	Email	CAPL thanked NYFL for their time and consultation. CAPL summarised NYFL's feedback that they have shared the last few months for NYFL's information: - Traditional Owner organisations were being inundated with proponents and that many Traditional Owners and TO organisations are experiencing consultation fatigue. NYFL noted that resourcing is required to support consultation. NYFL's position is that it is required to be consulted on EP matters that relate to the relevant environment. NYFL, like other TO organisations, need to be resourced appropriately - Noted that "People from the land speak for and care about the marine animals", even if they are far out to sea - Confirmed the nature of many traditional narratives have origins and connection to the seascape, and that impacts to the seascape can have cultural repercussions. - TO communities are rarely able to verify proponent management approaches to the seascape environment, including marine fauna, given it's not an observable environment. As such, there is still a significant lack of understanding about the industry. - There is an interconnectedness of the cultural landscape, whereby TOs from the western Pilbara are held to account by other Nyambali (Cultural bosses) when proponents impact land and sea.		

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				The cultural responsibilities transcend Native Title and other boundaries. - Were concerned about emissions. NYFL thanked CAPL for their time.		
Ningaloo Blue Dive	20/02/2023	CN-000205	Email	CAPL advised that Ningaloo Blue Dive had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Ningaloo Blue Dive that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Ningaloo Blue Dive's functions, interests or activities. No changes required.
	11/05/2023	OC-000446	Email	CAPL reached out to Ningaloo Blue Dive to provide any feedback they may have on the activity. CAPL confirmed that Ningaloo Blue Dive has not expressed specific concerns or objections to the planned activity.		
Ningaloo Coast World Heritage Advisory Committee (NCWHAC)	16/02/2023	CN-000489	Email	CAPL advised the Ningaloo Coast World Heritage Advisory Committee that they had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity in a factsheet. CAPL notified the Ningaloo Coast World Heritage Advisory Committee that they welcome meaningful feedback. Ningaloo Coast World Heritage Advisory Committee advised that the information would be shared with the Committee at a meeting in May 2023 and would revert back to CAPL with any feedback. CAPL contacted The Committee to see whether there was any feedback from the Committee meeting. No response was received.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address NCWHAC's functions, interests or activities. No changes required.
Ningaloo Glass Bottom Boat	20/02/2023	CN-000414	Email	CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Ningaloo Glass Bottom Boats that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks.	CAPL considers the measures and controls in the EP address Ningaloo Glass Bottom Boat's

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	11/05/2023	OC-000445	Email	CAPL reached out to Ningaloo Glass Bottom Boats to provide any feedback they may have on the activity. CAPL confirmed that Ningaloo Glass Bottom Boats has not expressed specific concerns or objections to the planned activity.	CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	functions, interests or activities. No changes required.
Ningaloo Visitor Centre	09/01/2023	OC-000176	Email	CAPL advised that the Ningaloo Visitors centre had been identified as a relevant person with functions, interests or activities that may be affected by the activity and ensure CAPL have the correct contact.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Ningaloo Visitor Centre's functions, interests or activities. No changes required.
	20/02/2023	CN-000179	Email	CAPL advised that the Ningaloo Visitors Centre had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the Ningaloo Visitors Centre that they welcome meaningful feedback.		
	11/05/2023	OC-000447	Email	CAPL reached out to Ningaloo Visitor Centre to provide any feedback they may have on the activity. CAPL confirmed that Ningaloo Visitor Centre has not expressed specific concerns or objections to the planned activity.		
Ningaloo Whaleshark n Dive	20/02/2023	CN-000203	Email	CAPL advised that Ningaloo Whale Shark n Dive had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Ningaloo Whale shark n Dive that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider	CAPL considers the measures and controls in the EP address Ningaloo Whaleshark n Dive's functions, interests or activities. No changes required.

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					any feedback if they provide in the future.	
Ningaloo Whaleshark Swim	20/02/2023	CN-000202	Email	CAPL advised that Ningaloo Whaleshark Swim had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Ningaloo Whaleshark Swim that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Ningaloo Whaleshark Swim's functions, interests or activities. No changes required.
Northern Prawn Fishery	14/03/2023	CN-000193	Email	CAPL advised that the Northern Prawn Fishery (NPF) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the NPF that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Northern Prawn Fishery's functions, interests or activities. No changes required.

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Oil Spill Response Limited (OSRL)	15/02/2023	CN-000211	Email	CAPL advised that the OSRL had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the OSRL that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL will notify OSRL in the event of an emergency as per their request (see and Section 8.3.4.2) CAPL considers the measures and controls in the EP address OSRL's functions, interests or activities. No additional EP controls are required.
Onslow Chamber of Commerce and Industry - OCCI	17/01/2023	OC-000092	Email	CAPL advised the Onslow Chamber of Commerce and Industry had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL suggested they coordinate a phone call to discuss and agree on the communication protocols and to consult on the current Environment Plans.	In consultation in the course of preparing the EP, OCCI has provided no objection or claim in response to the proposed activity. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address OCCI's functions, interests or activities. No changes required.
	23/01/2023	OC-000286	Virtual Meeting	CAPL met with the Onslow Chamber of Commerce & Industry (OCCI) to provide an overview of their new approach to consultation along with an update on their Environment Plans.		
	07/02/2023	OC-000295	Virtual Meeting	CAPL spoke with a representative from the Onslow Chamber of Commerce and Industry (OCCI) to provide an overview of their new approach to consultation along with an update on their Environment Plans. CAPL provided guidance on how to find information regarding risks associated with the activities in CAPL's online consultation hub for upcoming activities.		
	08/02/2023	CN-000093	Email	CAPL notified the Onslow Chamber of Commerce and Industry that the Environment Plans site on CAPL's website was live and CAPL had published in local, state and national newspaper to help identify additional relevant persons. CAPL also requested that the Onslow Chamber of Commerce		

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				and Industry share the advert internally via their EDM to their members.		
	16/02/2023	OC-000094	Email	CAPL reached out to the Onslow Chamber of Commerce and Industry (OCCI) to see if there were any questions that came through after the presentation and requested that if there were any questions, CAPL would be happy to have a chat.		
	02/03/2023	OC-000147	Email	Onslow Chamber of Commerce and Industry advised their community of CAPL's information briefing on their proposed offshore activities.		
	18/03/2023	OC-000095	Email	Onslow Chamber of Commerce and Industry sent through their newsletter that had an advert from CAPL seeking relevant persons engagement.		
Paspaley Pearls	10/05/2023	CN-000442	Email	CAPL advised that Paspaley Pearls had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified that Paspaley Pearls that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Pasaley Pearls functions, interests or activities. No changes required.
Pearl Producers Association (PPA)	08/02/2023	CN-000234	Email	CAPL advised that the Pearl Producers Association (PPA) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the PPA that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Pearl Producers Association's functions, interests or activities. No changes required.

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PGS Australia Pty Ltd	18/01/2022	OC-000461	Email	CAPL engaged with PGS on their upcoming activity. CAPL advised PGS of the possibility of an overlap in the spatial area between the CAPL and PGS projects. PGS advised that they were not expecting to acquire data during the time when CAPL are expected to undertake the activity.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address PGS's functions, interests or activities. No changes required.
	15/02/2023	CN-000213	Email	CAPL advised that PGS had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified PGS that they welcome meaningful feedback.		
	10/05/2023	OC-000436	Email	CAPL reached out to PGS to provide any feedback they may have on the activity. CAPL confirmed that PGS has not expressed specific concerns or objections to the planned activity.		
Pilbara Development Commission	19/12/2022	OC-000101	Email	CAPL advised the Pilbara Development Commission had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL suggested they coordinate a phone call to discuss and agree on the communication protocols and to consult on the current Environment Plans. Pilbara Development Commission responded they would be pleased to meet with CAPL. A meeting was organised.	In consultation in the course of preparing the EP, Pilbara Development Commission has provided no objection or claim in response to the proposed activity. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Pilbara Development Commission's functions, interests or activities. No changes required.
	01/02/2023	OC-000289	Face-to-face	CAPL met with the Pilbara Development Commission to provide an overview of their new approach to consultation along with an update on CAPL's Environment Plans.		
	08/02/2023	CN-000102	Email	CAPL advised the Pilbara Development Commission had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Pilbara Development		

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				Commission that they welcome meaningful feedback.		
	17/02/2023	OC-000103	Email	Chevron Australia shared the contact details with the Pilbara Development Commission to discuss the new Hostel in Newman for Martu kids that are travelling down for School.		
Pilbara Ports Authority	08/02/2023	CN-000236	Email	CAPL advised that the Pilbara Port Authority (PPA) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the PPA that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Pilbara Ports Authority's functions, interests or activities. No changes required.
Protect Ningaloo	10/02/2023	CN-000223	Email	CAPL advised that Protect Ningaloo had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Protect Ningaloo that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Protect Ningaloo's functions, interests or activities. No changes required.
Recfishwest (WA)	09/11/2021	CN-000569	Email	CAPL advised Recfishwest had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and	In consultation in the course of preparing the EP, Recfishwest had no objection	CAPL considers the measures and controls in the EP address WAFIC's

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				provided a link to their website for further information regarding the activity.	or claim raised regarding the activity impacts or risks. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	functions, interests or activities. No changes required.
	24/02/2023	CN-000125	Email	CAPL sent out formal notice advising that Recfishwest had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Recfishwest that they welcome meaningful feedback. Recfishwest acknowledged receipt of email and requested to be included in consultations and advised the appropriate contact for all correspondence in the future.		
	28/02/2023	OC-000264	Virtual Meeting	CAPL spoke with representatives from Recfishwest. CAPL provided an overview of their new online interaction hub and update on their Environment Plans. Recfishwest advised that continued consultation is encouraged. CAPL offered to present current activities to the board and provided an EDM for Recfishwest.		
	10/03/2023	OC-000185	Email	CAPL provided details of the activity and discussed the best method to circulate information about activities with Recfishwest and their members.		
	23/03/2023	OC-000165	Phone	CAPL contacted Recfishwest to request that CAPL's EP identification information be published in the Recfishwest EDM. Recfishwest advised that the content is inappropriate for the newsletter.		
	03/04/2023	OC-000367	Email	Recfishwest responded to CAPL's notification of the proposed activity and noted that the planned activities are located 150 km north-west of Dampier and 37 km from the Montebello Islands,		

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				the area is still accessed by the charter industry and recreational fishers in larger vessels. Recfishwest asked that they be kept informed as activity dates are confirmed so that they are able to communicate relevant details with the recreational fishing community.		
Sail Ningaloo	20/02/2023	CN-000199	Email	CAPL advised that Sail Ningaloo had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Sail Ningaloo that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Sail Ningaloo's functions, interests or activities. No changes required.
	10/05/2023	OC-000434	Email	Chevron Australia reached out to Sail Ningaloo to provide any feedback they may have on the activity. Chevron Australia confirmed that Sail Ningaloo has not expressed specific concerns or objections to the planned activity.		
Santos	20/03/2023	CN-000186	Email	CAPL advised that Santos had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Santos that they welcome meaningful feedback.	In consultation in the course of preparing the EP, Santos has provided no objection or claim in response to the proposed activity. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Santos' functions, interests or activities. No changes required.
	10/05/2023	OC-000432	Email	CAPL reached out to Santos to provide any feedback they may have on the activity. CAPL confirmed that Santos has not expressed specific concerns or objections to the planned activity.		
SapuraOMVUpstream	14/02/2023	CN-000218	Email	CAPL advised that Sapura OMV had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity	No objection or claim raised regarding the activity impacts or risks.	CAPL considers the measures and controls in the EP address SapuraOMVUpstream's

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				and provided a link to their website for further information regarding the activity. CAPL notified Sapura OMV that they welcome meaningful feedback.	CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	functions, interests or activities. No changes required.
Shire of Ashburton (Pilbara)	17/01/2023	OC-000096	Email	CAPL advised that the Shire of Ashburton had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL requested that at the next meeting to provide an overview of the activity. Shire of Ashburton advised that previously CAPL has firstly presented to council their activity and then to the community.	In consultation in the course of preparing the EP, Shire of Ashburton has provided no objection or claim in response to the proposed activity. CAPL reached out to the additional contacts provided by the Shire of Ashburton. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Shire of Ashburton's functions, interests or activities. No changes required.
	25/01/2023	OC-000285	Phone	CAPL provided a follow up phone call regarding a email CAPL sent on the Environment Plan consultation process. CAPL provided an overview of their new approach to consultation along with an update on their Environment Plans.		
	07/02/2023	CN-000097	Email	CAPL advised that the Shire of Ashburton had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the Shire of Ashburton that they welcome meaningful feedback.		
		OC-000293	Virtual Meeting	The Shire of Ashburton shared their concerns regarding impacts on recreation and fishing and suggested CAPL present at an information session in Onslow.		
	14/02/2023	OC-000098	Email	Shire of Ashburton thanked CAPL for presenting on their upcoming activities. The Shire of Ashburton noted that other titleholders have spoken to them about risk protocols in		

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				Commonwealth and State waters and possible contingencies in place for accidents in relation to a hydrocarbon incident. The Shire of Ashburton provided contact names and details for people within the Shire of Ashburton that assist in emergency management.		
	01/03/2023	OC-000128	Email	Shire of Ashburton thanked CAPL for presenting on their upcoming activities. CAPL provided the Shire of Ashburton with an overview of their new online consultation Hub and activities. The Shire of Ashburton was informed that if they had any further queries to contact CAPL.		
		OC-000269	Virtual Meeting	CAPL met with representatives from Shire of Ashburton. CAPL provided an overview of their new online interaction hub. CAPL answered and discussed relevant questions and queries from the Shire of Ashburton and defined contacts and procedures in the event an emergency occurs. The Shire of Ashburton invited CAPL to attend the next oil spill response exercise at Wheatstone and local Emergency Management Committee in Onslow.		
	10/05/2023	OC-000438	Email	CAPL reached out to the Shire of Ashburton to provide any feedback they may have on the activity. CAPL confirmed that the Shire of Ashburton has not expressed specific concerns or objections to the planned activity.		
Shire of Carnarvon (Gascoyne)	20/12/2022	OC-000178	Email	CAPL advised that the Shire of Carnarvon had been identified as a relevant person with functions, interests or activities that may be affected by the activity. Chevron confirmed contact details for future consultation.	In consultation in the course of preparing the EP, the Shire of Carnarvon has provided no objection or claim in response to the proposed activity. CAPL reached out to the additional contacts provided by the Shire of Carnarvon.	CAPL considers the measures and controls in the EP address the Shire of Carnarvon's functions, interests or activities. No changes required.
	03/01/2023	OC-000083	Email	CAPL engaged the Shire of Carnarvon to provide an overview of the activity and consultation. CAPL showed their gratitude in support from the Shire of Carnarvon to begin engagement with relevant persons in the Shire of Carnarvon. The Shire of Carnarvon identified additional		

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				Relevant Persons CAPL should have engagements with.	CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	
		OC-000248	Phone	CAPL spoke to the Shire of Carnarvon and established initial contact and provided an update on the EP process. The Shire of Carnarvon agreed to discuss internally who the primary relevant persons are within the Shire that would be the central points of dissemination and provide these contacts back to CAPL.		
	27/01/2023	OC-000287	Phone	CAPL met with representatives from the Shire of Carnarvon in Exmouth. The Shire of Carnarvon provided advice on local relevant persons and traditional owners that we should be engaging.		
	06/02/2023	CN-000177	Email	CAPL advised that the Shire of Carnarvon had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the Shire of Carnarvon that they welcome meaningful feedback.		
	10/03/2023	OC-000169	Email	CAPL provided a summary of consultation actions and expectations with continued engagement with the Shire of Carnarvon.		
	04/05/2023	OC-000398	Email	CAPL reached out to the Shire of Carnarvon to provide any feedback they may have on the activity. CAPL confirmed that the Shire of Carnarvon has not expressed specific concerns or objections to the planned activity. The Shire of Carnarvon confirmed that they have no concerns or objections to CAPL's Environment Plans		
Shire of Exmouth (Gascoyne)	17/01/2023	OC-000279	Phone	CAPL attempted to make first initial contact with the Shire of Exmouth.	In consultation in the course of preparing the EP, Shire of Exmouth has provided no objection or claim in response to the proposed activity.	CAPL considers the measures and controls in the EP address Shire of Exmouth’s functions, interests or activities. No changes required.
	18/01/2023	OC-000107	Email	CAPL advised that the Shire of Exmouth had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL suggested they coordinate a phone call to discuss and agree on the communication protocols and to consult on the current Environment Plans.		

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				Shire of Exmouth would be pleased to meet with CAPL and a meeting was organised.	CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	
	24/01/2023	OC-000284	Face-to-face	CAPL met with representatives from Shire of Exmouth in Exmouth. The Shire of Exmouth provided advice on local relevant persons that we should be engaging. CAPL provided an overview of their new approach to consultation along with an update on their Environment Plans. The Shire of Exmouth invited CAPL to present at the Council meeting.		
	01/02/2023	OC-000170	Email	CAPL reached out to the Shire of Exmouth to understand who they should contact locally from an environment/conservation perspective. The Shire of Exmouth provided CAPL with relevant persons to contact who may be affected by their activities.		
	08/02/2023	CN-000540	Email	CAPL advised that the Shire of Exmouth had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the Shire of Exmouth that they welcome meaningful feedback.		
	24/02/2023	OC-000268	Virtual Meeting	CAPL met with representatives from the Shire of Exmouth. The Shire of Exmouth provided feedback from the Council and the current need for a waste management master plan due to high volumes of land fill or transport per week. CAPL provided possible alternatives and identified the Shire of Exmouth's main priorities.		
	01/03/2023	OC-000276	Phone	The Shire of Exmouth advised that it would be good for CAPL to become a member of the Chamber and get involved with the community reference groups that will be able to support CAPL's consultation process. The Shire of Exmouth spoke to various issues that they are currently dealing with.		

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	02/05/2023	OC-000356	Email	CAPL contacted Shire of Exmouth to confirm that there were no objections or further input required on our upcoming Offshore activities.		
Terrafirma Offshore PTY LTD	09/01/2023	OC-000175	Email	CAPL advised that the Terrafirma Offshore had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL contacted Terrafirma to confirm contact details for future consultation.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Terrafirma Offshore's functions, interests or activities. No changes required.
	01/05/2023	CN-000405	Email	CAPL advised Terrafirma Offshore that they had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Terrafirma Offshore that they welcome meaningful feedback.		
	15/05/2023	OC-000448	Email	CAPL reached out to Terrafirma Offshore to provide any feedback they may have on the activity. CAPL confirmed that Terrafirma Offshore has not expressed specific concerns or objections to the planned activity.		
TGS NOPEC Geophysical Company Pty Ltd	18/01/2022	OC-000460	Email	CAPL engaged with TGS on their upcoming seismic activity. CAPL advised TGS of the possibility of an overlap in the spatial area between CAPL and TGS projects. CAPL and TGS agreed to stay in contact and collaborate where possible.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address TGS's functions, interests or activities. No changes required.
	15/02/2023	CN-000212	Email	CAPL advised that TGS NOPEC had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified TGS NOPEC that they welcome meaningful feedback.		
	10/05/2023	OC-000437	Email	CAPL reached out to TGS to provide any feedback they may have on the activity. CAPL confirmed that TGS has not expressed specific concerns or objections to the planned activity.		

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Top Gun Charters	04/05/2023	CN-000396	Email	CAPL advised that Top Gun Charters had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Top Gun Charters that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Top Gun Charter's functions, interests or activities. No changes required.
Tourism Western Australia	09/01/2023	OC-000230	Email	CAPL advised that Tourism WA had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL suggested they coordinate a phone call to discuss and agree on the communication protocols and to consult on the current Environment Plans. Tourism Western Australia would be pleased to meet with CAPL and a meeting was organised.	In consultation in the course of preparing the EP, Tourism Western Australia has provided no objection or claim in response to the proposed activity. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Tourism Western Australia's functions, interests or activities. No changes required.
	27/02/2023	CN-000370	Email	CAPL advised that Tourism Western Australia had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Tourism Western Australia that they welcome meaningful feedback.		
		OC-000266	Virtual Meeting	CAPL spoke with Tourism WA and provided relevant persons CAPL should speak with. Tourism WA provided advice on potential investment opportunities with local tourism operators and showed interested in partnering with CAPL to develop tourism capacity.		
Vermilion Oil & Gas	14/02/2023	CN-000187	Email	CAPL advised that Vermillion had been identified as a relevant person with functions, interests or activities that may be affected by the activity.	No objection or claim raised regarding the activity impacts or risks.	CAPL considers the measures and controls in the EP address

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				CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Vermillion that they welcome meaningful feedback.	CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	Vermillion Oil and Gas' functions, interests or activities. No changes required.
View Ningaloo	20/02/2023	CN-000200	Email	CAPL advised that the View Ningaloo had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the View Ningaloo that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address View Ningaloo's functions, interests or activities. No changes required.
	11/05/2023	OC-000449	Email	CAPL reached out to View Ningaloo to provide any feedback they may have on the activity. CAPL confirmed that View Ningaloo has not expressed specific concerns or objections to the planned activity.		
Vocus Communications	15/09/2022	OC-000464	Email	CAPL advised Vocus Communications (Vocus) of the upcoming activity and the possibility of an overlap of projects. Vocus and CAPL exchanged information regarding both project types and plans. CAPL advised Vocus that the projects would no longer be overlapping due to a delay in operations.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Vocus Communications' functions, interests or activities. No changes required.
	04/05/2023	CN-000397	Email	CAPL advised that Vocus Communications had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Vocus Communications that they welcome meaningful feedback.		

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WA Coastal and Marine Community Network	10/02/2023	CN-000222	Email	CAPL advised the WA Coastal and Marine Community Network had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified WA Coastal and Marine Community network that they welcome meaningful feedback.	In consultation in the course of preparing the EP, WA Coastal and Marine Community Network has provided no objection or claim in response to the proposed activity.	CAPL considers the measures and controls in the EP address WA Coastal and Marine Community Network's functions, interests or activities. No changes required.
	21/03/2023	OC-000119	Virtual Meeting	CAPL provided WA Coastal and Marine Community Network information on upcoming activities via the Interaction Hub during a Teams meeting.	CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	
	22/03/2023	OC-000120	Email	CAPL followed up with WA Coastal and Marine Community Network email after their Teams Meeting with links to CAPL's Interaction Hub.		
WA Marine Science Institute	01/03/2023	CN-000196	Email	CAPL advised that WA Marine Science Institute (WAMSI) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified WAMSI that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address WA Marine Science Institute's functions, interests or activities. No changes required.
Western Australian Fishing Industry Council (WAFIC)	21/05/2021	OC-000465	Email	CAPL advised WAFIC that they were ready to start consultation with an information brochure about upcoming activities. WAFIC responded with comments for the information brochure before sending on for consultation.	In consultation in the course of preparing the EP, WAFIC requested further information regarding the 4D seismic Activity.	As referenced in EPS Section 7 and detailed in Table 8-5, CAPL will provide WAFIC ongoing consultation of the activity milestones or if there is a material change to the proposed activity. CAPL will also notify WAFIC in the event of an emergency as per
	08/06/2021	CN-000364	Email	On behalf of CAPL, WAFIC sent out a written notice of CAPL's Wheatstone 4-D Seismic Survey activity information to relevant identified fishers. • West Coast Deep Sea Crustacean • Mackerel Managed Fishery (Area 2) • Onslow Prawn Managed Fishery	WAFIC had no further objections or claims raised regarding the activity impacts or risks and WAFIC	

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				• Pilbara Crab Managed Fishery • Pilbara Trap Managed Fishery • Pilbara Line Fishery • North West Slope Trawl Fishery • Western Tuna and Billfish Fishery • Commonwealth Fisheries Association (CFA) • Australian Southern Bluefin Tuna Industry Association (ASBTIA) • Tuna Australia • Pearl Producers Association (PPA)	also confirmed that no feedback, objections or claims had been received from the fishers. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	their request (see and Section 8.3.4.2) CAPL considers the measures and controls in the EP address WAFIC's functions, interests or activities. No changes required.
	10/06/2021	OB-000362	Email	Fisher responded with concerns over the proposed seismic area as the area is a large part of the fishers, fishing area and wishes to have more consultation soon. Chevron Australia and WAFIC made numerous attempts to get in contact with the fisher.		
	17/06/2021	OB-000363	Email	WAFIC listed the potential risks of the activity on finfish: • Mobile invertebrates – Moderate to High • Immobile invertebrates – High to Low • Finfish demersal – High to Moderate • Pelagic – Negligible Commercial fishers have advised WAFIC that they are encountering a significant change in catchability of mackerel species following seismic survey activity. Fish behaviour and species distribution are changing which is having a direct impact on the economic viability of commercial fishers and potential fish stocks for those species. Based on the risks above, assessment of the impacts at the population level for key species should be undertaken and included in the EP. CAPL responded to the evaluation of impacts and risks to demonstrate that they are as low as reasonable practicable (ALARP) and acceptable based on a systematic consideration of factors including regulatory guidelines. CAPL acknowledged that control measures and demonstration of impacts and risks to ALARP will		

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				be detailed in the EP following completion of consultation process.		
	09/11/2021	CN-000360	Email	CAPL re-engaged WAFIC to send out the stakeholder consultation information to the relevant fishers again.		
		OB-000361	Email	Query from a fisher asking why the full power zone is significantly larger than what would be the geographic boundaries of their reservoir. CAPL responded to the inquiry and explained that they had to allow for additional data (a buffer zone) outside the geographical field boundaries to be acquired to fully image the subsurface covering the two gas fields. Additionally, the survey had to align with the area in which full power acquisition was undertaken in the 2011-2012 survey.		
	10/01/2023	OC-000085	Email	CAPL reached out to WAFIC and a meeting was organised to discuss and agree the communication protocols for consultation.		
	12/01/2023	OC-000278	Phone	CAPL established contact with WAFIC to organise a time to provide an overview of upcoming projects. WAFIC spoke to some concerns they are currently facing and would be very eager to come together and work out the best model to communicate to fishers.		
	03/02/2023	CN-000086	Email	CAPL thanked WAFIC for their time and providing further information for CAPL to understand more about their challenges as an industry and organisation. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the WAFIC that they welcome meaningful feedback. CAPL noted down all of WAFICs challenges that they shared in respect to dealing with large volumes of proponent activity and the burdens that this places on them as an organisation. CAPL notified WAFIC that they will discuss some options internally with our leadership first and revert back. In the interim, if WAFIC have some ideas on how		

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				CAPL can engage directly with their industry CAPL requested WAFIC let us know.		
		OC-000087	Email	WAFIC thanked CAPL for meaningful discussions and provided a link to their consultation approach along with WAFIC included a post in their February newsletter advising their members of CAPL's new online interaction hub for feedback.		
	07/02/2023	CN-000088	Email	CAPL engaged WAFIC to re-send out the Wheatstone 4D seismic survey activity information. WAFIC confirmed they sent out the information sheet to the identified fishers on 15 March 2023 to the following fishers for feedback: o Pilbara Line Fishery o Pilbara Trap Fishery o Mackerel Managed Fishery – Area 2 o West Coast Deep Sea Crustacean o Pilbara Crab Fishery		
	10/02/2023	OC-000549	Email	Western Australian Fishing Industry Council (WAFIC) provided a link to CAPL's consultation hub in their monthly newsletter for the activity that was sent out to WAFIC's email list including the below identified fishery groups within the Operational Area: - Mackerel Managed Fishery - Pilbara Crab Managed Fishery - Pilbara Line Fishery - Pilbara Trap Managed Fishery - Marine Aquarium Fish Managed Fishery - Specimen Shell Managed Fishery		
	28/02/2023	OC-000263	Virtual Meeting	CAPL spoke with representative from WAFIC. WAFIC responded with positive feedback on CAPL's consultation process and advised relevant persons to contact in regard to Bluefin Tuna spawning area.		
	02/03/2023	OC-000291	Face-to-face	CAPL met with WAFIC at their office to provide an overview of their new approach to consultation along with an update on their Environment Plans. WAFIC provided an overview of their current concerns and there was discussions on how CAPL could support/assist with these concerns.		

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	15/03/2023	CN-000089	Email	WAFIC sent out the 4D Seismic survey information sheet to the relevant fishers. WAFIC confirmed no fisheries had provided feedback from the recent notification, however they did not that feedback had been previously provided in consultation from June/November 2021.		
	01/05/2023	OC-000358	Email	CAPL contacted WAFIC to confirm that there were no concerns or objections to the planned activities discussed in the consultation process. CAPL acknowledged that they would like to develop a framework with WAFIC for ongoing consultation and engagement. CAPL confirmed they will advise of any material changes to the proposed activities and provide reasonable time for WAFIC to reassess potential impacts and risks on values and sensitivities. CAPL look forward to our ongoing consultations and continuing to explore new opportunities with WAFIC.		
	07/06/2023	OC-000570	Email	CAPL and WAFIC organised a time to catch up to discuss their ongoing relationship and CAPL engaged early to discuss future approvals. WAFIC provided their draft Consultation Guideline and welcomed any feedback from CAPL.		
	19/06/2023	Oc-000560	Face-to-face	CAPL met with WAFIC representatives to discuss their continued relationship and the development of OPP and the opportunity for WAFIC's involvement in the process. WAFIC appreciated the opportunity provided by CAPL to be involved in the early stages of development of the OPP so that it can best represent the WA Fishing Industry. WAFIC advised that they are a significant and important stakeholder given the growing demands on the industry, particularly the increase in expanse of the offshore renewables sector. WAFIC also provided CAPL with a draft consultation framework.		

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Western Australian Museum	24/04/2023	CN-000382	Email	CAPL advised that the Western Australian Museum had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified the Western Australian Museum that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Western Australian Museum's functions, interests or activities. No changes required.
Western Gas	14/02/2023	CN-000219	Email	CAPL advised that Western Gas had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Western Gas that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Western Gas' functions, interests or activities. No changes required.
Western Rock Lobster Council	19/01/2023	OC-000280	Phone	CAPL established contact with Western Rock Lobster Council to organise a time to provide an overview of upcoming projects. Western Rock Lobster Council confirmed their fishing areas and also shared their concerns about seismic impacts on lobsters. CAPL agreed to providing further information regarding the operational areas and providing the information sheet.	In consultation in the course of preparing the EP, The Western Rock Lobster Council requested further information regarding Wheatstone Well Intervention Infill Drilling and 4D Seismic Activity which were addressed. The Western Rock Lobster Council had no further	As referenced in EPS Section 7 and detailed in Table 8-5, CAPL will provide Western Rock Lobster Council ongoing consultation of the activity milestones or if there is a material change to the proposed activity. CAPL will also notify the Western Rock Lobster Council in the event of an emergency
	08/02/2023	CN-000411	Email	CAPL sent out formal notice advising that the Western Rock Lobster Council had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and		

Relevant Person	Interaction Date	Record ID	Method	Summary	Assessment of Objection/Claim	Changes made to EP in response to consultation
				provided a link to their website for further information regarding the activity. CAPL notified the Western Rock Lobster Council that they welcome meaningful feedback.	objections or claims raised regarding the activity impacts or risks post-consultation. Confirmation that no feedback, objections or claims had been received from the Western Rock Lobster Council. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future (see Section 8.3.4.1)	as per their request (see and Section 8.3.4.2) CAPL considers the measures and controls in the EP address Western Rock Lobster Council's functions, interests or activities. No changes required.
	27/03/2023	OB-000164	Email	CAPL responded to Western Rock Lobsters queries with regard to the proposed Wheatstone Well Intervention Infill Drilling and 4D Seismic Activity, confirming that the Wheatstone Well Intervention Infill Drilling will only take place in the prescribed operational area and that further information on the modelling developed for Wheatstone 4D Seismic Activity was available on the NOPSEMA website. CAPL confirmed that impacts to crustaceans are not expected outside of the operational area.		
Whale and Dolphin Conservation Society	10/03/2023	CN-000221	Email	CAPL advised that Whale and Dolphin Conservation Society had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Whale and Dolphin Conservation Society that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Whale and Dolphin Conservation Society's functions, interests or activities. No changes required.
	27/03/2023	OC-000161	Phone	CAPL contacted Whale and Dolphin Conservation Society to confirm receipt of EP information using the number listed on their website however the number was not connected.		
Wilderness Island	23/02/2023	CN-000198	Email	CAPL advised that Wilderness Island had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Wilderness Island that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing	CAPL considers the measures and controls in the EP address Wilderness Island's functions, interests or activities. No changes required.
	11/05/2023	OC-000443	Email	CAPL reached out to Wilderness Island to provide any feedback they may have on the activity. CAPL		

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				confirmed that Wilderness Island has not expressed specific concerns or objections to the planned activity.	consultation and will consider any feedback if they provide in the future.	
Wilderness Society	10/02/2023	CN-000198	Email	CAPL advised that Wilderness Society had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Wilderness Society that they welcome meaningful feedback.	No objection or claim raised regarding the activity impacts or risks. CAPL has provided a reasonable period to receive feedback, which is consistent with CAPL's intended outcome of consultation (Section 6). CAPL is committed to ongoing consultation and will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Wilderness Society's functions, interests or activities. No changes required.
Wirrawandi Aboriginal Corporation RNTBC (WAC)	24/11/2022	OC-000371	Email	CAPL contacted the Wirrawandi Aboriginal Corporation (WAC) to provide an overview of their current approach to consultation and Environment Plans for upcoming activities. CAPL informed WAC of their commitment to consultation.	In consultation in the course of preparing the EP, Wirrawandi Aboriginal Corporation has provided no objection or claim in response to the proposed activity. Wirrawandi Aboriginal Corporation have requested to be included in ongoing consultation and in the event of an emergency they be included in the notification to relevant persons. CAPL is committed to ongoing consultation including working with traditional owners on a broader understanding of sea country and underwater	CAPL considers the measures and controls in the EP address Wirrawandi Aboriginal Corporation functions, interests or activities. No changes required.
	30/11/2022	OC-000372	Virtual Meeting	CAPL advised WAC of the new NOPSEMA consultation requirements, CAPL's environmental plans and what the best course of action is to consult with the WAC members and community. WAC suggested the best course of action was to focus on developing a communication plan between CAPL and WAC to commence rebuilding the relationship prior to discussions around CAPL's upcoming project activities (environmental plans). Both parties agreed to identify a suitable meeting date before the end of the year via email correspondence.		

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	06/12/2022	OC-000546	Email	CAPL engaged with WAC to confirm possible dates to meet the WAC board and elders and develop a relationship. CAPL presented WAC with some questions regarding expectations to discuss when CAPL meet with the WAC board and elders including co-design and drafting up of a consultation agreement and the CAPL representation WAC would expect to see. WAC and CAPL organised to have an informal meeting prior to the Board meeting.	cultural heritage. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future (see Section 8.3.4.1)	
	22/12/2022	OC-000476	Face-to-face	A CAPL representative and the WAC General Manager met to discuss the draft agenda for the upcoming meeting between CAPL and the WAC Board and Elders, scheduled in January 2023.		
	30/12/2022	OC-000374	Email	CAPL and WAC exchanged Emails looking at a proposal from WAC on future partnership opportunities.		
	05/01/2023	OC-000375	Email	CAPL and WAC exchanged emails discussing meeting quotes, agenda, and scheduling a meeting to socialise the agenda with the WAC Board prior to the meeting in January.		
	10/01/2023	OC-000376	Face-to-face	CAPL met with WAC to discuss the upcoming WAC/CAPL meeting planned for the 17th and 18th of January. A discussion about the CAPL and WAC relationship, past, present and future was had; and the agenda for the upcoming WAC/CAPL meeting.		
	17/01/2023	OC-000274	Face-to-face	CAPL met with the board of directors, elders' council and staff of the WAC to present an overview of their upcoming offshore activities and to discuss the re-building of the relationship between CAPL and WAC. CAPL sought feedback		

Relevant Person	Interaction Date	Record ID	Method	Summary	Assessment of Objection/Claim	Changes made to EP in response to consultation
				on areas of significance and cultural values including sea country and underwater cultural heritage. The key items discussed; CAPL explained its facilities and projects, and activities covered by upcoming Environment Plans and answered questions from WAC regarding seismic, whales and environmental monitoring on Barrow Island. CAPL requested advice as to whether additional relevant persons not present at the meeting should be informed and consulted with.		
	03/02/2023	CN-000426	Email	CAPL sent out formal notice advising WAC that they had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified WAC that they welcome meaningful feedback.		
	15/02/2023	OC-000338	Face-to-face	CAPL met with WAC rangers. WAC informed CAPL of their connection and history to country and shared their history and story.		
	16/02/2023	OC-000349	Email	CAPL informed WAC of their travel plans to Karratha and confirmed time and date to meet with CEO and Chair of the Board of Directors while in Karratha.		
	22/02/2023	OC-000347	Face-to-face	CAPL engaged with representatives from WAC and continued discussions from previous board meeting in January.		
	16/03/2023	OC-000350	Email	CAPL advised WAC of the proposed agenda for the board meeting in Perth. • Recap of the initial meeting between CAPL and WAC from January 20223. • Feedback on CAPL projects, CAPL will provide an overview of the upcoming projects and using a map highlight		

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				significant area(s) of concerns for WAC that surrounds the EMBA. • Re-build the relationship between WAC and CAPL by developing a guideline and structure for WAC and CAPL relationship and working group.		
	22/03/2023	OC-000273	Face-to-face	CAPL met with the board of directors, elders council and staff of the WAC to provide a follow up presentation of their upcoming offshore activities and to review draft terms of reference for joint working group to further develop governance of relationship.		
	06/04/2023	OC-000351	Email	CAPL sent through minutes of previous meeting with the WAC board of directors which occurred on the 22nd of March and additional documents requested during the meeting. The key discissions from the meeting was: The drafted terms of reference were reviewed by the group: - Purpose of terms of reference to be edited based on discussions which included Heritage Agreement and Process for Negotiation - Terms of reference to be the same between WAC and BTAC - Minimum of 4 meetings to occur throughout the year and additional meeting will occur if needed. - Informal check in meetings to occur with the extended membership once or twice a year e.g., BBQ's - WAC staff member to be included in the working group. - Include a co-chair or vice-chair. - This working group is to the lead communication group, when needed, guest or advisors to attend meetings to support initiatives. - Protocols for meeting discussion and engagement to be replaced with WAC code conduct.		

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				CAPL also requested permission of WAC members to display pictures in internal presentation for educational purposes.		
	12/04/2023	OC-000275	Face-to-face	CAPL met with representative of WAC to discuss actions arising from the initial meeting in January with the board of directors and elders council of WAC.		
	26/04/2023	OC-000354	Face-to-face	CAPL met WAC representatives to discuss and agree on ongoing communications between CAPL and WAC and provide a summary of CAPL's consultations with WAC in respect to CAPL's current Environment Plans in development for WAC's approval.		
	01/05/2023	OC-000348	Email	CAPL confirmed time and date of meeting with the CEO of WAC.		
	15/05/2023	OC-000528	Email	CAPL advised WAC of the draft documents they have prepared in preparation for the board meeting in the following week. CAPL informed WAC that they would be happy to discuss any of the documents. Draft Consultation Response and Statement: - captures the consultation and engagements with WAC over the last 6 months and summarises the information that CAPL will include in our upcoming EP's. WAC presented and discussed with the board. Draft Engagement Plan: - capture all the possible engagement and interactions that may occur between CAPL and WAC going forward. From consultation with WAC, CAPL understands that: - The coastal area, sea country, and adjacent islands are highly valuable to the Yaburara & Mardudhunera people. Impact on these areas from a planned or unplanned event may cause harm to the cultural landscape, individuals, and the community.		

