EMPEROR ENERGY LIMITED

Judith-2 Exploration Drilling Environment Plan

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Acronyms

TERM/ACRONYM	DEFINITION
ABARES	Australian Bureau of Agricultural and Resource Economics and Sciences
AFMA	Australian Fishing Management Authority
AFZ	Australian Fishing Zone
AGR	AGR Australia Pty Ltd
AHO	Australian Hydrological Office
AHSV	Anchor Handling Support Vessels
ALARP	As Low as Reasonably Possible
AMP	Australian Marine Park
AMSA	Australian Maritime Safety Authority
ANSI	American National Standards Institute
AS/NZS	Australian Standard/New Zealand Standard
BIAs	Biologically Important Behaviours
bbl	Barrell
BOP	Blow-Out Preventer
Bscf	Billions of standard Cubic feet of gas
CAMBA	China-Australia Migratory Bird Agreement
CGR	Condensate Gas Ratio
CHIRP	Compressed High-Intensity Radar Pulse
CM	Control Measure
CMP	Crisis Management Plan
CMT	Crisis Management Team
CoA	Commonwealth of Australia
DAFF	Department of Agriculture, Fisheries and Forestry
DAWE	Department of Agriculture Water and Environment now DCCEEW
DAWR	Department of Agriculture and Water Resources now DAFF

TERM/ACRONYM	DEFINITION
DCCEEW	Department of Climate Change, Energy, Environment and Water
DELWP	Department of Environment, Land, Water and Planning
DIMT	Drilling Incident Management Team
DJPR	Department of Jobs Precincts and Regions
DNRET	Department of Natural Resources and Environment Tasmania
DP	Dynamic Positioning
DPI	Department of Primary Industries
DPIPWE	Department of Primary Industries, Parks, Water and Environment
DIMT	Drilling Incident Management Team
DoT	Department of Transport
EMBA	Environment that May Be Affected
Emperor Energy	Emperor Energy Limited
EMS	Environment Management System
ENIVD	Environmental Impact Identification
EP	Environment Plan
EPA	Environment Protection Authority
EPBC Act	Environment Protection and Biodiversity Conservation Act 1999
EPO	Environmental Performance Outcome
EPS	Environmental Performance Standard
ERC	Emergency Response Coordinator
ERP	Emergency Response Plan
ERR	Earth Resources Regulation
ESD	Ecologically Sustainable Development
GHGs	Green House Gases
HSE	Health Safety and Environment
HSEMS	Health, Safety and Environment Management System

TERM/ACRONYM	DEFINITION
IAP	Incident Action Plan
ILUAs	Indigenous Land Use Agreements
IMCRA	Integrated Marine and Coastal Regionalisation of Australia
IMS	Invasive Marine Species
IOGP	International Oil and Gas Producers
IPR	Inflow Performance Relationship
JAMBA	Japan-Australia Migratory Bird Agreement
JRCC	Joint Rescue Coordination Centre
JSA	Job Safety Analysis
KFFs	Key Ecological Features
LCM	Lost Circulation Material
LOWC	Loss of Well Control
LTD	Limited
LWD	Logging While Drilling
MBES	Multibeam echo sounder
MC	Measurement Criteria
MES	Monitoring, Evaluation and Surveillance
MFO	Marine Fauna Observer
MMscf	Million standard cubic feet
MMSI	Maritime Mobile Service Identity
MNES	Matter of National Environmental Significance
MO	Marine Orders
MoC	Management of Change
MODU	Mobile Offshore Drilling Unit
MoU	Memorandum of Understanding
MNP	Marine National Park

TERM/ACRONYM	DEFINITION
MP	Marine Park
NatPlan	National Plan for Maritime Environmental Emergencies
NCVA	National Conservation Values Atlas
NEBA	Net Environmental Benefit Analysis
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NO_2	Nitrogen dioxide
NSW	New South Wales
NTM	Notice to Mariners
OA	Operational Area
OBP	Orange-bellied Parrot
OPEP	Oil Pollution Emergency Plan
OPGGS Act.	Offshore Petroleum and Greenhouse Gas Storage Act 2006
OPGGS(E) Regulations	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023
OIM	Offshore Installation Manager
OSM-BIP	Operational and Scientific Monitoring Bridging Implementation Plan
OSTM	Oil Spill Trajectory Modelling
OWR	Oiled Wildlife Response
PAM	Passive Acoustic Monitoring
PBW	Pygmy Blue Whale
PCPT	Piezo cone penetrometer test
PEP	Project Execution Plan
POB	Persons on board
PK	Peak Sound Pressure Level
PSZ	Petroleum Safety Zone
PTS	Permanent Threshold Shift
QLD	Queensland

TERM/ACRONYM	DEFINITION
RO	Reverse Osmosis
RMR	Riserless Mud Recovery
ROKAMBA	Republic of Korea-Australia Migratory Bird Agreement
ROV	Remotely Operated Vehicle
SA	Southern Australia
SBP	Sub-Bottom Profiler
SCAT	Shoreline Clean-up Assessment Technique
SCE	Solids Control Equipment
SCCP	Source Control Contingency Plan
SCR	Source Control Response
SECE	Safety and Environmentally Critical Elements
SECP	Safety and Environmentally Critical Positions
SEL	Sound Exposure Level
SESSF	Southern and Eastern Scalefish and Shark Fishery
SETFIA	South East Trawl Fishing Industry Association
SIMAP	Spill Impact Mapping Analysis Program
SIV	Seafood Industry Victoria
SMPEP	Shipboard Marine Pollution Emergency Plan
SOLAS	Safety of Life at Sea
SPL	Sound Pressure Level
SRW	Southern Right Whale
SSS	Side-Scan Sonar
SSDI	Subsea Dispersant Injection
SSIA	Southern Shark Industry Alliance
STB	Standard barrels
TAC	Total Allowable Catch

TERM/ACRONYM	DEFINITION
TAS	Tasmania
TECs	Threatened Ecological Communities
TD	Target Depth
TSS	Total Suspended Solids
USBL	Ultra-Short Baseline
VFA	Victorian Fisheries Authority
VHF	Very High Frequency
Vic	Victoria
VOCs	Volatile Organic Compounds
VRLA	Victorian Rock Lobster Association
VSP	Vertical Seismic Profiling
WA	Western Australia
WCD	Worst Case Discharge
WBM	Water-Based Mud
WDP	Well Delivery Process
WOMP	Well Operations Management Plan

Units

UNIT	DEFINITION
km	Kilometre
Bscf	Billion Standard Cubic Feet
cm	Centimetre
Cum[1]	
db	Decibel
dB re 1µPa @ 1 m	dB level of the time-integrated, sound pressure normalised at one metre
dB re 1 µPa^{2}s	dB level of the time-integrated, squared sound pressure normalised to a one second period

e-CO_2	Atmospheric emissions
g	Gram
g/cm^2	Gram per square centimetre
g/cm^3	Gram per cubic centimetre
g/m^2	Gram square metre
ha	Hectare
hrs	Hours
in	Inch
Kg	Kilogram
kHZ	Kilohertz
Km/hr	Kilometre per hour
ktCO_2e	Metric Kiloton of CO_2 emissions
L	Litre
m	Meter
m^2	Square meter
m^3	Cubic meter
mg/L	Milligram per Litre
mm	Millimetre
MMscf/day	Million Standard Cubic Feet per Day
m/s	Meter per Second
MtCO_2-e	Metric Tons of Carbon Dioxide Equivalent
nm	Nautical Mile
^{o}	Degree
PK-PK	Peak to peak
ppb	Parts per billion
Psi	Pounds per Square Foot
SEL	Sound Exposure Level

SEL_{24h}	Sound Exposure Level over 24 Hours
SPL	Sound Pressure Level
stb/MMscf	Stock Tank Barrel per Million Standard Cubic Feet
stb/day	Stock Tank Barrel per Day
t	Tonne
UTM	Universal Transverse Mercator
%	Percentage

1. INTRODUCTION

1.1. Project Overview

Emperor Energy Limited (Emperor Energy), as the Titleholder under *the Offshore Petroleum and Greenhouse Gas Storage Act 2006 (Cth)* and the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (*Cth*) (referred to as the Environment Regulations), is proposing to undertake exploration and appraisal drilling activities, for one well in the VIC/P47 permit area.

The activities to be undertaken in the VIC/P47 permit area comprise of site surveys, drilling and appraisal activities, plug and abandonment activities that are defined as Petroleum Activities in Regulation 5 of the Environment Regulations. Therefore, an Environment Plan (EP) is required. A detailed description of the activities is provided in Section 3.

1.2. Environment Plan Summary

The Judith-2 Exploration Well EP summary has been prepared from material provided in this EP. The summary (Table 1-1) consists of the information required by Regulation 35(7) Commonwealth Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (OPGGS(E)) Regulations.

Table 1-1: Environmental Plan Summary

EP SUMMARY MATERIAL REQUIREMENTS	RELEVANT SECTION OF EP CONTAINING EP SUMMARY MATERIALS
Details of the titleholders nominated liaison person for the activity	Section 1.3
A description of the activity	Section 3
The location of the activity	Section 3.2
A description of the receiving environment	Section 4
Details of the environmental impacts and environment	Section 5
The control measures for the activity	Section 5
Consultation already undertaken and plans for ongoing consultation	Section 7
The arrangements for ongoing monitoring of the titleholder’s environmental performance	Section 8
Response arrangements in the oil pollution emergency plan (OPEP)	Section 8.6 and OPEP

1.3.Purpose of the Environment Plan

In accordance with the objectives of the Environment Regulations, the purpose of this EP is to demonstrate the:

- potential environmental impacts and risks (planned (routine and non-routine) and unplanned) that may result from the activity are identified.
- management controls are implemented to reduce impacts and risks to a level 'as low as reasonably practicable' (ALARP) and acceptable.
- Activity is carried out in a manner consistent with the principles of ecologically sustainable development (ESD) (as defined in Section 3A of the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* [EPBC Act]). The principles of ESD include:
  - Decision-making processes should effectively integrate both long-term and short term economic, environmental, social and equitable considerations; the 'integration principle'.
  - If there are threats of serious or irreversible damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation; the 'precautionary principle'.
  - The present generation should ensure the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations; the 'intergenerational principle'.
  - The conservation of biological diversity and ecological integrity should be a fundamental consideration in decision-making; the 'biodiversity principle'.
  - Improved valuation, pricing and incentive mechanisms should be promoted; the 'valuation principle'.
- And does not involve that activity or any part of the activity, other than emergency response arrangements for monitoring or responding to an emergency, being undertaken in any part of a World Heritage property.
- EP describes the process and resulting outputs of the risk assessment, whereby impacts and risks are managed accordingly.
- The EP provides for appropriate environmental performance outcomes (EPO), environmental performance standards (EPS) and measurement criteria.
- Titleholder has carried out consultations required by Regulation 25 of the Environmental Regulations, and the measures (if any) that the titleholder has adopted or proposes to adopt because of the consultations are appropriate.