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				- Based on the current activity proposal, WAC, as representatives for the Yaburara and Mardudhunera people, has not expressed specific concerns or objections to the planned activities discussed in the consultation process. WAC has not advised CAPL of any individual Yaburara and Mardudhunera persons that has a function, interest or activity in the EMBA that we should consult with separately. - WAC requests CAPL continues engaging to gain a deeper understanding of the values and sensitivities, so emergency response plans are well informed. CAPL has committed to continue engagement with WAC to ensure emergency response plans are well informed.		
Woodside	10/10/2022	OC-000550	Email	CAPL emailed Woodside and provided details of the proposed activity and asked for details of any activities Woodside plans to undertake which may be affected by CAPLs activities. Woodside confirmed their Scarborough Seabed Intervention & Trunkline Installation teams has monthly SIMPOs meeting with CAPL with the intent of developing SIMOPS plans, however there had been no mention of CAPL's seismic survey. Woodside requested the shapefile of the Wheatstone seismic survey operational area so Woodside could map it over their activity operational area. CAPL shared the shapefile and noted the overlap in timing of activities should be able to be managed through SIMOPS plans without any issues. Woodside shared with CAPL a figure that shows Woodside's overlapping operational areas as well as overlap with the Pygmy Blue Whale migration BIA and Montebello Marine Park Multiple Use Zone.	In consultation in the course of preparing the EP, Woodside has provided no objection or claim in response to the proposed activity. CAPL is committed to ongoing consultation. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future.	CAPL considers the measures and controls in the EP address Woodside’s functions, interests or activities. No changes required.

Relevant Person	Interaction Date	Record ID	Method	Summary	Assessment of Objection/Claim	Changes made to EP in response to consultation
	21/11/2022	OC-000551	Phone	CAPL had a phone call with Woodside to discuss the timing of the Wheatstone 4D Marine Seismic Survey timing. CAPL confirmed that the Wheatstone survey timing has been moved from mid-Dec 2022 – mid-April 2023 (timing in EP under assessment) to Jan-April 2024 (timing has to align with previous survey).		
	14/02/2023	CN-000118	Email	CAPL advised that Woodside had been identified as a relevant organisation with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified Woodside that they welcome meaningful feedback. Woodside acknowledged receipt of email.		
	10/05/2023	OC-000433	Email	CAPL reached out to Woodside to provide any feedback they may have on the activity. CAPL confirmed that Woodside has not expressed specific concerns or objections to the planned activity. Woodside confirmed receipt of email and forwarded the email onto appropriate representatives that will reach out to CAPL if they have any feedback. Woodside responded stating they had no feedback regarding the activities.		
Yamatji Marlpa Aboriginal Corporation (YMAC)	28/07/2021	OC-000457	Email	CAPL engaged with the Yamatji Marlpa Aboriginal Corporation (YMAC) for consultation on the upcoming 4D seismic Environment Plan and to advise on the best method of communication for ongoing consultation.	In consultation in the course of preparing the EP, Yamatji Marlpa Aboriginal Corporation has provided no objection or claim in response to the proposed activity. CAPL is committed to ongoing consultation including working with traditional owners on a broader understanding of sea country and underwater	As referenced in EPS Section 7 and detailed in Table 8-5, CAPL will provide Yamatji Marlpa Aboriginal Corporation ongoing consultation of the activity milestones. CAPL will also notify Yamatji Marlpa Aboriginal Corporation in the event of an emergency (see and Section 8.3.4.2)
	03/01/2023	OC-000313	Email	CAPL contacted YMAC for early engagement to provide an overview of their current approach to consultation and upcoming activities and Environment plans. CAPL offered to meet and discuss future communication protocols to build a relationship with YMAC. YMAC contacted CAPL to discuss consultation obligations under the OPGGS(E)R 2009. YMAC communicated the surge of consultation requests		

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				following the federal court decision resulting in the development of a procedure protocol for consultations. YMAC suggested availability for informal meeting. CAPL acknowledged YMAC's email and pressures following the court's decision. CAPL and YMAC organised a time to meet.	cultural heritage. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future (see Section 8.3.4.1)	CAPL considers the measures and controls in the EP address Yamatji Marlpa Aboriginal Corporation functions, interests or activities.
	02/02/2023	OC-000341	Face-to-face	CAPL met with YMAC and had a very positive meeting. YMAC advised CAPL of their intention to assist in introductions to other traditional owners. YMAC requested referrals for independent environmental advisors to better comprehend the Environment plans and impacts, to make informed decisions. CAPL sought feedback on areas of significance and cultural values including sea country and underwater cultural heritage. CAPL requested advice as to whether additional relevant persons not present at the meeting should be informed and consulted with.		
	03/02/2023	CN-000314	Email	CAPL advised that the YMAC had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL provided an overview of the activity and provided a link to their website for further information regarding the activity. CAPL notified YMAC that they welcome meaningful feedback. CAPL thanked YMAC for their assistance and for the opportunity to build a relationship between the organisations. Additionally, CAPL provided YMAC with a written notice to pass on to relevant traditional owner corporations.		
	22/02/2023	OC-000316	Email	CAPL connected with YMAC to request if any further correspondence relating to forwarded Environment Plans was needed. YMAC advised CAPL of best correspondence methods to other relevant stakeholders.		

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Yinggarda Aboriginal Corporation (YAC)	03/02/2023	CN-000324	Email	CAPL advised that the Yinggarda Aboriginal Corporation (YAC) had been identified as a relevant person with functions, interests or activities that may be affected by the activity. CAPL advised that they are interested in speaking to a representative of YAC about CAPLs activities. CAPL advised that they welcome meaningful feedback. CAPL acknowledged the workloads and pressures Traditional Owner Corporations are under and advised they would be available to discuss further at YAC's convenience.	In consultation in the course of preparing the EP, Yinggarda Aboriginal Corporation has provided no objection or claim in response to the proposed activity. CAPL is committed to ongoing consultation including working with traditional owners on a broader understanding of sea country and underwater cultural heritage. CAPL notes that further feedback may be received as part of ongoing consultation. CAPL will consider any feedback if they provide in the future (see Section 8.3.4.1)	As referenced in EPS Section 7 and detailed in Table 8-5, CAPL will provide Yinggarda Aboriginal Corporation ongoing consultation of the activity milestones. CAPL will also notify Yinggarda Aboriginal Corporation in the event of an emergency (see and Section 8.3.4.2) CAPL considers the measures and controls in the EP address Yinggarda Aboriginal Corporation functions, interests or activities.
	07/03/2023	OC-000327	Email	Yinggarda Aboriginal Corporation (YAC) contacted CAPL to identify themselves as a relevant person and to welcome consultation with CAPL. YAC requested some additional information on the Environment plans outlined in CAPL's previous correspondence as they were of a highly technical nature. YAC expressed that to ensure fully informed engagement and consultation CAPL should attend a half or full day Board meeting to present the activities and if necessary assist in engaging an environmental scientist to advise the Board about the impact of proposed activities. This will allow the Board to draft an appropriate response to include in CAPL's EP. CAPL and YAC confirmed a meeting with its members for CAPL to present upcoming activities and answer any queries. CAPL also suggested an initial phone call to discuss details.		
		OC-000337	Phone	CAPL spoke with representatives of Yinggarda Aboriginal Corporation (YAC) and were advised of a meeting time and date.		
	23/03/2023	OC-000149	Face-to-face	CAPL presented to the Board of the Yinggarda Aboriginal Corporation (YAC) on the upcoming offshore activities and sought feedback on areas of significance and cultural values including sea		

Relevant Person	Interaction Date	Record ID	Method	Summary	Assessment of Objection/Claim	Changes made to EP in response to consultation
				country and underwater cultural heritage. CAPL provided clarification on the EP and OPP processes and advised YAC that they would be consulting with them soon regarding other activities. CAPL requested advice as to whether additional relevant persons not present at the meeting should be informed and consulted with.		
		OC-000379	Email	CAPL contacted YAC to thank them for their time and to discuss the possibility of organising another meeting in May or June to answer any follow up queries. CAPL also mentioned their intention to expand their social investment framework beyond Onslow. CAPL requested any feedback YAC may have. CAPL followed up with YAC's representative to ask if there had been any comments or feedback from the community with respect to CAPL's activities YMAC representative for Yinggarda Aboriginal Corporation contacted CAPL to advise that YMAC is no longer acting on behalf of Yinggarda. CAPL Thanked the YMAC representative for the new contact representative and their assistance.		
	04/05/2023	OC-000517	Email	CAPL contacted the new YAC representative to request any feedback about the upcoming activities from the previous board meeting. CAPL acknowledged the current changes at YAC and expressed their appreciation for YACs time and consideration. Following a call with the new YAC representative, CAPL inquired whether any of the YAC Board had any feedback from their meeting earlier in the year. CAPL informed YAC that they require any feedback formally to include in the Environment plans. CAPL also reiterated their desire to meet with the Board again to discuss any further queries.		

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				CAPL asked if YAC had any time to catch up on the phone. YAC thanked CAPL for their email and apologised for the delay in response. YAC advised CAPL that they had forwarded the information to the relevant person and would be in touch in early June following the Board meeting.		
	08/05/2023	OC-000544	Phone	Gumala advised CAPL that Yinggarda's Executive services were being transferred from YMAC to Gumala which includes Gumala being responsible for governance and cultural heritage. Gumala provided CAPL with the updated contact details for consultation with Yinggarda.		
	08/06/2023	OC-000548	Email	YAC requested further information from CAPL regarding CAPL's activity so it can be presented to the YAC board: 1. Has an environmental consultant been engaged to provide independent advice to the YAC Board on what is proposed? - It will be difficult for YAC to provide any useful feedback on environmental and cultural concerns, in the absence of obtaining that advice, particularly in respect of the EP submissions. 2. What does CAPL have in mind regarding Engagement framework and Potential partnership opportunities? - Can you please provide us with an understanding on what might be on the table for a sustainable future partnership with CAPL? CAPL responded: 1. It had been raised by YMAC as to whether we would provide support to YAC via YMAC for an independent environment specialist to review our information sheets. The role of the environmental specialist was not to reassess our environment assessment but to help the board understand the potential risks and impacts to their		

Relevant Person	Interaction Date	Record ID	Method	Summary	Assessment of Objection/Claim	Changes made to EP in response to consultation
				values and sensitivities. We also offered at this meeting to return to answer any questions that the board. We have received no further direction or requests from YAC in relation to this. CAPL will continue to improve the environmental management of our activities post submission of our Environment Plans to NOPSEMA and our plans will benefit from the ongoing consultations and discussions with YAC as well as all Traditional Owner groups and other Relevant Persons. This includes any specific information on values and sensitivities that are nominated from a potential review by the Environmental Consultant. 2. In terms of an engagement framework, CAPL would welcome the opportunity, based on interest from YAC, to codesign how we can share information about our activities going forward, acknowledging the burdens on people's time. We are currently investigating how we can be supporting PBC's, particularly with respect to emergency response and this was something we discussed with the Yinggarda board when we met.		

appendix e acoustic modelling

Wheatstone 4D MSS Acoustic Modelling for Assessing Marine Fauna Sound Exposures

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Wheatstone 4D MSS

Acoustic Modelling for Assessing Marine Fauna Sound Exposures

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	Name	Signature	Date
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Wheatstone 4D Survey

Acoustic Modelling for Assessing Marine Fauna Sound Exposures

Submitted to:

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Chevron Australia Pty Ltd
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Disclaimer:

The results presented herein are relevant within the specific context described in this report. They could be misinterpreted if not considered in the light of all the information contained in this report. Accordingly, if information from this report is used in documents released to the public or to regulatory bodies, such documents must clearly cite the original report, which shall be made readily available to the recipients in integral and unedited form.

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Executive Summary

JASCO Applied Sciences (JASCO) performed a numerical estimation study of underwater sound levels associated with the planned Wheatstone 4D Marine Seismic Survey (MSS) to assist in understanding the potential acoustic effect on receptors including marine mammals, fish, sea turtles, benthic invertebrates, plankton, sponges and corals, and divers. Modelling considered a 4130 in^3 seismic source in a dual source configuration (18.75 m inter pulse interval), towed at 5 m depth behind a single vessel.

A specialised airgun array source model was used to predict the acoustic signature of the seismic source, and complementary underwater acoustic propagation models were used in conjunction with the modelled array signature to estimate sound levels over a large area around the source. Single-impulse sound fields were predicted at eight sites within the survey area. The water depths at the modelled sites ranged between 64 and 1000 m. Accumulated sound exposure fields were predicted for two representative scenarios for likely operations within the survey area over 24 hours.

The modelling methodology considered source directivity and range-dependent environmental properties in each of the areas assessed. Estimated underwater acoustic levels are presented as sound pressure levels (SPL, L_{p}), zero-to-peak pressure levels (PK, L_{pk}), peak-to-peak pressure levels (PK-PK; $L_{\mathrm{pk\text{-}pk}}$), and either single-impulse (i.e., per-pulse) or accumulated sound exposure levels (SEL, L_{E}) as appropriate for different noise effect criteria. A conservative sound speed profile that would be most supportive of sound propagation conditions for the period of the survey was defined and applied to all modelling.

The sound footprints are highly directional, and while the maximum distances to criteria are presented in the summary, this distance may not be relevant to receptors or areas of interest in a specific direction. For example, the distances to SPL criteria for behavioural response in marine mammals, and behavioural response and disturbance in turtles are typically greater for the shallower sites, and those close to the continental shelf. However, the orientation of the source is also key, as the array has a pronounced directivity pattern, with greater distances to sound levels in the broadside direction as compared to the endfire direction. The influence of the bathymetry on the sound fields and the orientation of the source are the reason the humpback whale migratory BIA is not predicted to be ensonified above the marine mammal behavioural disturbance threshold or the shallow waters around the Montebello Islands are not predicted to be ensonified above the human health assessment threshold of 145 dB re 1 µPa.

The SEL_{24h} is a cumulative metric that reflects the dosimetric impact of noise levels within 24 hours based on the assumption that an animal is consistently exposed to such noise levels at a fixed position. Where the corresponding SEL_{24h} radii are larger than those for peak pressure criteria, they often represent an unlikely worst-case scenario. More realistically, marine mammals, fish and sea turtles would not stay in the same location for 24 hours, but rather a shorter period, depending upon their behaviour and the proximity and movements of the source. Therefore, a reported radius for SEL_{24h} criteria does not mean that marine fauna travelling within this radius of the source will be impaired, but rather that an animal could be exposed to the sound level associated with impairment (either permanent threshold shift (PTS) or temporary threshold shift (TTS)) if it remained in that location for 24 hours.

The analysis considered the distances from the seismic source at which several effects criteria or relevant sound levels were reached. The results are summarised below for the representative single-impulse sites and accumulated SEL scenarios. The noise effect criteria for impairment of marine mammals, fish and sea turtles use dual metrics (PK and SEL_{24h}), and the longest distance associated with either metric is required to be applied, and thus is presented in this summary.

At long ranges off 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 long range off the continental shelf do not accurately represent the actual exposures whales migrating at predominantly shallow depths will receive.

Marine mammals

Table 1. Maximum (R_{max}) horizontal distances (in km) from modelled sites or scenarios to behavioural response thresholds and PTS and TTS thresholds for marine mammals.

Hearing group	Modelled distance to effect threshold (R_{max})		
	Behavioural response[1]	Impairment: TTS[2]	Impairment: PTS[2]
LF cetaceans		95.4	6.61
MF cetaceans	13.45	-	-
HF cetaceans		1.63	0.450

[1] Noise exposure criteria: NOAA (2019)
[2] Noise exposure criteria: NMFS (2018)

Sea turtles

Table 2. Maximum (R_{max}) horizontal distances (in km) from modelled sites or scenarios to behavioural response thresholds and PTS and TTS thresholds for sea turtles.

Hearing group	Modelled distance to effect threshold (R_{max})			
	Behavioural response[1]	Behavioural disturbance[2]	Impairment: TTS[3]	Impairment: PTS[3]
Turtles	7.11	2.83	3.84	<0.02

[1] Noise exposure criteria: NSF (2011)
[2] Noise exposure criteria: McCauley et al. (2000b)
[3] Noise exposure criteria: Finneran et al. (2017)

Fish, fish eggs, and fish larvae

- This modelling study assessed the ranges for quantitative criteria based on Popper et al. (2014) and considered both PK (seafloor and water column) and SEL_{24h} metrics associated with mortality and potential mortal injury as well as impairment in the following groups:
    - Fish without a swim bladder (also appropriate for sharks in the absence of other information)
    - Fish with a swim bladder not used for hearing
    - Fish that use their swim bladders for hearing
    - Fish eggs and fish larvae

Table 3. Summary of maximum fish, fish eggs and larvae injury and TTS onset distances for single impulse and SEL_{24h} modelled scenarios

Relevant hearing group	Effect criteria	Scenario 1		Scenario 2	
		Metric associated with longest distance to criteria	R_{max} (km)	Metric associated with longest distance to criteria	R_{max} (km)
Fish: No swim bladder	Injury	PK	0.096 (seafloor)	PK	0.07
	TTS	SEL_{24h}	8.63	SEL_{24h}	7.56
Fish: Swim bladder not involved in hearing and Swim bladder involved in hearing	Injury	PK	0.27	PK	0.15
	TTS	SEL_{24h}	8.63	SEL_{24h}	7.56
Fish eggs and larvae	Injury	PK	0.27	PK	0.15

Invertebrates, Sponges, Coral and Plankton

To assist with assessing the potential effects on these receptors, the following were determined:

- Crustaceans: The sound level of 202 dB re 1 µPa PK-PK from Payne et al. (2008) was considered for seafloor sound levels; the sound level was reached at ranges between 0.431 and 0.913 km depending on the modelled site.
- Sponges and coral: the PK sound level at the seafloor directly underneath the seismic source was estimated at three modelled sites and compared to the no effect sound level of 226 dB re 1 µPa PK for sponges and corals (Heyward et al. 2018); it was not reached.
- Plankton: The maximum distance to potential injury in plankton, applying the threshold from Popper et al. (2014), is 0.27 km within the water column.

1. Introduction

JASCO Applied Sciences (JASCO) performed a numerical estimation study of underwater sound levels associated with the planned Wheatstone 4D Marine Seismic Survey (MSS) to assist in understanding the potential acoustic impact on receptors including marine mammals, fish, sea turtles, benthic invertebrates, plankton, sponges and corals, and divers.

JASCO's specialised Airgun Array Source Model (AASM) was used to predict acoustic signatures and spectra for a 4130 in^3 airgun array. AASM accounts for individual airgun volumes, airgun bubble interactions, and array geometry to yield accurate source predictions.

Complementary underwater acoustic propagation models were used in conjunction with the selected array signature to estimate sound levels considering environmental effects. Single-impulse sound fields were predicted at eight defined locations within the potential survey area, and an accumulated sound exposure field was predicted for two representative scenarios for survey operations over 24 h (Section 2). A conservative sound speed profile that would be most supportive of sound propagation conditions for the potential survey period was defined and applied throughout.

The modelling methodology considered source directivity and range-dependent environmental properties. Estimated underwater acoustic levels are presented as sound pressure levels (SPL, L_p), zero-to-peak pressure levels (PK, L_{pk}), peak-to-peak pressure levels (PK-PK; $L_{pk\text{-}pk}$), and either single-impulse (i.e., per-pulse) or accumulated sound exposure levels (SEL, L_E) as appropriate for different noise effect criteria.

Section 3 explains the metrics used to represent underwater acoustic fields and the effect criteria considered. Section 4 details the methodology for predicting the source levels and modelling the sound propagation, including the specifications of the seismic source and all environmental parameters the propagation models require. Section 5 presents the results, which are then discussed and summarised in Section 6.

2. Modelling Scenarios

Eight standalone single impulse sites and two scenarios for survey operations over 24 hours to assess accumulated SEL were modelled. The locations of all modelled sites are provided in Table 4, with all sites and the acquisition lines shown in Figure 1 along with the survey boundaries. The modelling assumed that a survey vessel sailed along survey lines at ~4.5 knots, with an impulse interval of 18.75 m.

The proposed survey plan includes lines orientated either 60/240° (represented by Scenario 1) or 120/300° (represented by Scenario 2). The two sets of survey lines modelled represent 24 h of survey; this period is based on the various effect criteria that are evaluated in this study. The line scenarios were selected to incorporate both potential acquisition line orientations (referred to as either 60 or 120°), and the offshore and inshore sections of the Full Power Area, to aid in the assessment of sound levels within the Biologically Important Areas (BIAs) and Key Ecological Features (KEFs) within the region. The different line orientations are essential considering the potential sound propagation characteristics that may arise during survey acquisition. The 60/240° (Scenario 1) lines considered were in the southern part of the Full Power Area, close to coastal receptors, with the broadside aspect of the source orientated towards both the humpback whale and pygmy blue whale migration BIAs. The 120/300° (Scenario 2) lines considered were in the northern part of the Full Power Area, and included the most offshore full-length survey lines, which extend into the pygmy blue whale migration BIA. The Scenario 2 lines also will represent the potential sound fields parallel to the continental shelf.

Both accumulated SEL scenarios consisted of four full lines and a fifth partial line during a 24-hour period and included 8,233 seismic impulses. During line turns, the seismic source was not operating. It is computationally prohibitive to perform sound propagation modelling for every seismic impulse. Therefore, a subset of seismic impulse locations was selected based on the variation in environmental properties within the entire survey area. For this study, seven locations were considered sufficient to represent the variation in sound propagation along the modelled survey lines; their selection was mainly based on the variation in water depth within the survey area. The modelled sound fields at these seven single impulse sites were transposed along the survey lines to model the scenarios' SEL_{24h} sound fields (see Appendix C.3). An eighth location was chosen to represent the shallowest point within the Full Power Area. This location was used to calculate single impulse metrics, including evaluating the distance to the human health assessment threshold of 145 dB re 1 µPa (SPL), in relation to the Montebello Islands, south of the survey area.

Table 4. Location details for the single impulse modelled sites and associated SEL_{24h} scenario.

Relevant SEL_{24} Scenario	Site	Latitude (S)	Longitude (E)	UTM Zone 50 X (m)	UTM Zone 50 Y (m)	Water depth (m)	Tow direction (°)
1	1	19° 56' 03.3456" S	115° 26' 08.5946" E	336285	7795031	82	60
	2	19° 55' 21.1646" S	115° 19' 17.9753" E	324332	7796213	126	
	3	19° 45' 32.2431" S	115° 22' 01.9962" E	328926	7814368	200	
2	2	19° 55' 21.1646" S	115° 19' 17.9753" E	324332	7796213	126	120
	3	19° 45' 32.2431" S	115° 22' 01.9962" E	328926	7814368	200	
	4	19° 40' 51.5469" S	115° 22' 06.4766" E	328974	7823000	400	
	5	19° 39' 42.2812" S	115° 20' 02.9133" E	325354	7825095	600	
	6	19° 38' 47.8390" S	115° 18' 25.4959" E	322500	7826741	800	
	7	19° 41' 24.5095" S	115° 14' 39.2009" E	315957	7821857	1000	
N/A	A†	20° 01' 42.5825" S	115° 23' 54.7001" E	332491	7784563	64	120

†Shallowest location within Full Power Area.

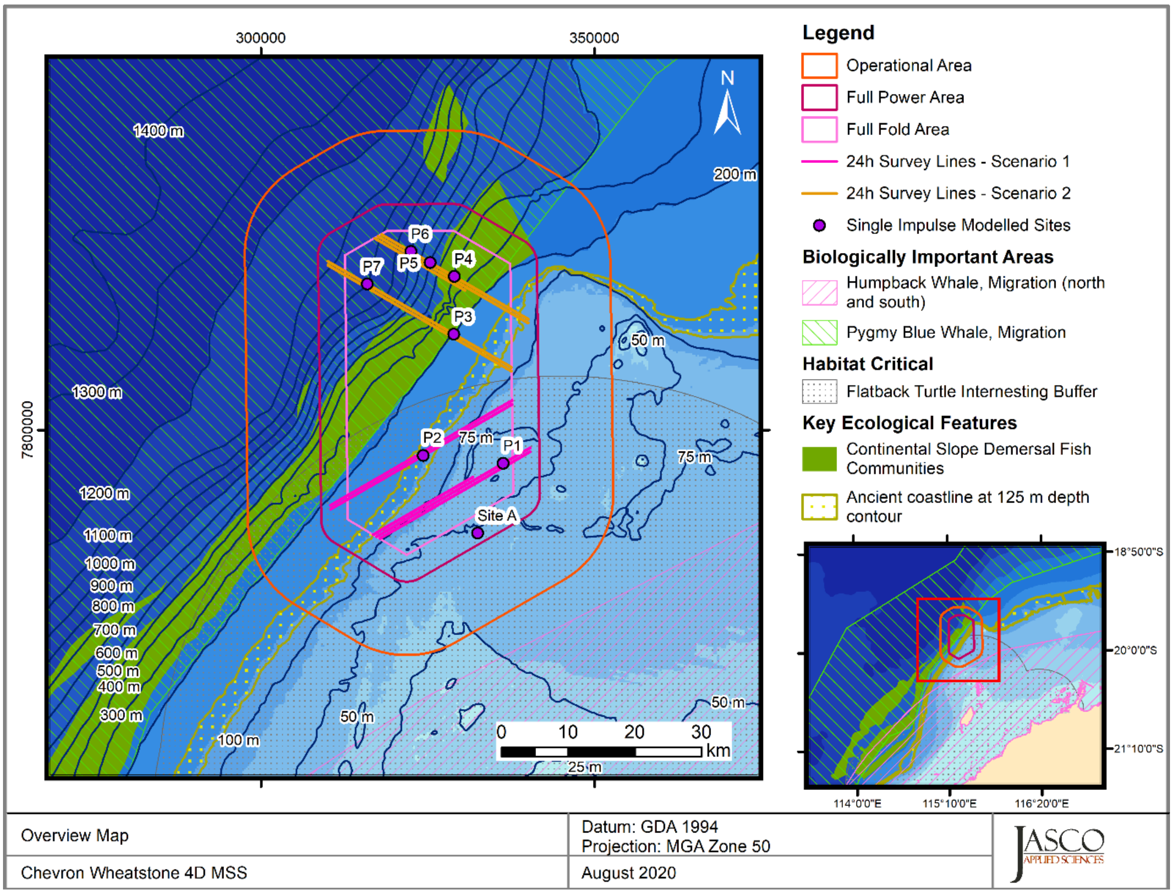

Figure 1. Overview of the modelled sites, acquisition lines, and features for the Wheatstone 4D MSS.

3. Noise Effect Criteria

The perceived loudness of sound, especially impulsive noise such as from seismic airguns, is not generally proportional to the instantaneous acoustic pressure. Rather, perceived loudness depends on the pulse rise-time and duration, and the frequency content. Several sound level metrics, such as PK, SPL, and SEL, are commonly used to evaluate noise and its effects on marine life (Appendix A). The period of accumulation associated with SEL is defined, with this report referencing either a "per pulse" assessment or over 24 h, and appropriate notations indicate any applied frequency weighting; unweighted SEL is defined as required. The acoustic metrics in this report reflect the updated ISO standard for acoustic terminology, ISO/DIS 18405:2017 (2017).

Whether acoustic exposure levels might injure, impair or disturb marine fauna is an active research topic. Since 2007, several expert groups have developed SEL-based assessment approaches for evaluating auditory injury and impairment, with key works including Southall et al. (2007), Finneran and Jenkins (2012), Popper et al. (2014), United States National Marine Fisheries Service (NMFS 2018) and Southall et al. (2019). The number of studies that have investigated the level of behavioural disturbance to marine fauna by anthropogenic sound has also increased substantially.

The following thresholds, guidelines and sound levels for this study were chosen because they represent the best available science, and sound levels presented in literature for fauna with no defined thresholds:

1. Peak pressure levels (PK; L_{pk}) and frequency-weighted accumulated sound exposure levels (SEL; $L_{E,24h}$) from the U.S. National Oceanic and Atmospheric Administration (NOAA) Technical Guidance (NMFS 2018) for the onset of permanent threshold shift (PTS) and temporary threshold shift (TTS) in marine mammals.
2. Marine mammal behavioural threshold based on the current NOAA (2019) criterion for marine mammals of 160 dB re 1 µPa (SPL; L_p) for impulsive sound sources.
3. Sound exposure guidelines for fish, fish eggs and larvae (including plankton) (Popper et al. 2014).
4. Peak pressure levels (PK; L_{pk}) and frequency-weighted accumulated sound exposure levels (SEL; $L_{E,24h}$) from Finneran et al. (2017) for the onset of PTS and TTS in turtles.
5. Turtle behavioural response threshold of 166 dB re 1 µPa (SPL; L_p) (NSF 2011), as applied by the US NMFS, along with a sound level associated with behavioural disturbance 175 dB re 1 µPa (SPL; L_p) (McCauley et al. 2000a, 2000b).
6. Peak-peak pressure levels (PK-PK; $L_{pk\text{-}pk}$) at the seafloor to help assess effects of noise on crustaceans through comparing to results in Day et al. (2016a), Day et al. (2019b) , Day et al. (2016b), Day et al. (2017) and Payne et al. (2008).
7. For comparison to current literature, a no effect sound level for sponges and corals of 226 dB re 1 µPa (PK; L_{pk}), is reported for comparing to Heyward et al. (2018).
8. An SPL human health assessment threshold of 145 dB re 1 µPa (SPL; L_p) for sound exposure to people swimming and diving derived from Parvin (2005), and considering Ainslie (2008).

Additionally, to assess the size of the low-power zone required under the Australian Environment Protection and Biodiversity Conservation (EPBC) Act Policy Statement 2.1, Department of the Environment, Water, Heritage and the Arts (DEWHA 2008), the distance to an unweighted per-pulse SEL of 160 dB re 1 µPa^2·s (SEL; L_E) is reported.

The following sections (Sections 3.1–3.4.2 and Appendix A.3 and A.5) expands on the thresholds and sound levels for marine mammals, fish, fish eggs, fish larvae, sea turtles, benthic invertebrates and humans.

3.1. Marine Mammals

There are two categories of auditory threshold shifts or hearing loss: PTS, a physical injury to an animal's hearing organs; and TTS, a temporary reduction in an animal's hearing sensitivity as the result of receptor hair cells in the cochlea becoming fatigued.

To help assess the potential for the possible injury and hearing sensitivity changes in marine mammals, this report applies the criteria recommended by NMFS (2018), considering both PTS and TTS, which are numerically identical to Southall et al. (2019). These criteria, along with the applied behavioural criteria (NOAA 2019), are summarised in Table 5, with descriptions included in Appendix A.3.1 (auditory impairment) and Appendix A.3.2 (behavioural response), with frequency weighting explained in Appendix A.4.

Table 5. Unweighted SPL, SEL_{24h}, and PK thresholds for acoustic effects on marine mammals.

Hearing group	NOAA (2019)	NMFS (2018)			
	Behaviour	PTS onset thresholds* (received level)		TTS onset thresholds* (received level)	
	SPL (L_p; dB re 1 µPa)	Weighted SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²·s)	PK (L_{pk}; dB re 1 µPa)	Weighted SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²·s)	**PK** (L_{pk}; dB re 1 µPa)
Low-frequency cetaceans	160	183	219	168	213
Mid-frequency cetaceans		185	230	170	224
High-frequency cetaceans		155	202	140	196

* Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS and TTS onset. If a non-impulsive sound has the potential of exceeding the peak sound pressure level thresholds associated with impulsive sounds, these thresholds should also be considered.
L_p–denotes sound pressure level period and has a reference value of 1 µPa.
L_{pk}, flat–peak sound pressure is flat weighted or unweighted and has a reference value of 1 µPa.
L_E - denotes cumulative sound exposure over a 24-hour period and has a reference value of 1 µPa²s.
Subscripts indicate the designated marine mammal auditory weighting.

3.2. Fish, Fish Eggs, and Fish Larvae

In 2006, the Working Group on the Effects of Sound on Fish and Turtles was formed to continue developing noise exposure guidelines for fish and turtles, work begun by a panel convened by NOAA two years earlier. The resulting guidelines included noise exposure guidelines for different groups of species for different levels of effects and for different groups of species (Popper et al. 2014). These guidelines defined quantitative levels for three types of immediate effects:

- Mortality, including injury leading to death.
- Recoverable injury, including injuries unlikely to result in mortality, such as hair cell damage and minor haematoma.
- TTS.

Masking and behavioural effects can be assessed qualitatively, by assessing relative risk rather than by specific sound levels. However, as these depend upon activity-based subjective ranges, these effects are not addressed in this report and are included in Table 6 for completeness only. Because the presence or absence of a swim bladder has a role in hearing, fish's susceptibility to effect from noise exposure varies depending on the species and the presence and possible role of a swim bladder in hearing. Thus, different guidelines were proposed for fish without a swim bladder (also appropriate for sharks and applied to whale sharks in the absence of other information), fish with a swim bladder not used for hearing, and fish that use their swim bladders for hearing. Turtles, fish eggs, and fish larvae are considered separately. Table 6 lists relevant effect guidelines from Popper et al. (2014).

The SEL metric integrates noise intensity over some period of exposure. Because the period of integration for regulatory assessments is not well defined for sounds that do not have a clear start or end time, or for very long-lasting exposures, it is required to define a time. Popper et al. (2014) recommend applying a standard period, where this is either defined as a justified fixed period or the duration of the activity; however, Popper et al. (2014) also included caveats about how long the fish will be exposed because they can move (or remain in location) and so can the source. Popper et al. (2014) summarises that in all TTS studies considered, fish that showed TTS recovered to normal hearing levels within 18–24 hours. Due to this, a period of accumulation of 24 hours has been applied in this study for SEL, which is similar to that applied for marine mammals in NMFS (2016, 2018).

Additional information is provided in Appended A.5.

Table 6. Criteria for seismic noise exposure for fish, fish eggs, and fish larvae adapted from Popper et al. (2014).

Type of animal	Mortality and Potential mortal injury	Impairment			Behaviour
		Recoverable injury	TTS	Masking	
Fish: No swim bladder (particle motion detection)	>219 dB SEL_{24h} or >213 dB PK	>216 dB SEL_{24h} or >213 dB PK	>>186 dB SEL_{24h}	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low
Fish: Swim bladder not involved in hearing (particle motion detection)	210 dB SEL_{24h} or >207 dB PK	203 dB SEL_{24h} or >207 dB PK	>>186 dB SEL_{24h}	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low
Fish: Swim bladder involved in hearing (primarily pressure detection)	207 dB SEL_{24h} or >207 dB PK	203 dB SEL_{24h} or >207 dB PK	186 dB SEL_{24h}	(N) Low (I) Low (F) Moderate	(N) High (I) High (F) Moderate
Fish eggs and fish larvae (relevant to plankton)	>210 dB SEL_{24h} or >207 dB PK	(N) Moderate (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low

Notes: Peak sound level (PK) dB re 1 μPa; SEL_{24h} dB re 1μPa^2·s. All criteria are presented as sound pressure, even for fish without swim bladders, since no data for particle motion exist. Relative risk (high, moderate, or low) is given for animals at three distances from the source defined in relative terms as near (N), intermediate (I), and far (F).

3.3. Sea Turtles

There is a paucity of data regarding responses of turtles to acoustic exposure, and no studies of hearing loss due to exposure to loud sounds. Popper et al. (2014) suggested thresholds for onset of mortal injury and mortality for sea turtles and, in absence of taxon-specific information, adopted the levels for fish that do not hear well (suggesting that this likely would be conservative for sea turtles).

Finneran et al. (2017) presented revised thresholds for sea turtle injury and hearing impairment (TTS and PTS). Their rationale is that sea turtles have best sensitivity at low frequencies and are known to have poor auditory sensitivity (Bartol and Ketten 2006, Dow Piniak et al. 2012). Accordingly, TTS and PTS thresholds for turtles are likely more similar to those of fishes than to marine mammals (Popper et al. 2014).

McCauley et al. (2000a) observed the behavioural response of caged sea turtles—green (*Chelonia mydas*) and loggerhead (*Caretta caretta*)—to an approaching seismic airgun. For received levels above 166 dB re 1 µPa (SPL), the sea turtles increased their swimming activity and above 175 dB re 1 µPa they began to behave erratically, which was interpreted as an agitated state. The 166 dB re 1 µPa level has been used as the threshold level for a behavioural disturbance response by NMFS and applied in the Arctic Programmatic Environment Impact Statement (PEIS) (NSF 2011). In addition the 175 dB re 1 µPa level from McCauley et al. (2000a) is recommended as a criterion for behavioural disturbance. In addition, the Recovery Plan for Marine Turtles in Australia (Department of the Environment and Energy et al. 2017) acknowledges the 166 dB re1 µPa SPL reported by McCauley et al. (2000a) as the level that may result in a behavioural response to marine turtles. These thresholds are shown in Table 7.

Table 7. Criteria for acoustic effects of impulsive noise on sea turtles: Unweighted SPL, SEL_{24h}, and PK thresholds

Effect type	Criterion	SPL (L_p; dB re 1 µPa)	Weighted SEL_{24h} ($L_{E,24h}$; dB re 1 µPa^2·s)	PK (L_{pk}; dB re 1 µPa)
Behavioural response	NSF (2011)	166	NA	
Behavioural disturbance	McCauley et al. (2000b)	175		
PTS onset thresholds* (received level)	Finneran et al. (2017)	NA	204	232
TTS onset thresholds* (received level)			189	226

* Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS and TTS onset. If a non-impulsive sound has the potential of exceeding the peak sound pressure level thresholds associated with impulsive sounds, these thresholds should also be considered.
L_p denotes sound pressure level period and has a reference value of 1 µPa.
$L_{pk,flat}$ denotes peak sound pressure is flat weighted or unweighted and has a reference value of 1 µPa.
L_E denotes cumulative sound exposure over a 24 h period and has a reference value of 1 µPa^{2}s.

3.4. Invertebrates

3.4.1. Benthic Invertebrates (Crustaceans and Bivalves)

Research is ongoing into the relationship between sound and its effects on crustaceans and bivalves, including the relevant metrics for both effect and impact. 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.

At the seafloor interface, crustaceans and bivalves are subject to particle motion stimuli from several acoustic or acoustically-induced waves. These include the particle motion associated with an impinging sound pressure wave in the water column (the incident, reflected, and transmitted portions), substrate acoustic waves, and interface waves of the Scholte type. However, it is unclear which aspect(s) of these waves is/are most relevant to the animals, either when they normally sense the environment or their physiological responses to loud sounds so there is not enough information to establish similar criteria and thresholds as done for marine mammals and fish. Including recent research, such as Day et al. (2016b), current literature does not clearly define an appropriate metric or identify relevant levels (pressure or particle motion) for an assessment. This includes the consideration of what particle motion levels lead to a behavioural response, or mortality. Therefore, at this stage, we cannot propose authoritative thresholds to inform the impact assessment. However, levels can be determined for pressure metrics presented in literature to assist the assessment.

The pressure and acceleration examples provided in Day et al. (2016a)(Figures 11 and 12) indicate that the acceleration and pressure signals occurred simultaneously, which was interpreted as an indication that the waterborne sounds were responsible for the accelerations measured by the geophones. For clarity, it is important to distinguish that the acceleration from waterborne sound energy is *not* ground roll, which Day et al. (2016a) correctly define as the sound that propagates along the interface at a speed lower than the shear wave speed of the sediment. However, the report subsequently uses ground roll for all further discussions of particle acceleration. While Day et al. (2016a) discuss that they chose the simplest measure of ground roll, it should have been referring to as 'the acceleration from waterborne sound energy', or 'waterborne acceleration' for short.

For crustaceans, a PK-PK sound level of 202 dB re 1 µPa (Payne et al. 2008) is considered to be associated with no impact, and it is therefore applied in this assessment. Additionally for context, the maximum PK-PK sound levels measured during the passes of the 150 in^3 airgun and reported in Day et al. (2016a), Day et al. (2016b), and Day et al. (2019) 209–213 dB re 1 µPa are also included.

For bivalves, PK-PK sound levels of 212 and 213 dB re 1 µPa are presented to allow comparison to the maximum sound levels measured in Day et al. (2016a) (also reported in Day et al. (2017)) during the passes of the 150 in^3 airgun (reported in Table 7 of Day et al. (2016a)).

3.4.2. Plankton

To assess impacts to plankton, there are only a few studies to base nominal thresholds for effect assessment on. Popper et al. (2014) cites many of the references and studies on potential impacts of noise emissions on fish eggs and larvae prior to 2014. Results presented in Day et al. (2016b) for embryonic lobsters and Fields et al. (2019) for copepods align with those presented in Popper et al. (2014), which is that mortality and sub-lethal injury are limited to within tens of metres of seismic sources. Additionally, the Popper et al. (2014) guidelines (Table 6), are extrapolated from simulated pile driving signals which have a more rapid rise time and greater potential for trauma than pulses from a seismic source.

Other research, such as McCauley et al. (2017), has indicated the potential for effects at longer range, however Fields et al. (2019) noted that it was difficult to reconcile the high mortality reported by McCauley et al. (2017) with the low mortalities reported in the greater previous body of earlier research and their experiment. They recommended further research into whether it is the sound pulse itself (i.e. the energy, peak pressures, or particle acceleration), the (turbulent) fluid flow occurring more slowly (i.e. not related to the sound pulse), or other effects such as the bubble cloud that which might cause higher mortality near the seismic source.

3.5. Human health assessment threshold

Underwater, the human ear is about 20 dB less sensitive than it is in air at low frequencies (20 Hz), increasing to 40 dB at mid-frequencies (less than 1 kHz), and increasing to 70–80 dB less sensitive at higher frequencies (Parvin 1998). Divers who wear neoprene hoods have even higher hearing thresholds (lower sensitivity) above 500 Hz because the hood material absorbs high-frequency sounds (Sims et al. 1999). Exposure studies related to divers have typically focused on military sonar exposure, with little information on seismic survey operations, and as such care is required when considering thresholds for recreational divers and swimmers, particularly for impulsive sounds such as seismic surveys (Ainslie 2008).

The auditory threshold of hearing under water was lowest at 1 kHz (70 dB re 1 µPa SPL) and increased for lower and higher frequencies to around 120 dB re 1 µPa at 20 Hz and at 20 kHz (Parvin 1998). Fothergill et al. (2000) and Fothergill et al. (2001) conducted controlled acoustic exposure experiments on military divers under fully controlled conditions at a US Ocean Simulation Facility and an US Open water test facility; in all tests, the diver were covered with soft or hard shell dive suits and their position and distance relative to sound source, signal characteristics and received levels were controlled and documented (Pestorius et al. 2009). A total of 89 male Navy divers were exposed to pure tone signals and sweeps between 160-320 Hz at SPLs up to 160 dB re 1 µPa. The divers were exposed to these sounds over 100 seconds at depths from 10 to 40 metres. The divers rated the sounds on a severity scale. For frequencies between 100 and 500 Hz, at a received SPL of 130 dB re 1 µPa, divers and swimmers detected body vibration. None of the divers tested rated levels of 140 dB re 1 µPa as “very severe”; however, at 157 dB re 1 µPa, sound was rated as “very severe” 19 per cent of the time. No physiological damage was observed at the highest levels tested: 160 dB re 1 µPa (Fothergill et al. 2001). In a subsequent study, recreational divers were exposed to tonal signals or 30 Hz-sweeps at frequencies between 100 and 500 Hz at received levels of 130-157 dB re 1 µPa (Pestorius et al. 2009). Each exposure lasted for seven seconds. Nine female and 17 male scuba divers were tested, all wearing full body neoprene wetsuits. Diver aversion and perception of body vibration were used as test parameters. The results showed no sex-specific differences. The results differed as a function of frequency – while test results showed a strong overall variation between subjects, signals at 100 Hz elicited the strongest aversion in all tests and even at 148 dB a few diver ratings indicated extreme aversion. Due to this and the strong variation between test subjects, the following exposure limit for both military and recreational divers was suggested as a conservative measure: For frequencies between 100 and 500 Hz, the maximum SPL should be 145 dB re 1 µPa over a maximum continuous exposure of 100 seconds or with a maximum duty cycle of 20 per cent and a maximum daily cumulative total of three hours. The trading relation between the maximum SPL and duration was 4 dB per doubling of duration (e.g. 141 dB SPL for a 200 second exposure) (Pestorius et al. 2009).

Considering only frequencies between 100 and 500 Hz, Parvin (2005) suggested 145 dB re 1 μPa as a safety criterion for recreational divers and swimmers. Seismic impulses are broadband sources, and therefore, to be precautionary, the 145 dB re 1 μPa SPL suggested by Fothergill et al. (2001) and Parvin (2005) has been applied in this study as a broadband SPL and as a human health assessment threshold for recreational divers and swimmers. This does not imply that this level is associated with the onset of injury.

4. Methods

4.1. Parameters Overview

Sound propagation was modelled up to 100 km from each single impulse modelled site (listed in Table 4). The specifications of the seismic source and the environmental parameters used in the propagation models are described in detail in Appendix C. A single sound speed profile for May was considered in this modelling study; this was identified as the period that would provide the farthest propagation over the potential operational window (November to the end of May; see Appendix C.4.2).

The acoustic properties of the seabed in the survey acquisition area vary depending on the water depth and the area on the continental shelf. Three geoacoustic profiles were developed and used for various modelled sites (see Appendix C.4.3).

For sites with water depths <100 m the seabed profile consisted of acoustic properties to represent fine calcareous sand layer, approximately 45 m overlying an acoustic basement. For sites with water depths between 100 and 300 m the seabed profile consisted of a thick fine calcareous sand layer, approximately 400 m thick, overlying an acoustic basement. Finally, for sites with water depths greater than 300 m, a thick calcareous silt layer, approximately 400 m thick, overlying an acoustic basement was considered for the seabed acoustic properties. Further detail is provided in Appendix C.4.3.

4.2. Acoustic Source Model

The pressure signature of the individual airguns and the composite decidecade-band point-source equivalent directional levels (i.e., source levels) of the seismic sources were modelled with JASCO's Airgun Array Source Model (AASM). Although AASM accounts for notional pressure signatures of each seismic source with respect to the effects of surface-reflected signals on bubble oscillations and inter-bubble interactions, the surface-reflected signal (known as surface ghost) is not included in the far-field source signatures. The acoustic propagation models account for those surface reflections, which are a property of the propagating medium rather than the source.

AASM considers:

- Array layout.
- Volume, tow depth, and firing pressure of each airgun.
- Interactions between different airguns in the array.

All seismic sources considered were modelled over AASM's full frequency range, up to 25 kHz. Appendix B.1details this model.

4.3. Sound Propagation Models

Three sound propagation models were used to predict the acoustic field around the seismic source:

- Combined range-dependent parabolic equation and Gaussian beam acoustic ray-trace model (MONM-BELLHOP, 5 Hz to 25 kHz).
- Full Waveform Range-dependent Acoustic Model (FWRAM, 5 Hz to 2048 Hz).
- Wavenumber integration model (VSTACK, 5 Hz to 1024 Hz).

The models were used in combination to characterise the acoustic fields at short and long ranges in terms of SEL, SPL, PK, and PK-PK. Appendix B.2 details each model. MONM-BELLHOP was used to calculate SEL of a 360° area around each source location. The model calculated propagation losses up to distances of 100 km from the source in each cardinal direction, with a horizontal separation of

10 m between receiver points along the modelled radials. The sound fields were modelled with a horizontal angular resolution of $\Delta\theta = 2.5°$ for a total of $N = 144$ radial planes. Receiver depths were chosen to span the entire water column over the modelled areas, from 2 m to a maximum of 1750 m, with step sizes that increased with depth. To supplement the MONM results, high-frequency results for propagation loss were modelled using Bellhop for frequencies from 5 to 25 kHz. The MONM and Bellhop results were combined to produce results for the full frequency-range of interest.

FWRAM was used to model synthetic seismic pulses and to generate a generalised range-dependent SEL to SPL conversion function for the considered modelled sites (Appendix C.2). FWRAM was run to 100 km at five of the eight single impulse modelling sites, along four radials (fore and aft endfire, and port and starboard broadside) for computational efficiency. Along each radial, the computation was done with a regular depth step of 1 m over the entire water column, and a horizontal range step of 10 m. The range-dependent conversion function was applied to predicted per-pulse SEL results from MONM-BELLHOP to estimate SPL values. FWRAM was also used to calculate water column PK levels.

VSTACK was used to calculate close range PK and PK-PK levels along transects at the seafloor from the loudest direction of the seismic source at the shallowest modelled site within the survey area (Site A). The maximum modelled range for VSTACK was 1000 m and a variable receiver range increment that increased away from the source was used, which increased from 10 to 25 m. Received levels were computed for receivers at the seafloor.

During a seismic survey, new sound energy is introduced into the environment with each pulse from the seismic source. The vessel towing the airgun was modelled travelling at 4.5 knots, with each of the two airgun arrays operational every 37.5 m, or an overall inter-pulse-interval of 18.75 m. Both modelling scenarios included 8233 seismic impulses and a racetrack turn distance of 7.5 km. While some effect criteria are based on the per-pulse energy released, others, such as the marine mammal, turtle and fish SEL criteria used in this report (Sections 3) account for the total acoustic energy marine fauna is subjected to over a specified period of time, defined in this report as 24 h. An accurate assessment of the accumulated sound energy depends not only on the parameters of each seismic pulse impulse, but also on the number of impulses delivered in a period and the relative positions of the impulses. Appendix C.3 provides additional details on the methods used to calculate the accumulated sound energy for the considered scenarios.

5. Results

5.1. Acoustic Source Levels and Directivity

AASM (Section 4.2) was used to predict the horizontal and vertical overpressure signatures and corresponding power spectrum levels for the seismic source, with results provided in Appendix C.5.1 along with the horizontal directivity plots.

Table 8 shows the PK and per-pulse SEL source levels in the horizontal-plane broadside (perpendicular to the tow direction), endfire (along the tow direction), and vertical directions. The vertical source level that accounts for the "surface ghost" (the out of phase reflected pulse from the water surface) is also presented to make it easier to compare the output of other seismic source models.

Figure C-10 shows the broadside, endfire, and vertical overpressure signature and corresponding power spectrum levels for the source. The signature consists of a strong primary peak, related to the initial release of high-pressure air, followed by a series of pulses associated with bubble oscillations. Most energy was produced at frequencies below 500 Hz. Frequency-dependent peaks and nulls in the spectrum result from interference among airguns in the source and correspond with the volumes and relative locations of the airguns to each other.

Table 8. Far-field source level specifications for the 4130 in^3 seismic source, for a 5 m tow depth. Source levels are for a point-like acoustic source with equivalent far-field acoustic output in the specified direction. Sound level metrics are per-pulse and unweighted.

Direction	Peak source pressure level ($L_{S,pk}$) (dB re 1 µPa m)	Per-pulse source SEL ($L_{S,E}$) (dB 1 µPa²m²s)		
		5–2000 Hz	2000–25000 Hz	5–25000 Hz
Broadside	250.1	229.6	188.3	229.6
Endfire	248.2	229.2	190.3	229.2
Vertical	258.9	235.8	200.8	235.8
Vertical (surface affected source level)	258.9	238.8	205.2	238.8

5.2. Per-Pulse sound fields

This section presents the per-pulse sound fields in terms of maximum-over-depth SPL, SEL, PK, and seafloor PK and PK-PK.

The different metrics are presented for the following reasons:

- SPL sound fields were used to determine the distances to marine mammal and turtle behavioural thresholds (see Sections 3.1 and 3.3) and the human health assessment threshold (Section 3.4.2).
- Per-pulse SEL sound fields are used as inputs into the 24 h SEL scenarios and context for the range to 160 dB re 1 µPa^2·s, relevant for the EPBC Act Policy Statement 2.1 (DEWHA 2008).
- PK metrics within the water column are relevant to thresholds and guidelines for marine mammals, sea turtles, fish, fish eggs and larvae (as well as plankton) (Sections 3.1–3.3).
- PK metrics at the seafloor are relevant to guidelines for fish, fish eggs and larvae (Section 3.3) and the sound level for no effect on corals and sponges
- PKPK metrics at the seafloor are relevant to sound levels used in the assessment of impacts to benthic invertebrates (Section 3.4.1).

SPL sound fields were used to determine the distances to marine mammal and turtle behavioural thresholds (see Sections 3.1 and 3.3). The maximum and 95% distances (calculated as detailed in Appendix C.1) for per-pulse SEL and SPL metrics are presented in Tables 9–13. The SPL sound fields, and distances to relevant isopleths can be visualised on the contour maps presented in Figures 2 to 9, whilst the per-pulse SEL sound field maps are presented in Appendix D.

The SPL sound fields are also presented as vertical slices along the endfire and broadside directions out to 50 km, with the airgun array in the centre (Figures 11 to 18). These figures help illustrate how sound propagates in various water depth regimes (e.g. from shallow versus deep sites, and toward deep-water versus over the continental shelf). The figures are arranged with the slice orientated towards deep-water always shown on top, and the slice parallel to the continental shelf on the bottom. Long-range slices (out to 100 km) in the broadside direction are shown for Site 2, offshore (Figure 19) and Site 7, parallel to the continental shelf (Figure 20).

The humpback whale migratory BIA is not predicted to be ensonified to the sound level used to assess marine mammal behavioural disturbance (160 dB re 1 µPa, NOAA (2019)) from the closest modelling site, Site A, or the closest modelling site with the broadband lobe orientated towards the BIA, Site 1.

The shallow waters (< 25m) around the Montebello Islands are not predicted to be ensonified above 140 dB re 1 µPa (Figure 10) considering the closest potential location where the source could be active (Site A) with a tow azimuth of 120°. Therefore, the isopleth corresponding to the human health assessment threshold of 145 dB re 1 µPa will not be exceeded in water depths (< 25m) relevant to recreational diving.

Maximum distances to PK thresholds were calculated over the entire water column (maximum-over-depth) at five sites (Sites 1, 3, 4, 6 and 7; Table 13), and at the seafloor at three sites (Sites 2, 5 and A; Table 14). The maximum-over-depth PK sound fields were used to determine distances to marine mammal, turtle, fish, fish egg and larvae injury thresholds. The seafloor PK sound fields were used to determine distances to sponges and corals, fish, fish eggs and larvae injury thresholds.

The PK-PK at the seafloor were modelled at Sites 2, 5, and A. These sound fields were used to calculate maximum distances to thresholds for benthic invertebrates (Section 3.4.1).

5.2.1. Tabulated results

Table 9. *Scenario 1, tow azimuth 60°*: Maximum (R_{max}) and 95% ($R_{95\%}$) horizontal distances (in km) from the 4130 in^3 source to modelled maximum-over-depth SPL isopleths from the modelled single impulse sites, with water depth indicated.

SPL (L_p; dB re 1 µPa)	**Site 1 (Depth: 82 m)**		**Site 2 (Depth: 126 m)**	
	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$
200	0.05	0.05	0.05	0.05
190	0.28	0.26	0.34	0.31
180	1.55	1.27	1.14	1.00
175#	2.83	2.33	2.4	1.97
170	4.36	3.56	4.06	3.4
166†	6.25	5.08	6.25	4.96
160‡	9.98	8.06	13.45	10.36
150	26.57	19.7	64.46	39.65
145	50.18	32.56	>100.0	/
140	>100.0	/	>100.0	/

Threshold for turtle behavioural disturbance from impulsive noise (McCauley et al. 2000a).
† Threshold for turtle behavioural response to impulsive noise (NSF 2011).
‡ Marine mammal behavioural threshold for impulsive sound sources (NOAA 2019).
A slash indicates that $R_{95\%}$ radius to threshold is not reported when the R_{max} is greater than the maximum modelling extent.

Table 10. *Scenario 2, tow azimuth 120º*: Maximum (R_{max}) and 95% ($R_{95\%}$) horizontal distances (in km) from the 4130 in^3 source to modelled maximum-over-depth SPL isopleths from the modelled single impulse sites, with water depth indicated.

SPL (L_p; dB re 1 µPa)	Site 3 (Depth: 200 m)		Site 4 (Depth: 400 m)		Site 5 (Depth: 600 m)		Site 6 (Depth: 800 m)		Site 7 (Depth: 1000 m)		Site A (Depth: 64 m)	
	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$
200	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05	0.05
190	0.16	0.14	0.16	0.14	0.16	0.14	0.16	0.13	0.16	0.14	0.34	0.29
180	0.95	0.81	0.57	0.49	0.52	0.44	0.51	0.44	0.51	0.44	1.89	1.62
175#	2.1	1.74	1.43	1.26	1.12	0.95	1.00	0.82	0.92	0.78	2.81	2.39
170	3.83	3.14	2.58	2.24	2.4	2.04	2.67	2.31	2.74	2.34	4.87	3.95
166†	5.75	4.99	5.04	3.44	4.38	3.73	4.41	3.75	3.71	3.2	7.11	5.64
160‡	11.15	9.66	12.28	8.46	10.19	7.79	9.95	7.45	8.37	6.44	12.26	9.82
150	45.09	26.03	39.28	31.44	35.27	27.27	31.64	23.11	28.59	21.22	32.63	25.62
145	>100.0	/	67.75	56.08	65.43	52.10	54.49	47.8	55.9	44.18	51.07	36.89
140	>100.0	/	>100.0	/	>100.0	/	>100.0	/	>100.0	/	81.92	58.83

\# Threshold for turtle behavioural disturbance from impulsive noise (McCauley et al. 2000a).
† Threshold for turtle behavioural response to impulsive noise (NSF 2011).
‡ Marine mammal behavioural threshold for impulsive sound sources (NOAA 2019).
A slash indicates that $R_{95\%}$ radius to threshold is not reported when the R_{max} is greater than the maximum modelling extent.

Table 11. *Scenario 1, tow azimuth 60º*: Maximum (R_{max}) and 95% ($R_{95\%}$) horizontal distances (in km) from the 4130 in^3 source to modelled maximum-over-depth per-pulse SEL isopleths from the modelled single impulse sites, with water depth indicated.

Per-pulse SEL (L_p; dB re 1 µPa^2·s)	Site 1 (Depth: 82 m)		Site 2 (Depth: 126 m)	
	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$
200	<0.02	<0.02	<0.02	<0.02
190	0.05	0.04	0.05	0.04
180	0.39	0.29	0.36	0.33
170	2.26	1.57	1.5	1.23
160#	6.07	5.0	5.74	4.8
150	15.1	11.0	16.3	12.8
140	35.8	24.4	73.4	56.8
130	>100.0	/	>100.0	/

\# Low power zone assessment criteria DEWHA (2008).
A slash indicates that $R_{95\%}$ radius to threshold is not reported when the R_{max} is greater than the maximum modelling extent.

Table 12. *Scenario 2, tow azimuth 120º*: Maximum (R_{max}) and 95% ($R_{95\%}$) horizontal distances (in km) from the 4130 in^3 source to modelled maximum-over-depth per-pulse SEL isopleths from the modelled single impulse sites, with water depth indicated..

Per-pulse SEL (L_p; dB re 1 µPa^2·s)	**Site 3 (Depth: 200 m)**		**Site 4 (Depth: 400 m)**		**Site 5 (Depth: 600 m)**		**Site 6 (Depth: 800 m)**		**Site 7 (Depth: 1000 m)**		**Site A (Depth: 64 m)**	
	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$	R_{max}	$R_{95\%}$
200	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
190	0.05	0.04	0.05	0.05	0.06	0.04	0.05	0.04	0.05	0.05	0.05	0.05
180	0.18	0.16	0.19	0.16	0.18	0.16	0.18	0.15	0.18	0.15	0.35	0.33
170	1.03	0.88	0.7	0.59	0.59	0.5	0.58	0.5	0.58	0.49	2.37	1.91
160#	5.57	4.69	2.8	2.43	3.26	2.34	2.94	2.52	3.11	2.72	7.01	5.51
150	19.4	14.7	13.5	11.0	14.1	11.4	13.2	9.75	9.82	8.04	17.3	13.4
140	57.1	44.5	45.1	37.4	47.7	38.1	42.6	34.4	40.9	31.4	38.9	31.2
130	>100.0	/	>100.0	/	>100.0	/	>100.0	/	>100.0	/	>100.0	/

Low power zone assessment criteria DEWHA (2008).
A slash indicates that $R_{95\%}$ radius to threshold is not reported when the R_{max} is greater than the maximum modelling extent.

Table 13. Maximum (R_{max}) horizontal distances (km) from the 4130 in^3 array to modelled maximum-over-depth peak pressure level (PK) thresholds based on the NOAA Technical Guidance (NMFS 2018) for marine mammals, and Popper et al. (2014) for fish and Finneran et al. (2017) for turtles, at five modelling sites (Table 4) , with water depth and tow azimuth indicated.

Hearing group	**PK threshold** (L_{pk}; dB re 1 µPa)	**Distance R_{max} (km)**				
		Tow 60º	Tow 120º			
		Site 1 (Depth: 82 m)	Site 3 (Depth: 200 m)	Site 4 (Depth: 400 m)	Site 6 (Depth: 800 m)	Site 7 (Depth: 1000 m)
Low-frequency cetaceans (PTS)	219	0.04	0.04	0.04	0.04	0.04
Low-frequency cetaceans (TTS)	213	0.07	0.07	0.07	0.07	0.07
Mid-frequency cetaceans (PTS)	230	—	—	—	—	—
Mid-frequency cetaceans (TTS)	224	0.02	0.02	0.02	0.02	0.02
High-frequency cetaceans (PTS)	202	0.45	0.26	0.26	0.26	0.26
High-frequency cetaceans (TTS)	196	1.00	0.84	0.52	0.52	0.52
Turtles (PTS)	232	—	—	—	—	—
Turtles (TTS)	226	0.02	0.02	0.02	0.02	0.02
Fish: No swim bladder (also applied to sharks)	213	0.07	0.07	0.07	0.07	0.07
Fish: Swim bladder not involved in hearing, Swim bladder involved in hearing Fish eggs, and larvae	207	0.27	0.15	0.15	0.15	0.15

A dash indicates the threshold is not reached within the limits of the modelling resolution (20 m).

Table 14. Maximum (R_{max}) horizontal distances (in m) from the 4130 in^3 array to modelled seafloor peak pressure levels (PK) from three single-impulse modelled sites (Table 4), with water depth indicated.

Hearing group/animal type	PK threshold (L_{pk}; dB re 1 µPa)	Distance R_{max} (km)		
		Site 2 (Depth: 126 m)	Site 5 (Depth: 600 m)	Site A (Depth: 64 m)
Sponges and corals†	226	*	*	*
Fish: No swim bladder (also applied to sharks)	213	0.069	*	0.096
Fish: Swim bladder not involved in hearing, Swim bladder involved in hearing Fish eggs, and larvae	207	0.192	*	0.237

† Heyward et al. (2018)
An asterisk indicates that the sound level was not reached.

Table 15. Maximum (R_{max}) horizontal distances (in m) from the 4130 in^3 seismic source to modelled seafloor peak-peak pressure levels (PK-PK) from three single-impulse modelled sites (Table 4), with water depth indicated. Results included in relation to benthic invertebrates (Section 3.4.1).

PK-PK ($L_{pk\text{-}pk}$; dB re 1 µPa)	Distance R_{max} (km)		
	Site 2 (Depth: 126 m)	Site 5 (Depth: 600 m)	Site A (Depth: 64 m)
213[a,b,c]	0.159	*	0.230
212[b,c]	0.197	*	0.241
210[a,b]	0.354	0.101	0.274
209[a,b]	0.366	0.141	0.290
202[d]	0.842	0.431	0.913

[a] Day et al. (2019a), lobster experiments, maximum single impulse exposure measured.
[b] Day et al. (2016a), lobster and scallop experiments, maximum single impulse exposure measured.
[c] Day et al. (2017), scallop experiments, maximum single impulse exposure measured.
[d] Payne et al. (2008), lobster, no mortality or damage to mechano-sensory systems, recoverable injury

5.2.2. Sound field maps and graphs

5.2.2.1. Sound Level Contour Maps

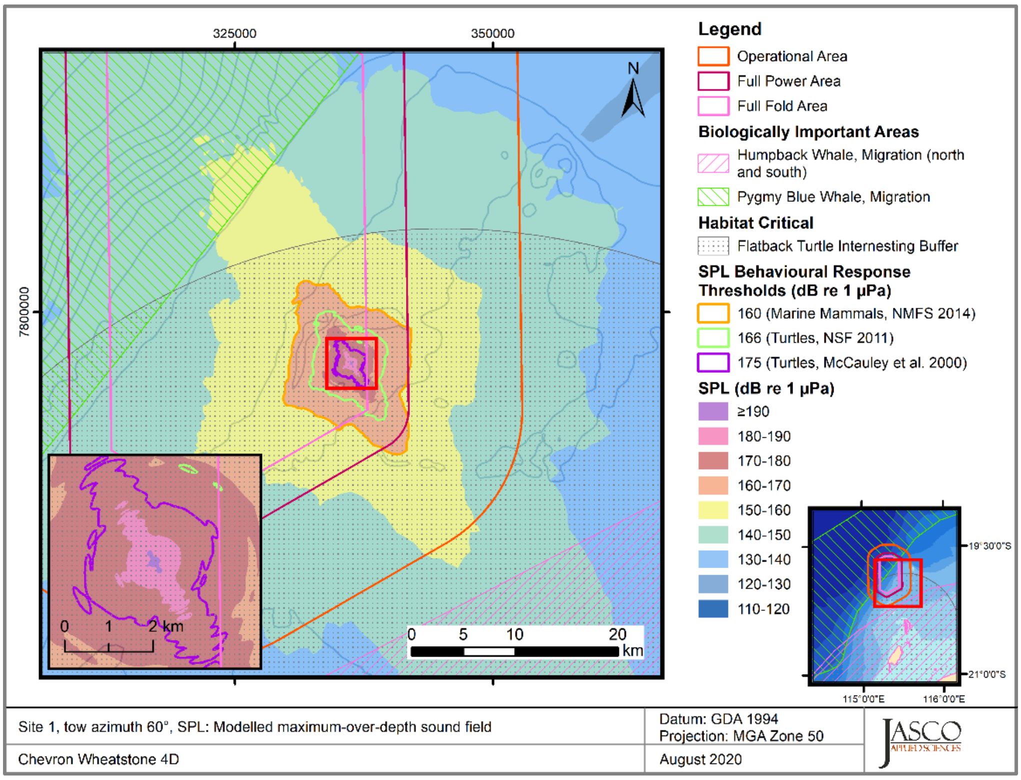

Figure 2. *Site 1, tow azimuth 60º, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleth of behavioural response thresholds for marine mammals and turtles.

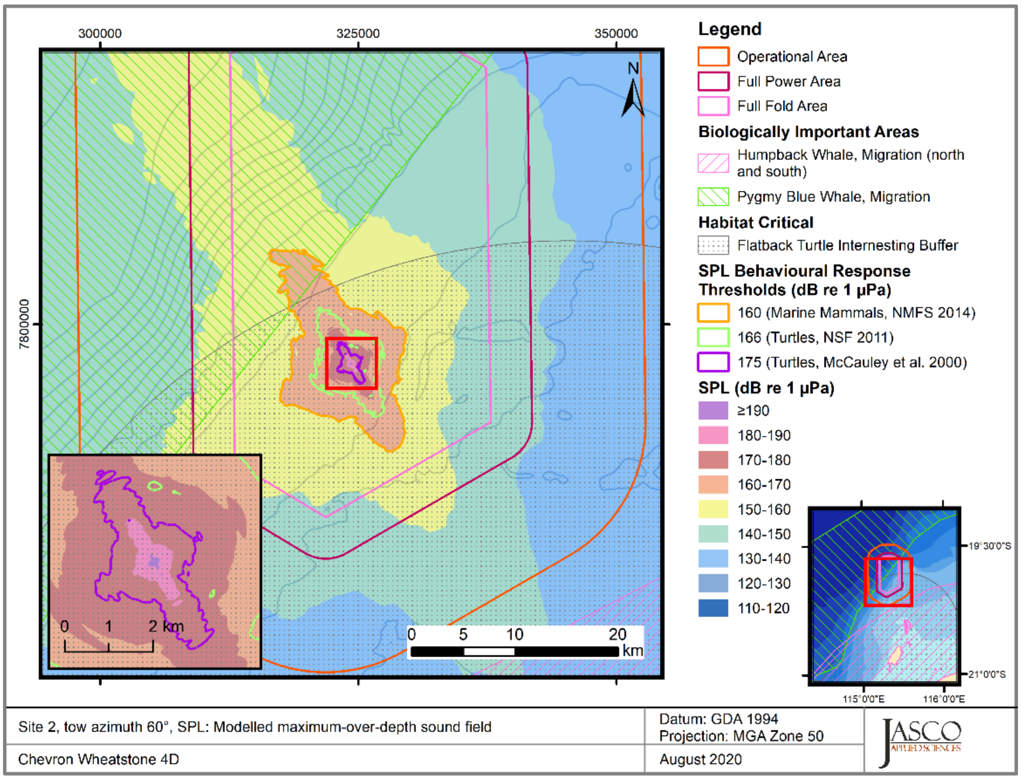

Figure 3. *Site 2, tow azimuth 60º, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleth of behavioural response thresholds for marine mammals and turtles.

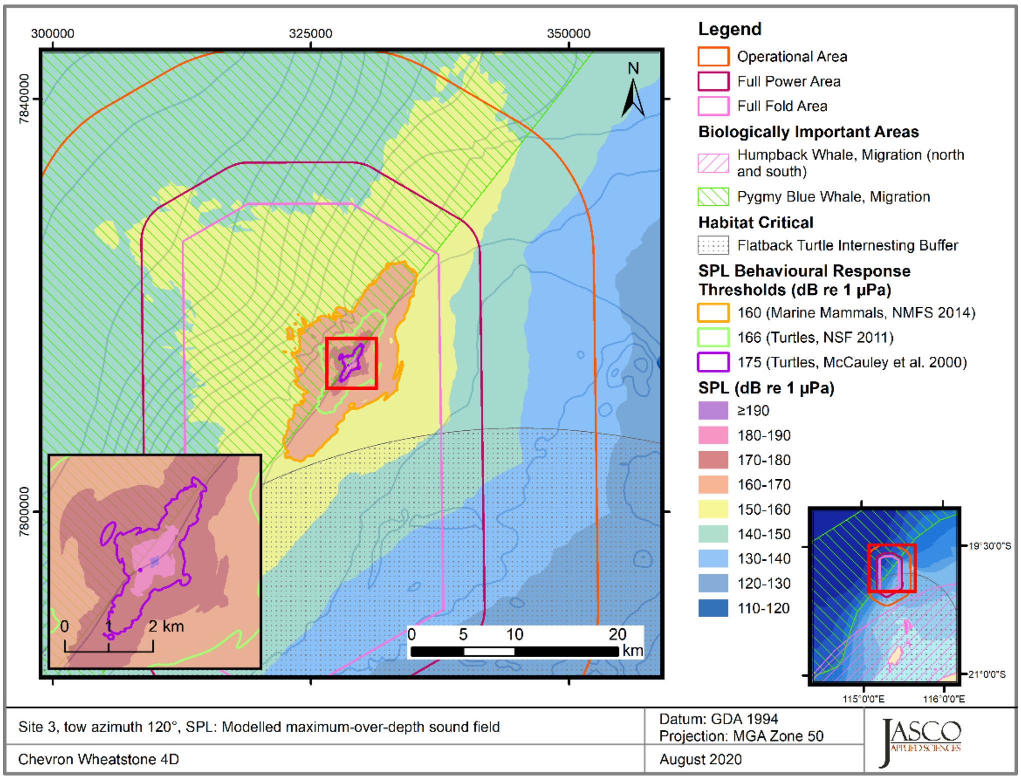

Figure 4. *Site 3, tow azimuth 120º, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleth of behavioural response thresholds for marine mammals and turtles.

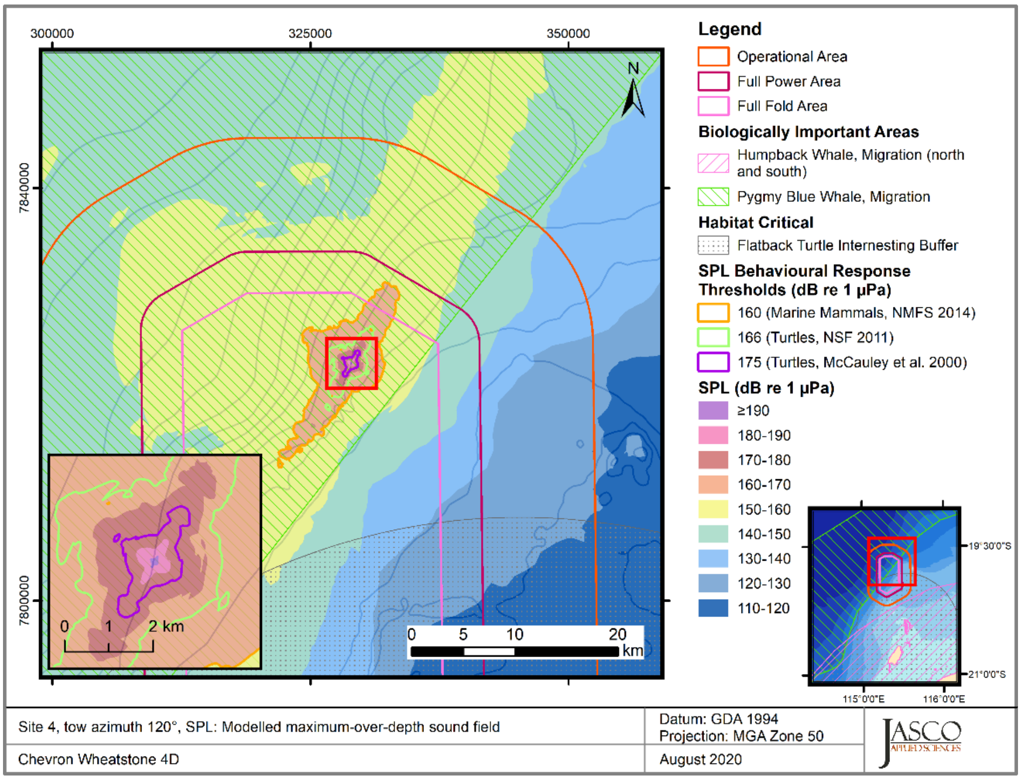

Figure 5. *Site 4, tow azimuth 120º, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleth of behavioural response thresholds for marine mammals and turtles.

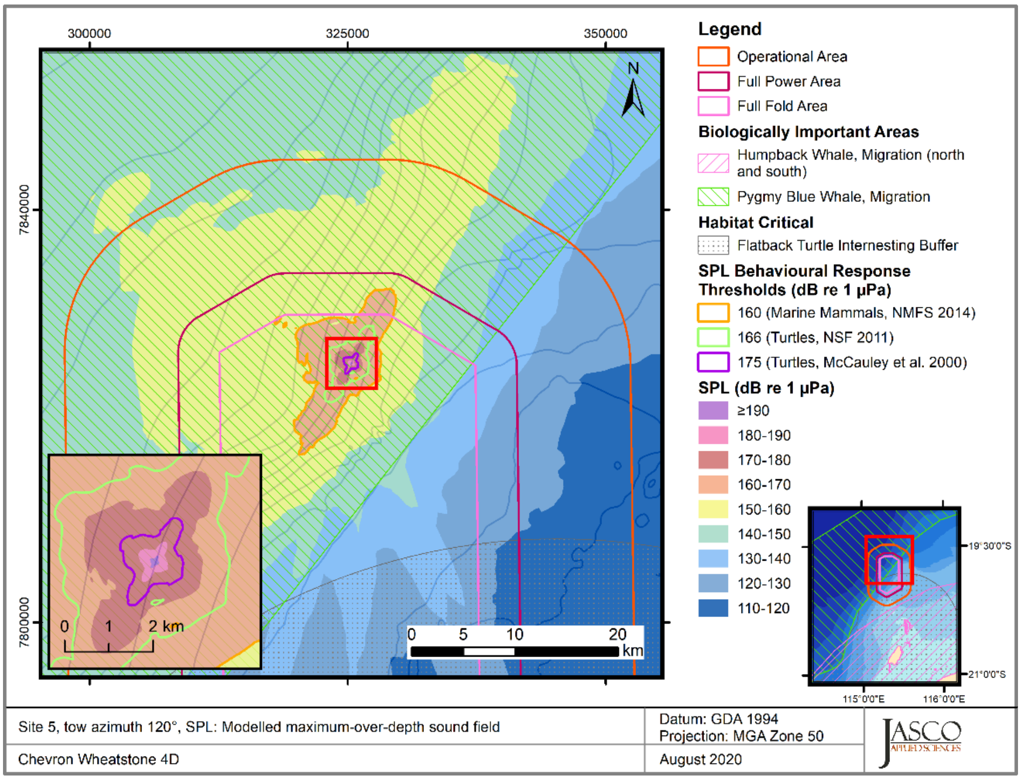

Figure 6. *Site 5, tow azimuth 120º, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleth of behavioural response thresholds for marine mammals and turtles.

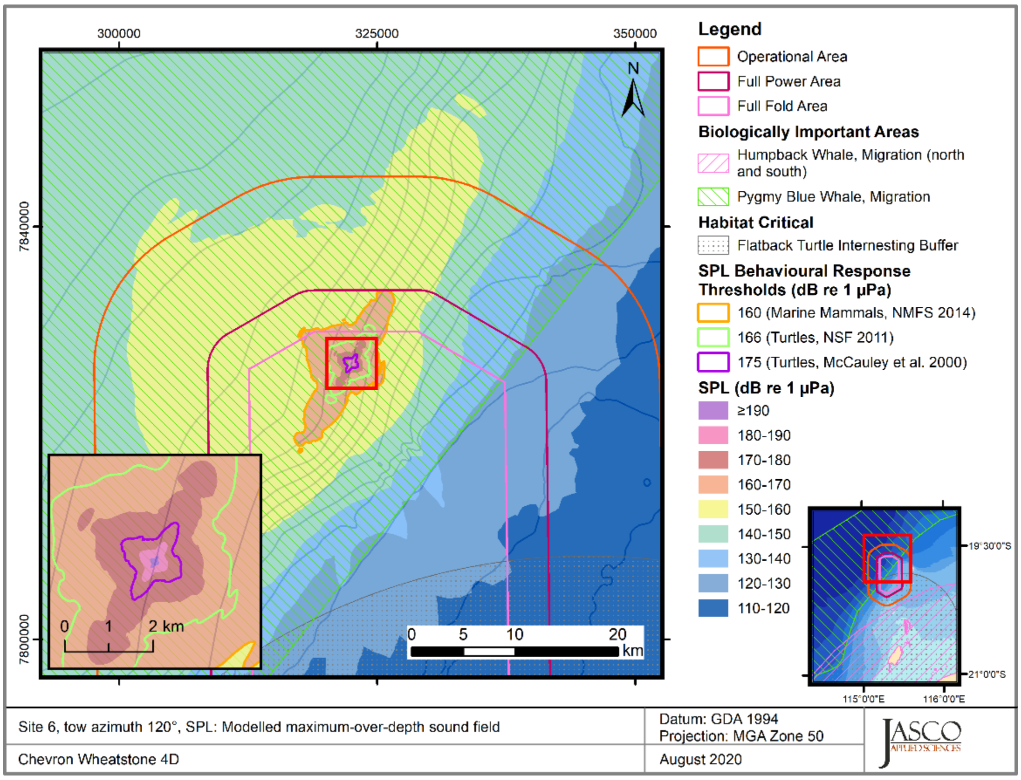

Figure 7. *Site 6, tow azimuth 120º, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleth of behavioural response thresholds for marine mammals and turtles.