1.4.Scope of the EP

The scope of this EP covers the activities that are described in Section 3. The Operational Area defines the spatial boundary of the activities, as described and risk assessed in this EP and is shown in Figure 3-1. This EP considers potential environmental impacts from planned activities, contingent activities, and any unplanned risks originating from within the Operational Area. Transit to and from the Operational Area by the MODU and support vessels, as well as port activities related to these vessels, are excluded from this EP's scope. Vessels supporting the activities outside the Operational Area (e.g., transiting to and from port) are governed by all applicable maritime regulations and other requirements, and thus are not managed by this EP.

1.5. Titleholder Details

Emperor Energy is a diversified energy company with upstream and downstream assets in Australia. The company's strategic asset is Vic/P47 in the Gippsland Basin.

1.5.1. Titleholder

Name:	Emperor Energy Limited (Operator)
Business address:	Level 4, 55 York Street, Sydney, New South Wales (NSW) 2000
Email:	stakeholder@emperorenergy.com.au
ACN:	006 024 764

1.5.2. Nominated Liaison Person

Name:	Carl Dumbrell
Business address:	Level 4, 55 York Street, Sydney, NSW 2000
Email:	stakeholder@emperorenergy.com.au

In the event of a change in titleholder, nominated liaison person or contact details, Emperor Energy will submit the amended details to National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) referencing the EP document number and NOPSEMA reference.

1.6. Requirements

This section provides information on the requirements that apply to the activity and are relevant to the activity's environmental management. Requirements include relevant laws, codes, other approvals and conditions, standards, agreements, treaties, conventions, or practices (in whole or part) that apply to jurisdiction that the activity takes place in.

The activity is in Commonwealth waters. Relevant Commonwealth requirements are summarised in Table 1-2. Recovery Plans, Threat Abatement Plans and Species Conservation Advice relevant to the activity are detailed in Section 4.

Table 1-2: Commonwealth Environmental Requirements Relevant to the Activity

LEGISLATION	SCOPE	APPLICATION TO ACTIVITY	ADMINISTERING AUTHORITY
Australian Ballast Water Management Requirements (CoA 2020d)	The Australian Ballast Water Management Requirements set out the obligations on vessel operators with regards to the management of ballast water and ballast tank sediment when operating within Australian seas.	Provides requirements on how vessel operators should manage ballast water when operating within Australian seas to comply with the Biosecurity Act. Section 5.2 details these requirements in relation to the management of ballast water.	Department of Agriculture, Fisheries and Forestry (DAFF)
Australia Biofouling Management Requirements (DAWE 2022)	The Australian biofouling management requirements set out vessel operator obligations for the management of biofouling when operating vessels under biosecurity control within Australian territorial seas.	Provides requirements on how vessel operators should manage biofouling when operating within Australian seas to comply with the Biosecurity Act. Section 5.2 details these requirements in relation to the management of biofouling.	DAFF
Australian Maritime Safety Authority Act 1990	This Act facilitates international cooperation and mutual assistance in preparing and responding to a major oil spill incident and encourages countries to develop and maintain an adequate capability to deal with oil pollution emergencies. Requirements are affected through Australian Maritime Safety Authority (AMSA) who administers the National Plan for Maritime Environmental Emergencies (NatPlan).	The Act is applicable to offshore petroleum activities where these have the potential to affect maritime safety and/or result in pollution and other environmental damage associated with the operation of ships. AMSA is the designated Control Agency for oil spills with offshore petroleum activities. These arrangements are detailed in the Judith-2 Exploration Well OPEP.	Australian Maritime Safety Authority (AMSA)
Biosecurity Act 2015 Biosecurity Regulations 2016	This Act is the primary legislation for the management of the risk of diseases and pests that may cause harm to	The Biosecurity Act and regulations apply to 'Australian territory' which is the airspace over	DAFF

LEGISLATION	SCOPE	APPLICATION TO ACTIVITY	ADMINISTERING AUTHORITY
Biosecurity Amendment (Biofouling Management) Regulations 2021	human, animal or plant health, the environment and the economy. The objects of this Act are to provide for: (a) managing biosecurity risks; human disease; risks related to ballast water; biosecurity emergencies and human biosecurity emergencies; (b) to give effect to Australia's international rights and obligations, including under the International Health Regulations, the Sanitary and Phytosanitary Agreement and the Biodiversity Convention.	and the coastal seas out to 12 m from the coastline. For the activity the Act and regulations regulates vessels entering Australian territory regarding ballast water and hull fouling. Biosecurity risks associated with the activity are detailed in Section 5.2.	
Environment Protection and Biodiversity Conservation Act 1999 (EPBC Act)	This Act applies to actions that have, will have or are likely to have a significant impact on matters of national environmental or cultural significance. The Act protects Matters of National Environmental Significance (MNES) and provides for a Commonwealth environmental assessment and approval process for actions. There are eight MNES, these being: • World heritage properties • Ramsar wetlands • Listed Threatened species and communities • Listed Migratory species under international agreements • Nuclear actions • Commonwealth marine environment	Petroleum activities are excluded from within the boundaries of a World Heritage Area (Sub regulation 10A(f)). The activity is not within a World Heritage Area. The EP must describe matters protected under Part 3 of the EPBC Act and assess any impacts and risks to these. Section 4 describes matters protected under Part 3 of the EPBC Act. The EP must assess any actual or potential impacts or risks to MNES from the activity. Section 5 provides an assessment of the impacts and risks from the activity to matters protected under Part 3 of the EPBC Act.	Department of Climate Change, Energy, the Environment and Water (DCCEEW)

LEGISLATION	SCOPE	APPLICATION TO ACTIVITY	ADMINISTERING AUTHORITY
	• Great Barrier Reef Marine Park • Water trigger for coal seam gas and coal mining developments		
Environment Protection and Biodiversity Conservation Regulations 2000	Part 8 of the regulations provide distances and actions to be taken when interacting with cetaceans.	The interaction requirements are applicable to the activity in the event that a cetacean is sighted. Section 5 details how these requirements will be applied.	DCCEEW
Environment Protection (Sea Dumping) Act 1981	Aims to prevent the deliberate disposal of wastes (loading, dumping, and incineration) at sea from vessels, aircraft, and platforms.	May be triggered in the event equipment is decommissioned on the seabed. This is not the base case for planning purposes.	DCCEEW
Hazardous Waste (Regulation of Exports and Imports) Act 1989	To ensure the management of Australia's hazardous waste is exported, imported and transited in an environmentally sound manner.	The Basel Convention is implemented in Australia by the Act.	DCCEEW
Marine Pest Plan 2018–2023: National Strategic Plan for Marine Pest Biosecurity (DAWR 2018)	Australia's national strategic plan for marine pest biosecurity. It outlines a coordinated approach to building Australia's capabilities to manage the threat of marine pests over the next five years. It represents agreed priorities and actions of governments, marine industries, and other stakeholders to achieve a common purpose: to manage the risks posed by marine pests and minimise their potential harm to marine industries, communities and the environment.	Applying the recommendations within this document and implementing effective biofouling controls can reduce the risk of the introduction of an introduced marine species Section 5.2.details how these requirements will be applied.	DAFF

LEGISLATION	SCOPE	APPLICATION TO ACTIVITY	ADMINISTERING AUTHORITY
National Biofouling Management Guidelines for the Petroleum Production and Exploration Industry (Marine Pest Sectoral Committee 2018)	The guidance document provides recommendations for the management of biofouling risks by the petroleum industry.	Applying the recommendations within this document and implementing effective biofouling controls can reduce the risk of the introduction of an introduced marine species. Section 5.2.details how these requirements will be applied.	DAFF
National Light Pollution Guidelines for Wildlife (DCCEEW, 2023b)	The Guidelines outline the process to be followed where there is the potential for artificial lighting to affect wildlife.	Applying the recommendations within this document and implementing effective controls can reduce the impact of light to sensitive receptors. Section 5.2.details how these requirements will be applied.	DCCEEW
National Strategy for Reducing Vessel Strike on Cetaceans and other Marine Megafauna (CoA, 2017)	The overarching goal of the strategy is to provide guidance on understanding and reducing the risk of vessel collisions and the impacts they may have on marine megafauna.	Applying the recommendations within this document and implementing effective controls can reduce the risk of the vessel collisions with megafauna. Section 5.2.details how these requirements will be applied.	DCCEEW
Navigation Act 2012	his Act regulates ship-related activities and invokes certain requirements of the International Convention for the Prevention of Pollution from Ships (MARPOL 73/78) relating to equipment and construction of ships. Several Marine Orders (MO) are enacted under this Act relating to offshore petroleum activities, including: MO 21: Safety and emergency arrangements. MO 30: Prevention of collisions.	The relevant vessels (according to class) will adhere to the relevant MO with regard to navigation and preventing collisions in Commonwealth waters. Section 5 details how these requirements will be applied.	AMSA

LEGISLATION	SCOPE	APPLICATION TO ACTIVITY	ADMINISTERING AUTHORITY
	MO 31: SOLAS and non-SOLAS certification.		
Offshore Petroleum and Greenhouse Gas Storage Act 2006 (OPGGS Act) Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations (OPGGS(E) 2023	The Act addresses all licensing, health, safety, environmental and royalty issues for offshore petroleum exploration and development operations extending beyond the three-nautical mile limit. The OPGGS(E) Regulations specifies that an EP must be prepared for any petroleum activity and that activities are undertaken in an ecologically sustainable manner and in accordance with an accepted EP.	The OPGGS Act provides the regulatory framework for all offshore petroleum exploration and production activities in Commonwealth waters, to ensure that these activities are carried out: • consistent with the principles of ecologically sustainable development as set out in section 3A of the EPBC Act. • so that environmental impacts and risks of the activity are reduced to ALARP. • so that environmental impacts and risks of the activity are of an acceptable level. Demonstration that the activity will be undertaken in line with the principles of ecologically sustainable development, and that impacts and risks resulting from these activities are ALARP and acceptable is provided in Section 5.	NOPSEMA
Protection of the Sea (Prevention of Pollution from Ships) Act 1983	This Act regulates Australian regulated vessels with respect to ship-related operational activities and invokes certain requirements of the MARPOL Convention relating to discharge of noxious liquid substances, sewage, garbage, air pollution etc.	All ships involved in petroleum activities in Australian waters are required to abide to the requirements under this Act. Several Marine Orders (MO) are enacted under this Act relating to offshore petroleum activities.	AMSA

LEGISLATION	SCOPE	APPLICATION TO ACTIVITY	ADMINISTERING AUTHORITY
		Section 5.details how these requirements will be applied.	
Protection of the Sea (Harmful Antifouling Systems) Act 2006	Under this Act, it is an offence for a person to engage in negligent conduct that results in a harmful anti-fouling compound being applied to or present on a ship. The Act also provides that Australian ships must hold 'anti-fouling certificates', provided they meet certain criteria.	All ships involved in offshore petroleum activities in Australian waters are required to abide to the requirements under this Act. The MO 98: Marine Pollution Prevention – Anti-fouling Systems is enacted under this Act. Section 5 details how these requirements will be applied.	AMSA
Underwater Cultural Heritage Act 2018	Protects the heritage values of shipwrecks, sunken aircraft and relics (older than 75 years) in Australian Territorial waters from the low water mark to the outer edge of the continental shelf (excluding the State's internal waterways). The Act allows for protection through the designation of protection zones. Activities / conduct prohibited within each zone will be specified.	In the event of removal, damage or interference to shipwrecks, sunken aircraft or relics declared to be historic under the legislation, activity is proposed with declared protection zones, or there is the discovery of shipwrecks or relics. Section 4.7.5 identifies no known shipwrecks or sunken aircraft in the Operational Area.	DCCEEW

2. IMPACT AND RISK ASSESSMENT APPROACH

2.1. Risk Assessment and Management System Framework

The Emperor Energy Health, Safety and Environment Management System (HSEMS) framework provides a risk-based methodology to manage environmental impacts and risks through their activities. This involves:

- Identification of environmental aspects and impacts / risks.
- Assessment of impacts and risks to receptors.
- Selection, implementation, and maintenance of a structured system of controls.
- Monitoring the effectiveness of the process and identifying areas for improvement.

2.2. Environmental Risk Assessment Methodology

The Environmental Risk Assessment Methodology used for this EP considers impacts resulting from planned activities, and risks resulting from unplanned events, and assesses the potential impacts to receptors. The methodology evaluates the consequence of impacts associated with planned activities on receptors and the likelihood and consequence of risks associated with unplanned events on receptors.

The Environmental Risk Assessment Methodology is consistent with the approach outlined in the following standards:

- Australian Standard/New Zealand Standard (AS/NZS) ISO 31000:2009 Risk Management – Principles and Guidelines (Standards Australia / Standards New Zealand 2009).
- AS/NZS Handbook 203:2012 Environmental Risk Management – Principles and Process (Standards Australia / Standards New Zealand 2012).

2.2.1. Terminology

Throughout the impact and risk assessment process, the following terminology is used in accordance with the OPGGS(E) Regulations and standard industry practice (Table 2-1).

Table 2-1: Risk Management and Environmental Performance Terminology

TERMINOLOGY	DEFINITION
Planned Activity	An activity that is intended to occur.
Unplanned Event	An event that is not intended to occur despite control measures in place.
Environmental Impact	Any change to the environment, whether adverse or beneficial, that wholly or partially results from an activity.
Environmental Risk	A function of the likelihood of an event occurring and the consequence of the environmental impact.
Likelihood	The probability or frequency of an event occurring.

TERMINOLOGY	DEFINITION
Severity (Consequence)	The severity of the impact being realised (i.e. an impact in terms of adverse effects on the people, environment, assets or reputation).
Control Measure (CM)	A system, an item of equipment, a person or a procedure, that is used as a basis for managing environmental impacts and risks.
ALARP	As Low As Reasonably Practicable The ALARP principle is that the residual impacts and risks shall be 'as low as reasonably practicable'.
Acceptability	A measure of whether the impact or risk will be of an acceptable level to affected receptors. Determined from a demonstration of the ALARP principle, consistency the principles of ecologically sustainable development (ESD) with internal context (e.g. corporate requirements), applicable state, national and international legislations; other requirements (national, international standards and best practice); and external context (e.g. consideration of relevant stakeholder consultation when determining control measures).
Environmental Performance Outcome	An outcome that demonstrates that the environmental performance will meet or better the acceptable level of impacts and risks of the activity.
Environmental Performance Standard	A statement of the performance required of a control measure.
Environmental Measurement Criteria	Verification to demonstrate that the Environmental Performance Outcome and Environmental Performance Standard are being met.

2.2.2. Environmental Impact Assessment Methodology (Planned Events)

The impact assessment methodology for planned events is based on the risk assessment methodology outlined in Section 2.2.3. However, for planned events, environmental impacts are assessed solely on the severity (i.e. consequence) component of the risk matrix as per the descriptors in Table 2-2. Corresponding acceptability criteria and response guidance for severity levels are also described.

Table 2-2: Severity Categories and Descriptors

SEVERITY/ CONSEQUENCE LEVEL	ENVIRONMENT SEVERITY DESCRIPTOR	IMPACT ACCEPTABILITY	SEVERITY/ CONSEQUENCE LEVEL
5 - Catastrophic	Massive effect: environmental impact could last for decades; long term contamination requiring remediation.	Unacceptable	Not meeting legal, community or stakeholder requirements and expectations or Emperor Energy standards. Impact not acceptable based on severity and the planned event leading to the impact.
4 - Major	Major effect: environmental impact could last for years; area becomes restricted for a limited period of time.	Unacceptable	Not meeting legal, community or stakeholder requirements and expectations or Emperor Energy standards. Impact not acceptable based on severity and the planned event leading to the impact.
3 - Severe	Severe effect: environmental impact could last for months; reportable quantity spill or release; spill or release requires clean-up.	Unacceptable	Impact not acceptable and the planned activity leading to the impact cannot progress without additional long-term impact reduction measures. Increased resources and management focus required to ensure impact reduced to ALARP and an acceptable level.
2 - Minor	Minor effect: environmental impact could last for weeks; spill or release external to facility; no clean-up required.	Acceptable with impacts managed via the Company's Management Systems and ALARP demonstrated.	Impact is acceptable if reasonable safeguards/management systems are confirmed to be in place, where it has been demonstrated as being ALARP and of an acceptable level.
1 - Slight	Slight effect: environmental impact could last for days; no long-term consequences; spill or release internal to facility.	Acceptable, with impacts managed via the Company's Management Systems and ALARP demonstrated.	Impact is generally regarded as acceptable by a broad range of stakeholders. Adequate resources and management focus to ensure impact are ALARP and of an acceptable level.

2.2.3. Environmental Risk Assessment Methodology (Unplanned Events)

The methodology used to assess risks resulting from unplanned events is illustrated schematically in Figure 2-1.

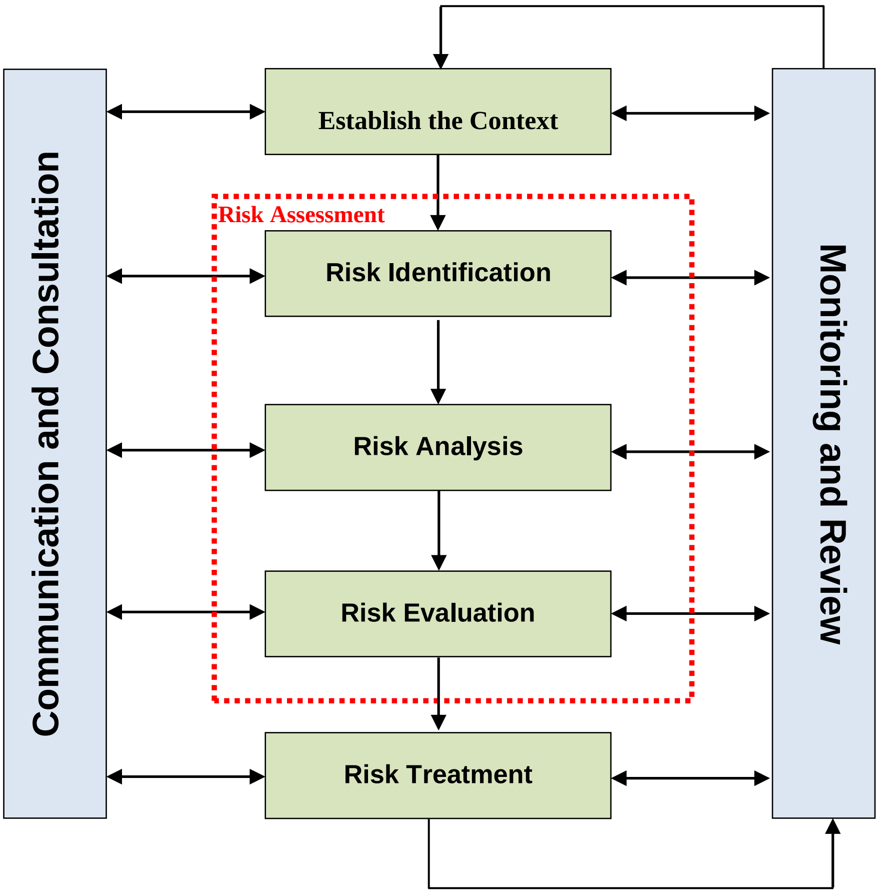

Figure 2-1: Schematic of Risk Assessment Methodology

The main components of the risk assessment methodology include:

- Identify the activities and the events / aspects associated with them that could cause a potential impact to the values (receptors) at risk within and adjacent to the Project Areas.
- Determine the likelihood and severity (i.e. consequence) of the events with standard control measures. Where practicable, quantification of the magnitude of the stressor, the concentration of the contaminant and/or level of disturbance was made. Further, timing, duration and other factors affecting the risk were considered.
- The environmental risk rating of an unplanned event is determined from the combination of the likelihood and the expected severity (i.e. consequence). Risks are rated using the Qualitative Risk Matrix (Figure 2-2) with a 'severity' ranking of 1 (slight) to 5 (catastrophic) and a 'likelihood' ranking of A (rare) to E (almost certain).