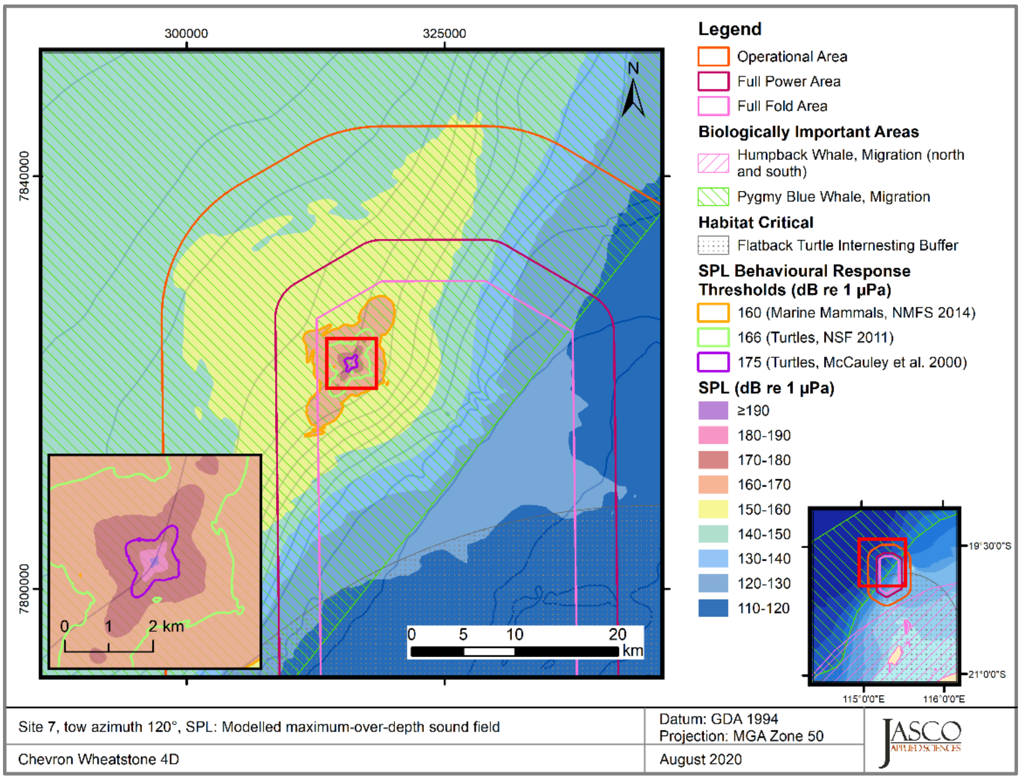

Figure 8. *Site 7, tow azimuth 120º, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleth of behavioural response thresholds for marine mammals and turtles.

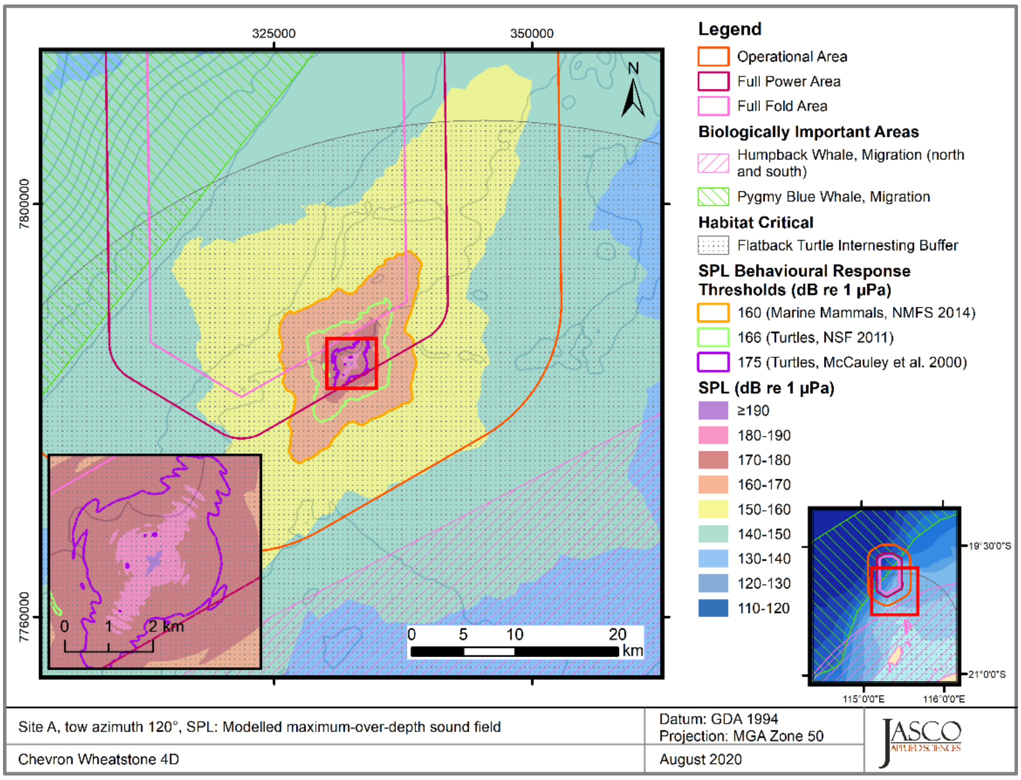

Figure 9. *Site A, tow azimuth 120º, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleth of behavioural response thresholds for marine mammals and turtles.

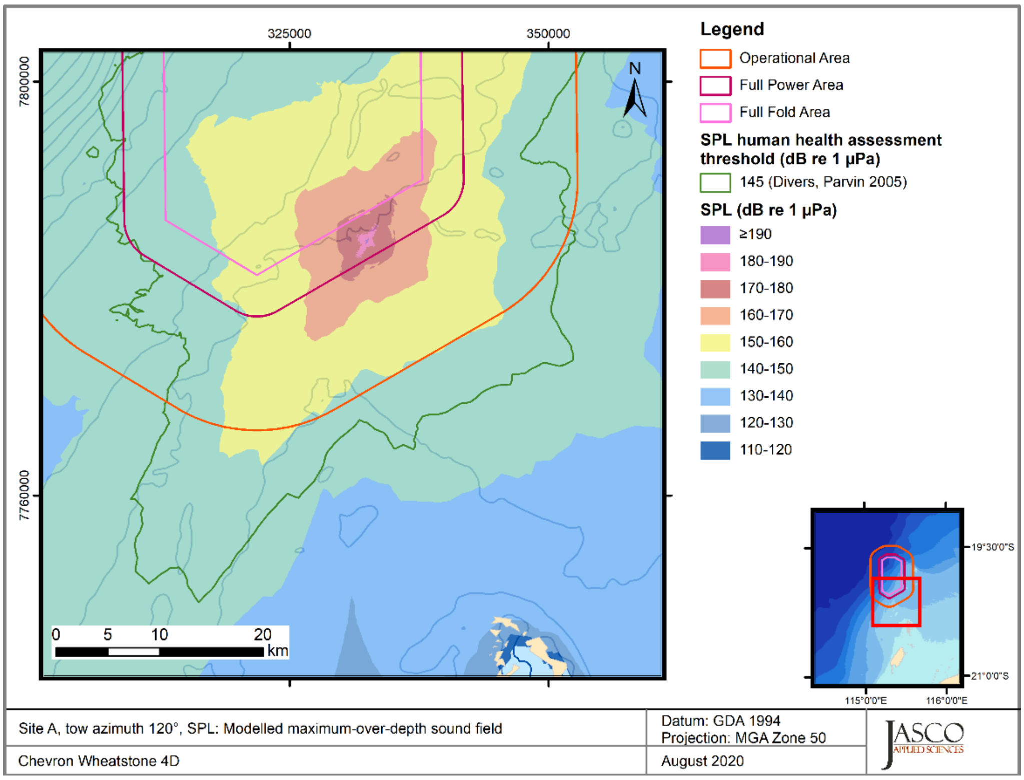

Figure 10. *Site A, tow azimuth 120º, SPL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleth for the human divers health assessment threshold.

5.2.2.2. Vertical Slices of Modelled Sound Fields

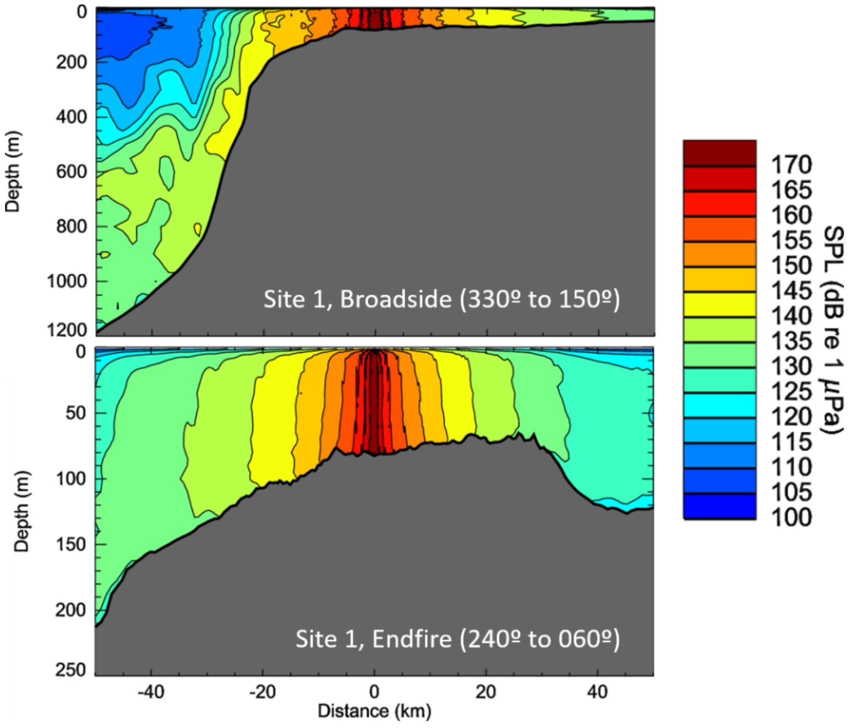

Figure 11. Site 1, *tow azimuth 60º, SPL*: Sound level contours on vertical slice of the sound field, along (endfire) and perpendicular to the tow direction (broadside). The direction of each slice is also indicated in degrees from UTM north.

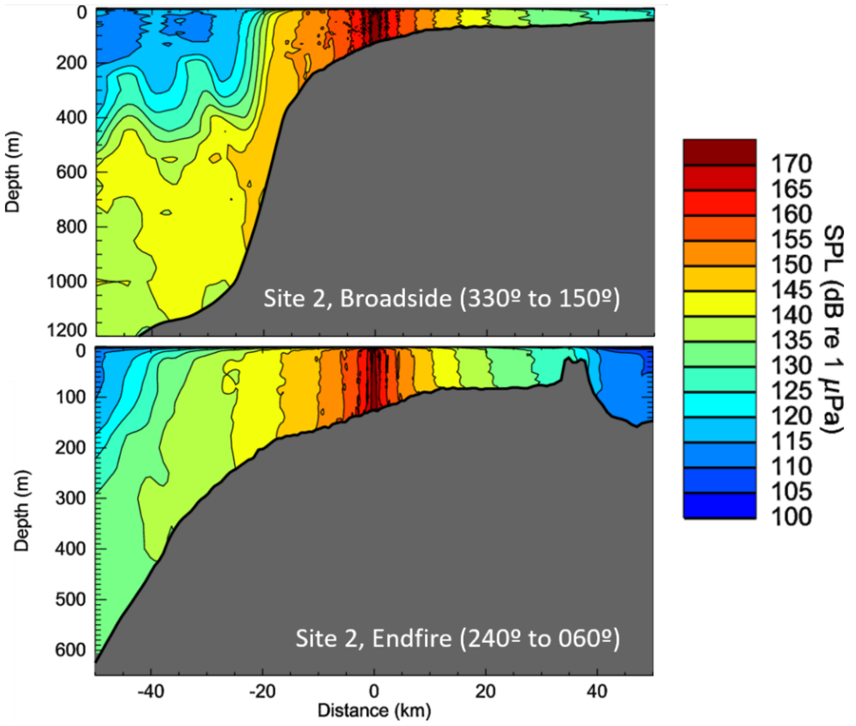

Figure 12. Site 2, *tow azimuth 60º, SPL*: Sound level contours on vertical slice of the sound field, along (endfire) and perpendicular to the tow direction (broadside). The direction of each slice is also indicated in degrees from UTM north.

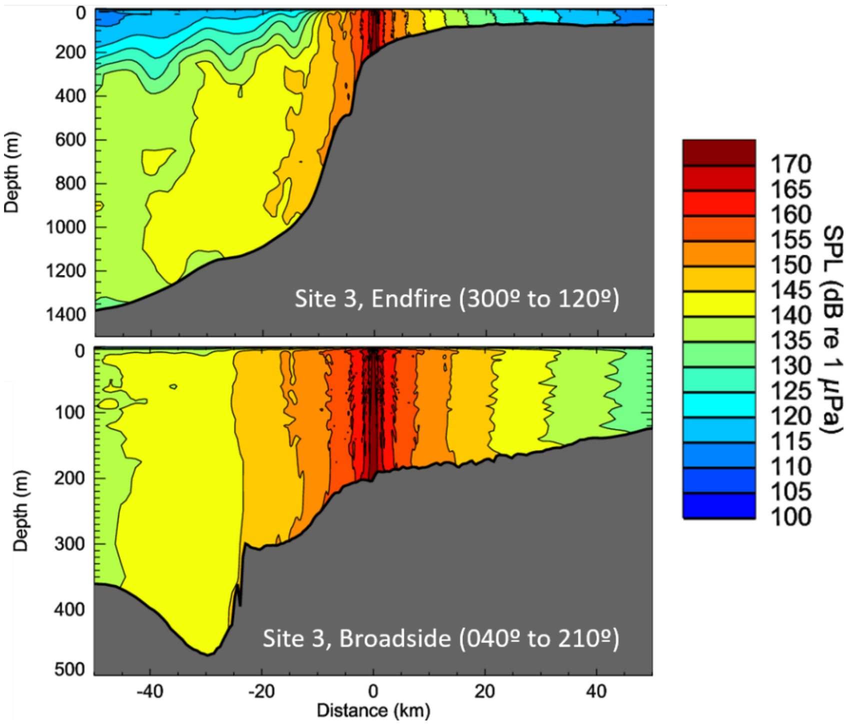

Figure 13. Site 3, *tow azimuth 120º, SPL*: Sound level contours on vertical slice of the sound field, along (endfire) and perpendicular to the tow direction (broadside). The direction of each slice is also indicated in degrees from UTM north.

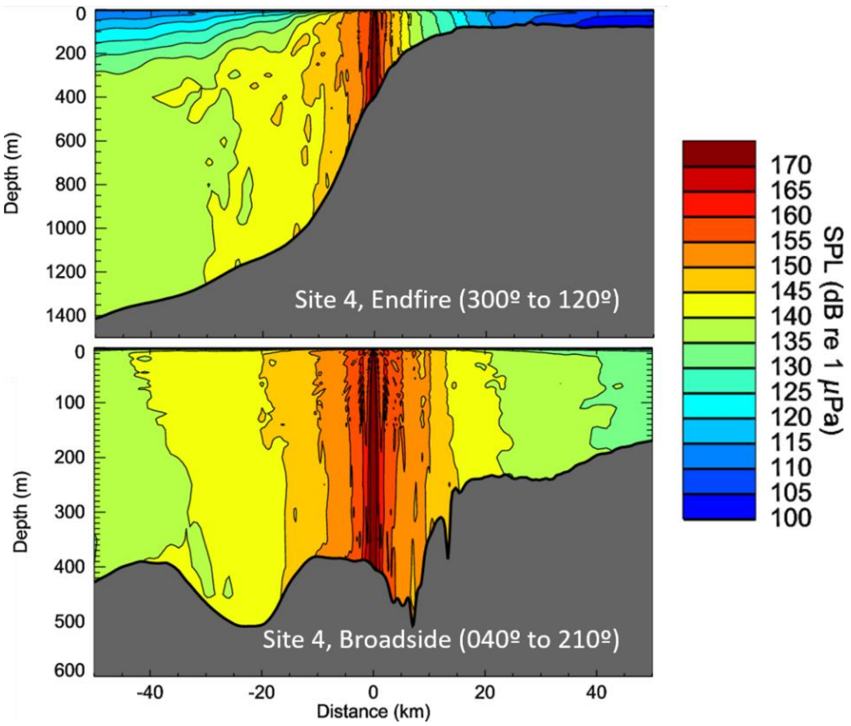

Figure 14. Site 4, *tow azimuth 120º, SPL*: Sound level contours on vertical slice of the sound field, along (endfire) and perpendicular to the tow direction (broadside). The direction of each slice is also indicated in degrees from UTM north.

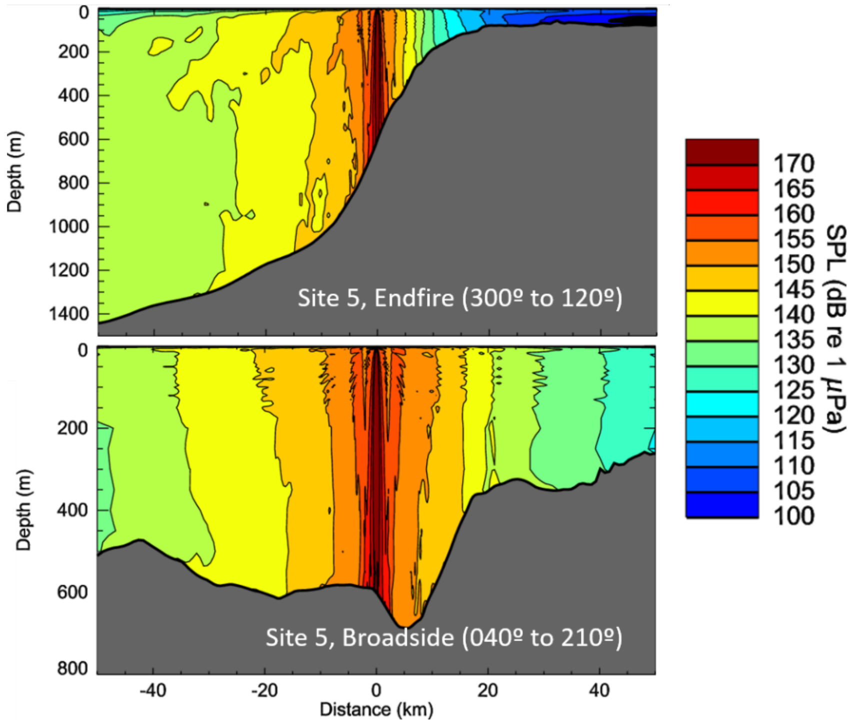

Figure 15. Site 5, *tow azimuth 120º, SPL*: Sound level contours on vertical slice of the sound field, along (endfire) and perpendicular to the tow direction (broadside). The direction of each slice is also indicated in degrees from UTM north.

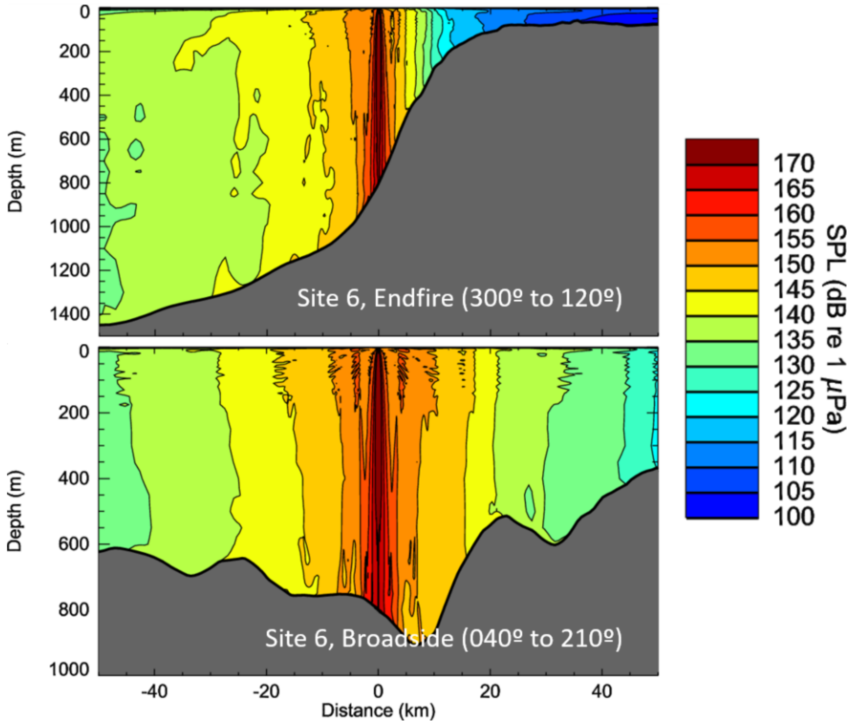

Figure 16. Site 6, *tow azimuth 120º, SPL*: Sound level contours on vertical slice of the sound field, along (endfire) and perpendicular to the tow direction (broadside). The direction of each slice is also indicated in degrees from UTM north.

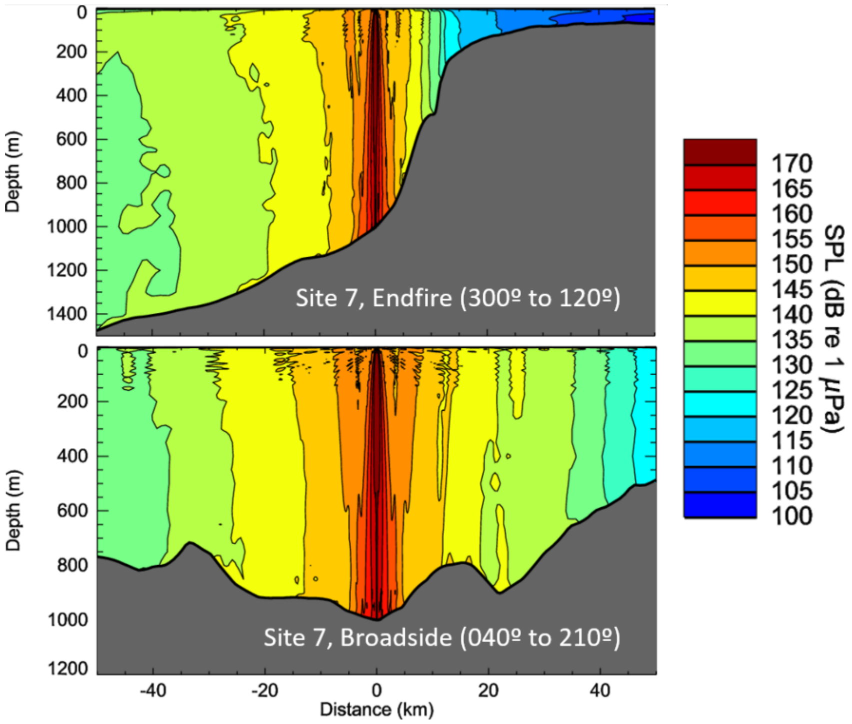

Figure 17. Site 7, *tow azimuth 120º, SPL*: Sound level contours on vertical slice of the sound field, along (endfire) and perpendicular to the tow direction (broadside). The direction of each slice is also indicated in degrees from UTM north.

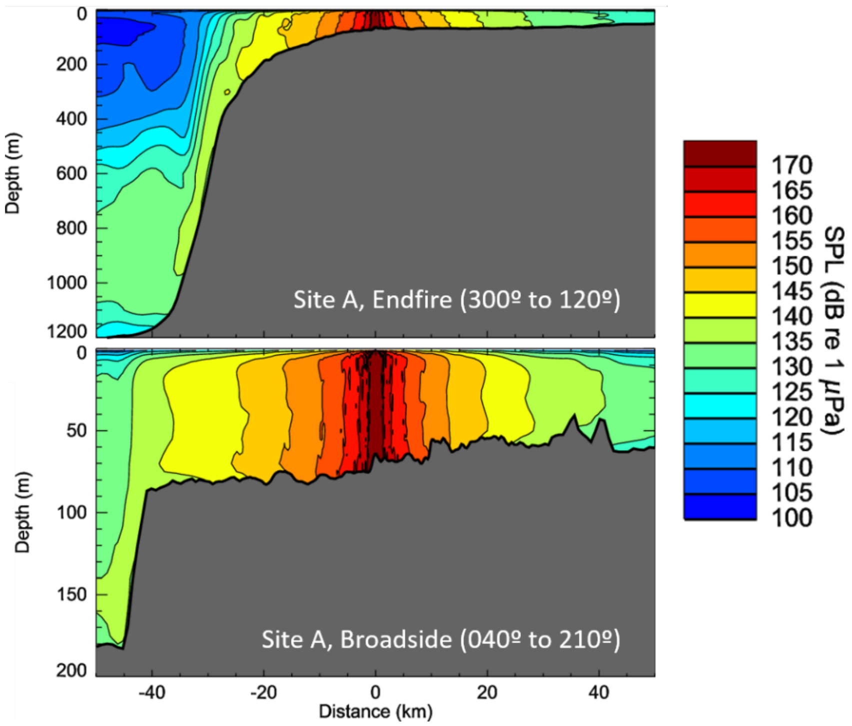

Figure 18. Site A, *tow azimuth 120º, SPL*: Sound level contours on vertical slice of the sound field, along (endfire) and perpendicular to the tow direction (broadside). The direction of each slice is also indicated in degrees from UTM north.

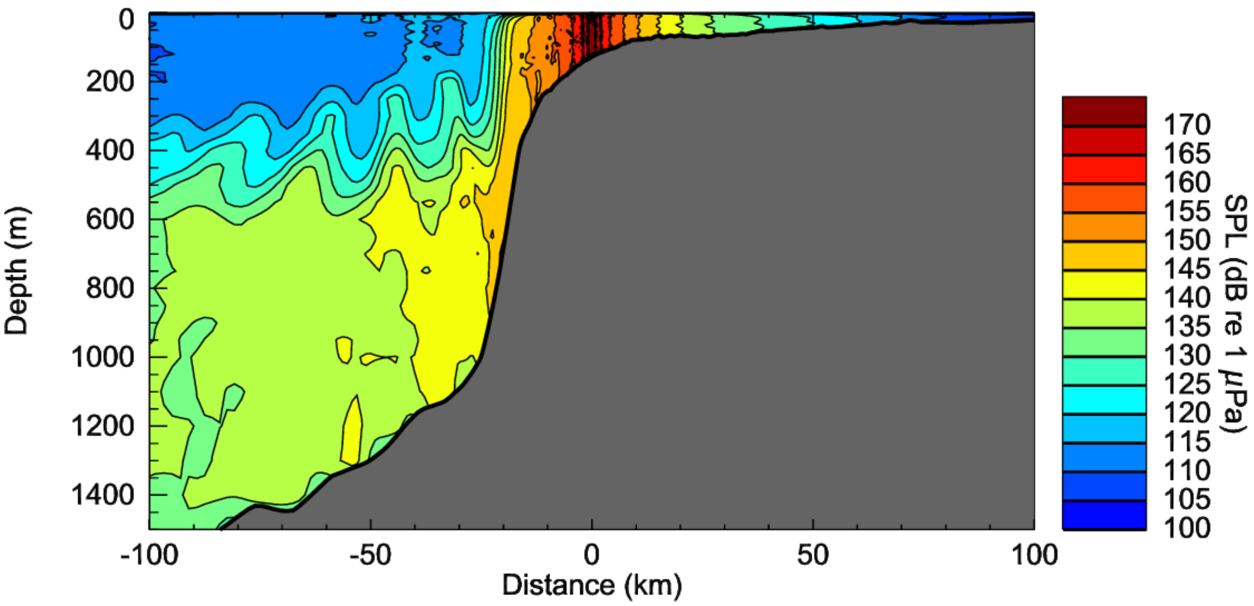

Figure 19. *Site 2, tow azimuth 60º, SPL*: Sound level contours on vertical slice of the sound field, perpendicular to the tow direction (broadside) along Broadside, (330 º to 150º).

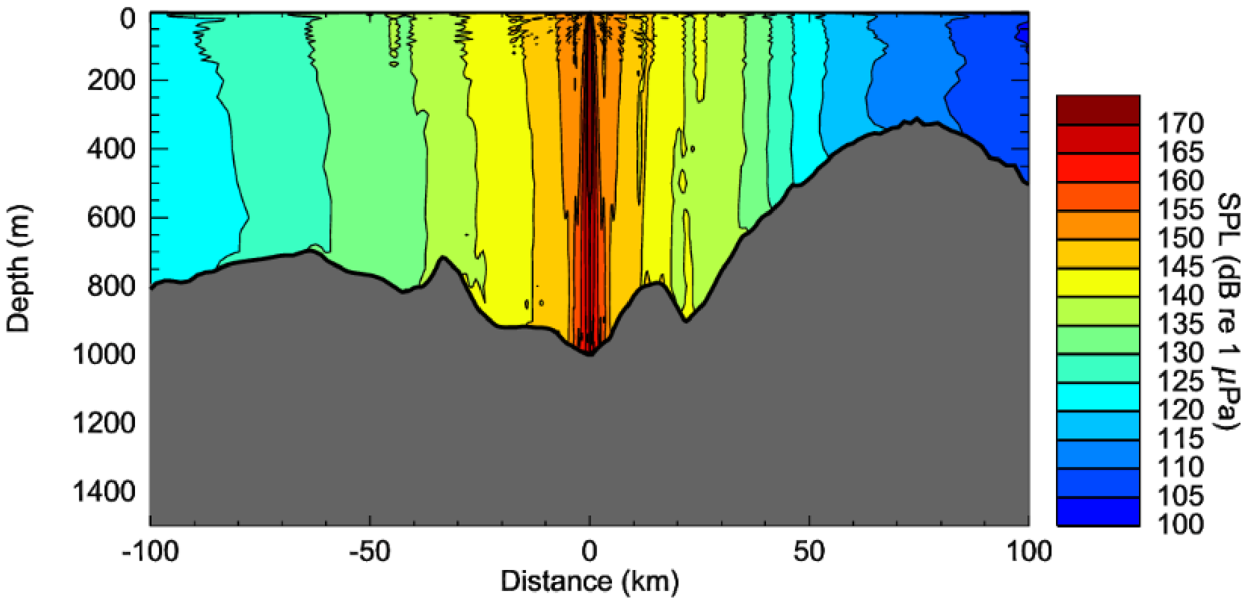

Figure 20. *Site 7, tow azimuth 120º, SPL*: Sound level contours on vertical slice of the sound field, perpendicular to the tow direction (broadside) along Broadside, (300 º to 120º).

5.3. Multiple Pulses Sound Fields

This section presents the sound fields in terms of SEL accumulated over 24 h of survey, for the modelled two survey scenarios: in the southern part of the survey area, along a tow azimuth 60º, and in the northern section of the survey area, along a tow azimuth of 120º. Frequency-weighted SEL_{24h} sound fields were used to estimate the maximum and 95% distances (R_{max} and $R_{95\%}$; calculated as detailed in Appendix C.1) to marine mammals and turtle PTS and TTS thresholds (listed in Table 16), and to estimate maximum distance and the area to injury and TTS guidelines for fish (Table 17). The distances to TTS for fish are presented as maximum-over-depth only, distances at the seafloor will be approximately similar given the distribution of sound within the water column at the sites within the scenarios, as evident in the vertical slice plots (Section 5.2.2.2).

The SEL_{24h} sound fields are presented as contour maps in Figures 21 and 22. These figures present the unweighted SEL_{24h} in 10 dB steps, as well as the isopleths corresponding to thresholds or guidelines for which R_{max} is greater than 20 m.

For each modelling scenario, the distance from the centre point of each outside acquisition line, either the northern-most (most offshore) or southern-most (most nearshore) line to the furthest point on the TTS isopleth was calculated. For Scenario 1, the 60º tow azimuth lines, the extent from north-most line centre point to the edge of the offshore TTS isopleth lobe was 95.4 km, whilst the extent from south-most line centre point to the edge of the inshore TTS isopleth lobe was 35.1 km. For Scenario 2, the 120º tow azimuth lines, the extent from north-most line centre point to the edge of the offshore TTS isopleth lobe was 54.8 km, whilst the extent from the south-most line centre point to the edge of the inshore TTS isopleth lobe was 14.8 km.

5.3.1. Tabulated Results

Table 16. *Marine Mammal and sea turtle criteria*: Maximum (R_{max}) and 95% ($R_{95\%}$) horizontal distances (in km) from the survey lines to permanent threshold shift (PTS) and temporary threshold shift (TTS) thresholds considering 24 h of survey activity.

Hearing group	Weighted SEL thresholds ($L_{E,24h}$; dB re 1 µPa²·s)	Scenario 1 (tow azimuth 60º)		Scenario 2 (tow azimuth 120º)	
		R_{max} (km)	$R_{95\%}$ (km)	R_{max} (km)	$R_{95\%}$ (km)
PTS					
Low-frequency cetaceans	183	6.61	5.28	5.91	4.35
Mid-frequency cetaceans	185	-	-	-	-
High-frequency cetaceans	155	<0.02	/	<0.02	/
Sea Turtles	204	<0.02	/	<0.02	/
TTS					
Low-frequency cetaceans	168	95.4	81.6	64.7	51.8
Mid-frequency cetaceans	170	-	-	-	-
High-frequency cetaceans	140	1.63	0.99	0.97	0.57
Sea Turtles	189	3.84	3.09	3.53	2.78

A dash indicates the threshold was not reached within the limits of the modelling resolution (20 m).
A slash indicates that $R_{95\%}$ radius to threshold is not reported when the R_{max} is smaller than the modelling resolution (20 m).

Table 17. *Fish guideline*: Maximum horizontal distances (R_{max}, in km) from the survey lines and area (km^2) to injury and temporary threshold shift (TTS) thresholds considering 24 h of survey activity.

Marine fauna group	Guidline for SEL24h ($L_{E,24h}$; dB re 1 µPa²·s)	Maximum-over-depth			
		Scenario 1		Scenario 2	
		R_{max} (km)	Area (km^2)	R_{max} (km)	Area (km^2)
Mortality and potential mortal injury					
I	219	<0.02	/	<0.02	/
II, fish eggs and fish larvae	210	<0.02	/	<0.02	/
III	207	<0.02	/	<0.02	/
Fish recoverable injury					
I	216	<0.02	/	<0.02	/
II, III	203	<0.02	/	<0.02	/
Fish TTS					
I, II, III	186	8.63	832.2	7.56	657.9

Fish I–No swim bladder; Fish II–Swim bladder not involved with hearing; Fish III–Swim bladder involved with hearing.
A slash indicates that the area is not reported when the R_{max} is smaller than the modelling resolution (20 m).

5.3.2. Sound Level Contour Maps

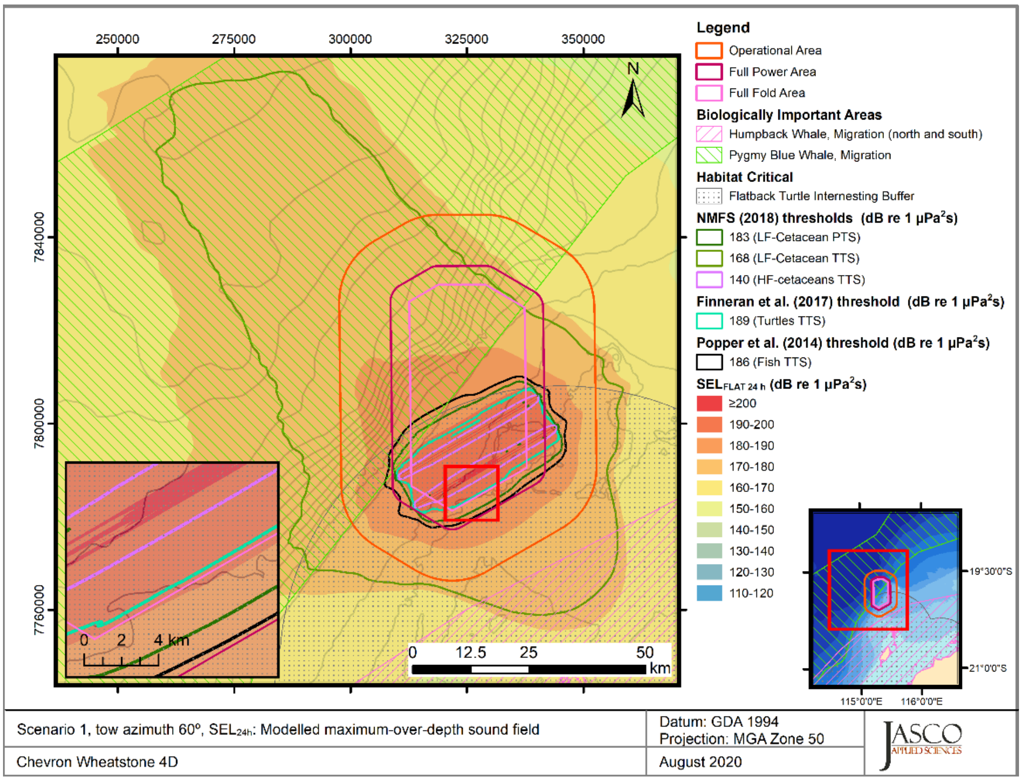

Figure 21. *Scenario 1, tow azimuth 60°*: Sound level contour map showing unweighted maximum-over-depth SEL_{24h} results, along with isopleths for cetaceans, turtles and fish.Isopleths omitted here were not reached or large enough to display graphically at the mapped scale.

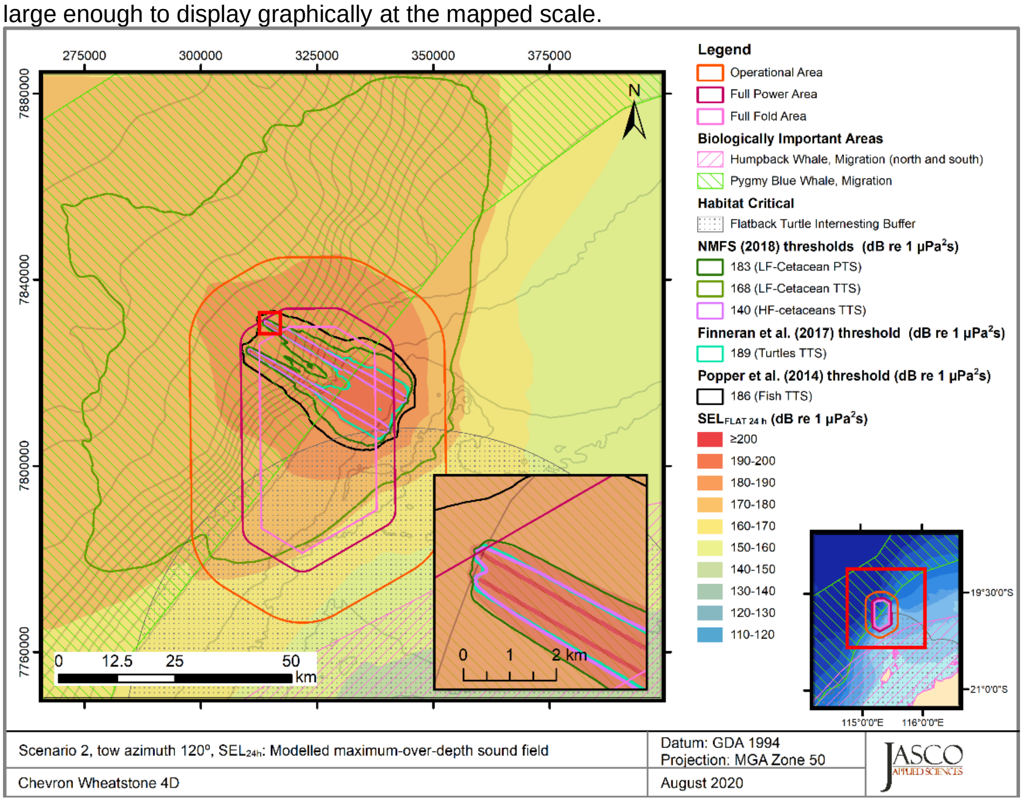

Figure 22. *Scenario 2, tow azimuth 120°*: Sound level contour map showing unweighted maximum-over-depth SEL_{24h} results, along with isopleths for cetaceans, turtles and fish.Isopleths omitted here were not reached or large enough to display graphically at the mapped scale.

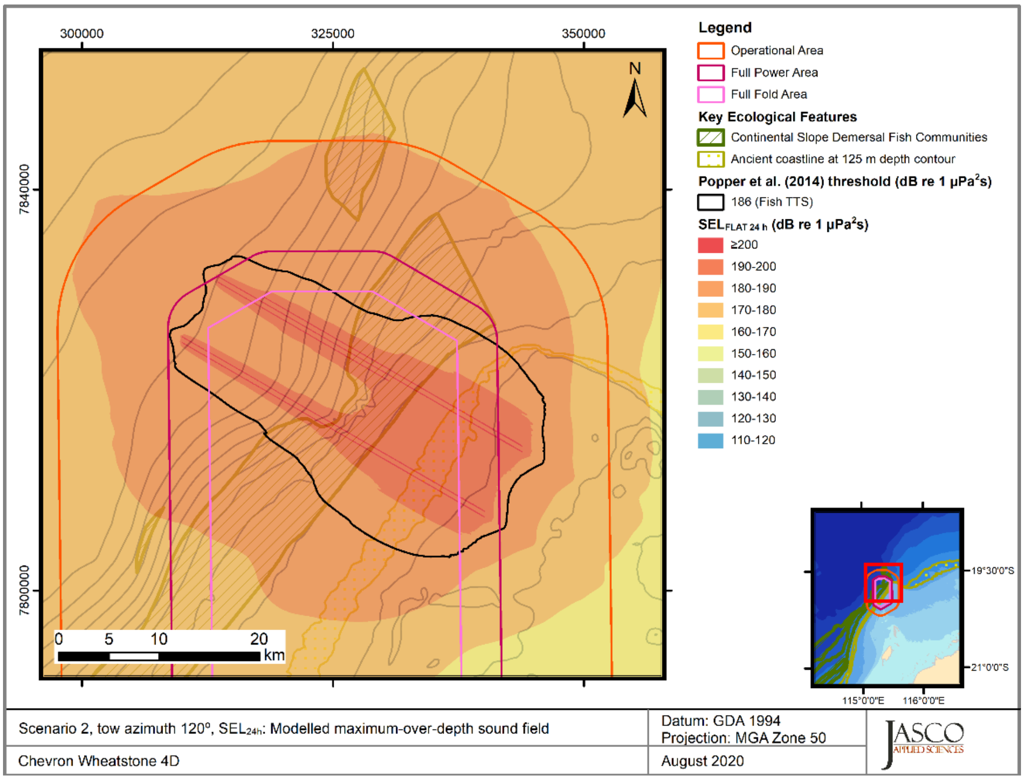

Figure 23. *Scenario 2, tow azimuth 120º*: Sound level contour map showing unweighted maximum-over-depth SEL_{24h} results, along with isopleths for fish TTS in relation to the Continental Slope Demersal Fish Communities KEF.

6. Discussion and Conclusion

This modelling study predicted underwater sound levels associated with the planned Wheatstone 4D MSS. The underwater sound field was modelled for a 4130 in^3 seismic source (Appendix C.5).

An analysis of seasonal sound speed profiles for the initial potential survey time period (November to May), the results of which are presented in Appendix C.4.2, determined that the profile from May was expected to be most favourable to longer-range sound propagation, and thus precautionary estimates of distances to received sound level thresholds within the water column, due to the a slight upward refracting profile in the upper 50 m. Modelling also accounted for site-specific bathymetric variations (Appendix C.4.1) and local geoacoustic properties (Appendix C.4.3).

Most acoustic energy from a seismic source is output at lower frequencies, in the tens to hundreds of hertz. The modelled 4130 in^3 array had a pronounced broadside directivity for 1/3-octave-bands between ~125 to 316 Hz (Appendix C.5.1), which caused a noticeable axial bulge in the modelled acoustic footprints.

The overall broadband (10–25000 Hz) unweighted per-pulse SEL source level of the 4130 in^3 seismic source operating at 5 m depth was 229.6 dB 1 μPa^{2}m^{2}s in the broadside direction and 229.2 dB 1 μPa^{2}m^{2}s in the endfire direction. The peak source pressure level in the same directions was 250.1 and 248.2 dB re 1 μPa m, respectively (Table 8).

6.1. Per-Pulse Sound Levels

The per-pulse modelling sites encompassed water depths from 64 to 1000 m across three different geological areas with a single representative water column profile. At all single impulse sites the distances to identified isopleths were greater in the broadside direction than in the endfire direction, a difference apparent in all footprint maps in Section 5.2.2.1. The array directionality and frequency content coupled with the bathymetry had a considerable effect on propagation at longer distances, with generally larger lobes of sound energy extending into the deeper waters or along the continental shelf. The vertical slice plots (Section 5.2.2.2) assist in demonstrating the influence of the bathymetry, source location and sound speed profile on the sound field. Furthermore, sources located in deeper water have a lower “cut-off frequency (f_c)” than sources in shallower water. The cut-off frequency is a single number that describes how much acoustic energy can propagate with minimal loss between then sea-surface and seafloor interfaces. For a given acoustic signal, frequencies below f_c are subject to higher loss compared to frequencies above the f_c (Jensen et al. 2011). For sources in waters greater than 150 m deep (Sites 3–7), the cut off frequency was less than 10 Hz, and for these sites a large amount of low-frequency energy can propagate in the water column compared to sources in shallow water below 150 m (Sites 1, 2 and A).

The sound speed profile (Figure C-8) was primarily downwards refracting apart from a moderate surface duct and the profile had a minimum sound speed at approximately 1000 m that forms the sound channel axis, which is indicative of deep ocean profiles. For source locations above the continental shelf break and continental slope significant amounts energy reflected from the seabed can be trapped in the deep sound channel and propagate for large distances within the ocean interior. This is particularly obvious in the slice plots showing 100 km either side of the source in the broadside direction (Figures 19 and 20). This phenomenon resulted in large ranges to all isopleths in the offshore directions, furthermore the largest ranges occur when the broadside azimuth of the array points in the offshore direction. The shallow surface duct (≤50 m deep) in the profiles shown in Figure C-8 is not deep enough to trap energy below approximately 550 Hz (Equation 1.36 in Jensen et al. (2011)). The surface duct therefore can only trap the higher frequencies of the array that contribute less to the broadband source level than lower frequencies (Figure C-10). However, when trapped, high frequencies can propagate with little loss and can produce higher levels near the sea-surface than scenarios where no surface duct is present.

At longer ranges, particularly in the offshore direction, there is significantly less sound energy above 400 m as compared to greater depths (Figure 19). The implications of the distribution of the sound field within the water column for marine mammals is that migratory mysticetes, such as pygmy blue whales within the BIA, who mainly use the shallower depths (Owen et al. 2016), will not be exposed to higher sound levels at longer ranges. For instance, the mean maximum depth of exploratory dives was 107 ± 81 m, ranging between 23–320 m, while the majority of migration (94% of observed time) was spent at water depths of less than 24 m (Owen et al. 2016).

Three geoacoustic profiles have been considered for the modelling sites, which vary depending on the water depth and the area on the continental shelf. The three profiles are comparable, and the differences had a less pronounced influence on the sound field than the directionality of the airgun array and interaction with the bathymetry and sound speed profile.

The distances to SPL thresholds for behavioural response in marine mammals, and behavioural response and disturbance in turtles typically decrease as water depth increases (Tables 9 and 10). However, the orientation of the source is also key, as the array has a pronounced directivity pattern, with greater distances to sound levels in the broadside direction as compared to the endfire direction. The influence of the bathymetry on the sound fields and the orientation of the source are the reason the humpback whale migratory BIA is not predicted to be ensonified above the marine mammal behavioural disturbance threshold or the shallow waters around the Montebello Islands are not predicted to be ensonified above the human health assessment threshold of 145 dB re 1 µPa.

The distances to seafloor effect criteria (Sections 3.2 and 3.4) for fish and benthic invertebrates at the seafloor decrease with increasing depth.

6.2. Multiple Pulse Sound Fields

The accumulated SEL over 24 hours of seismic source operation was modelled considering two representative scenarios with a realistic acquisition pattern for the Wheatstone 4D MSS. The modelling predicted the accumulation of sound energy, considering the change in location and the azimuth of the source at each pulse point, which were used to assess possible impacts to marine mammals and the SEL_{24h} based fish and marine mammal criteria. The results were presented as maps of the accumulated exposure levels and tabulated values of ranges to threshold levels and exposure areas for the given effects criteria (Section 5.3).

The footprints and range maxima for all SEL_{24h} criteria are substantially influenced by the locations of the source near the shelf break and slope. For an acquisition line which transitions from shallow to deep water, more low frequency energy is transmitted into the water column, where it can be trapped in the deep-water sound channel and propagate with minimal loss. This effect is manifested in the large extent for isopleths and R_{max} distances to thresholds in the offshore direction shown Figures 21–23. Furthermore, the rate of attenuation decreases as range from the acquisition lines increases, and propagation of this nature can further reduce the attenuation rate and allow lower levels to persist to longer ranges.

The pygmy blue whale migratory BIA is ensonified above the low-frequency cetacean TTS threshold for both scenarios. The 60º tow azimuth acquisition lines within Scenario 1 orientate the broadside lobe towards the humpback whale migratory BIA, thus leading to its ensonification above the TTS threshold. Similar distances to the TTS threshold in a southern direction are expected from other acquisition lines with a tow azimuth of 60° which may be closer to the humpback whale migratory BIA. Therefore the measured distance of 14.8 km, the extent from the south-most line centre point to the edge of the inshore TTS isopleth lobe, (Section 5.3) can likely be used as a buffer distance to calculate the potential overlap of the TTS isopleth with the BIA.

Given the distribution of the single impulse sound fields over the water column, particularly in deeper water, as discussed in Section 6.1, it is likely that the maximum-over-depth SEL_{24h} results for TTS in low-frequency cetaceans at long range off the continental shelf do not accurately represent the actual exposures whales migrating at predominantly shallow depths will receive.

6.3. Summary

This section presents a summary of the distances to the noise effect criteria applied in this study (Section 3) as relevant to the impact assessment. The effect criteria for impairment of marine mammals, fish and sea turtles use dual metrics (PK and SEL_{24h}), and the longest distance associated with either metric is required to be applied, and thus is presented in this summary.

The SEL_{24h} is a cumulative metric that reflects the dosimetric impact of noise levels within 24 hours based on the assumption that an animal is consistently exposed to such noise levels at a fixed position. Where the corresponding SEL_{24h} radii are larger than those for peak pressure criteria, they often represent an unlikely worst-case scenario. More realistically, marine mammals, fish and sea turtles would not stay in the same location for 24 hours, but rather a shorter period, depending upon their behaviour and the proximity and movements of the source. Therefore, a reported radius for SEL_{24h} criteria does not mean that marine fauna travelling within this radius of the source will be impaired, but rather that an animal could be exposed to the sound level associated with impairment (either PTS or TTS) if it remained in that location for 24 hours.

Marine mammals

- Table 18 summarises the distances to effect thresholds for marine mammals.

Table 18. Maximum (R_{max}) horizontal distances (in km) from modelled sites or scenarios to behavioural response thresholds and PTS and TTS thresholds for marine mammals (PK values from Table 13 and SEL_{24h} values from Table 16).

Hearing group	Modelled distance to effect thresholds (R_{max})		
	Behavioural response[1]	Impairment: TTS[2]	Impairment: PTS[2]
LF cetaceans	13.45	95.4	6.61
MF cetaceans		-	-
HF cetaceans		1.63	0.450

[1] Noise exposure criteria: NOAA (2019)
[2] Noise exposure criteria: NMFS (2018)

Sea turtles

- Table 19 summarises the distances to effect thresholds for sea turtles.

Table 19. Maximum (R_{max}) horizontal distances (in km) from modelled sites or scenarios to behavioural response thresholds and PTS and TTS thresholds for sea turtles (PK values from Table 13 and SEL_{24h} values from Table 16).

Hearing group	Modelled distance to effect thresholds (R_{max})			
	Behavioural response[1]	Behavioural disturbance[2]	Impairment: TTS[3]	Impairment: PTS[3]
Turtles	7.11	2.83	3.84	<0.02

[1] Noise exposure criteria: NSF (2011)
[2] Noise exposure criteria: McCauley et al. (2000b)
[3] Noise exposure criteria: Finneran et al. (2017)

Fish, fish eggs, and fish larvae

- This modelling study assessed the ranges for quantitative guidelines based on Popper et al. (2014) and considered both PK (seafloor and water column) and SEL_{24h} metrics associated with mortality and potential mortal injury as well as impairment in the following groups:
    - Fish without a swim bladder (also appropriate for sharks in the absence of other information)
    - Fish with a swim bladder that do not use it for hearing
    - Fish that use their swim bladders for hearing
    - Fish eggs and fish larvae
- Table 20 summarises the distances to injury guidelines for fish, fish eggs, and fish larvae along with the relevant metric and the location of the information within this report.

Table 20. Summary of maximum fish, fish eggs, and larvae injury and TTS onset distances for single impulse and SEL_{24h} modelled scenarios (PK values from Tables 13 and 14 and SEL_{24h} values from Table 17).

Relevant hearing group	Effect criteria	Scenario 1		Scenario 2	
		Metric associated with longest distance to criteria	R_{max} (km)	Metric associated with longest distance to criteria	R_{max} (km)
Fish: No swim bladder	Injury	PK	0.096 (Site A, seafloor)	PK	0.07
	TTS	SEL_{24h}	8.63	SEL_{24h}	7.56
Fish: Swim bladder not involved in hearing and Swim bladder involved in hearing	Injury	PK	0.27	PK	0.15
	TTS	SEL_{24h}	8.63	SEL_{24h}	7.56
Fish eggs, and larvae	Injury	PK	0.27	PK	0.15

Invertebrates, Sponges, Coral, and Plankton

To assist with assessing the potential effects on these receptors, the following were determined:

- Crustaceans: The sound level of 202 dB re 1 µPa PK-PK from Payne et al. (2008) was considered for seafloor sound levels; the sound level was reached at ranges between 0.431 and 0.913 km depending on the modelled site (Table 15).
- Sponges and coral: the PK sound level at the seafloor directly underneath the seismic source was estimated at all modelled sites and compared to the no effect sound level of 226 dB re 1 µPa PK for sponges and corals (Heyward et al. 2018); it was not reached at any of the modelled sites (Table 14).
- Plankton: The maximum distance to potential injury in plankton, applying the threshold from Popper et al. (2014), is 0.27 km (Table 13) within the water column.

Glossary

1/3-octave
One third of an octave. Note: A one-third octave is approximately equal to one decidecade (1/3 oct ≈ 1.003 ddec; ISO 2017).

1/3-octave-band
Frequency band whose bandwidth is one one-third octave. Note: The bandwidth of a one-third octave-band increases with increasing centre frequency.

A-weighting
Frequency-selective weighting for human hearing in air that is derived from the inverse of the idealized 40-phon equal loudness hearing function across frequencies.

absorption
The reduction of acoustic pressure amplitude due to acoustic particle motion energy converting to heat in the propagation medium.

attenuation
The gradual loss of acoustic energy from absorption and scattering as sound propagates through a medium.

Auditory frequency weighting (auditory weighting function, frequency-weighting function)
The process of band-pass filtering sounds to reduce the importance of inaudible or less-audible frequencies for individual species or groups of species of aquatic mammals (ISO 2017). One example is M-weighting introduced by Southall et al. (2007) to describe "Generalized frequency weightings for various functional hearing groups of marine mammals, allowing for their functional bandwidths and appropriate in characterizing auditory effects of strong sounds".

azimuth
A horizontal angle relative to a reference direction, which is often magnetic north or the direction of travel. In navigation it is also called bearing.

bandwidth
The range of frequencies over which a sound occurs. Broadband refers to a source that produces sound over a broad range of frequencies (e.g., seismic airguns, vessels) whereas narrowband sources produce sounds over a narrow frequency range (e.g., sonar) (ANSI/ASA S1.13-2005 R2010).

bar
Unit of pressure equal to 100 kPa, which is approximately equal to the atmospheric pressure on Earth at sea level. 1 bar is equal to 10^5 Pa or 10^{11} µPa.

boxcar averaging
A signal smoothing technique that returns the averages of consecutive segments of a specified width.

broadband sound level
The total sound pressure level measured over a specified frequency range. If the frequency range is unspecified, it refers to the entire measured frequency range.

broadside direction
Perpendicular to the travel direction of a source. Compare with endfire direction.

cetacean
Any animal in the order Cetacea. These are aquatic, mostly marine mammals and include whales, dolphins, and porpoises.

compressional wave
A mechanical vibration wave in which the direction of particle motion is parallel to the direction of propagation. Also called primary wave or P-wave.

continuous sound
A sound whose sound pressure level remains above ambient sound during the observation period (ANSI/ASA S1.13-2005 R2010). A sound that gradually varies in intensity with time, for example, sound from a marine vessel.

decade
Logarithmic frequency interval whose upper bound is ten times larger than its lower bound (ISO 2006).

decidecade
One tenth of a decade (ISO 2017). Note: An alternative name for decidecade (symbol ddec) is “one-tenth decade”. A decidecade is approximately equal to one third of an octave (1 ddec ≈ 0.3322 oct) and for this reason is sometimes referred to as a “one-third octave”.

decidecade band
Frequency band whose bandwidth is one decidecade. Note: The bandwidth of a decidecade band increases with increasing centre frequency.

decibel (dB)
One-tenth of a bel. Unit of level when the base of the logarithm is the tenth root of ten, and the quantities concerned are proportional to power (ANSI S1.1-1994 R2004).

endfire direction
Parallel to the travel direction of a source. See also broadside direction.

ensonified
Exposed to sound.

far-field
The zone where, to an observer, sound originating from an array of sources (or a spatially distributed source) appears to radiate from a single point. The distance to the acoustic far-field increases with frequency.

fast-average sound pressure level
The time-averaged sound pressure levels calculated over the duration of a pulse (e.g., 90%-energy time window), using the leaky time integrator from Plomp and Bouman (1959) and a time constant of 125 ms. Typically used only for pulsed sounds.

frequency
The rate of oscillation of a periodic function measured in cycles-per-unit-time. The reciprocal of the period. Unit: hertz (Hz). Symbol: f. 1 Hz is equal to 1 cycle per second.

hearing group
Groups of marine mammal species with similar hearing ranges. Commonly defined functional hearing groups include low-, mid-, and high-frequency cetaceans, pinnipeds in water, and pinnipeds in air.

geoacoustic
Relating to the acoustic properties of the seabed.

hearing threshold
The sound pressure level for any frequency of the hearing group that is barely audible for a given individual in the absence of significant background noise during a specific percentage of experimental trials.

hertz (Hz)
A unit of frequency defined as one cycle per second.

high-frequency (HF) cetacean
The functional cetacean hearing group that represents those odontocetes (toothed whales) specialized for hearing high frequencies.

impulsive sound
Sound that is typically brief and intermittent with rapid (within a few seconds) rise time and decay back to ambient levels (NOAA 2013, ANSI S12.7-1986 R2006). For example, seismic airguns and impact pile driving.

low-frequency (LF) cetacean
The functional cetacean hearing group that represents mysticetes (baleen whales) specialized for hearing low frequencies.

mean-square sound pressure spectral density
Distribution as a function of frequency of the mean-square sound pressure per unit bandwidth (usually 1 Hz) of a sound having a continuous spectrum (ANSI S1.1-1994 R2004). Unit: $\mu Pa^2/Hz$.

median
The 50th percentile of a statistical distribution.

mid-frequency (MF) cetacean
The functional cetacean hearing group that represents those odontocetes (toothed whales) specialized for mid-frequency hearing.

mysticete
Mysticeti, a suborder of cetaceans, use their baleen plates, rather than teeth, to filter food from water. They are not known to echolocate, but they use sound for communication. Members of this group include rorquals (Balaenopteridae), right whales (Balaenidae), and grey whales (*Eschrichtius robustus*).

non-impulsive sound
Sound that is broadband, narrowband or tonal, brief or prolonged, continuous or intermittent, and typically does not have a high peak pressure with rapid rise time (typically only small fluctuations in decibel level) that impulsive signals have (ANSI/ASA S3.20-1995 R2008). For example, marine vessels, aircraft, machinery, construction, and vibratory pile driving (NIOSH 1998, NOAA 2015).

octave
The interval between a sound and another sound with double or half the frequency. For example, one octave above 200 Hz is 400 Hz, and one octave below 200 Hz is 100 Hz.

odontocete
The presence of teeth, rather than baleen, characterizes these whales. Members of the Odontoceti are a suborder of cetaceans, a group comprised of whales, dolphins, and porpoises. The skulls of toothed whales are mostly asymmetric, an adaptation for their echolocation. This group includes sperm whales, killer whales, belugas, narwhals, dolphins, and porpoises.

otariid
A common term used to describe members of the Otariidae, eared seals, commonly called sea lions and fur seals. Otariids are adapted to a semi-aquatic life; they use their large fore flippers for propulsion. Their ears distinguish them from phocids. Otariids are one of the three main groups in the superfamily Pinnipedia; the other two groups are phocids and walrus.

otariid pinnipeds in water (OPW)
The functional pinniped hearing group that represents eared seals under water.

parabolic equation method
A computationally efficient solution to the acoustic wave equation that is used to model transmission loss. The parabolic equation approximation omits effects of back-scattered sound, simplifying the computation of transmission loss. The effect of back-scattered sound is negligible for most ocean-acoustic propagation problems.

particle acceleration
The rate of change of particle velocity. Unit: metre per second squared (m/s^2). Symbol: *a*.

particle velocity
The physical speed of a particle in a material moving back and forth in the direction of the pressure wave. Unit: metre per second (m/s). Symbol: *v*.

peak pressure level (PK)
The maximum instantaneous sound pressure level, in a stated frequency band, within a stated period. Also called zero-to-peak pressure level. Unit: decibel (dB).

peak-to-peak pressure level (PK-PK)
The difference between the maximum and minimum instantaneous pressure levels. Unit: decibel (dB).

percentile level, exceedance
The sound level exceeded *n*% of the time during a measurement.

permanent threshold shift (PTS)
A permanent loss of hearing sensitivity caused by excessive noise exposure. PTS is considered auditory injury.

phocid
A common term used to describe all members of the family Phocidae. These true/earless seals are more adapted to in-water life than are otariids, which have more terrestrial adaptations. Phocids use their hind flippers to propel themselves. Phocids are one of the three main groups in the superfamily Pinnipedia; the other two groups are otariids and walrus.

phocid pinnipeds in water (PPW)
The functional pinniped hearing group that represents true/earless seals under water.

pinniped
A common term used to describe all three groups that form the superfamily Pinnipedia: phocids (true seals or earless seals), otariids (eared seals or fur seals and sea lions), and walrus.

point source
A source that radiates sound as if from a single point (ANSI S1.1-1994 R2004).

power spectrum density
Generic term, formally defined as power in W/Hz, but sometimes loosely used to refer to the spectral density of other parameters such as square pressure or time-integrated square pressure.

pressure, acoustic
The deviation from the ambient hydrostatic pressure caused by a sound wave. Also called overpressure. Unit: pascal (Pa). Symbol: *p*.

pressure, hydrostatic
The pressure at any given depth in a static liquid that is the result of the weight of the liquid acting on a unit area at that depth, plus any pressure acting on the surface of the liquid. Unit: pascal (Pa).

rms
root-mean-square.

shear wave
A mechanical vibration wave in which the direction of particle motion is perpendicular to the direction of propagation. Also called secondary wave or S-wave. Shear waves propagate only in solid media, such as sediments or rock. Shear waves in the seabed can be converted to compressional waves in water at the water-seabed interface.

signature
Pressure signal generated by a source.

sound
A time-varying pressure disturbance generated by mechanical vibration waves travelling through a fluid medium such as air or water.

sound exposure
Time integral of squared, instantaneous frequency-weighted sound pressure over a stated time interval or event. Unit: pascal-squared second (Pa²·s) (ANSI S1.1-1994 R2004).

sound exposure level (SEL)
A cumulative measure related to the sound energy in one or more pulses. Unit: dB re 1 µPa²·s. SEL is expressed over the summation period (e.g., per-pulse SEL [for airguns], single-strike SEL [for pile drivers], 24-hour SEL).

sound exposure spectral density
Distribution as a function of frequency of the time-integrated squared sound pressure per unit bandwidth of a sound having a continuous spectrum (ANSI S1.1-1994 R2004). Unit: µPa²·s/Hz.

sound field
Region containing sound waves (ANSI S1.1-1994 R2004).

sound intensity
Sound energy flowing through a unit area perpendicular to the direction of propagation per unit time.

sound pressure level (SPL)
The decibel ratio of the time-mean-square sound pressure, in a stated frequency band, to the square of the reference sound pressure (ANSI S1.1-1994 R2004).

For sound in water, the reference sound pressure is one micropascal (p_0 = 1 µPa) and the unit for SPL is dB re 1 µPa²:

$$L_p = 10\log_{10}(p^2/p_0^2) = 20\log_{10}(p/p_0)$$

Unless otherwise stated, SPL refers to the root-mean-square (rms) pressure level. See also 90% sound pressure level and fast-average sound pressure level. Non-rectangular time window functions may be applied during calculation of the rms value, in which case the SPL unit should identify the window type.

sound speed profile
The speed of sound in the water column as a function of depth below the water surface.

source level (SL)
The sound level measured in the far-field and scaled back to a standard reference distance of 1 metre from the acoustic centre of the source. Unit: dB re 1 µPa·m (pressure level) or dB re 1 µPa²·s·m (exposure level).

spectrum
An acoustic signal represented in terms of its power, energy, mean-square sound pressure, or sound exposure distribution with frequency.

temporary threshold shift (TTS)
Temporary loss of hearing sensitivity caused by excessive noise exposure.

transmission loss (TL)
The decibel reduction in sound level between two stated points that results from sound spreading away from an acoustic source subject to the influence of the surrounding environment. Also referred to as propagation loss.

wavelength
Distance over which a wave completes one cycle of oscillation. Unit: metre (m). Symbol: λ.

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Appendix A. Acoustic Metrics

A.1. Pressure Related Acoustic Metrics

Underwater sound pressure amplitude is measured in decibels (dB) relative to a fixed reference pressure of p_0 = 1 μPa. Because the perceived loudness of sound, especially pulsed sound such as from seismic airguns, pile driving, and sonar, is not generally proportional to the instantaneous acoustic pressure, several sound level metrics are commonly used to evaluate sound and its effects on marine life. Here we provide specific definitions of relevant metrics used in the accompanying report. Where possible, we follow the American National Standard Institute and International Organization for Standardization definitions and symbols for sound metrics (e.g., ISO 2017, ANSI R2013), but these standards are not always consistent.

The zero-to-peak sound pressure, or peak sound pressure (PK or $L_{p,pk}$; dB re 1 µPa), is the decibel level of the maximum instantaneous acoustic pressure in a stated frequency band attained by an acoustic pressure signal, $p(t)$:

$$L_{p,\mathrm{pk}} = 10\log_{10}\left(\frac{\max|p^2(t)|}{p_0^2}\right) = 20\log_{10}\left(\frac{\max|p(t)|}{p_0}\right) \tag{A-1}$$

PK is often included as a criterion for assessing whether a sound is potentially injurious; however, because it does not account for the duration of an acoustic event, it is generally a poor indicator of perceived loudness.

The peak-to-peak sound pressure (PK-PK or $L_{p,pk\text{-}pk}$; dB re 1 µPa) is the difference between the maximum and minimum instantaneous sound pressure, possibly filtered in a stated frequency band, attained by an impulsive sound, $p(t)$:

$$L_{p,\mathrm{pk\text{-}pk}} = 10\log_{10}\left(\frac{[\max(p(t)) - \min(p(t))]^2}{p_0^2}\right) \tag{A-2}$$

The sound pressure level (SPL or L_p; dB re 1 µPa) is the root-mean-square (rms) pressure level in a stated frequency band over a specified time window (T; s). It is important to note that SPL always refers to an rms pressure level and therefore not instantaneous pressure:

$$L_p = 10\log_{10}\left(\frac{1}{T}\int_T g(t)\,p^2(t)\,dt \Big/ p_0^2\right) \tag{A-3}$$

where $g(t)$ is an optional time weighting function. In many cases, the start time of the integration is marched forward in small time steps to produce a time-varying SPL function. For short acoustic events, such as sonar pulses and marine mammal vocalizations, it is important to choose an appropriate time window that matches the duration of the signal. For in-air studies, when evaluating the perceived loudness of sounds with rapid amplitude variations in time, the time weighting function $g(t)$ is often set to a decaying exponential function that emphasizes more recent pressure signals. This function mimics the leaky integration nature of mammalian hearing. For example, human-based fast time-weighted SPL ($L_{p,fast}$) applies an exponential function with time constant 125 ms. A related simpler approach used in underwater acoustics sets $g(t)$ to a boxcar (unity amplitude) function of width 125 ms; the results can be referred to as $L_{p,boxcar\ 125ms}$. Another approach, historically used to evaluate SPL of impulsive signals underwater, defines $g(t)$ as a boxcar function with edges set to the times corresponding to 5% and 95% of the cumulative square pressure function encompassing the duration of an impulsive acoustic event. This calculation is applied individually to each impulse signal, and the results have been referred to as 90% SPL ($L_{p,90\%}$). In this report, SPL refers to $L_{p,boxcar\ 125ms}$.

The sound exposure level (SEL or L_E; dB re 1 µPa²·s) is the time-integral of the squared acoustic pressure over a duration (T):

$$L_E = 10\log_{10}\left(\int_T p^2(t)\,dt \Big/ T_0 p_0^2\right) \quad \text{(A-4)}$$

where T_0 is a reference time interval of 1 s. SEL continues to increase with time when non-zero pressure signals are present. It is a dose-type measurement, so the integration time applied must be carefully considered for its relevance to impact to the exposed recipients.

SEL can be calculated over a fixed duration, such as the time of a single event or a period with multiple acoustic events. When applied to pulsed sounds, SEL can be calculated by summing the SEL of the N individual pulses. For a fixed duration, the square pressure is integrated over the duration of interest. For multiple events, the SEL can be computed by summing (in linear units) the SEL of the N individual events:

$$L_{E,N} = 10\log_{10}\sum_{i=1}^{N} 10^{\frac{L_{E,i}}{10}} \quad \text{(A-5)}$$

Because the SPL and SEL are both computed from the integral of square pressure, these metrics are related numerically by the following expression, which depends only on the duration of the time window T:

$$L_p = L_E - 10\log_{10}(T) \quad \text{(A-6)}$$

When applied, the frequency weighting of an acoustic event should be specified, as in the case of weighted SEL (e.g., *LE,LF,24h*; see Appendix 0).

A.2. Decidecade Band Analysis

The distribution of a sound's power with frequency is described by the sound's spectrum. The sound spectrum can be split into a series of adjacent frequency bands. Splitting a spectrum into 1 Hz wide bands, called passbands, yields the power spectral density of the sound. This splitting of the spectrum into passbands of a constant width of 1 Hz, however, does not represent how animals perceive sound.

Because animals perceive exponential increases in frequency rather than linear increases, analysing a sound spectrum with passbands that increase exponentially in size better approximates real-world scenarios. In underwater acoustics, a spectrum is commonly split into decidecade bands, which are one tenth of a decade wide. They are approximately one third of an octave (base 2) wide and are therefore often referred to as 1/3-octave-bands. Each octave represents a doubling in sound frequency. The centre frequency of the ith band, $f_\mathrm{c}(i)$, is defined as:

$$f_\mathrm{c}(i) = 10^{\frac{i}{10}}\,\mathrm{kHz} \quad \text{(A-7)}$$

and the low (f_lo) and high (f_hi) frequency limits of the ith decade band are defined as:

$$f_{\mathrm{lo},i} = 10^{\frac{-1}{20}} f_\mathrm{c}(i) \quad \text{and} \quad f_{\mathrm{hi},i} = 10^{\frac{1}{20}} f_\mathrm{c}(i) \quad \text{(A-8)}$$

The decidecade bands become wider with increasing frequency, and on a logarithmic scale the bands appear equally spaced (Figure A-1). The acoustic modelling spans from band 7 (f_c (7) = 5 Hz) to band 44 ($f_\mathrm{c}(44)$ = 25 kHz).

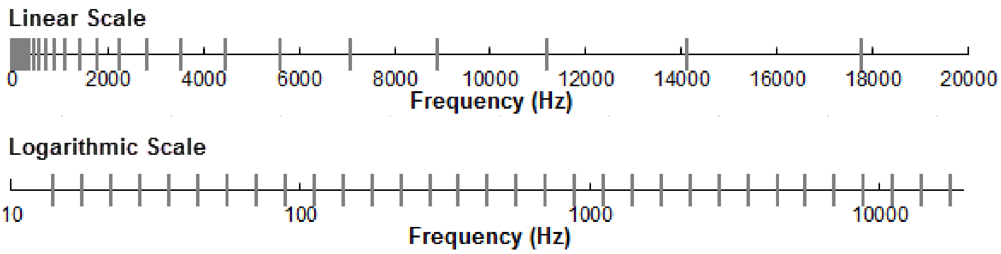


Figure A-1. Decidecade frequency bands (vertical lines) shown on a linear frequency scale and a logarithmic scale.

The sound pressure level in the ith band ($L_{p,i}$) is computed from the spectrum $S(f)$ between $f_{\mathrm{lo},i}$ and $f_{\mathrm{hi},i}$:

$$L_{p,i} = 10 \log_{10} \int_{f_{\mathrm{lo},i}}^{f_{\mathrm{hi},i}} S(f)\, df \tag{A-9}$$

Summing the sound pressure level of all the bands yields the broadband sound pressure level:

$$\text{Broadband SPL} = 10 \log_{10} \sum_i 10^{\frac{L_{p,i}}{10}} \tag{A-10}$$

Figure A-2 shows an example of how the decidecade band sound pressure levels compare to the sound pressure spectral density levels of an ambient noise signal. Because the decidecade bands are wider with increasing frequency, the decidecade band SPL is higher than the spectral levels at higher frequencies. Acoustic modelling of decidecade bands requires less computation time than 1 Hz bands and still resolves the frequency-dependence of the sound source and the propagation environment.

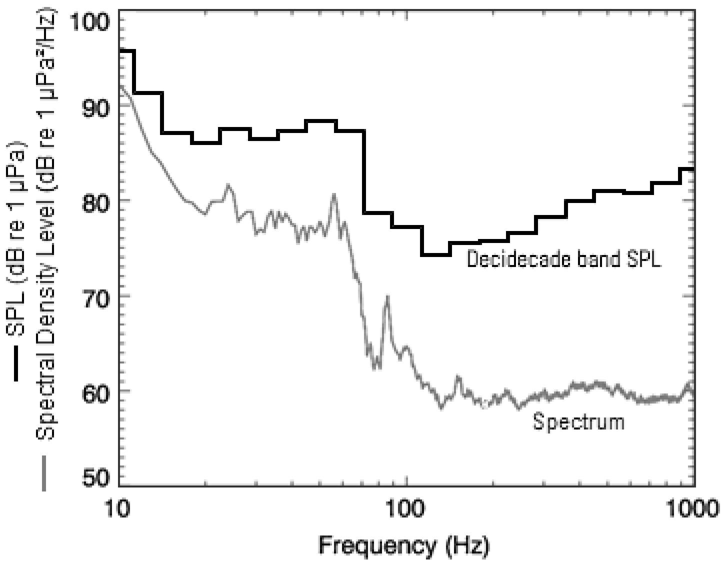


Figure A-2. Sound pressure spectral density levels and the corresponding decidecade band sound pressure levels of example ambient noise shown on a logarithmic frequency scale.

A.3. Marine Mammal Effect Criteria

It has been long recognised that marine mammals can be adversely affected by underwater anthropogenic noise. For example, Payne and Webb (1971) suggested that communication distances of fin whales are reduced by shipping sounds. Subsequently, similar concerns arose regarding effects of other underwater noise sources and the possibility that impulsive sources–primarily airguns used in seismic surveys–could cause auditory impairment. This led to a series of workshops held in the late 1990s, conducted to address acoustic mitigation requirements for seismic surveys and other underwater noise sources (NMFS 1998, ONR 1998, Nedwell and Turnpenny 1998, HESS 1999, Ellison and Stein 1999). In the years since these early workshops, a variety of thresholds have been proposed for both impairment and disturbance. The following sections summarise the recent development of thresholds; however, this field remains an active research topic.

A.3.1. Auditory Impairment

There are two categories of auditory threshold shifts (also termed Noise Induced Threshold Shift, NITS): Permanent Threshold Shift (PTS), a physical injury to an animal's hearing system; and Temporary Threshold Shift (TTS), a temporary reduction in an animal's hearing sensitivity as the result of physiological and mechanical processes in the inner ear. While PTS undoubtedly constitutes an injury, TTS (as a temporary effect) was not considered in the same way. However, recent research clearly indicates that already moderate levels (<12 dB) of TTS produced an accelerated hearing loss (PTS) resulting from progressive neural degeneration with age (Kujawa and Liberman 2006, 2009, Maison et al. 2013, Kujawa and Liberman 2015).

The criteria for assessing possible effects of impulsive sounds (such as pile driving or seismic impulses) noise on marine mammals, NMFS (2018), was applied in this study.

A.3.2. Behavioural response

Numerous studies on marine mammal behavioural responses to sound exposure have not resulted in consensus in the scientific community regarding the appropriate metric for assessing behavioural reactions. However, it is recognised that the context in which the sound is received affects the nature and extent of responses to a stimulus (Southall et al. 2007, Ellison and Frankel 2012, Southall et al. 2016).

For impulsive noise, NMFS currently uses step function thresholds of 160 dB re 1 µPa SPL (unweighted) to assess and regulate noise-induced behavioural impacts for marine mammals (NOAA 2018, NOAA 2019). The threshold for impulsive sound is derived from the High-Energy Seismic Survey (HESS) panel (HESS 1999) report that, in turn, is based on the responses of migrating mysticete whales to airgun sounds (Malme et al. 1984). The HESS team recognised that behavioural responses to sound may occur at lower levels, but significant responses were only likely to occur above a SPL of 140 dB re 1 µPa. Southall et al. (2007) found varying responses for most marine mammals between a SPL of 140 and 180 dB re 1 µPa, consistent with the HESS (1999) report, but lack of convergence in the data prevented them from suggesting explicit step functions.