The likelihood of an event's occurrence is assessed with standard industry controls in place; however, the severity (i.e. consequence) is assessed without controls.

The risk ratings are aligned with risk tolerance and associated response guidance to manage or to reduce (as necessary) the risks as described in Table 2-3. Review of the standard industry control measures for each of the risks and proposing additional control measures is then considered, as required.

	A	B	C	D	E	
	Likelihood					
5 Catastrophic	Medium 5	Medium 10	High 15	High 20	High 25	Severity
4 Major	Medium 4	Medium 8	Medium 12	High 16	High 20	
3 Severe	Low 3	Medium 6	Medium 9	Medium 12	High 15	
2 Minor	Low 2	Low 4	Medium 6	Medium 8	Medium 10	
1 Slight	Low 1	Low 2	Low 3	Medium 4	Medium 5	
	A	B	C	D	E	
	The event may only occur in exceptional circumstances	The event could occur at some time	The event may occur at some time	The event will probably occur in most cuircumstances	The event is expected to occur in most circumstances	
	Rare	Unlikely	Possible	Probable	Almost Certain	
	Likelihood					

Figure 2-2: Qualitative Risk Matrix

Table 2-3: Risk Rating and Risk Tolerance

RISK RATING		RISK TOLERANCE	DEFINITION AND RESPONSE
	High	Intolerable (Unacceptable)	If the risk level is High, it is considered to be unacceptable. If a high-risk result remains, once all available controls have been identified, the task must not be undertaken. Further review, consultation and risk assessment is required.
	Medium	Tolerable (Acceptable)	A risk defined as Medium is considered tolerable. Although risk is tolerable, efforts should still be made to reduce them to levels that are as low as reasonably practicable (ALARP).
	Low	Acceptable	A risk defined as Low is considered acceptable. If a risk is acceptable, this does not necessarily preclude the initiation of improvements if they are economic, readily identified, and practicable.

2.2.4. ALARP Demonstration

Regulation 21(5) of the OPGGS(E) Regulations requires that the Environment Plan must demonstrate that the environmental impacts and risks of the activity will be reduced to ALARP.

For an activity to be considered ALARP, the Environment Plan must demonstrate, through reasoned and supported arguments, that there are no other practicable control measures that could reasonably be implemented to reduce the environmental impacts and risks of the Activity.

The key principles underpinning the ALARP principle include:

- There are no reasonably practicable alternatives to the activity.
- There are no additional reasonably practicable measures available to further reduce the risk or impact.
- The sacrifice (cost, time, effort) for implementing further control measures is grossly disproportionate to the reduction in risk or impact and the environmental benefit gained.

In alignment with NOPSEMA's ALARP Guidance Note (N-04300-GN0166, Rev 6, 2015), Emperor Energy have adapted the approach developed by Oil and Gas UK (OGUK) (OGUK, 2014) for use in an environmental context to determine the assessment technique required to demonstrate that potential impacts and risks are ALARP (Figure 2-3). Specifically, the framework considers impact severity and several guiding factors:

- Activity type.
- Risk and uncertainty.
- Stakeholder influence.

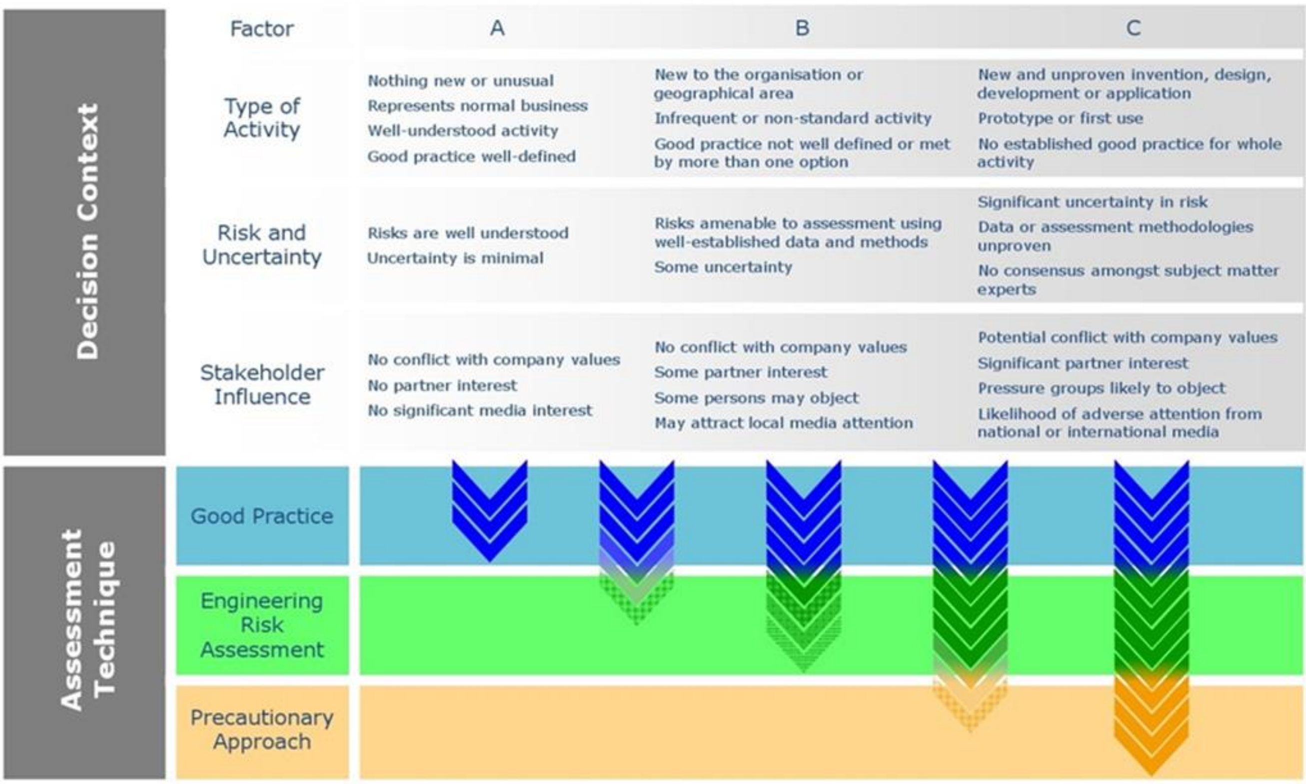

Figure 2-3: ALARP Decision Support Framework (Oil & Gas UK 2014)

A Type A decision is made if the risk is relatively well understood, the potential impacts are low, activities are well practised, and there are no conflicts with company values, no partner interests, and no significant media interests. However, if good practice is not sufficiently well-defined, additional assessment may be required.

A Type B decision is made if there is greater uncertainty or complexity around the activity and/or risk, the potential impact is moderate, and there are no conflict with company values, although there may be some partner interest, some persons may object, and it may attract local media attention. 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 typically involves sufficient complexity, high potential impact, uncertainty, or stakeholder influence to require a precautionary approach. In this case, relevant good practice still must be met, additional assessment is required, and the precautionary approach applied for those controls that only have a marginal cost benefit.

In accordance with the regulatory requirement to demonstrate that environmental impacts and risks are ALARP, Emperor Energy has considered the above decision context in determining the level of assessment required. This is applied to each aspect described in Section 5.

The assessment techniques considered include:

- Good practice.
- Engineering risk assessment.
- Precautionary approach.

2.2.4.1. Good Practice

OGUK (2014) 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 Australian policies.
- Relevant Australian Government guidance.
- Relevant industry standards.
- Relevant international conventions.

If the ALARP technique is determined to be 'Good Practice', further assessment ('Engineering Risk Assessment') is not required to identify additional controls. However, additional controls that provide a suitable environmental benefit for an insignificant cost are also identified at this point.

2.2.4.2. Engineering Risk Assessment

All potential impacts and risks that require further assessment are subject to an 'Engineering Risk Assessment'. Based on the various approaches recommended in OGUK (2014), Emperor Energy 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.

2.2.4.3. Precautionary Approach

OGUK (2014) state that if the assessment, considering all available engineering and scientific evidence, is insufficient, inconclusive, or uncertain, then a precautionary approach to impact and risk 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.

Following the determination of ALARP Decision Context, and identification of controls, the residual environmental risk is evaluation. Table 2-4 shows the determination of ALARP for residual risk.

Table 2-4: Demonstration of ALARP

	RESIDUAL RISK		
Impact (Table 2-2)	Severe, Major or Catastrophic (Unacceptable)	Minor (Acceptable)	Slight (Acceptable)
Risk (Table 2-3)	High (intolerable)	Medium (tolerable)	Low (Acceptable)
ALARP Determination	Activity is not ALARP and should not be carried out	The risk and impact are tolerable/acceptable, and ALARP is demonstrated. Efforts should still be made to identify additional control measures (if any) that are not disproportionate to the benefit gained, to demonstrate the levels are reduced to ALARP.	Control measures are consistent with good industry practice, then ALARP is demonstrated. If a readily available control measure will further reduce the impact or risk and the cost of implementation is not disproportionate to the benefit gained, then it is considered 'reasonably practicable' and is implemented.

2.2.5. Acceptability Determination

Regulation 34(c) of the OPGGS(E) Regulations requires that the Environment Plan demonstrates that the environmental impacts and risks of the Activity will be of an acceptable level. The Acceptable level of impact is considered for each receptor potentially affected by an impact or risk.