A.4. Marine Mammal Frequency Weighting

The potential for noise to affect animals depends on how well the animals can hear it. Noises are less likely to disturb or injure an animal if they are at frequencies that the animal cannot hear well. An exception occurs when the sound pressure is so high that it can physically injure an animal by non-auditory means (i.e., barotrauma). For sound levels below such extremes, the importance of sound components at particular frequencies can be scaled by frequency weighting relevant to an animal's sensitivity to those frequencies (Nedwell and Turnpenny 1998, Nedwell et al. 2007).

A.4.1. Marine mammal frequency weighting functions

In 2015, a U.S. Navy technical report by Finneran (2015) recommended new auditory weighting functions. The overall shape of the auditory weighting functions is similar to human A-weighting functions, which follows the sensitivity of the human ear at low sound levels. The new frequency-weighting function is expressed as:

$$G(f) = K + 10\log_{10}\left[\left(\frac{(f/f_{lo})^{2a}}{\left[1+(f/f_{lo})^2\right]^a\left[1+(f/f_{hi})^2\right]^b}\right)\right] \tag{A-11}$$

Finneran (2015) proposed five functional hearing groups for marine mammals in water: low-, mid-, and high-frequency cetaceans, phocid pinnipeds, and otariid pinnipeds. The parameters for these frequency-weighting functions were further modified the following year (Finneran 2016) and were adopted in NOAA's technical guidance that assesses noise impacts on marine mammals (NMFS 2016, NMFS 2018). Table A-1 lists the frequency-weighting parameters for each hearing group; Figure A-3 shows the resulting frequency-weighting curves.

Table A-1. Parameters for the auditory weighting functions used in this project as recommended by NMFS (2018).

Hearing group	a	b	f_{lo} (Hz)	f_{hi} (kHz)	K (dB)
Low-frequency cetaceans (baleen whales)	1.0	2	200	19,000	0.13
Mid-frequency cetaceans (dolphins, plus toothed, beaked, and bottlenose whales)	1.6	2	8,800	110,000	1.20
High-frequency cetaceans (true porpoises, *Kogia*, river dolphins, cephalorhynchid, *Lagenorhynchus cruciger* and *L. australis*)	1.8	2	12,000	140,000	1.36

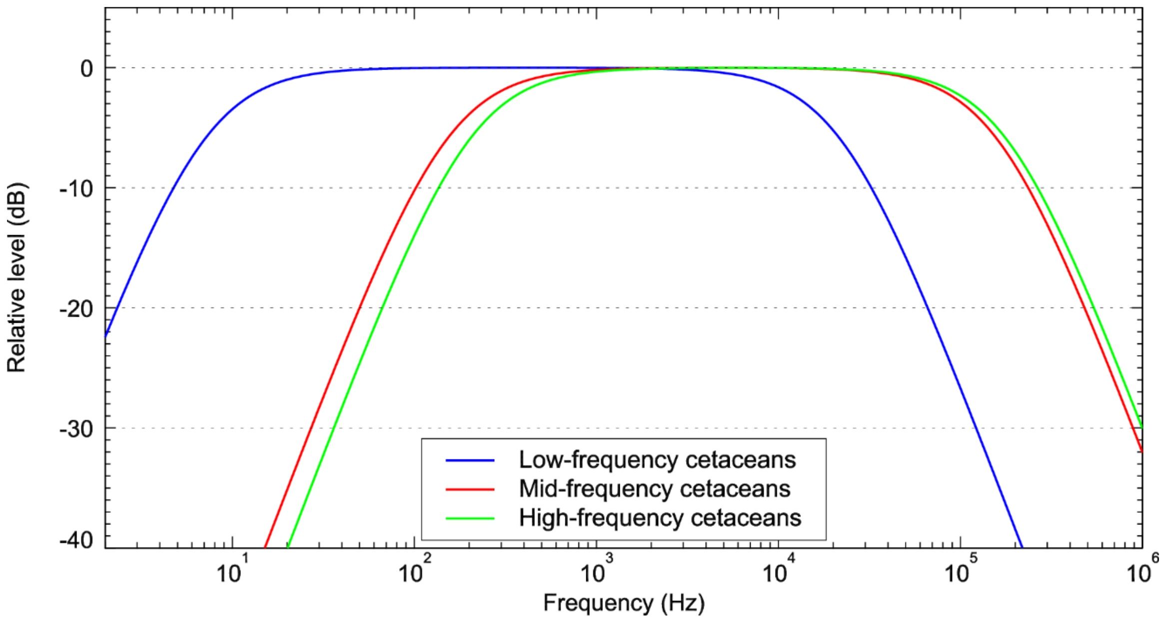


Figure A-3. Auditory weighting functions for functional marine mammal hearing groups used in this project as recommended by NMFS (2018).

A.5. Fish, Fish Eggs, and Fish Larvae Effect Criteria

In general, any adverse effects of seismic sound on fish behaviour depends on the species, the state of the individuals exposed, and other factors. We note that, despite mortality being a possibility for fish exposed to airgun sounds, Popper et al. (2014) do not reference an actual occurrence of this effect. Since the publication of that work, newer studies have further examined the question of possible mortality. Popper et al. (2016) adds further information to the possible levels of impulsive seismic airgun sound to which adult fish can be exposed without immediate mortality. They found that the two fish species in their study, with body masses in the range 200–400 g, exposed to a single-impulse of a maximum received level of either 231 dB re 1 μPa (PK) or 205 dB re 1 μPa^2·s (SEL), remained alive for 7 days after exposure and that the probability of mortal injury did not differ between exposed and control fish.

In the discussion of the criteria, Popper et al. (2014) discuss the complications in determining a relevant period of mobile seismic surveys, as the received levels at the fish change between impulses because the source is moving, and that in reality a revised guideline based on the closest PK or the per-pulse SEL might be more useful than one based on accumulated SEL. This is because exposures at the closest point of approach (CPA) are the primary exposures contributing to a receiver's accumulated level (Gedamke et al. 2011). Additionally, several important factors determine the likelihood and duration a receiver is expected to be in close proximity to a sound source (i.e., overlap in space and time between the source and receiver). For example, accumulation time for fast moving (relative to the receiver) mobile sources is driven primarily by the characteristics of the source (i.e., speed, duty cycle; NMFS 2016, 2018).

As discussed in Popper (2018), many fish species move around, some over large distances. The author suggests that it is reasonable to think that if the sound of a seismic source becomes too loud, the fish will move away from the source because they are able to determine the direction of a sound source. If the fish moves away, the amount of energy to which it is exposed is likely to be one or a few seismic pulses, and these would not likely be loud enough to result in any effect because the fish would move away at a much lower level signal than could cause harm. Data on TTS for fish are very limited, with the only study that examined recovery from seismic impulses being Popper et al. (2005). Popper (2018) states that if this study had been conducted on wild, free-swimming fish instead of caged ones, there would have been no effect whatsoever because they were likely to have moved away from the source as it approached them, as would happen with normally free-moving demersal and pelagic fish species associated with a 3-D seismic survey in northern Australian waters, extrapolating from the Bethany 3-D assessed in Popper (2018).

Therefore, 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, and 24 h is likely too long a period for calculating the accumulation of energy in determining potential harm (e.g., damage or TTS) (Popper 2018). Even if fish 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 h (or less) is very likely. If TTS does occur, the duration of exposure to the most intense sounds that could result in TTS will be over just a few hours. Thus, energy accumulating over longer periods than a few hours is probably inappropriate (Popper 2018).

Appendix B. Models

B.1. Acoustic Source Model

The source levels and directivity of the seismic source were predicted with JASCO's Airgun Array Source Model (AASM). AASM includes low- and high-frequency modules for predicting different components of the seismic source spectrum. The low-frequency module is based on the physics of oscillation and radiation of airgun bubbles, as originally described by Ziolkowski (1970), that solves the set of parallel differential equations that govern bubble oscillations. Physical effects accounted for in the simulation include pressure interactions between airguns, port throttling, bubble damping, and generator-injector (GI) gun behaviour discussed by Dragoset (1984), Laws et al. (1990), and Landrø (1992). A global optimisation algorithm tunes free parameters in the model to a large library of airgun source signatures.

While airgun signatures are highly repeatable at the low frequencies, which are used for seismic imaging, their sound emissions have a large random component at higher frequencies that cannot be predicted using a deterministic model. Therefore, AASM uses a stochastic simulation to predict the high-frequency (800−25,000 Hz) sound emissions of individual airguns, using a data-driven multiple-regression model. The multiple-regression model is based on a statistical analysis of a large collection of high quality seismic source signature data recently obtained from the Joint Industry Program (JIP) on Sound and Marine Life (Mattsson and Jenkerson 2008). The stochastic model uses a Monte-Carlo simulation to simulate the random component of the high-frequency spectrum of each airgun in an array. The mean high-frequency spectra from the stochastic model augment the low-frequency signatures from the physical model, allowing AASM to predict airgun source levels at frequencies up to 25,000 Hz.

AASM produces a set of "notional" signatures for each array element based on:

- Array layout
- Volume, tow depth, and firing pressure of each airgun
- Interactions between different airguns in the array

These notional signatures are the pressure waveforms of the individual airguns at a standard reference distance of 1 m; they account for the interactions with the other airguns in the array. The signatures are summed with the appropriate phase delays to obtain the far-field source signature of the entire array in all directions. This far-field array signature is filtered into decidecade frequency bands to compute the source levels of the array as a function of frequency band and azimuthal angle in the horizontal plane (at the source depth), after which it is considered a directional point source in the far field.

A seismic array consists of many sources and the point source assumption is invalid in the near field where the array elements add incoherently. The maximum extent of the near field of an array (R_{nf}) is:

$$R_{\mathrm{nf}} < \frac{l^2}{4\lambda} \tag{B-1}$$

where λ is the sound wavelength and l is the longest dimension of the array (Lurton 2002, §5.2.4). For example, a seismic source length of l = 21 m yields a near-field range of 147 m at 2 kHz and 7 m at 100 Hz. Beyond this R_{nf} range, the array is assumed to radiate like a directional point source and is treated as such for propagation modelling.

The interactions between individual elements of the array create directionality in the overall acoustic emission. Generally, this directionality is prominent mainly at frequencies in the mid-range between tens of hertz to several hundred hertz. At lower frequencies, with acoustic wavelengths much larger than the inter-airgun separation distances, the directionality is small. At higher frequencies, the pattern of lobes is too finely spaced to be resolved and the effective directivity is less.

B.2. Sound Propagation Models

B.2.1. MONM-BELLHOP

Long-range sound fields were computed using JASCO's Marine Operations Noise Model (MONM). Compared to VSTACK, MONM less accurately predicts steep-angle propagation for environments with higher shear speed but is well suited for effective longer-range estimation. This model computes sound propagation at frequencies of 5 Hz to 2 kHz via a wide-angle parabolic equation solution to the acoustic wave equation (Collins 1993) based on a version of the U.S. Naval Research Laboratory's Range-dependent Acoustic Model (RAM), which has been modified to account for a solid seabed (Zhang and Tindle 1995). MONM computes sound propagation at frequencies > 2 kHz via the BELLHOP Gaussian beam acoustic ray-trace model (Porter and Liu 1994).

The parabolic equation method has been extensively benchmarked and is widely employed in the underwater acoustics community (Collins et al. 1996). MONM accounts for the additional reflection loss at the seabed, which results from partial conversion of incident compressional waves to shear waves at the seabed and sub-bottom interfaces, and it includes wave attenuations in all layers. MONM incorporates the following site-specific environmental properties: a bathymetric grid of the modelled area, underwater sound speed as a function of depth, and a geoacoustic profile based on the overall stratified composition of the seafloor.

MONM computes acoustic fields in three dimensions by modelling transmission loss within two-dimensional (2-D) vertical planes aligned along radials covering a 360° swath from the source, an approach commonly referred to as N×2-D. These vertical radial planes are separated by an angular step size of $\Delta\theta$, yielding N = 360°/$\Delta\theta$ number of planes (Figure B-1).

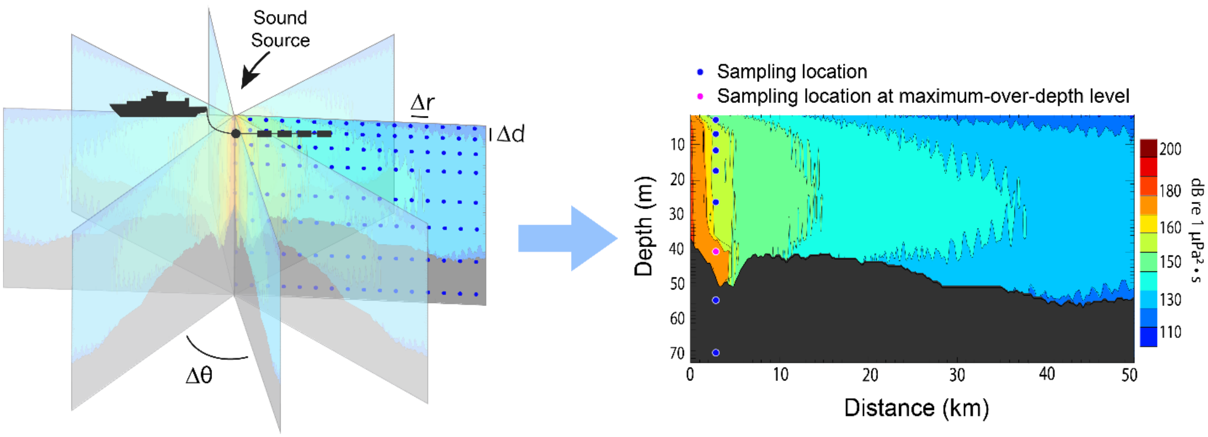


Figure B-1. The N×2-D and maximum-over-depth modelling approach used by MONM.

MONM treats frequency dependence by computing acoustic transmission loss at the centre frequencies of decidecade bands. Sufficiently many frequency bands, starting at 5 Hz, are modelled to include most of the acoustic energy emitted by the source. At each centre frequency, the transmission loss is modelled within each of the N vertical planes as a function of depth and range from the source. The decidecade-band received per-pulse SEL are computed by subtracting the band transmission loss values from the directional source level in that frequency band. Composite broadband received per-pulse SEL are then computed by summing the received decidecade-band levels.

The received per-pulse SEL sound field within each vertical radial plane is sampled at various ranges from the source, generally with a fixed radial step size. At each sampling range along the surface, the sound field is sampled at various depths, with the step size between samples increasing with depth below the surface. The step sizes are chosen to provide increased coverage near the depth of the source and at depths of interest in terms of the sound speed profile. For areas with deep water, sampling is not performed at depths beyond those reachable by marine mammals. The received per-pulse SEL at a surface sampling location is taken as the maximum value that occurs over all samples within the water column, i.e., the maximum-over-depth received per-pulse SEL. These maximum-over-depth per-pulse SEL are presented as colour contours around the source.

An inherent variability in measured sound levels is caused by temporal variability in the environment and the variability in the signature of repeated acoustic impulses (sample sound source verification results is presented in Figure B-2). While MONM's predictions correspond to the averaged received levels, cautionary estimates of the threshold radii are obtained by shifting the best fit line (solid line, Figure B-2) upward so that the trend line encompasses 90% of all the data (dashed line, Figure B-2).

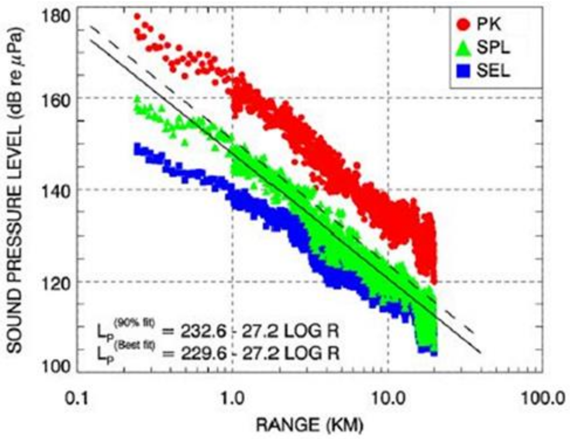


Figure B-2. PK and SPL and per-pulse SEL versus range from a 20 in^3 seismic source. Solid line is the least squares best fit to SPL. Dashed line is the best fit line increased by 3.0 dB to exceed 90% of all SPL values (90th percentile fit) (Ireland et al. 2009, Figure 10).

B.2.2. Full Waveform Range-dependent Acoustic Model: FWRAM

For impulsive sounds from the seismic source, time-domain representations of the pressure waves generated in the water are required to calculate SPL and PK. Furthermore, the seismic source must be represented as a distributed source to accurately characterise vertical directivity effects in the near-field zone. For this study, synthetic pressure waveforms were computed using FWRAM, which is a time-domain acoustic model based on the same wide-angle parabolic equation (PE) algorithm as MONM. FWRAM computes synthetic pressure waveforms versus range and depth for range-varying marine acoustic environments, and it takes the same environmental inputs as MONM (bathymetry, water sound speed profile, and seafloor geoacoustic profile). Unlike MONM, FWRAM computes pressure waveforms via Fourier synthesis of the modelled acoustic transfer function in closely spaced frequency bands. FWRAM employs the array starter method to accurately model sound propagation from a spatially distributed source (MacGillivray and Chapman 2012).

Besides providing direct calculations of the PK and SPL, the synthetic waveforms from FWRAM can also be used to convert the SEL values from MONM to SPL.

B.2.3. Wavenumber Integration Model

Sound pressure levels near the seismic source were modelled using JASCO's VSTACK wavenumber integration model. VSTACK computes synthetic pressure waveforms versus depth and range for arbitrarily layered, range-independent acoustic environments using the wavenumber integration approach to solve the exact (range-independent) acoustic wave equation. This model is valid over the full angular range of the wave equation and can fully account for the elasto-acoustic properties of the sub-bottom. Wavenumber integration methods are extensively used in the field of underwater acoustics and seismology where they are often referred to as reflectivity methods or discrete wavenumber methods. VSTACK computes sound propagation in arbitrarily stratified water and seabed layers by decomposing the outgoing field into a continuum of outward-propagating plane cylindrical waves. Seabed reflectivity in the model is dependent on the seabed layer properties: compressional and shear wave speeds, attenuation coefficients, and layer densities. The output of the model can be post-processed to yield estimates of the SEL, SPL, and PK.

VSTACK accurately predicts steep-angle propagation in the proximity of the source, but it is computationally slow at predicting sound pressures at large distances due to the need for smaller wavenumber steps with increasing distance. Additionally, VSTACK assumes range-invariant bathymetry with a horizontally stratified medium (i.e., a range-independent environment) which is azimuthally symmetric about the source. VSTACK is thus best suited to modelling the sound field near the source.

B.3. Model Validation Information

Predictions from JASCO's Airgun Array Source Model (AASM) and propagation models (MONM, FWRAM and VSTACK) have been validated against experimental data from a number of underwater acoustic measurement programs conducted by JASCO globally, including the United States and Canadian Artic, Canadian and southern United States waters, Greenland, Russia and Australia (Hannay and Racca 2005, Aerts et al. 2008, Funk et al. 2008, Ireland et al. 2009, O'Neill et al. 2010, Warner et al. 2010, Racca et al. 2012a, Racca et al. 2012b, Matthews and MacGillivray 2013, Martin et al. 2015, Racca et al. 2015, Martin et al. 2017a, Martin et al. 2017b, Warner et al. 2017, MacGillivray 2018, McPherson et al. 2018, McPherson and Martin 2018).

In addition, JASCO has conducted measurement programs associated with a significant number of anthropogenic activities which have included internal validation of the modelling (including McCrodan et al. 2011, Austin and Warner 2012, McPherson and Warner 2012, Austin and Bailey 2013, Austin et al. 2013, Zykov and MacDonnell 2013, Austin 2014, Austin et al. 2015, Austin and Li 2016, Martin and Popper 2016).

Appendix C. Methods and Parameters

This section describes the specifications of the seismic source that was used at all sites and the environmental parameters used in the propagation models.

C.1. Estimating Range to Thresholds Levels

Sound level contours were calculated based on the underwater sound fields predicted by the propagation models, sampled by taking the maximum value over all modelled depths above the sea floor for each location in the modelled region. The predicted distances to specific levels were computed from these contours. Two distances relative to the source are reported for each sound level: 1) R_{max}, the maximum range to the given sound level over all azimuths, and 2) $R_{95\%}$, the range to the given sound level after the 5% farthest points were excluded (see examples in Figure C-1).

The $R_{95\%}$ is used because sound field footprints are often irregular in shape. In some cases, a sound level contour might have small protrusions or anomalous isolated fringes. This is demonstrated in the image in Figure C-1(a). In cases such as this, where relatively few points are excluded in any given direction, R_{max} can misrepresent the area of the region exposed to such effects, and $R_{95\%}$ is considered more representative. In strongly asymmetric cases such as shown in Figure C-1(b), on the other hand, $R_{95\%}$ neglects to account for significant protrusions in the footprint. In such cases R_{max} might better represent the region of effect in specific directions. Cases such as this are usually associated with bathymetric features affecting propagation. The difference between R_{max} and $R_{95\%}$ depends on the source directivity and the non-uniformity of the acoustic environment.

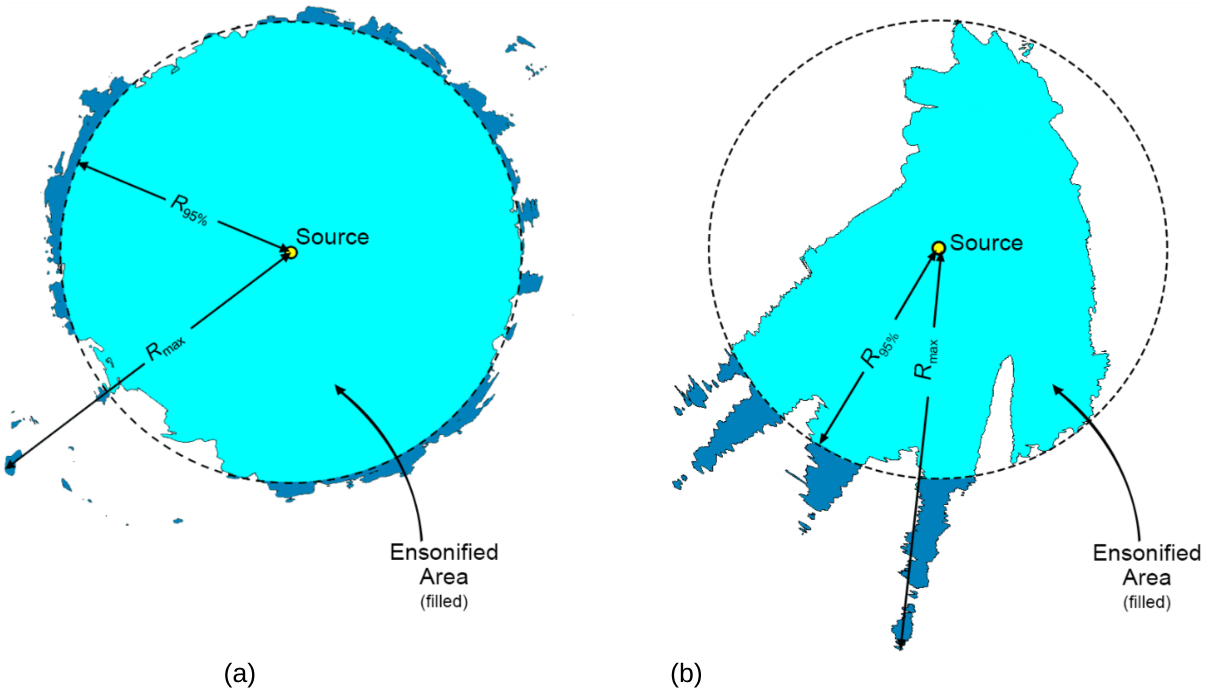


Figure C-1. Sample areas ensonified to an arbitrary sound level with R_{max} and $R_{95\%}$ ranges shown for two different scenarios. (a) Largely symmetric sound level contour with small protrusions. (b) Strongly asymmetric sound level contour with long protrusions. Light blue indicates the ensonified areas bounded by $R_{95\%}$; darker blue indicates the areas outside this boundary which determine R_{max}.

C.2. Estimating SPL from Modelled SEL Results

The per-pulse SEL of sound pulses is an energy-like metric related to the dose of sound received over a pulse's entire duration. The pulse SPL on the other hand, is related to its intensity over a specified time interval. Seismic pulses typically lengthen in duration as they propagate away from their source, due to seafloor and surface reflections, and other waveguide dispersion effects. The changes in pulse length, and therefore the time window considered, affect the numeric relationship between SPL and SEL. This study has applied a fixed window duration to calculate SPL (T_{fix} = 125 ms; see Appendix A.1), as implemented in Martin et al. (2017b). Full-waveform modelling was used to estimate SPL, but this type of modelling is computationally intensive, and can be prohibitively time consuming when run at high spatial resolution over large areas.

For the current study, FWRAM (Appendix B.2.2) was used to model synthetic seismic pulses over the frequency range 5–2048 Hz. This was performed along all broadside and endfire radials at three sites. FWRAM uses Fourier synthesis to recreate the signal in the time domain so that both the SEL and SPL from the source can be calculated. The differences between the SEL and SPL were extracted for all ranges and depths that corresponded to those generated from the high spatial-resolution results from MONM. A 125 ms fixed time window positioned to maximize the SPL over the pulse duration was applied. The resulting SEL -to-SPL offsets were averaged in 0.02 km range bins along each modelled radial and depth, and the 90th percentile was selected at each range to generate a generalised range-dependent conversion function for each site. The range- dependent conversion function was averaged between the two sites and applied to predicted per-pulse SEL results from MONM to model SPL values. Figures D-2–D-4 show the conversion offsets for Sites 1, 3, 4, 6 and 7; the spatial variation is caused by changes in the received airgun pulse as it propagates from the source.

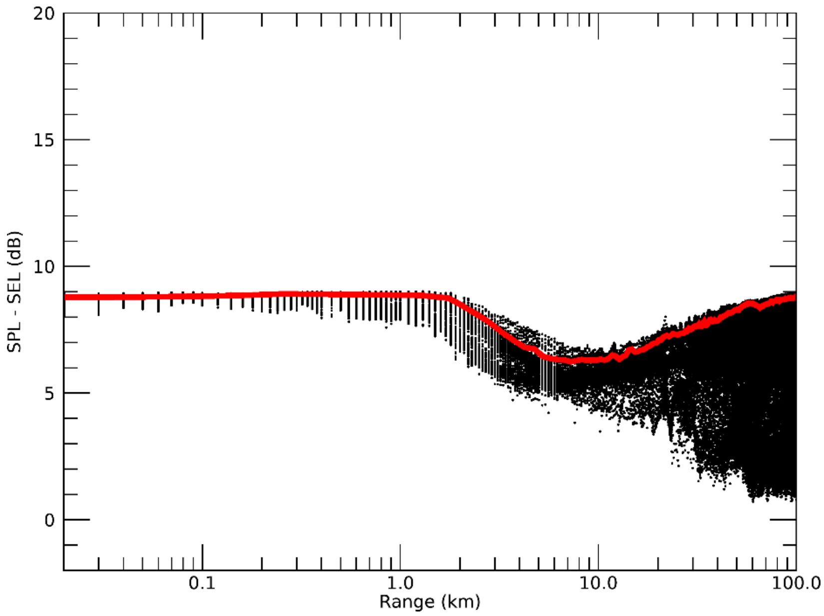


Figure C-2. *Site 1*: Range-and-depth-dependent conversion offsets for converting SEL to SPL for seismic pulses. Slices are shown for the 4130 in^3 seismic source. Black lines are the modelled differences between SEL and SPL across different radials and receiver depths; the solid red line is the 90th percentile of the modelled differences at each range.

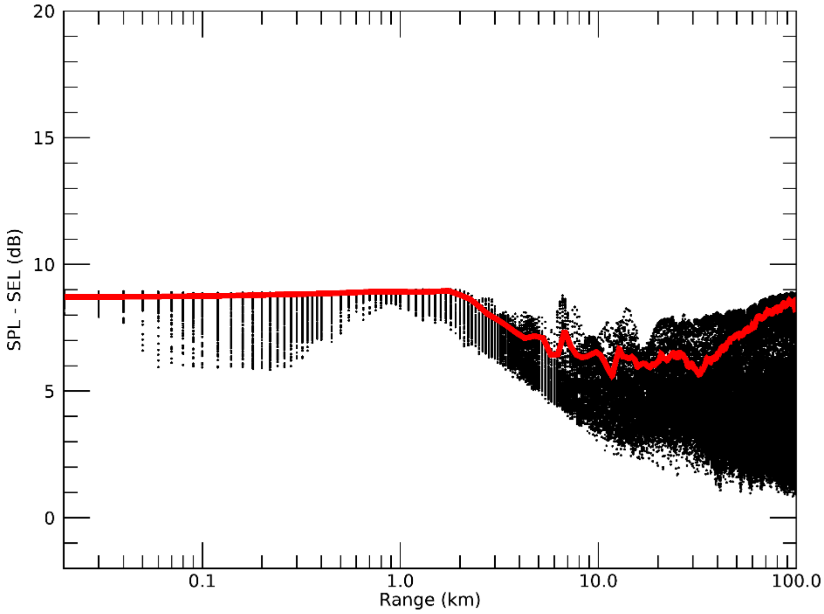


Figure C-3. *Site 3*: Range-and-depth-dependent conversion offsets for converting SEL to SPL for seismic pulses. Slices are shown for the 4130 in^3 seismic source. Black lines are the modelled differences between SEL and SPL across different radials and receiver depths; the solid red line is the 90th percentile of the modelled differences at each range.

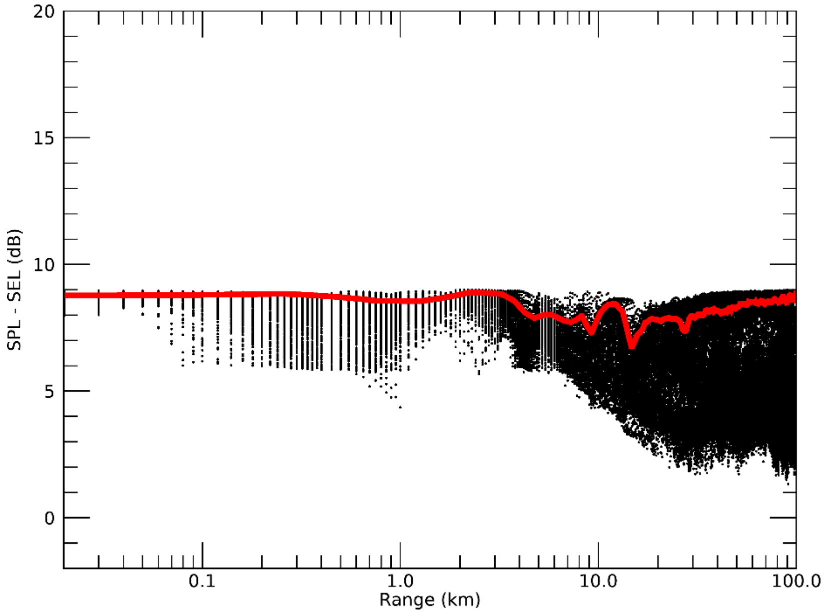


Figure C-4. *Site 4*: Range-and-depth-dependent conversion offsets for converting SEL to SPL for seismic pulses. Slices are shown for the 4130 in^3 seismic source. Black lines are the modelled differences between SEL and SPL across different radials and receiver depths; the solid red line is the 90th percentile of the modelled differences at each range.

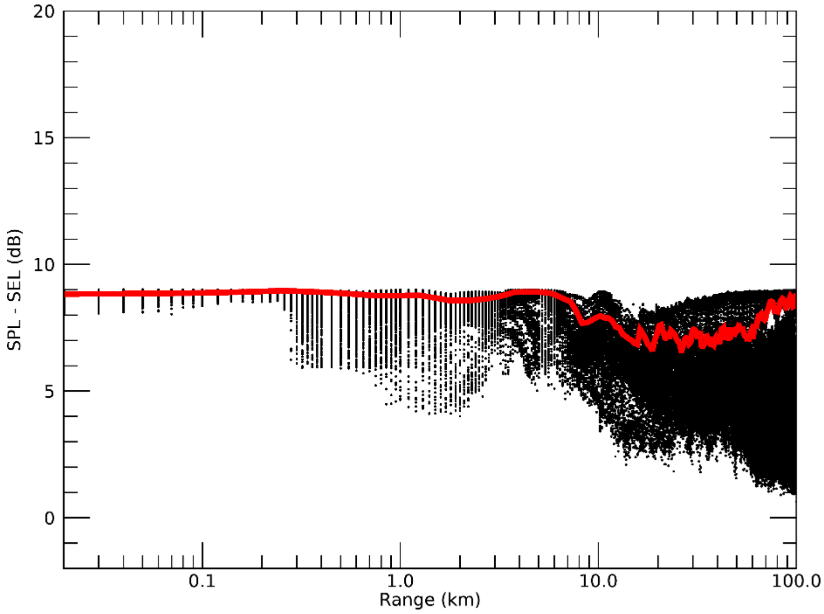


Figure C-5. *Site 6*: Range-and-depth-dependent conversion offsets for converting SEL to SPL for seismic pulses. Slices are shown for the 4130 in^3 seismic source. Black lines are the modelled differences between SEL and SPL across different radials and receiver depths; the solid red line is the 90th percentile of the modelled differences at each range.

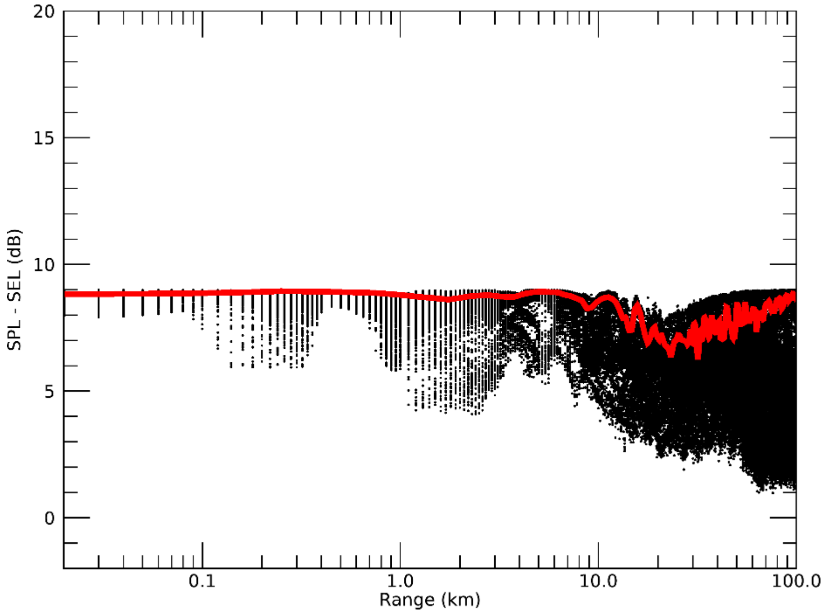


Figure C-6. *Site 7*: Range-and-depth-dependent conversion offsets for converting SEL to SPL for seismic pulses. Slices are shown for the 4130 in^3 seismic source. Black lines are the modelled differences between SEL and SPL across different radials and receiver depths; the solid red line is the 90th percentile of the modelled differences at each range.

C.3. Accumulated SEL Calculation

When there are many seismic pulses, it becomes computationally prohibitive to perform sound propagation modelling for every single event. The distance between the consecutive seismic impulses is small enough, however, that the environmental parameters that influence sound propagation are virtually the same for many impulse points. The acoustic fields can, therefore, be modelled for a subset of seismic pulses and estimated at several adjacent ones. After sound fields from representative impulse locations are calculated, they are adjusted to account for the source position for nearby impulses.

Although estimating the cumulative sound field with the described approach is not as precise as modelling sound propagation at every impulse location, small-scale, site-specific sound propagation features tend to blur and become less relevant when sound fields from adjacent impulses are summed. Larger scale sound propagation features, primarily dependent on water depth, dominate the cumulative field. The accuracy of the present method acceptably reflects those large-scale features, thus providing a meaningful estimate of a wide area SEL field in a computationally feasible framework.

To produce the map of accumulated received sound level distributions and calculate distances to specified sound level thresholds, the maximum-over-depth level was calculated at each sampling point within the modelled region. The radial grids of maximum-over-depth and seafloor sound levels for each impulse were then resampled (by linear triangulation) to produce a regular Cartesian grid. The sound field grids from all impulses were summed (Equation A-5) to produce the cumulative sound field grid with cell sizes of 20 m. The contours and threshold ranges were calculated from these flat Cartesian projections of the modelled acoustic fields. The single-impulse SEL fields were computed over model grids approximately 200 × 200 km in range, which encompasses the full area of the cumulative grid (the entire survey area).

The unweighted (fish and turtles) and frequency-weighted (mammals) SEL_{24h} results were rendered as contour maps, including contours that focus on the relevant criteria-based thresholds. Only contours at ranges larger than the nearfield of the seismic source were rendered.

C.4. Environmental Parameters

C.4.1. Bathymetry

Water depths throughout the modelled area were extracted from the Australian Bathymetry and Topography Grid, a 9 arc-second grid rendered for Australian waters (Whiteway 2009) for the region shown in Figure 1. Bathymetry data were extracted and re-gridded onto a Universal Transverse Mercator (UTM) coordinate projection (Zone 50) with a regular grid spacing of 100 × 100 m to generate the bathymetry in Figure C-7.

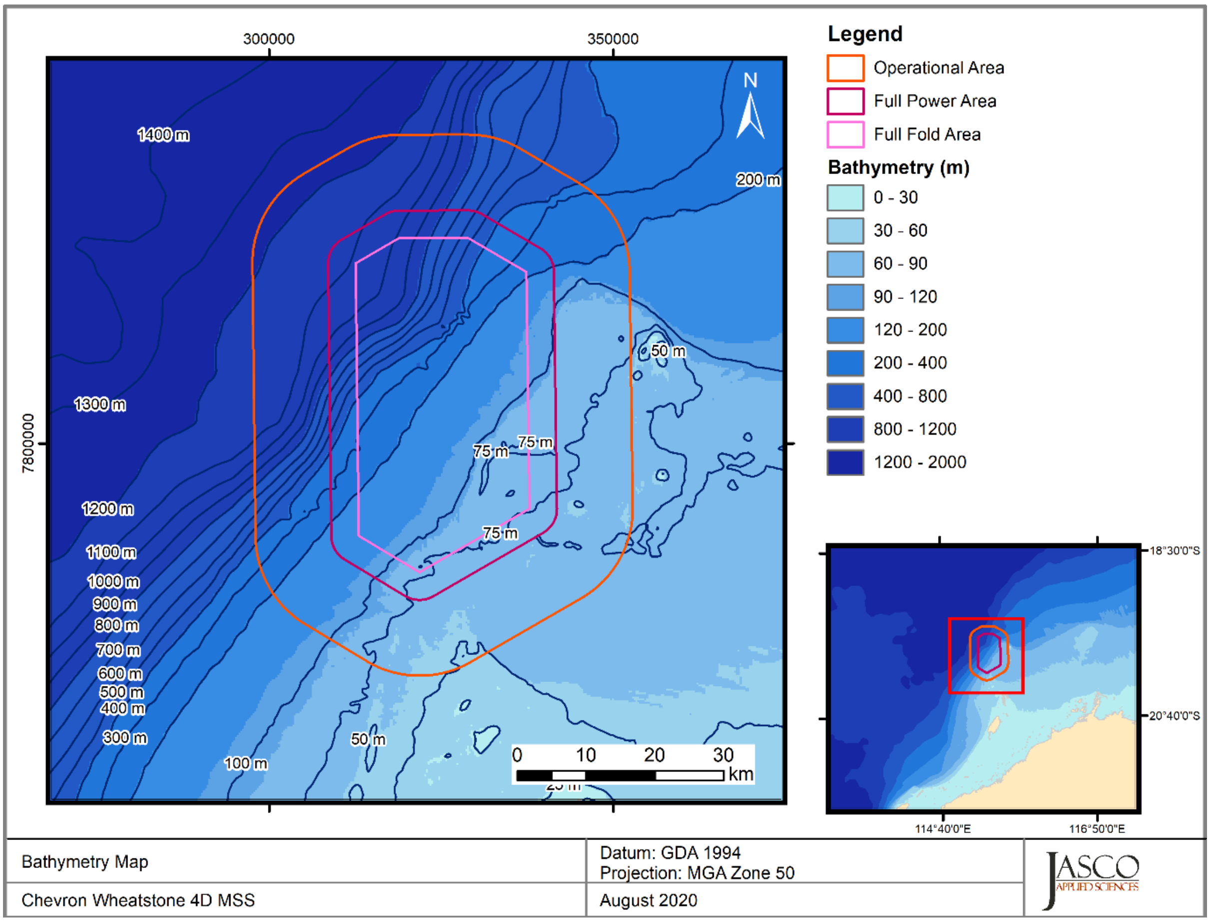


Figure C-7. Map of the modelling area presenting the variation in water depth.