The Acceptable Level of Impact is determined for each receptor, based on the values and sensitivities of that receptor in the Project Area relevant to this EP. Acceptable Level of Impact considers several important factors, including sensitivity of the receptor at the location (e.g. BIAs, critical habitats, protected areas), vulnerability of the receptor to change (i.e. is the receptor particularly vulnerable to disturbance events), timing of the activity (i.e. does the activity timings correspond to any important behaviours).

The Acceptable Level of Impact is compared against the predicted level of impact / risk resulting from the proposed activity, as determined during the Impact and Risk Assessment, to determine Acceptability of the impact or risk.

In the context of 'Acceptability' several elements need to be considered. In this Environment Plan, the environmental impacts and risks associated with the activity are determined 'Acceptable' if the following criteria are met:

- Principles of Ecologically Sustainable Development (ESD): The activity (and associated potential risks and impacts) will not contravene the Principles of ESD, as described in Section 3A of the EPBC Act. For planned (routine) events, this is achieved when residual environmental severity (i.e. consequence) is considered 'Minor' or 'Slight' and has been demonstrated ALARP. For unplanned (i.e. accident/incident) events, this is achieved when residual environment risk is considered 'Medium' (tolerable), or 'Low' (acceptable), and has been demonstrated ALARP.

- Internal Context: The activity (and associated potential risks and impacts) to the environment is consistent with Emperor Energy corporate policies, standards, and procedures.
- External Context: Stakeholder objections or claims related to the activity (and associated potential risks and impacts) have been considered and addressed through the consultation process.
- Other Requirements: The activity (and associated potential risks and impacts) to the environment is consistent with relevant legislation, industry standards and guidelines, offshore practice or benchmarking.

2.2.6. Application of the Impact and Risk Management Processes

Section 5 identifies the environmental impacts and risks of planned activities and unplanned events, assesses the impacts and risks to receptors, identifies control measures to reduce the impact or risk as far as practicable, determines ALARP and Acceptability.

The oil spill response strategies outlined in Section 6 were risk assessed separately along with ALARP and Acceptability justifications. The aim of the assessment was to identify if each spill response strategy is viable with respect to several environmental and operational considerations. Subsequently, ALARP and Acceptability justifications for each of the response strategies were made to enable a decision on their adoption.

2.2.7. Environmental Performance

A key objective of the Environmental Risk Assessment Methodology is to identify the appropriate control measures to reduce the impacts and risks of the activity to ALARP and to an acceptable level. Establishment of environmental performance outcomes (EPO), environmental performance standards (EPS) and their associated measurement criteria (MC) of these control measures is a process that also considers legal requirements, relevant guidelines, and stakeholder views. EPOs, EPS, and their associated MC are described in Section 5.

3. DESCRIPTION OF THE ACTIVITY

3.1. Overview

This section has been prepared in accordance with Regulation 13(1) of the Environment Regulations, and describes the activities to be performed as part of the EP. It includes the location and timing of the activity, operational details and field characteristics.

The Operational Area is the area within which petroleum activities will occur. The Operational Area for the Judith-2 well has been defined as a 4 km by 4 km area around the proposed Judith-2 well location. The Operational Area encompasses the area where site surveys will be undertaken, the outer extent of mooring equipment on the seabed, and the 500 m petroleum safety zone around the well.

Site surveys and drilling activities are planned to occur in 2026, but for contingency purposes due to approval timelines, MODU availability and weather constraints, may occur any time from January 2026 to the end of 2027. The site surveys will be undertaken by different vessels at different times with the geophysical survey estimated to take up to 4 days and the geotechnical survey estimated to take up to 5 days. The drilling of the Judith-2 well will be undertaken using a semi-submersible or jack-up MODU supported by up to 3 support vessels. Drilling is estimated to take up to 60 days. Following drilling and appraisal activities the well will be permanently plugged with the wellhead removed.

Any future development drilling and subsea installation activities associated with the well would be covered under subsequent environmental approvals (Primary and Secondary Approvals).

The activities described above and summarised in Table 3-1 will be referred to collectively herein, as the 'activities', unless otherwise described.

Table 3-1 Judith-2 Activities Program Overview

ITEM	DESCRIPTION
Petroleum Title	VIC/P47
Location	Gippsland Basin, approximately 36 km south of Marlo, Victoria.
Water Depth	The water depth at the Judith-2 well location is~70 m (at well location)
MODU	Jack-up or semi-submersible MODU will be used to complete the drilling activities.
Vessels	• The MODU will typically be supported by one, but up to 3 support vessels. Support vessels may include: • Anchor handling vessel (AHV) to set anchors and support the moored MODU during operations. • General offshore support vessels including cargo vessels and barges for transporting equipment and materials from port/staging area to the Operational Area (e.g. equipment, fluids and cement) and for general resupply and support for the MODU. • Vessels used for geophysical and geotechnical activities will be similar to the Sliver Star and Tech Ocean Spirit or Fugro Mariner, respectively.

	• Vessels will not anchor in the Operational Area, using dynamic positioning (DP) to maintain location on station.
Key activities	Geophysical surveys, to collect bathymetry data and detect seabed hazards using: • Multibeam echo sounder • Side-scan sonar • Sub-bottom profiler • Magnetometer • High resolution two-dimensional shallow reflective imaging (2D survey) Geotechnical surveys, to collect information on the properties of the seabed and the underlying shallow sediments using: • Borehole sampling • Core sampling • Piezo cone penetrometer test. Drilling: • MODU placement (anchoring or jacking) • Drilling activities • Well evaluation including vertical seismic profiling (VSP) • Well testing activities (flaring) • Permanent plugging of the well • Wellhead removal activities • Contingent drilling activities such as re-spudding the well or side-tracking may be required.
Support operations	ROV and helicopter operations.

3.2. Activity Location

The activities carried out in this EP will be located in Commonwealth waters, approximately 36 km south of Marlo, Victoria (Figure 3-1), at the closest landfall to the Operational Area.

3.2.1. Operational Area

The Operational Area is the area within which petroleum activities will occur. The Operational Area has been defined as a 4 km by 4 km area around the Judith-2 well location (Figure 3-1). The Operational Area encompasses the area where site surveys will be undertaken, the outer extent of mooring equipment on the seabed, and the 500 m petroleum safety zone around the well.

Vessels and the MODU transiting to or from the permit area are deemed to be operating under the *Navigation Act 2012* and are not considered part of the petroleum activity until within the permit area.

3.2.2. Well Location

The Judith-2 well will be drilled in Petroleum Title VIC/P47, in Commonwealth Waters, Indicative coordinates for the Judith-2 well are presented in Table 3-2. The final location for the Judith-2 well may be subject to change but is expected to be within 1,000 m of these coordinates.

Table 3-2: Judith-2 Exploration Well Indicative Coordinates

WELL	LATITUDE	LONGITUDE	WATER DEPTH
Judith-2 exploration well	38° 08’ 30.87	148° 32’ 21.8”	70 m

MGA 94 UTM 55

3.3. Activity Timeframe

3.3.1. Design Envelope

The design envelope is the broadest timeframe within which all activities can occur. The site surveys and drilling activities will be undertaken anytime from the 1 January 2026 to 31 December 2027. Activities may occur at any time, day and night, during this period (subject to complying with other requirements in the EP).

3.3.2. Operating Envelope

The operating envelope is the maximum anticipated timeframe activities will take to complete. Surveys are expected to take up to 9 full days of site surveys within the Operational Area consisting of:

- Geophysical: 4 days
- Geotechnical: 5 days

Site surveys are expected to be continuous, however may be interrupted due to weather delays and contractor downtime.

Drilling activities are expected to take up to 60 days (including testing, plugging and abandonment) within the Operational Area. Drilling is expected to be continuous, however may be interrupted due to weather delays and contractor downtime.

The site surveys, consisting of the geotechnical and geophysical surveys, will be completed separately prior to drilling activities. The geophysical and geotechnical surveys will be undertaken by different vessels at different times.

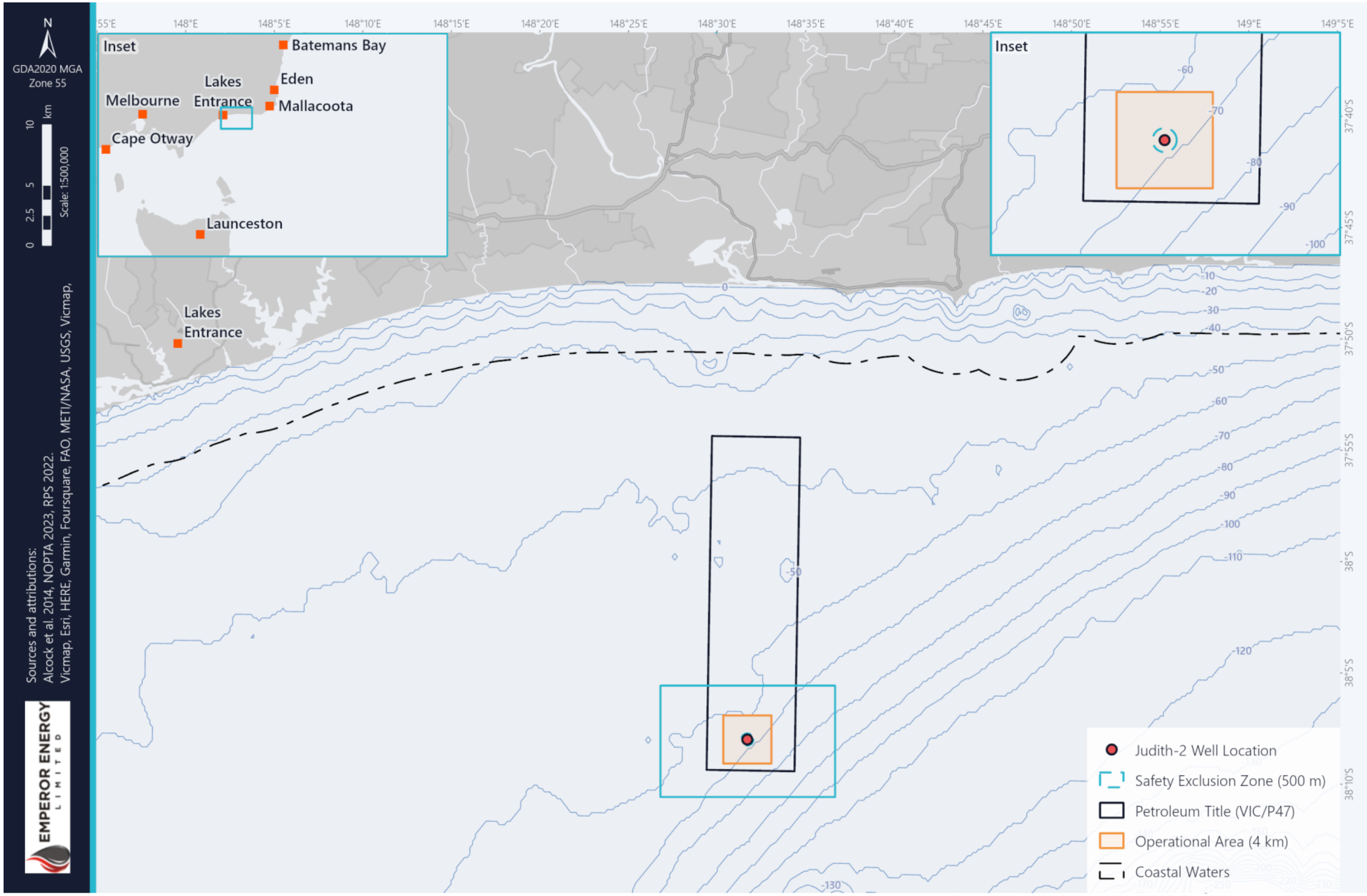

Figure 3-1: Judith-2 Proposed Well Location and Operational Area

3.4. Hydrocarbon Characteristics

The properties of the hydrocarbon prospects targeted as part of the exploration drilling program are discussed in the following subsections.

3.4.1. Hydrocarbon Composition

The Judith-2 well is planned to test the Upper Kipper, Lower Golden Beach, and Basal Golden Beach sands in the 12-1/4" section. While the 8-1/2" section will test the 4 Judith and 3 Longtom sands. The expected reservoir fluid is lean gas with the potential for condensate to be present.

3.4.2. Flow Rate

Based upon the proposed well design and expected reservoir characteristics, worse case discharge dynamic blowout modelling (Schlumberger 2022) was undertaken to estimate the potential flow rate during a credible worst-case discharge due to a total loss of well control.

Flow rate estimates were derived following internal guidance consistent with the "Guidance for complying with BOEM NTL No. 2010-N06 on Worst Case Discharge for Offshore Wells" prepared by the Society of Petroleum Engineers.

The modelling detailed:

- Day 1 worst case discharge rates for the 12-1/4" section were modelled at 274.3 MMscf/day of gas and 5,870.9 stb/day condensate for a CGR of 21.4 stb/MMscf. The day 1 worst case discharge rates for the 8-1/2" section are 80.56 MMscf/day of gas and 805.6 stb/day condensate for a CGR of 10 stb/MMscf.
- The depleted flow after 77 days for the 12-1/4" section is 147.4 MMscf/day gas and 3,153.6 stb/day condensate and 77.9 MMscf/day gas and 778.8 stb/day condensate for the 8-1/2" section.
- Approximately, 347,584 stb of condensate and 16.3 Bscf of gas could be expelled within 77 days during the blowout for the 12-1/4" section and 58,483 stb and 6.1 Bscf from the 8-1/2" section.

3.5.Site Surveys

Site surveys will be conducted prior to drilling the Judith-2 well. The objective of these surveys is to assess obstructions and hazards at and below the seafloor, including:

- Bathymetry.
- Seafloor geologic hazards including fault scarps, gas vents, hydrate mounds, unsuitable slopes, slumping, active mud gullies (crown cracks, collapsed depressions, furrows, sinkholes, surface channels and reefs).
- Subsurface geologic hazards including faults, gas-charged sediments, shallow water flow and buried channels.
- Manmade hazards including pipelines, wellheads, shipwrecks, ordinance, communication cables, remnant leg-holes and debris.
- The state of the seabed at the well location, anchoring and chain positions and relief well location.

3.5.1. Geophysical Survey

A description of the proposed geophysical survey activities is provided in Table 3-3.

The geophysical survey will consist of:

- Multibeam echo sounder (MBES)
- Side-scan sonar (SSS)
- Sub-bottom profiler (SBP)
- Magnetometer
- Ultra-Short Baseline (USBL) Positioning System
- 2D survey: High resolution two-dimensional (2D) shallow reflective imaging to inform shallow gas hazards.

3.5.2. Geotechnical Survey

A description of the proposed geotechnical survey activities is provided in Table 3-3.

The geotechnical survey is required to determine shallow and surface geology / sediments and verify geophysical survey interpretations. Geotechnical surveys comprise of in-situ testing and recovery of sediment samples consisting of:

- Coring
- Piezo cone penetrometer test (PCPT)
- Grab samples

Table 3-3: Geophysical and Geotechnical Survey Activities

EQUIPMENT	PURPOSE	ACTIVITY DETAILS
Geophysical survey		
Multi-beam echo sounder (MBES)	Measure bathymetry.	A MBES mounted on the vessel hull is likely to be used. A MBES acquires a wide swath (strip) of bathymetry data perpendicular to the vessel track and provides total seabed coverage with no gaps between vessel tracks. A MBES transmits a broad acoustic pulse from a transducer over a swath across a vessel track. The MBES then forms a series of received beams that are each much narrower and form a 'fan' (with a half-angle of 30-60°) across the seabed, perpendicular to the vessel track. The transducer(s) then 'listen' for the reflected energy from the seabed. The fans of seabed coverage produce a series of strips along each track, which are lined up side-by-side to generate two dimensional georeferenced bathymetric maps of the seabed.
Side scan sonar (SSS)	Detects hazards such as existing pipelines, lost shipping containers, boulders, debris, unmarked wrecks, reefs and craters.	The SSS method of surveying generates acoustic images of the seabed by towing a sonar 'towfish.' The towfish is provided with power and digital telemetry services and towed from the vessel using a reinforced or armoured tow cable. The towfish is equipped with a linear array of transducers that emit, and later receive, an acoustic energy pulse in a specific frequency range. Typically, a dual-channel, dual-frequency SSS is used. SSS is like MBES but operates at a wider fan angle. The acoustic energy received by the towfish (backscatter) provides information as to the general distribution and characteristics of the surficial sediment and outcropping strata. Shadows result from areas of no energy return, such as shadows from large boulders or sunken ships, and aid in interpretation of the sonogram image. The towfish is constructed of stainless steel and is a cylindrical torpedo-like device. Itis typically towed 10-15 m above the seabed depending on water depth and the frequency range. The SSS is operated at the same time as the MBES.
Sub-bottom profiler (SBP)	Investigate the layering and thickness of the uppermost seabed sediments.	Compressed High-Intensity Radar Pulse (CHIRP) Very high frequency systems including pingers, parametric echo sounding and CHIRP – produce a swept-frequency signal. CHIRP systems usually employ various types of transducers as the source. The transducer that emits the acoustic energy also receives the reflected signal. CHIRP signals typically penetrate only about 5-10 m into the seabed and provide the best resolution, but lowest penetration. A CHIRP is normally hull mounted when used for shallow water operations but may also be towed in a similar fashion to the SSS.

EQUIPMENT	PURPOSE	ACTIVITY DETAILS
		High-frequency boomers High frequency boomers generate a broadband, high amplitude impulsive acoustic signal in the water column that is directed vertically downward. Boomers are mostly surface towed but may also be towed below the surface to avoid sea surface wave related noise and movement. The receiver for the boomer system is usually a hydrophone or hydrophone array consisting of a string of individual hydrophone elements. They typically contain eight to 12 hydrophone elements evenly spaced in a tube that is 2.5 to 4.5 m in length and 25 mm in diameter. The SBP system is towed and operated at the same time as the MBES and SSS. The SBP survey is likely to be undertaken in two passes in conjunction with the MBES and SSS.
Magnetometer	Detect metallic objects on or below the seabed	A magnetometer sensor is housed in a towfish and is towed as close to the seabed as possible and sufficiently far away from the vessel to isolate the sensor from the magnetic field of the vessel. The magnetometer survey will be conducted at the same time as the MBES, SSS and SBP. The magnetometer towfish is constructed of stainless steel and is a cylindrical torpedo-like type device.
Ultra-Short Baseline (USBL) Positioning System	Positioning of towfish in water depths up to 3,000 m.	The side scan sonar towfish and geotechnical equipment are positioned utilising ultra-short baseline (USBL) methods. It is necessary to calibrate the transceiver, which is usually deployed on retractable pole under the vessel, or over the side. The calibration requires a transponder to be deployed on the sea floor, at working depth and the vessel; surveys a pattern around the transponder to ascertain the error (pitch, roll, heading & velocity) of the USBL transceiver. The transponder is lowered to the seabed with a sandbag fitted with an acoustic release. Once the calibration is complete, the acoustic release is triggered, and the transponder recovered. The sandbag anchor remains on the seabed. A hessian bag is typically utilised filled with sand. As the calibration must be completed at working depth and close passes are required it is impractical to buoy the transponder/sandbag, without the risk of entanglement. The USBL sandbag typically covers an area of 0.2 m^2.
High resolution 2D shallow reflective imaging	Identify shallow gas hazards.	The 2D survey will consist of a sound source and receiver to identify shallow gas. Equipment will consist of a sound source of up to 160 in^3 towed at a depth of approximately 1-3 m using compressed air to create a pulse of acoustic energy. For the 2D survey, the vessel will traverse a series of pre-determined sail lines at a speed of approximately 8-9 km/hr (4 – 5 knots). As the vessel travels along the sail lines a series of sound pulses (approximately every 10 seconds) are directed through the water column towards the seabed. The sound is attenuated and reflected at geological boundaries and the