C.4.2. Sound speed profile

The sound speed profiles for the modelled sites were derived from temperature and salinity profiles from the U.S. Naval Oceanographic Office's Generalized Digital Environmental Model V 3.0 (GDEM; Teague et al. 1990, Carnes 2009). GDEM provides an ocean climatology of temperature and salinity for the world's oceans on a latitude-longitude grid with 0.25° resolution, with a temporal resolution of one month, based on global historical observations from the U.S. Navy's Master Oceanographic Observational Data Set (MOODS). The climatology profiles include 78 fixed depth points to a maximum depth of 6800 m (where the ocean is that deep). The GDEM temperature-salinity profiles were converted to sound speed profiles according to Coppens (1981).

Mean sound speed profiles for November to May (operational time) were derived from the GDEM profiles within a 100 km box radius encompassing all modelling sites. The sound speed profile in May is expected to be most favourable to longer-range sound propagation during the proposed survey time frame due to a slight upward refracting profile in the upper 50 m. As such, May was selected for sound propagation modelling to ensure precautionary estimates of distances to received sound level thresholds. Figure C-8 shows the resulting profile used as input to the sound propagation modelling.

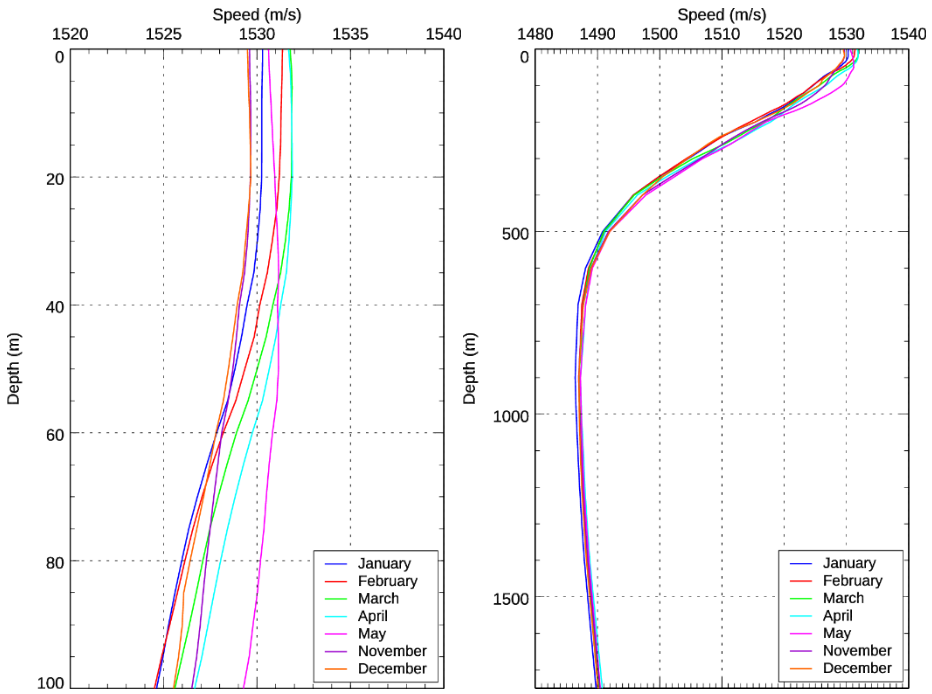


Figure C-8. Monthly averaged sound speed profiles for representative months over the year. The plot on the left shows the top 100 m of water; the plot on the right shows the profiles over the entire water column The profile for May was used in modelling all sound fields. All profiles were calculated from temperature and salinity profiles from GDEM V 3.0 (GDEM; Teague et al. 1990, Carnes 2009).

C.4.3. Geoacoustics

Geoacoustic parameters used for modelled sites at are located within the North West Transition Province (NWT) of the North West Marine Region of Australia (Baker et al. 2008), which is dominated by fine calcareous sand, fine muddy sand and sandy mud. Representative median grain sizes were estimated and used in the grain-shearing model proposed by Buckingham (2005) to predict the geoacoustic parameters for un-lithified (unconsolidated) sediments. Grainsizes were estimated at the seafloor from sedimentary grain size data obtained from the Australian Government's Marine Sediments (MARS) database (Heap 2009), data were queried within the vicinity of the operational area. The grain-shearing model proposed by Buckingham (2005) was used to calculate changes in geoacoustic properties with depth from the seafloor for the un-lithified sedimentary package.

Core information from IODP Cruise 356 (Gallagher et al. 2017) was used to determine the deeper stratigraphy and to estimate the thickness of un-lithified sediment. The geoacoustic parameters from Duncan et al. (2009) were used for the cemented sediments at the bottom of the un-lithified stack. Tables C-1 to C-3 list the parameters used for modelling.

Table C-1. Geoacoustic profile for the Site 1 and Site A. Each parameter varies linearly within the stated range.

Depth below seafloor (m)	Predicted lithology	Density (g/cm^3)	Compressional wave		Shear wave	
			Speed (m/s)	Attenuation (dB/λ)	Speed(m/s)	Attenuation (dB/λ)
0–10	Muddy carbonate sand (unconsolidated)	2.03	1627-1788	0.07-0.69	293.7	3.65
10–20	Increasingly consolidated muddy carbonate sand	2.03	1788-1842	0.69-0.89		
20–45		2.03	1842-1927	0.89-1.10		
>45	Calcarenite (Cemented)	2.4	2800	0.1		

Table C-2. Geoacoustic profile for the Sites 2-3. Each parameter varies linearly within the stated range.

Depth below seafloor (m)	Predicted lithology	Density (g/cm^3)	Compressional wave		Shear wave	
			Speed (m/s)	Attenuation (dB/λ)	Speed(m/s)	Attenuation (dB/λ)
0–10	Muddy carbonate sand (unconsolidated)	2.03	1617-1780	0.07-0.70	293.7	3.65
10–20	Increasingly consolidated muddy carbonate sand	2.03	1780-1833	0.70-0.87		
20–50		2.03	1833-1932	0.87-1.14		
40-400		2.03	1935-2362	1.14-1.97		
>400	Calcarenite (Cemented)	2.4	2800	0.1		

Table C-3. Geoacoustic profile for the Sites 4-7. Each parameter varies linearly within the stated range.

Depth below seafloor (m)	Predicted lithology	Density (g/cm^3)	Compressional wave		Shear wave	
			Speed (m/s)	Attenuation (dB/λ)	Speed(m/s)	Attenuation (dB/λ)
0–10	Carbonate silt (unconsolidated)	1.92	1545-1655	0.05-0.52	195.7	3.65
10–20	Increasingly consolidated carbonate silt	1.92	1655-1690	0.52-0.64		
20–50		1.92	1690-1753	0.64-0.86		
40-400		1.92	1753-2023	0.86-1.55		
>400	Calcarenite (Cemented)	2.4	2800	0.1		

C.5. Seismic Source

The layout of the 4130 in^3 seismic source used for modelling in this study is provided in Figures B.3-9. Details of the airgun parameters are provided in Tables B.3-4.

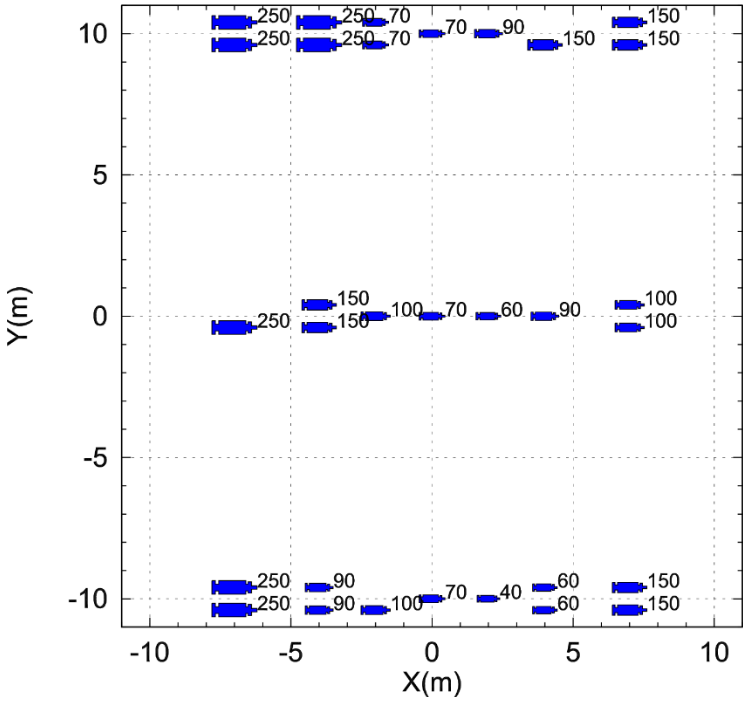


Figure C-9. Layout of the modelled 4130 in^3 array. Tow depth is 5 m. The labels indicate the firing volume (in cubic inches) for each airgun. Also see Table C-4.

Table C-4. Layout of the modelled 4130 in^3 array. Tow depth is 5 m. Firing pressure for all guns is 2000 psi. Also see Figure C-9.

String	Gun	x (m)	y (m)	z (m)	Vol (in^3)	String	Gun	x (m)	y (m)	z (m)	Vol (in^3)	String	Gun	x (m)	y (m)	z (m)	Vol (in^3)
1	1	7	-10.4	5	150	2	1	7	-0.4	5	100	3	1	7	9.6	5	150
	2	7	-9.6	5	150		2	7	0.4	5	100		2	7	10.4	5	150
	3	4	-10.4	5	60		3	4	0	5	90		3	4	9.6	5	150
	4	4	-9.6	5	60		4	2	0	5	60		4	4	10.4	5	spare
	5	2	-10	5	40		5	0	0	5	70		5	2	10	5	90
	6	0	-10	5	70		6	-2	0	5	100		6	0	10	5	70
	7	-2	-10.4	5	100		7	-4	-0.4	5	150		7	-2	9.6	5	70
	8	-2	-9.6	5	spare		8	-4	0.4	5	150		8	-2	10.4	5	70
	9	-4	-10.4	5	90		9	-7	-0.4	5	250		9	-4	9.6	5	250
	10	-4	-9.6	5	90		10	-7	0.4	5	spare		10	-4	10.4	5	250
	11	-7	-10.4	5	250								11	-7	9.6	5	250
	12	-7	-9.6	5	250								12	-7	10.4	5	250

C.5.1. Array Source Levels and Directivity

Figure C-10 shows the broadside (perpendicular to the tow direction), endfire (parallel to the tow direction) and vertical overpressure signature and corresponding power spectrum levels for the 4130 in^3 array (Appendix C.5). Horizontal decidecade-band source levels are shown as a function of band centre frequency and azimuth (Figure C-11).

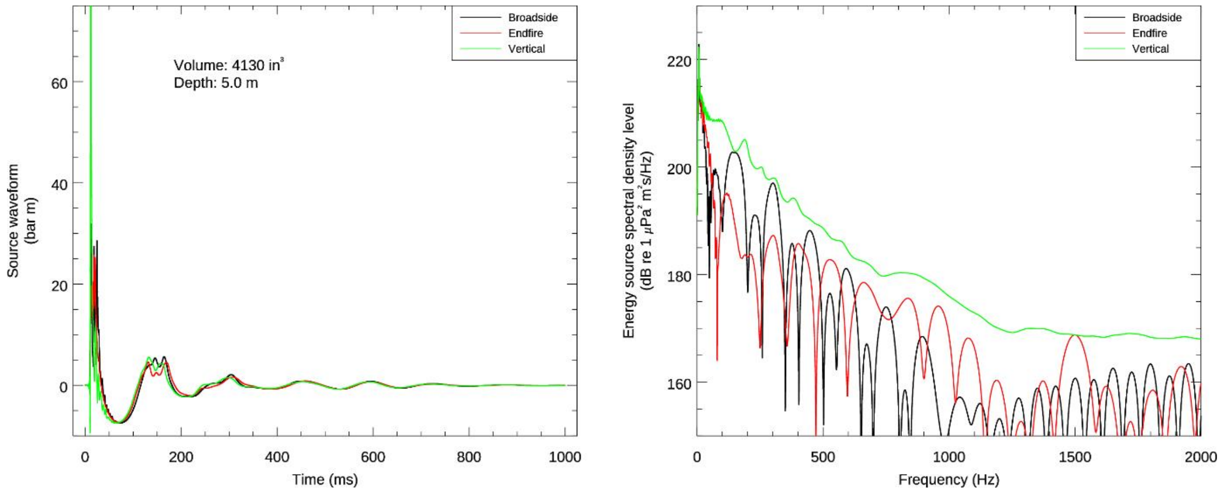


Figure C-10. Predicted source level details for the 4130 in^3 array at 5 m towed depth.(Left) the overpressure signature and (right) the power spectrum for in-plane horizontal (broadside), perpendicular (endfire), and vertical directions (no surface ghost).

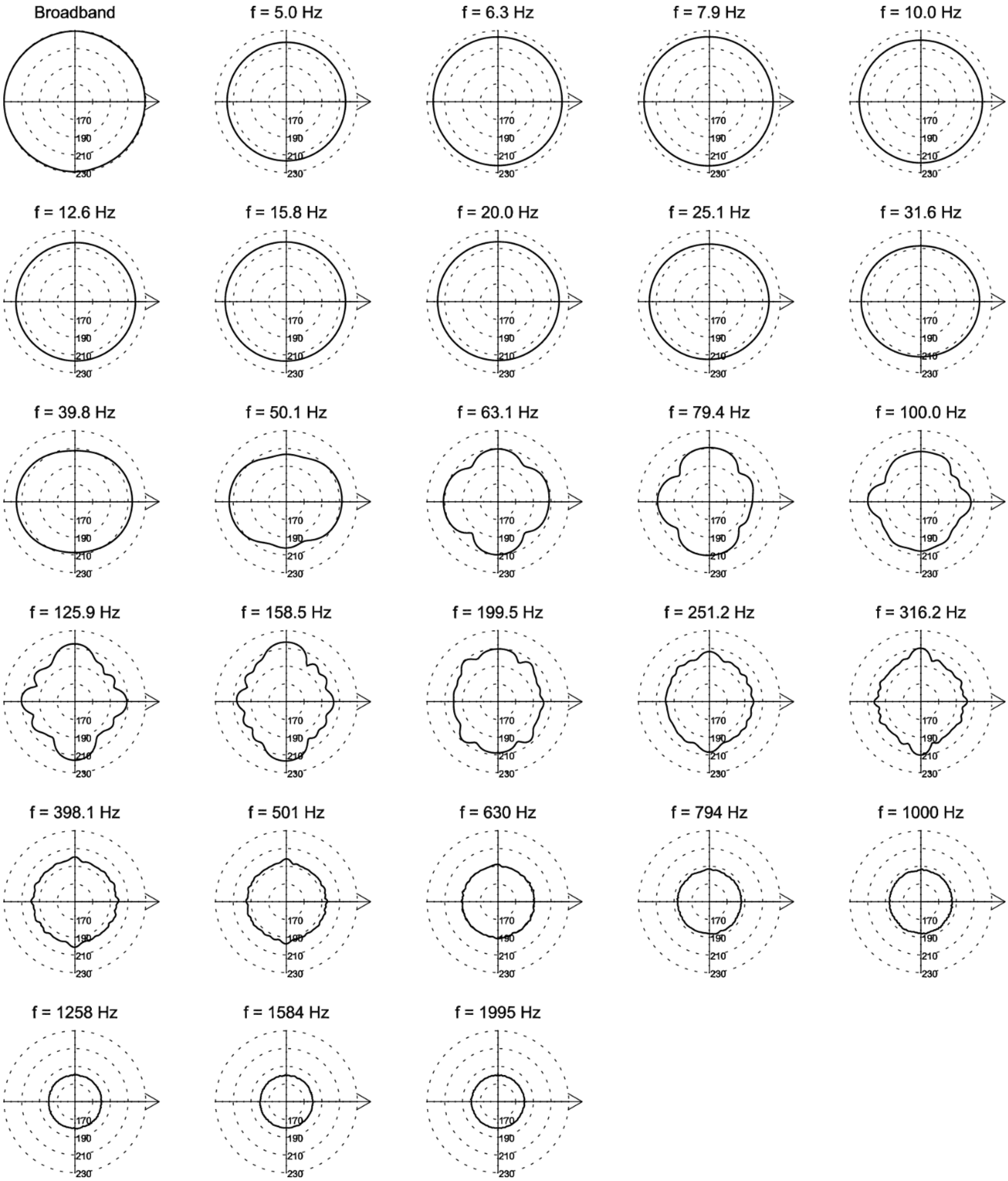


Figure C-11. Directionality of the predicted horizontal source levels for the 4130 in^3 seismic source, 5 Hz to 2 kHz. Source levels (in dB re 1 µPa^2·s m^2) are shown as a function of azimuth for the centre frequencies of the decidecade bands modelled; frequencies are shown above the plots. The perpendicular direction to the frame is to the right. Tow depth is 6 m (see Figure C-10).

Appendix D. Per-Pulse SEL Sound Field Maps

Per-pulse SEL maps for all modelled sites are provided in Figures D-1 through D-8.

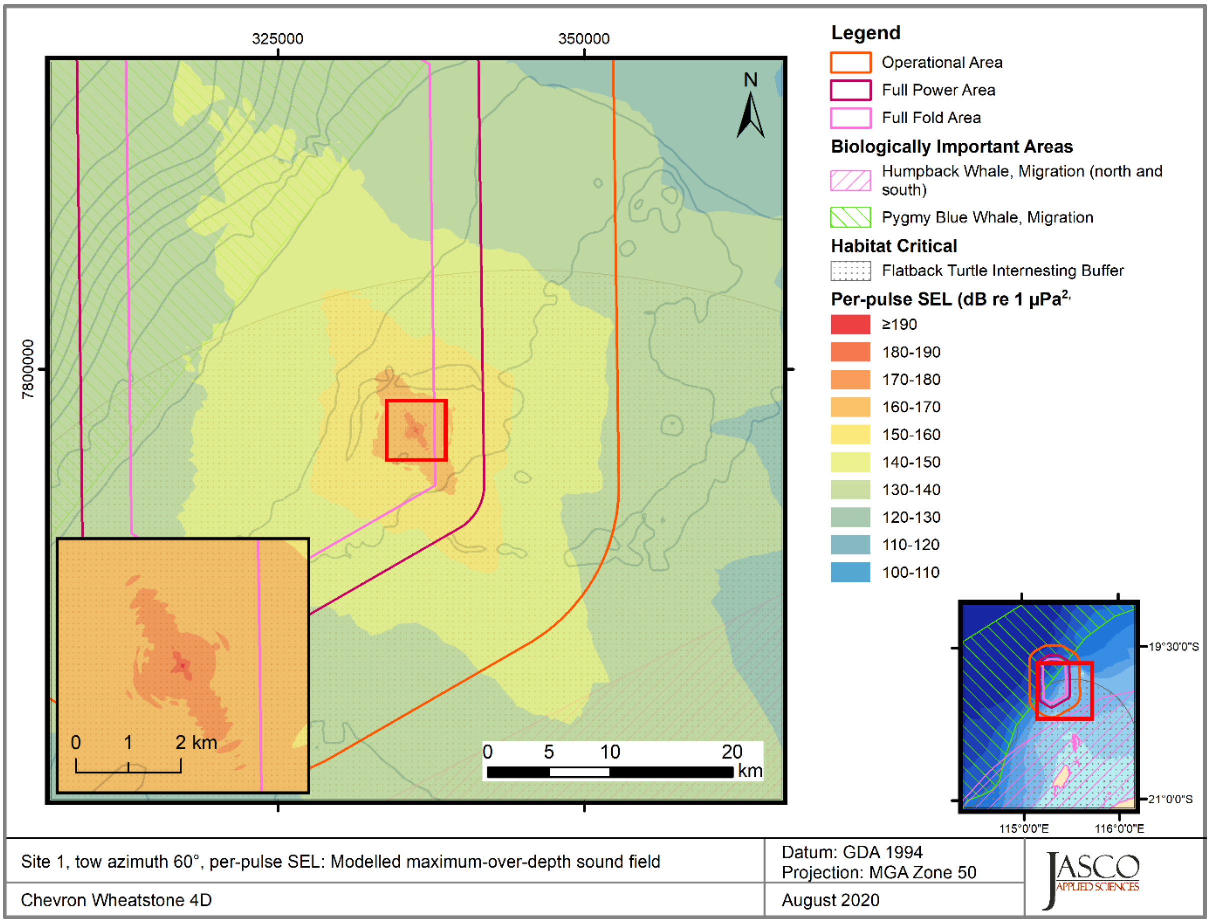
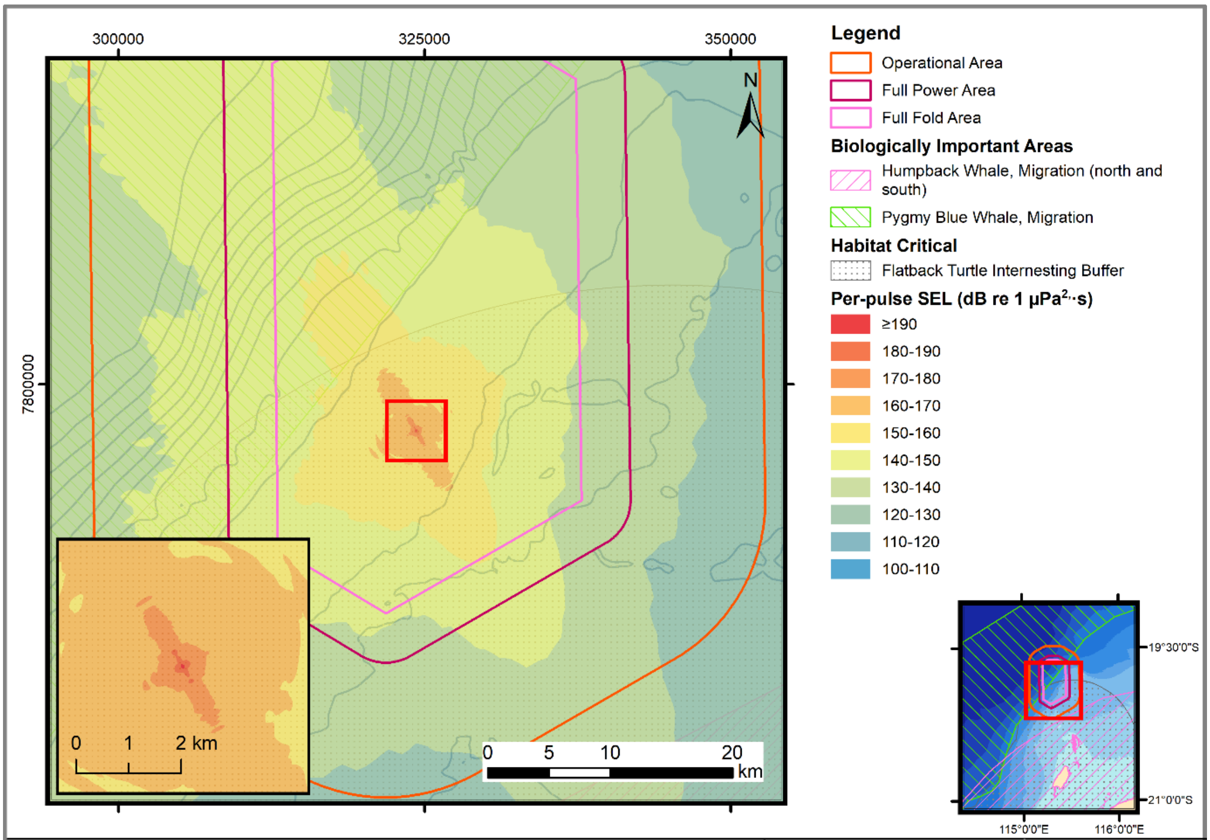


Figure D-1. *Site 1, tow azimuth 60º, per-pulse SEL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleth low-power zone.



Site 2, tow azimuth 60°, per-pulse SEL: Modelled maximum-over-depth sound field	Datum: GDA 1994 Projection: MGA Zone 50	JASCO APPLIED SCIENCES
Chevron Wheatstone 4D	August 2020	

Figure D-2. *Site 2, tow azimuth 60º, per-pulse SEL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleth low-power zone.

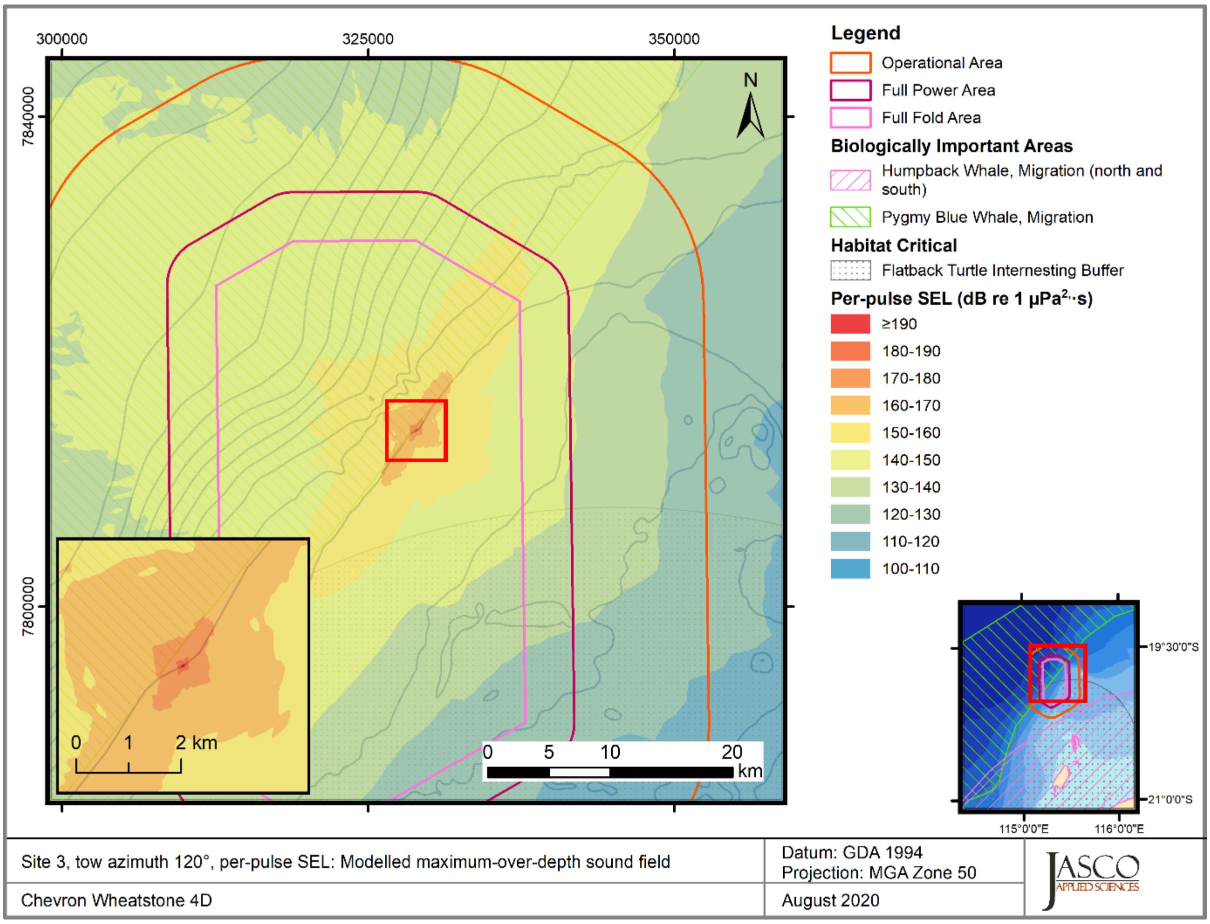


Figure D-3. *Site 3, tow azimuth 120º, per-pulse SEL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleth low-power zone.

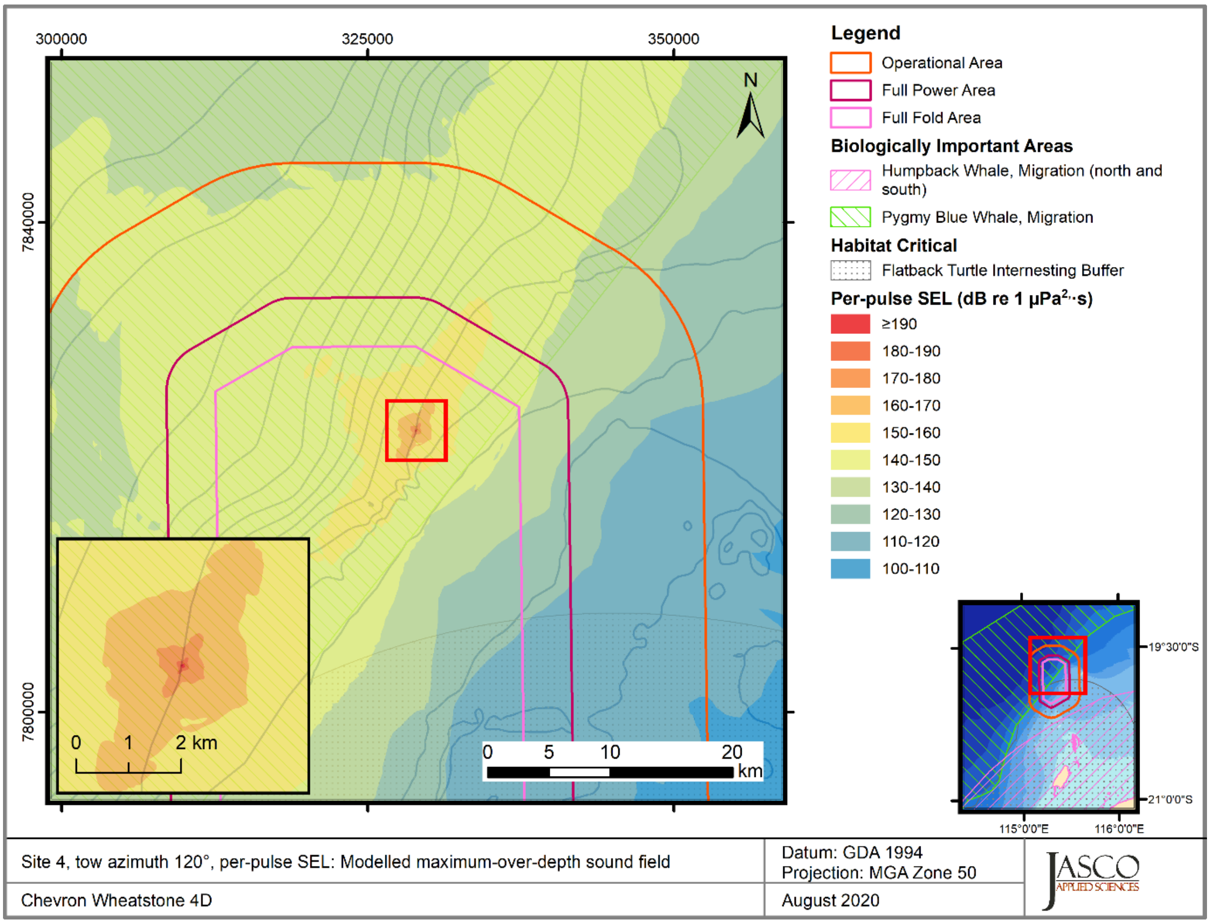
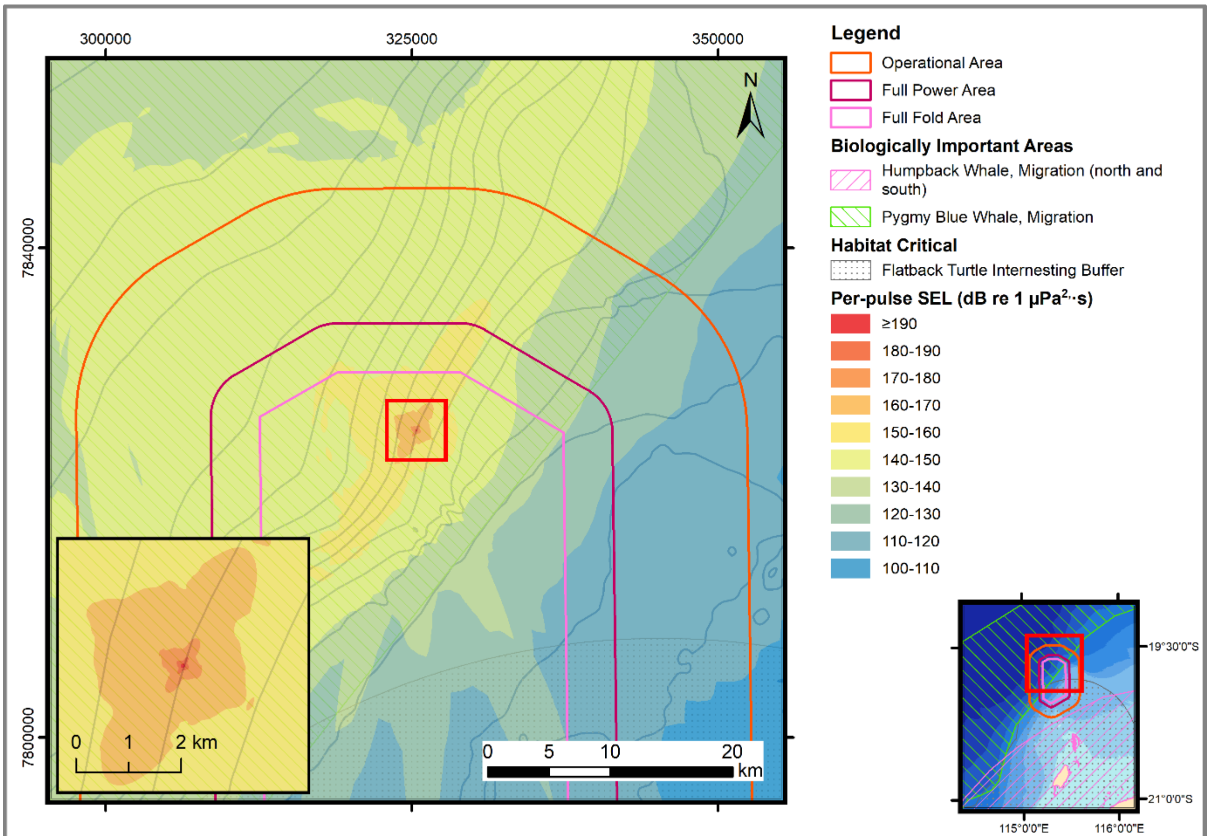


Figure D-4. *Site 4, tow azimuth 120º, per-pulse SEL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleth low-power zone.



Site 5, tow azimuth 120°, per-pulse SEL: Modelled maximum-over-depth sound field	Datum: GDA 1994 Projection: MGA Zone 50	JASCO APPLIED SCIENCES
Chevron Wheatstone 4D	August 2020	

Figure D-5. *Site 5, tow azimuth 120º, per-pulse SEL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleth low-power zone.

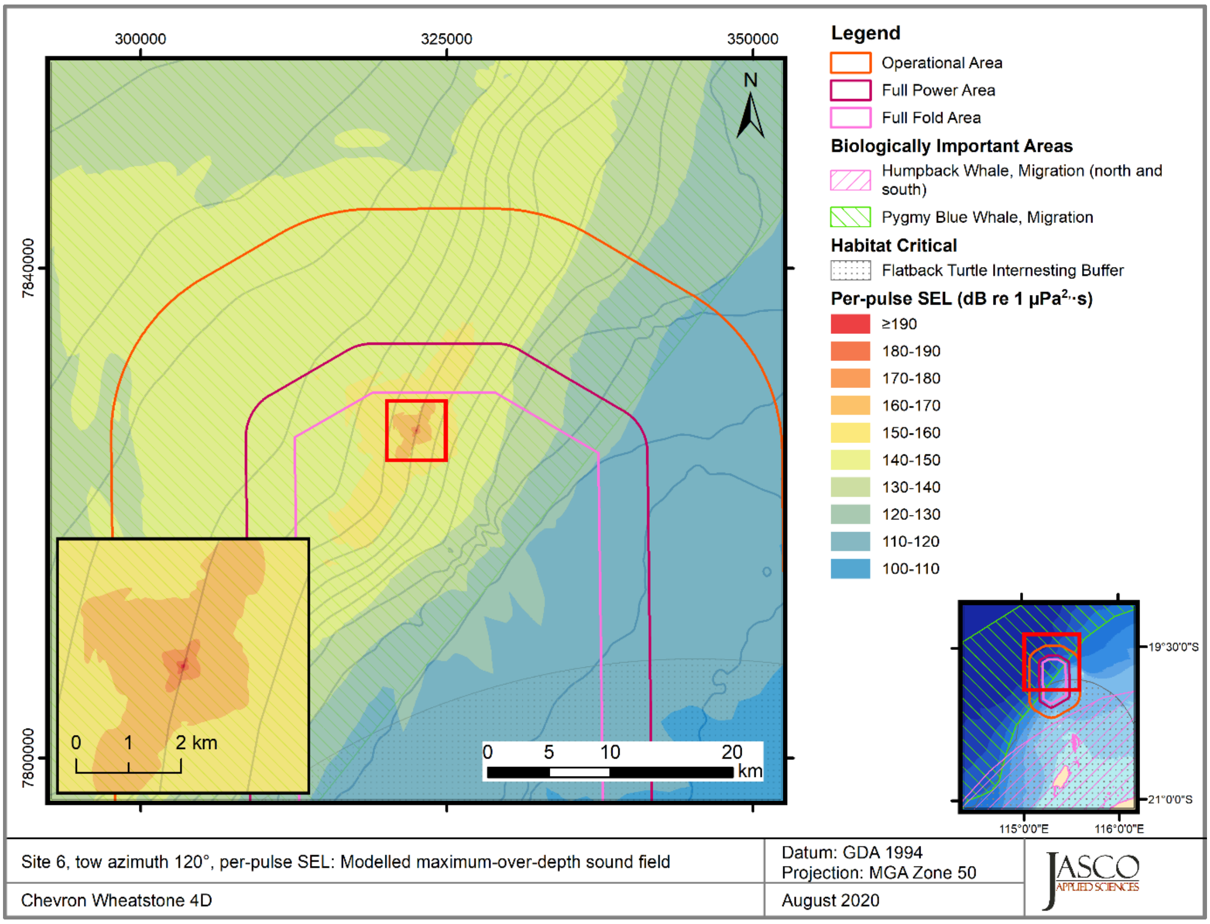


Figure D-6. Site 6, tow azimuth 120º, per-pulse SEL: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleth low-power zone.

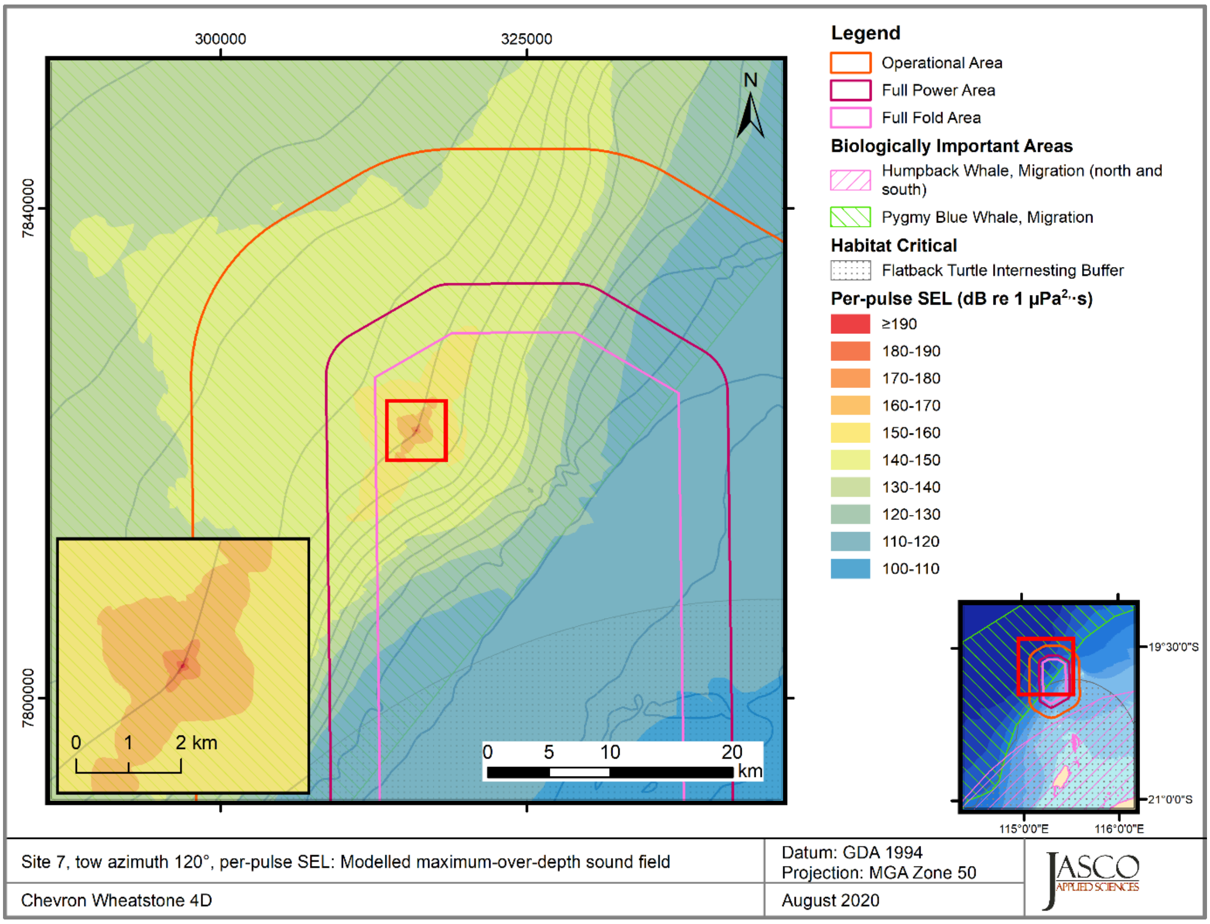


Figure D-7. Site 7, tow azimuth 120º, per-pulse SEL: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleth low-power zone.

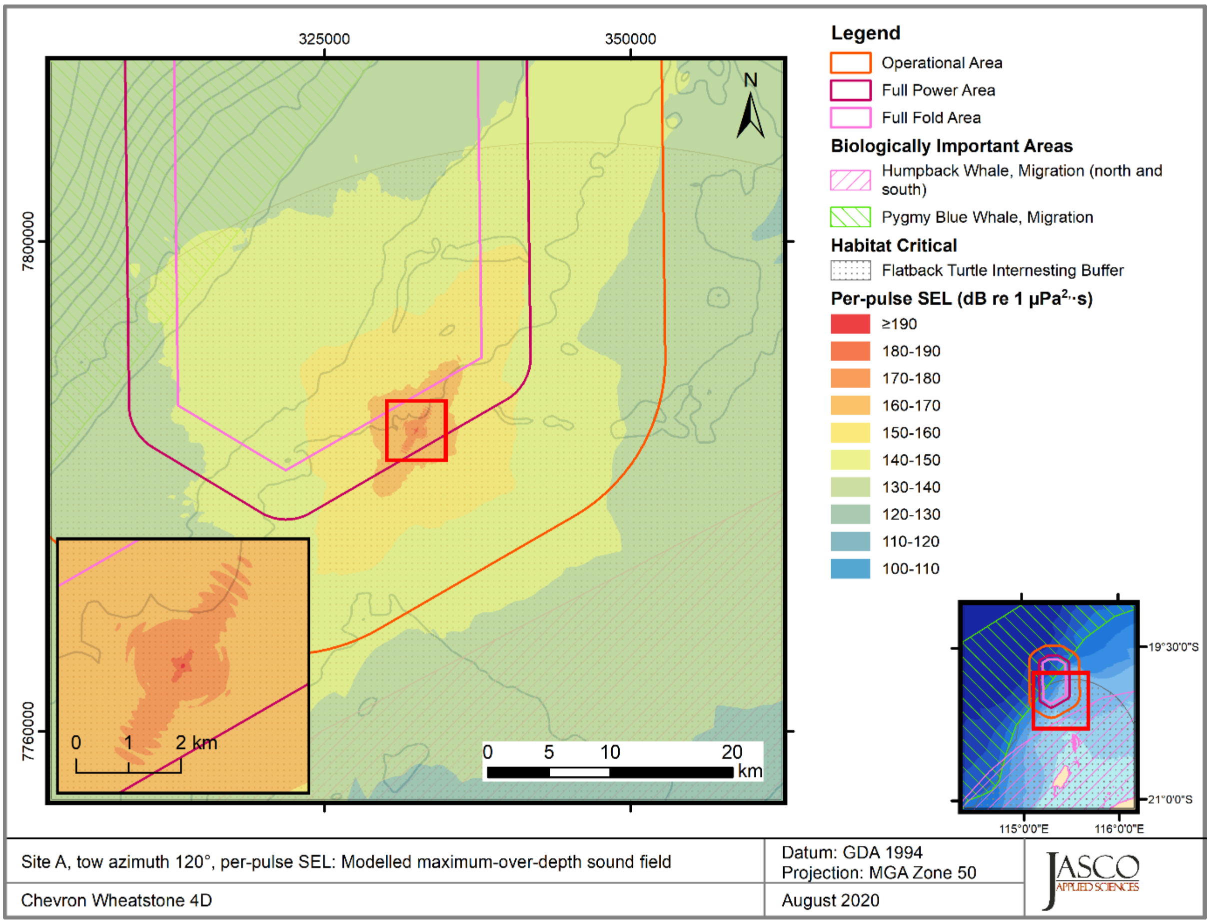


Figure D-8. *Site A, tow azimuth 120º, per-pulse SEL*: Sound level contour map showing the unweighted maximum-over-depth sound field in 10 dB steps, and the isopleth low-power zone.

appendix f pygmy blue whale exposure assessment

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Wheatstone 4D MSS Pygmy Blue Whale Exposure Modelling

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Wheatstone 4D MSS

Pygmy Blue Whale Exposure Modelling

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Wheatstone 4D Survey

Pygmy Blue Whale Exposure Modelling

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Executive Summary

JASCO Applied Sciences performed an acoustic exposure analysis study of pygmy blue whales near a migratory Biologically Important Area (BIA) where it intersected the planned survey operations for the Wheatstone 4D Marine Seismic Survey (MSS). Previously, acoustic modelling was conducted for this survey to determine ranges to acoustic exposure thresholds representing the best available science for potential injury, impairment and behavioural reactions of marine fauna including marine mammals, turtles, and fish (Matthews et al. 2020).

The aim of the present study was to employ animal movement (animat) modelling simulations in conjunction with these previously computed three-dimensional sound fields to predict the range at which pygmy blue whales are expected to be exposed above threshold criteria for permanent threshold shift (PTS), temporary threshold shift (TTS) and behavioural reponse. To achieve this, the JASCO Animal Simulation Model Including Noise Exposure (JASMINE) was used to integrate the sound fields with species-typical behaviour. JASMINE results provide a probabilistic estimate of sound exposure, which can be compared to acoustic thresholds to determine ranges.

Animat modelling focussed on migrating pygmy blue whales in the migratory BIA. The behaviour of pygmy blue whales (*Balaenoptera musculus brevicauda*) was modelled with a migration bias of 38 degrees during the north bound migration and reversed 180 degrees for modelling the south bound migration. The two behaviours observed during migration (migratory dives and exploratory dives) were modelled together, and the model did not include any potential aversion. Both of these approaches were chosen to present conservative results due to the limited data available.

To generate statistically reliable probability density functions, and thus range estimates, model simulations were run with animat densities of 2 animats/km^2. The modelling results are not related to real-world density estimates for pygmy blue whales within the migratory BIA, as the number of animals potentially exposed is not calculated.

Two exposure modelling scenarios were simulated, with each simulation run for a period of 5 days. On each day, a 24 hour segment of the planned seismic track lines was run. Using the distribution of ranges of animats predicted to be exposed to sound levels above threshold, the 95th percentile exposure range ($ER_{95\%}$) was computed. Noise effect metrics included peak pressure level (PK), sound exposure levels (SEL), and sound pressure level (SPL), The results of the animat analysis predicted that the $ER_{95\%}$ of migrating pygmy blue whales potentially exposed to sound levels above the U.S National Marine Fisheries Service (NMFS) (2018) PTS and TTS criteria were up to 0.06 km and 12.50 km, respectively, considering both PK and SEL_{24h} metrics. For both PTS and TTS, the maximum $ER_{95\%}$ to SEL threshold was greater than the maximum $ER_{95\%}$ to PK threshold. The maximum $ER_{95\%}$ for exposures above the U.S. National Oceanic and Atmospheric Administration (NOAA) (2019) behavioural threshold was 12.43 km.

The estimated 95th percentile ranges for all scenarios were lower than comparable ranges to threshold reported in Matthews et al. (2020). This was expected because previous modelling efforts did not incorporate both moving sources and moving receivers, but rather assumed that, as per the NMFS (2018) criteria, SEL_{24h} is a cumulative metric that reflects the dosimetric effect of noise levels within 24 hours considering that an animal is consistently exposed to such noise levels at a fixed position.

1. Introduction

JASCO Applied Sciences (JASCO), performed an acoustic exposure analysis study for pygmy blue whales (*Balaenoptera musculus brevicauda*) in association with the planned Wheatstone 4D Marine Seismic Survey (MSS) within the pygmy blue whale migration Biologically Important Area (BIA).

This report describes the modelled predictions of sound levels that individual pygmy blue whales may receive during the seismic survey. 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. This approach provides the most realistic prediction of the maximum expected root-mean-square sound pressure level (SPL, L_p), peak pressure level (PK, L_{pk}), and the temporal accumulation of sound exposure level (SEL, L_E) that are now considered the most relevant sound metrics for the assessment of effects. The most recent science in the peer-reviewed literature regarding sound propagation and animal movement modelling was used.

Matthews et al. (2020) conducted a detailed sound modelling study, and the resulting sound fields were used to predict animat sound exposures. The acoustic modelling locations from that study that were used in the current analysis are provided in Table 1.

Table 1. Location details for the single impulse modelled sites reported in Matthews et al. (2020).

Site	Latitude (S)	Longitude (E)	UTM Zone 50		Water depth (m)	Tow direction (°)
			X (m)	Y (m)		
1	19° 56' 03.3456" S	115° 26' 08.5946" E	336285	7795031	82	60
2	19° 55' 21.1646" S	115° 19' 17.9753" E	324332	7796213	126	
3	19° 45' 32.2431" S	115° 22' 01.9962" E	328926	7814368	200	
2	19° 55' 21.1646" S	115° 19' 17.9753" E	324332	7796213	126	120
3	19° 45' 32.2431" S	115° 22' 01.9962" E	328926	7814368	200	
4	19° 40' 51.5469" S	115° 22' 06.4766" E	328974	7823000	400	
5	19° 39' 42.2812" S	115° 20' 02.9133" E	325354	7825095	600	
6	19° 38' 47.8390" S	115° 18' 25.4959" E	322500	7826741	800	
7	19° 41' 24.5095" S	115° 14' 39.2009" E	315957	7821857	1000	

2. Exposure Modelling Scenarios

For the planned Wheatstone 4D MSS, source and propagation modelling were conducted (Matthews et al. 2020) to generate sound fields which are used in conjunction with animal movement modelling. Separate exposure modelling scenarios were simulated for both Scenario 1 and Scenario 2 . Each of the scenarios considered a total of 5 days of survey tracks. The migratory BIA partially overlaps the Scenario 2 tracks, while the Scenario 1 tracks are located completely outside the BIA. Simulated animats are seeded only within the BIA to represent the spatial distribution of this species. Exposure modelling simulation extents and animat seeding area are shown in Figure 1.

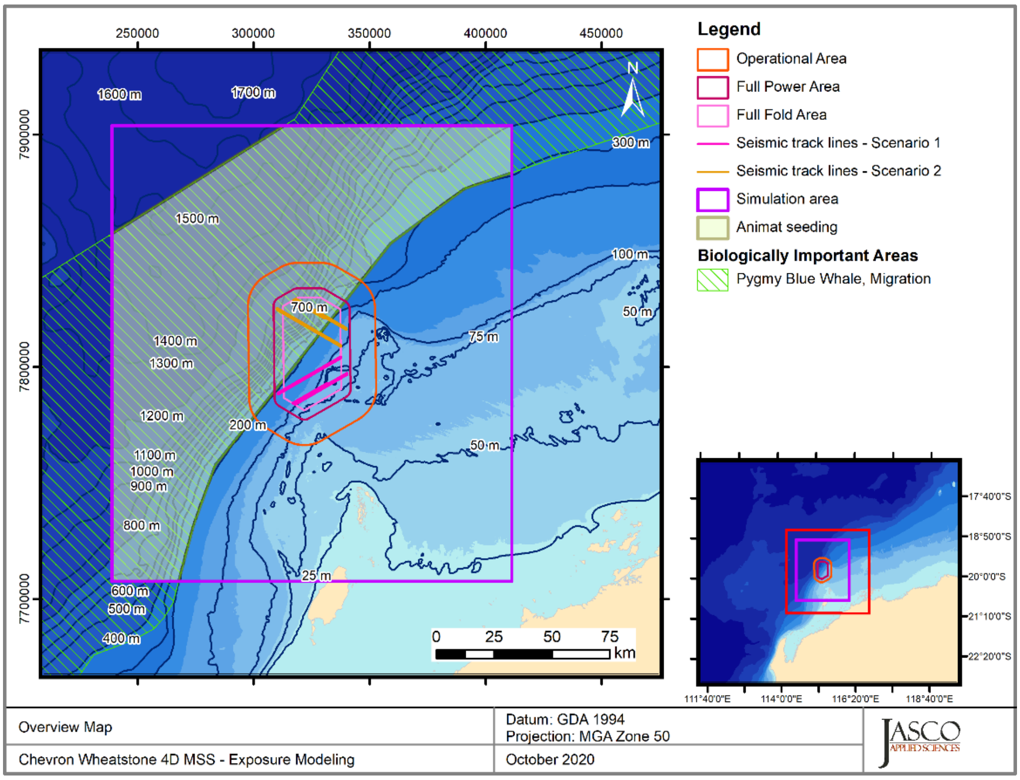

Figure 1. Animat modelling simulation extent, BIA seeding area, and modelled source tracks.

3. Noise Effect Criteria

The noise effect criteria which were considered for pygmy blue whales during acoustic modelling included metrics related to the behavioural response and impairment of pygmy blue whales (SPL, SEL, and PK). The acoustic modelling report, Matthews et al. (2020), provides further details on the noise effect criteria (Matthews et al. 2020). The acoustic metrics in this report reflect the updated ISO standard for acoustic terminology, ISO/DIS 18405.2:2017 (2017).

The noise criteria considered are:

1. Peak pressure levels (PK; L_{pk}) and frequency-weighted accumulated sound exposure levels (SEL; $L_{E,24h}$) from the US National Oceanic and Atmospheric Administration (NOAA) Technical Guidance (NMFS 2018) for the onset of Permanent Threshold Shift (PTS) and Temporary Threshold Shift (TTS) in marine mammals (Table 2).
2. Marine mammal behavioural threshold based on the NOAA (2019) criterion of 160 dB re 1 µPa SPL (L_p) for impulsive sound sources (Table 2).

Table 2. Unweighted SPL and PK, and weighted SEL_{24h} thresholds for acoustic effects on marine mammals.

Hearing group	NOAA (2019)	NMFS (2018)			
	Behaviour	PTS onset thresholds* (received level)		TTS onset thresholds* (received level)	
	SPL (L_p; dB re 1 µPa)	Weighted SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²·s)	PK (L_{pk}; dB re 1 µPa)	Weighted SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²·s)	**PK** (L_{pk}; dB re 1 µPa)
Low-frequency cetaceans	160	183	219	168	213
Mid-frequency cetaceans		185	230	170	224
High-frequency cetaceans		155	202	140	196

* Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating PTS and TTS onset.
L_p–denotes sound pressure level period and has a reference value of 1 µPa.
L_{pk}, flat–peak sound pressure is flat weighted or unweighted and has a reference value of 1 µPa.
L_E - denotes cumulative sound exposure over a 24-hour period and has a reference value of 1 µPa²s.
Subscripts indicate the designated marine mammal auditory weighting.

4. Methods

4.1. Animal Movement and Exposure Modelling

The JASCO Animal Simulation Model Including Noise Exposure (JASMINE) was used to predict the exposure of animats (virtual marine mammals) to sound arising from the seismic activity. Sound exposure models like JASMINE integrate the predicted sound field with biologically meaningful movement rules for each marine mammal species (here: pygmy blue whales) that result in an exposure history for each animat in the model. In JASMINE, the sound received by the animats is determined by the proposed seismic activity. As illustrated in Figure 2, animats are programmed to behave like the marine animals that may be present in the area. The parameters used for forecasting realistic behaviours (e.g., diving and foraging depth, swim speed, surface times) are determined and interpreted from marine mammal studies (e.g., tagging studies) where available, or reasonably extrapolated from related or comparable species. An individual animat's sound exposure levels are summed over a specified duration, to determine its total received energy, and then compared to the threshold criteria. For PK and SPL metrics, the maximum exposure is evaluated against single impulse threshold criteria. For additional information on JASMINE, see Appendix A.

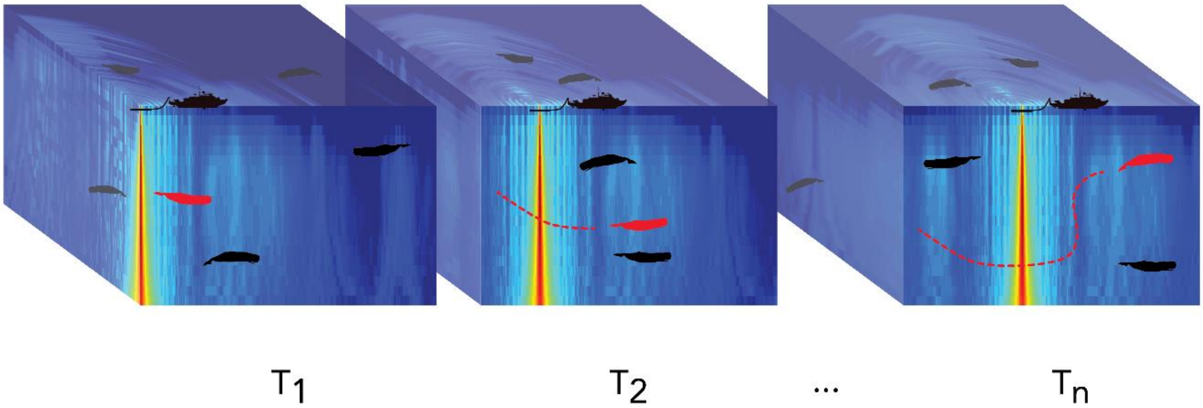

Figure 2. Cartoon of animats in a moving sound field. Example animat (red) shown moving with each time step (Tx). The acoustic exposure of each animat is determined by where it is in the sound field, and its exposure history is accumulated as the simulation steps through time.

The exposure criteria for impulsive sounds (described in Section 3) were used to determine the number of animats exceeding thresholds. To generate statistically reliable probability density functions, model simulations were run with animat densities of 2 animats/km^2, as this increases the probability of encounter, and thus more robust exposure range estimates. The modelling results are not related to real-world density estimates for pygmy blue whales within the migratory BIA, as the number of animals potentially exposed is not calculated. To evaluate PTS, TTS and behavioural response, exposure results were obtained using detailed behavioural information for migrating pygmy blue whales (described in Section 4.2). The simulation was run for a representative period of 5 days for each modelling scenario, with the spatial distribution of animats restricted to the BIA.

The seismic source was modelled as a vessel towing an airgun array at a speed of 4.5 knots, with each of the two arrays emitting sound every 37.5 m, resulting in an overall inter-pulse-interval of 18.75 m. The simulated source track followed a racetrack configuration with a turn distance of 7.5 km. At the time and location of each seismic pulse, the modelled source location with the most similar water depth was selected for exposure modelling. The track lines for each scenario along with the acoustic modelling locations are shown in Figure 3. Note that the Scenario 2 aquisition lines partially overlap the BIA area while the closest point of approach of the Scenario 1 aquisition lines is approximately 1.3 km. The acquisition lines used for exposure modelling were selected to match those used in the 24 h SEL modelling (Matthews et al. 2020). The same 24 h track segments were run for 5 consecutive days to provide a larger sample size, and thus enable more robust statistical sampling.

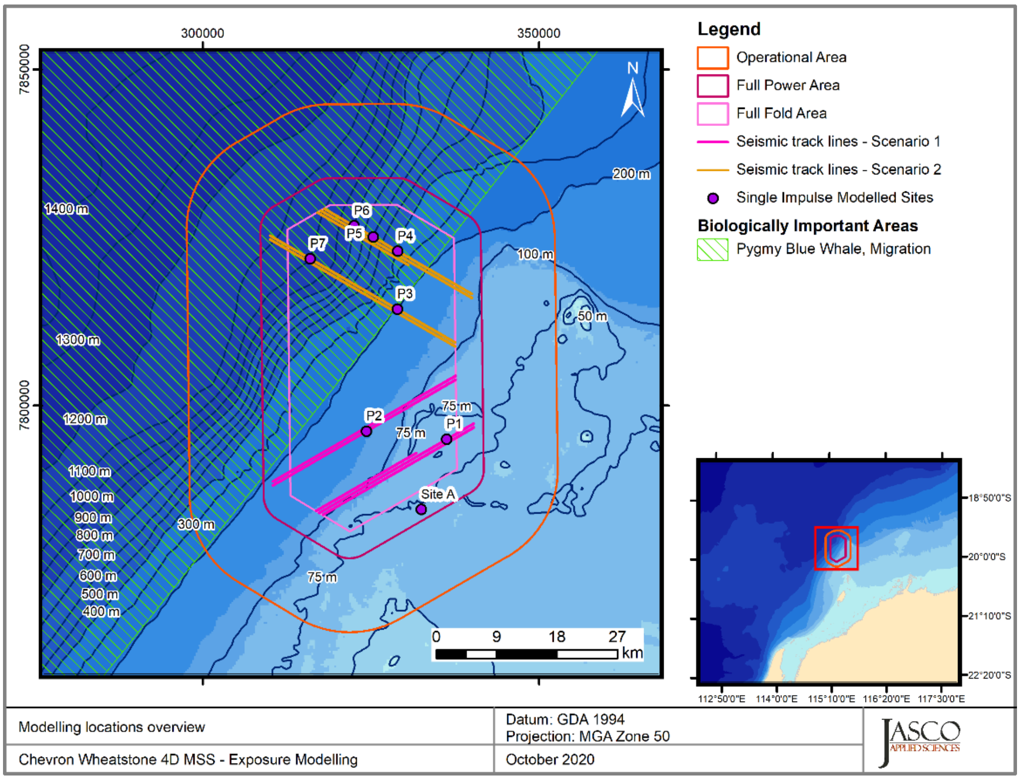

Figure 3. Seismic source tracks used in Scenarios 1 and 2, modelled acoustic source locations, and the BIA seeding area for migratory pygmy blue whales.

4.1.1. Exposure-based range estimation

The results from the animal movement and exposure modelling provided a way to estimate ranges to effect thresholds. The range to the closest point of approach (CPA) for each of the animats was recorded. The $ER_{95\%}$ (95% Exposure Range) is the horizontal range that includes 95% of the animat CPAs that exceeded a given effect threshold (Figure 4). Within the $ER_{95\%}$ range, there are generally some proportion of animats that do not exceed threshold criteria. The probability that an animat is exposed above threshold within the $ER_{95\%}$ is provided in the results tables.

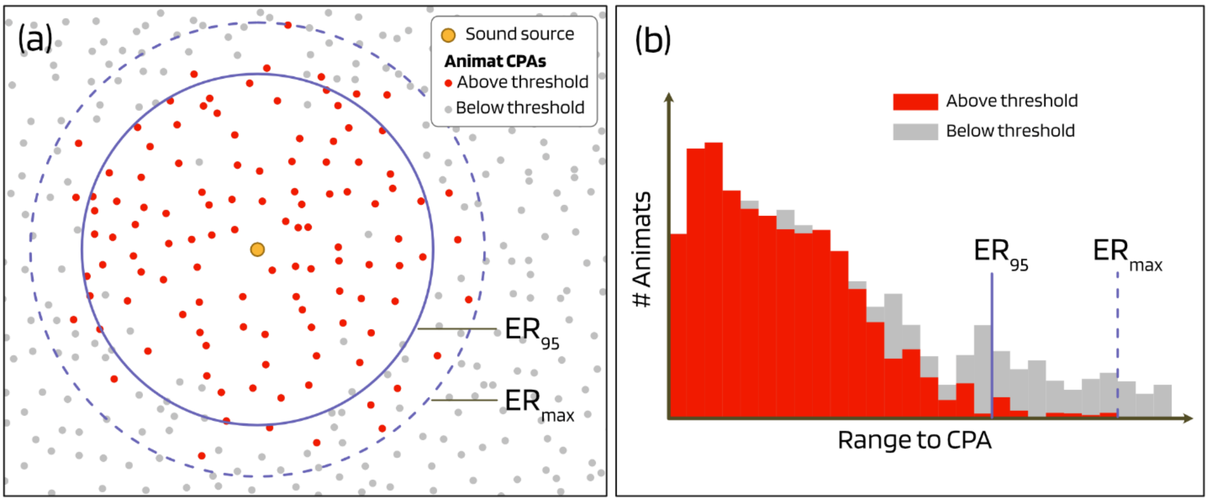

Figure 4. Example distribution of animat closest points of approach (CPAs). Panel (a) shows the horizontal distribution of animats near a sound source. Panel (b) shows the distribution of ranges to animat CPAs from Panel (a). The 95% and maximum exposure ranges ($ER_{95\%}$ and ER_{max}) are indicated in both panels, thus indicating the proportion of animats above and below threshold relative to their range to CPA.

4.2. Pygmy blue whales

4.2.1. Animal behaviour

Detailed information on pygmy blue whales (*Balaenoptera musculus brevicauda*) was derived from a range of sources which utilised multi-sensor tags to record fine-scale diving and movement behaviour (Double et al. 2014, Owen et al. 2016). These tags typically record the depth of the animal along with various movement parameters such as swimming speed and the orientation of the body.

Owen et al. (2016) equipped a sub-adult pygmy blue whale with a multi-sensor tag off Western Australia. They identified dives for their tagged animal as migratory, feeding, or exploratory (i.e. no lunges recorded which would indicate feeding). Pygmy blue whales in the simulation area are presumed to be migrating, and so feeding was not included in the model. Exploratory dives were considered to be part of migratory behaviour, and so the two dive types were modelled together such that the animats were migrating 95% of the time and engaged in exploratory dives 5% of the time (Owen et al. 2016). The analysis of the dive data showed that the depth of migratory dives was highly consistent over time and unrelated to local bathymetry. The mean depth of migratory dives was 14 ± 4 m while the mean maximum depth of exploratory dives was 107 ± 81 m (23–320 m range).

The behaviour of migrating pygmy blue whales was modelled to reflect the transition of the animats through the modelling area on a diagonal track. This represents the animals migrating along the west coast of Australia to and from Indonesia (Double et al. 2014). Speed of travel during migration (0.65 ± 0.61 m/s) was calculated from 11 pygmy blue whales tagged in this area (Double et al. 2014).

5. Results

A summary of exposure ranges for migrating pygmy blue whales is included in Table 3. Results include $ER_{95\%}$ exposure ranges calculated for the 160 dB behavioral response threshold and for both TTS and PTS PK and SEL thresholds. Each of the two scenarios are reported separately and the ranges to acoustic thresholds from Matthews et al. (2020) are included for comparison.

Table 3. Summary of animat simulation results for migrating pygmy blue whales. The 95th percentile exposure ranges ($ER_{95\%}$) in km and probability of animats being exposed above threshold within the $ER_{95\%}$ are provided. For comparison, maximum distances to threshold from previously completed acoustic modelling are also provided.

Threshold		**Maximum distance (km) to threshold from acoustic modelling**	**Scenario 1 (Tow azimuth 60°)**		**Scenario 2 (Tow azimuth 120°)**	
Description	Threshold level (dB)		$ER_{95\%}$ (km)	Probability of exposure (%)	$ER_{95\%}$ (km)	Probability of exposure (%)
TTS, PK	213*	0.07	0	0	0.06	88
TTS, SEL_{24h}	168†	Scenario 1: 95.4 Scenario 2: 64.7	12.50	65	11.33	66
PTS, PK	219*	0.04	0	0	0.03	78
PTS, SEL_{24h}	183†	Scenario 1: 6.6 Scenario 2: 5.9	0	0	0.06	70
Behavioural response	160‡	8.37-13.5	12.43	68	8.62	81

* PK (L_{pk}; dB re 1 µPa)
† LF-weighted SEL_{24h} ($L_{E,24h}$; dB re 1 µPa^2·s)
‡ SPL (L_p; dB re 1 µPa)

6. Discussion and Conclusion

The estimated sound fields produced by source and propagation models for the seismic survey were incorporated into a sound exposure model to estimate the range within which 95% of the exposure exceedances occur ($ER_{95\%}$), along with the probability that an animat with a closest point of approach within that range would be exposed above the relevant threshold.

The maximum $ER_{95\%}$ to SEL thresholds were 0.06 km for PTS and 12.5 km for TTS. PK thresholds were not exceeded for Scenario 1 since the closest point of approach to the BIA (~1.3 km) was larger than the maximum possible range to threshold. For Scenario 2, which partially overlapped with the BIA, the $ER_{95\%}$ to PK threshold was 0.03 km for PTS and 0.06 km for TTS.

The $ER_{95\%}$ to both the PTS and TTS SEL thresholds are substantially lower than ranges predicted by acoustic modelling (Table 3). Previous modelling efforts were inherently more conservative because they did not incorporate the complex interactions of both a moving sound field and moving receivers, but rather assumed a static receiver. In this case the moving receiver, the animats, were set to simulate the real-world movements of migrating pygmy blue whales within the migratory BIA.

The $ER_{95\%}$ to the 160 dB behavioral response threshold was 12.43 km for Scenario 1 and 8.62 km for Scenario 2 (Table 3). These ranges are similar to the ranges predicted by acoustic modelling, but this is expected because they are based on the single loudest exposures experienced by each of the animats in the simulation.

The probability of exposure within $ER_{95\%}$ in all cases varied between 65 and 88%, indicating that most, but not all, animats exposed within the 95th percentile range were exposed above threshold. 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 (Figure 4). Probabilities were slightly lower for Scenario 1 since animats were prevented from swimming closer than 1.3 km to the source at any point in the simulation due to the proximity of the BIA boundary to the source.

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Appendix A. Animal Movement and Exposure Modelling

Animal movement and exposure modelling takes into account the movement of both sound sources (if mobile) and animals over time. Acoustic source and propagation modelling are used to generate 3-D sound fields that vary as a function of range, depth, and azimuth. Sound sources are modelled at representative sites and the resulting sound fields are assigned to source locations using the minimum Euclidean distance. The sound received by an animal at any given time depends on its location relative to the source. Because the true locations of the animals within the sound fields are unknown, realistic animal movements are simulated using repeated random sampling of various behavioural parameters. The Monte Carlo method of simulating many animals within the operations area is used to estimate the sound exposure history of the population of simulated animals (animats).

Monte Carlo methods provide a heuristic approach for determining the probability distribution function (PDF) of complex situations, such as animals moving in a sound field. The probability of an event's occurrence is determined by the frequency with which it occurs in the simulation. The greater the number of random samples, in this case the more simulated animats, the better the approximation of the PDF. Animats are randomly placed, or seeded, within the simulation boundary at a specified density (animats/km^2). Higher densities provide a finer PDF estimate resolution but require more computational resources. To ensure good representation of the PDF, the animat density is set as high as practical allowing for computation time. The animat density is much higher than the real-world density to ensure good representation of the PDF. The resulting PDF is scaled using the real-world density.

Several models for marine mammal movement have been developed (Ellison et al. 1987, Frankel et al. 2002, Houser 2006). These models use an underlying Markov chain to transition from one state to another based on probabilities determined from measured swimming behaviour. The parameters may represent simple states, such as the speed or heading of the animal, or complex states, such as likelihood of participating in foraging, play, rest, or travel. Attractions and aversions to variables like anthropogenic sounds and different depth ranges can be included in the models.

The JASCO Animal Simulation Model Including Noise Exposure (JASMINE) was based on the open-source marine mammal movement and behaviour model (3MB, Houser 2006) and used to predict the exposure of animats to sound arising from the anthropogenic activities. Animats are programmed to behave like the species likely to be present in the survey area. The parameters used for forecasting realistic behaviours (e.g., diving, foraging, aversion, surface times, etc.) are determined and interpreted from marine species studies (e.g., tagging studies) where available, or reasonably extrapolated from related species. An individual animat's modelled sound exposure levels are summed over the total simulation duration to determine its total received energy, and then compared to the assumed threshold criteria.

JASMINE uses the same animal movement algorithms as 3MB (Houser, 2006), but has been extended to be directly compatible with JASCO's Marine Operations Noise Model (MONM) and Full Waveform Range-dependent Acoustic Model acoustic field predictions, for inclusion of source tracks, and importantly for animats to change behavioural states based on time and space dependent modelled variables such as received levels for aversion behaviour, although aversion was not considered in this study.

A.1. Animal Movement Parameters

JASMINE uses previously measured behaviour to forecast behaviour in new situations and locations. The parameters used for forecasting realistic behaviour are determined (and interpreted) from marine species studies (e.g., tagging studies). Each parameter in the model is described as a probability distribution. When limited or no information is available for a species parameter, a Gaussian or uniform distribution may be chosen for that parameter. For the Gaussian distribution, the user determines the mean and standard deviation of the distribution from which parameter values are drawn. For the uniform distribution, the user determines the maximum and minimum distribution from which parameter values are drawn. When detailed information about the movement and behaviour of a species are available, a user-created distribution vector, including cumulative transition probabilities, may be used (referred to here as a vector model; Houser 2006). Different sets of parameters can be defined for different behaviour states. The probability of an animat starting out in or transitioning into a given behaviour state can in turn be defined in terms of the animat's current behavioural state, depth, and the time of day. In addition, each travel parameter and behavioural state has a termination function that governs how long the parameter value or overall behavioural state persists in simulation.

The parameters used in JASMINE describe animal movement in both the vertical and horizontal planes. The parameters relating to travel in these two planes are briefly described below.

Travel sub-models

- **Direction**– determines an animat's choice of direction in the horizontal plane. Sub-models are available for determining the heading of animats, allowing for movement to range from strongly biased to undirected. A random walk model can be used for behaviours with no directional preference, such as feeding and playing. In a random walk, all bearings are equally likely at each parameter transition time step. A correlated random walk can be used to smooth the changes in bearing by using the current heading as the mean of the distribution from which to draw the next heading. An additional variant of the correlated random walk is available that includes a directional bias for use in situations where animals have a preferred absolute direction, such as migration. A user-defined vector of directional probabilities can also be input to control animat heading. For more detailed discussion of these parameters, see Houser (2006) and Houser and Cross (1999).
- **Travel rate**–defines an animat's rate of travel in the horizontal plane. When combined with vertical speed and dive depth, the dive profile of the animat is produced.

Dive sub-models

- **Ascent rate**–defines an animat's rate of travel in the vertical plane during the ascent portion of a dive.
- **Descent rate**–defines an animat's rate of travel in the vertical plane during the descent portion of a dive.
- **Depth**–defines an animat's maximum dive depth.
- **Reversals**–determines whether multiple vertical excursions occur once an animat reaches the maximum dive depth. This behaviour is used to emulate the foraging behaviour of some marine mammal species at depth. Reversal-specific ascent and descent rates may be specified.
- **Surface interval**–determines the duration an animat spends at, or near, the surface before diving again.

A.1.1. Exposure Integration Time

The interval over which acoustic exposure (L_E) should be integrated and maximal exposure (L_p) determined is not well defined. Both Southall et al. (2007) and the NMFS (2018) recommend a 24 h baseline accumulation period, but state that there may be situations where this is not appropriate (e.g., a high-level source and confined population). Resetting the integration after 24 h can lead to overestimating the number of individual animals exposed because individuals can be counted multiple times during an operation. The type of animal movement engine used in this study simulates realistic movement using swimming behaviour collected over relatively short periods (hours to days) and does not include large-scale movement such as migratory circulation patterns. For this study, 7 days were modelled, with results for the full period and also scaled down to 24 h.

Ideally, a simulation area is large enough to encompass the entire range of a population so that any animal that could approach the source during an operation is included. However, there are limits to the simulation area, and computational overhead increases with area. For practical reasons, the simulation area is limited. In the simulation, every animat that reaches a border is replaced by another animat entering at the opposing border—e.g., an animat crossing the northern border of the simulation is replaced by one entering the southern border at the same longitude. When this action places the animat in an inappropriate water depth, the animat is randomly placed on the map at a depth suited to its species definition. The exposures of all animats (including those leaving the simulation and those entering) are kept for analysis. This approach maintains a consistent animat density and allows for longer integration periods with finite simulation areas.