<table>
<tr><th>EQUIPMENT</th><th>PURPOSE</th><th>ACTIVITY DETAILS</th></tr>
<tr><td></td><td></td><td>reflected signals are detected using hydrophones along a streamer towed behind the survey vessel. Survey parameters are detailed below.
<table>
<tr><td></td><td colspan="9">Parameter</td></tr>
<tr><td></td><td>No. of streamers</td><td>Streamer length</td><td>Streamer depth</td><td>Sail lines</td><td>Vessel speed</td><td>Size of acoustic source array</td><td>Operating pressure</td><td>Source depth</td><td>Sound pulse interval</td></tr>
<tr><td>Value
2D survey</td><td>One (solid)</td><td>150 - 1,500 m</td><td>1 – 3 m</td><td>100 m</td><td>~8 – 9 km/hr</td><td>160 in^3</td><td>2,000 psi</td><td>7 m</td><td>10 seconds</td></tr>
</table></td></tr>
<tr><td colspan="3">Geotechnical</td></tr>
<tr><td>Borehole Sampling</td><td>Obtain core samples for geological analysis of formations below the seabed.</td><td>Borehole Sampling
Typically, one sample is collected from the centre of the MODU location (with a contingency for one sample at each MODU spud can location [i.e., four in total]), which is used to ground-truth the geophysical data and provides soil strength data that can be used for geotechnical analysis. The maximum depth of the boreholes ranges between 40 m and 80 m below the seabed.
Downhole sampling would be undertaken at predetermined intervals. Sampling will typically consist of rotary cores/push cores for the full length of one of the boreholes. If the standalone PCPT is unable to penetrate the seabed to the desired depth, PCPT's measurements may also be obtained in a separate borehole.</td></tr>
<tr><td>Seabed grab sampling</td><td>Seabed grab sampling provides samples for undertaking geological analysis of unconsolidated seabed sediments.</td><td>Grab sampling is used to collect small samples of surface sediments from the seafloor. Only surface sediments are collected as the sampler has no ability to penetrate to depth. The grab sampler is deployed from the vessel.
A grab sample is proposed to be taken at each core location.
Each grab sample typically covers a spatial area of <1 m^2.
5 grab samples at 2 well sites = 10 grab samples with a maximum total footprint of 10 m^2.</td></tr>
</table>

EQUIPMENT	PURPOSE	ACTIVITY DETAILS
Piezocone Penetrometer Test (PCPT)	PCPT determines soil strength and helps to delineate soil stratigraphy.	PCPT involves the in-situ measurement of the resistance of ground to continuous penetration. This process involves lowering a frame to the seabed and pushing the PCPT unit into the sediment at a steady penetration rate (usually 2 cm per second). A frame is lowered to the seabed with the PCPT unit integrated into it and operated remotely. When the required penetration depth is reached, all equipment is withdrawn from the seabed. A small hole will remain in the seabed, which will eventually collapse and infill with the movement of seabed sediments. A PCPT typically takes 2-2.5 hours to complete. The PCPT frame is ~ 5 m x 1 m with a footprint of ~ 5 m^2. The piezocone is either 5 cm or 10 cm in diameter and penetrates the seabed from 10 to 60 m.

3.6. Drilling Activities

3.6.1. Well Design

An indicative overview of the well drilling design and process is described in this section. This process is subject to change, depending on individual well design requirements and location of the well. Well schematics are provided in the Well Operations Management Plan (WOMP) submitted to NOPSEMA for assessment prior to drilling. The well is traditional well design (Table 3-4), which is used to enhance critical formation evaluation, log quality and drilling performance close to the seabed.

The top hole well sections (conductor and surface hole) will be drilled without a riser, which is standard practice. The cuttings (rock chips) and drilling fluids from this section will be discharged to sea. A riser and blow-out preventer (BOP) will be installed to facilitate the drilling of the deeper well sections once the surface casing is cemented in place. Once the riser and BOP are installed, drilling fluids and cuttings will be returned to the MODU, where the drilling fluids will be separated using solids control equipment. The solids control equipment comprises of shale shakers that remove coarse cuttings from drilling fluids.

The recovered fluids that have been separated from the cuttings may be directed to centrifuges to remove the finer solids. The cuttings are usually discharged below the water line and the reconditioned fluids are recirculated into the fluid system.

Drilling fluids used during the program will be Water Based Mud (WBM), where practicable. Synthetic based muds (SBM) may be used where it is not technically feasible to use WBM. Drilling fluid performs several functions including cooling and lubricating the drill bit; transporting drill cuttings to the surface; and maintaining hydrostatic pressure in excess of formation pressure, thereby preventing the influx of hydrocarbons from the formation into the wellbore. This is the primary well control barrier.

Drilling fluid, bulk dry products, brine and drill water are transferred to the MODU from supply vessels and stored in tanks and pits. Dry and liquid additives are mixed into the fluid system from sacks or containers. The base case drilling methodology for the Judith-2 well is outlined in Table 3-4.

Table 3-4: Base case well profile for Judith-2

HOLE SIZE	CASING / LINER SIZE	APPROX. SECTION DEPTH*	HOLE LENGTH	FLUID TYPE	APPROX. CUTTINGS VOLUME (M^3)	FLUID DISCHARGE LOCATION	CUTTINGS DISCHARGE LOCATION
36″	30″ casing	170 m	50 m	Seawater + high viscosity sweeps	48	Seabed	Seabed
17 ½ ″	13 3/8″ casing	850 m	680 m	Seawater + high viscosity sweeps	152	Seabed	Seabed
12 ¼ ″	9 5/8″ casing	2100 m	1250 m	WBM (or SBM, as contingency)	105	Surface / re-circulated	Below sea-level surface

HOLE SIZE	CASING / LINER SIZE	APPROX. SECTION DEPTH*	HOLE LENGTH	FLUID TYPE	APPROX. CUTTINGS VOLUME (M^3)	FLUID DISCHARGE LOCATION	CUTTINGS DISCHARGE LOCATION
8 ½ "	7" liner	3375 m	1275 m	WBM (or SBM, as contingency)	52	Surface / re-circulated	Below sea-level surface

3.6.1.1. Drilling discharges management

Consistent with industry practice, all cuttings generated during riser-less drilling will be returned directly to the seabed, where they will be deposited in the vicinity of the wellhead.

Where required, the Judith-2 well lower hole sections, may be drilled using a SBM recirculating drilling fluid system. The SBM will be treated to remove formation solids (drill cuttings), this allows the SBM to be recycled and recovered while drilling. The fluids returned with the drilled cuttings will initially pass through a shale shaker where most of the mud will be separated from the cuttings. To minimise the retention of SBM on cuttings and allow the additional recovery of drilling fluid, a cuttings dryer system will be used to also process the cuttings prior to discharge. Any recovered SBM will be returned to the active mud system. A centrifuge is also planned to be used to allow the removal of entrained solids from the drilling fluid to maximise longevity/recycling of the SBM.

While the majority of used SBM will be reconditioned for future use, not all drilling fluids can be removed from the cuttings, and a coating of residual drilling fluid may remain. Discharges of SBM overboard are confined to the material remaining within the treated drill cuttings.

Following treatment with the shakers and/or cuttings dryer the synthetic fluid residual oil on cuttings (ROC) will be less than 8 % by dry weight averaged over each hole section. The ROC is monitored by an on-board testing conducted once every 12-hour period.

No bulk SBM discharges (e.g. tank dumps) will be permitted.

3.6.2. Contingency Drilling Activities

Contingent drilling activities such as re-spudding the well or side-tracking may be required if surface casing strings do not reach their planned setting depth. This could be a result of bore hole instability, where the borehole does not maintain its size and shape which can result in structural integrity issues. Contingent drilling activities may also include the use of lost circulation materials in the event of downhole fluid losses to the formation. Lost circulation occurs when the drill bit encounters natural fissures in the rock formations, and drilling fluids flow into these spaces rather than circulate back to the MODU. In both cases, these contingent drilling activities are undertaken to maintain well control.

Potential contingent drilling activities may generate additional volumes of drilling fluids and cuttings to be discharged (Table 3-5). Any discharges, and therefore environmental hazards, will be the same as those described for the drilling operations.

Table 3-5: Contingent Drilling Activities

ABNORMAL CONDITION	CONTINGENT DRILLING ACTIVITY	PROCESS	ADDITIONAL DISCHARGE
Operational or technical issues when drilling the 30" conductor	Re-spud	Move the MODU and drill a new well in a suitable, safe location within the immediate area of the original well. Well construction issues resulting in a re-spud generally occur during riser-less operations when response or remediation options are more limited.	Maximum additional discharge equal to double the estimate of fluids and cuttings discharged during the 30" sections. With an additional 100 m cement plug.
Operational or technical issues when drilling the 17 1/2" open hole or 12 1/2" open hole	Side-track	Drilling a secondary well-bore away from an original well-bore, typically having isolated the original well-bore.	Maximum additional discharge equal to doubling the estimate of fluids and cuttings discharged for the relevant hole sections. With an additional 200 m cement plug.
Lost circulation. When drilling fluid preferentially flows into exposed geological formations instead of returning up the annulus.	Use of lost circulation materials (LCM)	Use of insoluble or fibrous fluid additives, bridging agents such as ground calcium carbonate, or in extreme cases cement.	Potential for additional cement discharges. Quantities will be dependent on the scenario encountered. For example, when using cement to respond to severe lost circulation it may be possible to continue drilling by drilling out the cement in the wellbore, however in other scenarios it may be necessary to side-track.

3.6.3. Blow-out Preventer Installation and Function Testing

A blow-out preventer (BOP) will be used to control well pressure during drilling operations. A BOP is installed onto the wellhead after completion of the top-hole sections. A BOP consists of a series of hydraulically operated valves and sealing mechanisms (annular preventers and ram preventers) that are normally open to allow the drill fluid to circulate up the marine riser to the MODU during drilling. The BOP is used to close in the well in the event of an influx. Once closed, the MODU's high-pressure circulating system will be used to remove the influx from the well and regain hydrostatic overbalance. The annular and ram preventers are used to shut in around various tubulars in the well, while the blind shear rams are designed to shear the pipe and seal the well.

Once the BOP is installed, regular function and pressure tests are undertaken. Function tests are generally undertaken every 7 days, and pressure tests every 21-days, in accordance with industry standards and the Drilling Contractor's maintenance system. Function testing is undertaken by activating the hydraulic control system onboard the MODU to confirm functionality of the BOP systems, whilst a pressure test is undertaken to verify seals on the BOP stack.

The BOP control system discharges control fluid into the sea upon operation. A full function test to close and open all ram and annular preventers discharges approximately 2,200 L of diluted control fluid. The control fluid used for function testing is a water-soluble product and is diluted with potable water (1 to 3% concentration). Similarly, water-based products are used for pressure testing. The fluids are fully biodegradable and will readily disperse after discharge from the BOP.

Greater detail on the performance standards for the BOP system, inclusive of design, functionality and preventative maintenance, is provided in a NOPSEMA-accepted Safety Case.

3.6.4. Cementing Operations

Cement is used to seal the casing following drilling of each section. Bulk dry cement is transported to the MODU via supply vessels and transferred to dry bulk storage tanks. During the transfer process, the holding tanks are vented to atmosphere, resulting in small amounts of dry cement being discharged from venting pipes located under the MODU.

Cement fluids are discharged to the marine environment as part of testing the cementing unit (up to 8 m^3 per test up to six times per well), on completion of each cementing job (1 m^3 discharged up to six times per well) and in the event the cement spoils or there is an issue with the cementing operations (up to 22 m^3).

After a string of casing or liner has been installed into the well, a cementing spacer is pumped to flush drilling fluids and filter cake from the well to allow a good cement bond to be formed with the formation. Cement slurry is pumped down the inside of the landing string, followed by casing (or liner). A displacement fluid is then pumped into the casing with a wiper plug to displace the cement out of the bottom of the casing and up into the annular space between the pipe and the borehole wall. For all other casing and liner cementations the cement will predominantly remain downhole. In the case of a liner cement job, some excess cement will be circulated back to surface and discharged into the sea. When the wiper plug is pumped and reaches the bottom of the casing string it stops and allows the casing to be pressure tested.

Abandonment cement plugs are planned to safely plug and abandon the well; the final abandonment program will ensure moveable hydrocarbons (identified while drilling) are isolated per the NOPSEMA-accepted WOMP.

If mixed batches of cement spoil within the cementing unit, or there is a problem during the cementing operation, cement slurry will be either flushed from the cement unit or circulated out of the well and discharged to sea. A discharged batch of cement slurry may be up to 22 m^3 (140 bbl). To ensure only sufficient amounts of cements are produced, detailed cementing procedures shall be developed including provision to mix only enough cement to complete the cementing operation with allowance for loss to formation and the monitoring and reconciliation of used quantities of cement against planned quantities for each cementing operation.

Upon completion of each cementing activity, the cementing head and blending tanks are cleaned which results in a release of cement contaminated water to the ocean. Cementing procedures will be used to manage the discharge of cement volumes. On completion of activities, remaining bulk cement may be left onboard the MODU to be handed to the next operator or discharged to the sea.

3.6.5. Formation Evaluation

During drilling, the formation is evaluated to determine the presence and quantity of hydrocarbon within the target reservoir. This information is gathered using the following techniques:

- Mud logging – mud samples are collected and analysed.

- Logging while drilling (LWD) logging – LWD tool string collects data from the well in real time, using a LWD downhole tool.
- Wireline logging - using electric instruments to continuously measure the properties of a formation.

Vertical Seismic Profiling (VSP) will be undertaken during the activity. VSP is a routine activity conducted as part of drilling activities to provide detailed information regarding geological structures and stratigraphy in the vicinity of the well. VSP operations involve deploying an acoustic sound source from the MODU or support vessel, while a number of receivers are positioned at different levels within the drilled hole to measure the travel time.

For this drilling program, the duration of VSP is up to 4 hrs and will utilise a small acoustic source (4 x 150 in^3).

3.6.6. Well Test

The type of hydrocarbon is expected to be gas with a potential for associated condensate. If hydrocarbons are determined and confirmed during formation evaluation, a well test may be undertaken. The purpose of a well test is to confirm the existence of transportable hydrocarbons, evaluate reservoir characteristics and flow rates, assess non-hydrocarbon components, and measure liquid yields, and obtain representative fluid samples.

The well test is of short duration. It involves a well clean up followed by a period of well flow. During a well test, reservoir fluids are flowed to the well test separator, which is used to separate and meter the three fluid phases (gas, oil/condensate, and water). Gas and liquid samples are taken at the test separator for later analysis. Fluids are then transferred to the flare boom, where they are flared. Flaring will last for approx 72 hours with a maximum flow rate of 60 MMscf/d.

The flare will be a 'Green Burning' system and will use air compressors to atomise the condensate to yield smoke free combustion.

Following the period of well flow, the well is killed by pumping kill weight brine into the well bore and recovering the test string and setting a cement plug.

3.6.7. Well Plug, Abandonment and Removal

Following completion of drilling and well testing activities, the Judith-2 well will be permanently plugged and abandoned in alignment with Section 572 of the OPGGS Act. Plug and abandonment procedures are designed to permanently isolate the well and mitigate the risk of a potential release of wellbore fluids to the marine environment.

Plug and abandonment operations involve setting a series of permanent cement plugs within the well. Plugs will be set above the hydrocarbon bearing intervals identified for isolation, at appropriate barrier depths in the well. These plugs are tested to confirm their integrity.

Following plug and abandonment operations and confirmation of the permanent barriers, the wellhead is cut with the use of a mechanical cutting tool and removed below the mudline (~1.5 m) leaving no remaining well infrastructure on the seabed. The cutting process produces metal shavings (swarf), some of which remain on the seabed. Conservatively, the retrieval of the wellhead will result in an area of approximately 50 m^2 of benthic disturbance.

Plug and abandonment operations will be conducted in accordance with a NOPSEMA-accepted WOMP.

3.6.8. Post Operation ROV survey

Once the well is plugged and abandoned, a ROV is deployed from the MODU to conduct a post operation survey. This survey records the condition of the seabed at the completion of the program to ensure that no dropped objects or subsea equipment intended for removal remain on the seabed.

3.7. Support Activities

3.7.1. MODU Positioning

The MODU will be towed into position by up to two anchor handling support vessels (AHSV). The MODU will be either a semi-submersible or jack-up.

A semi-submersible MODU will use an anchor spread of up to 12 anchors to hold position. Anchors will be laid in position, then the MODU will winch in the slack from the mooring lines to the required tension. Anchors are spread in a radial pattern extending from the MODU. The size of the anchor spread will be dependent on the MODU and the MODU specific mooring analysis conducted during the well planning stage. Typically, mooring lines extend approximately 2,000 m from the MODU with approximately 1,000 m of grounded chain. Each anchor typically occupies a total seabed area of approximately up to 60 m^2 and the chain covers ~ 300 m^2, giving a total area of up to 360 m^2 per anchor. Retrieval of anchors at the end of the activity is the reverse of the deployment procedures.

A jack-up MODU has three legs with a spud can type footing on which the MODU jacks up. Each spud can have an area up to 254 m^2 (based on the Tom Prosser specifications).

3.7.2. MODU Operations

Drilling activities will be undertaken using a semi-submersible or jack-up MODU which can have up to 150 persons on board (POB). Routine MODU operational discharges at full POB are detailed in Table 3-6.

Table 3-6: Routine MODU and Vessel Discharges

DISCHARGE TYPE	QUANTITY MODU (APPROX.)	QUANTITY SUPPORT VESSEL (APPROX.)	QUANTITY SITE SURVEY VESSEL (APPROX.)
Putrescible waste (1-2 kg pp/day)	1 m^3/day (300 kg/day)	0.11 m^3/day 30 kg/day	0.24 m^3/day (64 kg/day)
Sewage & Grey water (0.45 m^3 pp/day)	67.5 m^3/day	7 m^3/day	14.4 m^3/day
Cooling Water	4,800 m^3/d combined (MODU + single vessel)		160 m^3/day
Atmospheric emissions (e-CO_2)	42 ktCO_2e/month combined (MODU + single vessel)		0.73 ktCO_2e
Reverse Osmosis (RO) Brine	168 m^3/day combined (MODU + single vessel)		5.6 m^3/day

3.7.2.1. Power generation system

The MODU engine room is equipped with a number of diesel engines coupled to generators. Additionally, the MODU is fitted with emergency diesel engine and generator auxiliary system, including batteries, transformers, and switchboards.

3.7.2.2. Saltwater distribution and cooling system

The primary purpose of the saltwater distribution and cooling system is to provide saltwater for the reverse osmosis (RO) units, the fire water system, the main engine cooling system heat exchanger, the anchor chain washing system, the draw works brake cooling unit heat exchanger and various flushing and deck wash connection points throughout the facility.

3.7.2.3. Freshwater generation, distribution, and cooling system

The freshwater generation system provides freshwater to the potable water, drill water, engine jacket water, anchor winch and draw works brake cooling system. The RO freshwater generators use seawater to generate freshwater. Seawater is supplied from a RO submersible pump. The salty brine is discharged from the RO system back to the sea.

3.7.2.4. Drainage, effluent, and waste systems

The drainage, effluent and associated environmental pollution control systems on the facility include:

- Non-contaminated bilge sumps, deck drains, headers and oily water tanks and separators.
- Contaminated drains, oily water tanks and solids separators.
- Helideck drainage and containment system.
- Sewage and greywater drainage and sewage treatment plant.
- Domestic waste segregation and disposal.
- Galley waste disposal including macerator.
- Equipment oil drainage, bunding and waste oil tanks.
- Cutting processing equipment (see solids control equipment).

3.7.2.5. Solids control equipment

Solids control equipment (SCE) will be used when drilling to separate the solids in the drilling fluids. SCE onboard the facility may include:

- Shale shakers
- Centrifuging systems
- Cuttings dryer (SBM only)

3.7.3. Vessel Operations

The MODU will be supported by up to three vessels. One vessel will be within the Operational Area to support the MODU with the other two vessels outside the Operational Area. Vessels only enter the 500 m PSZ under instruction from the MODU when transferring cargo to the MODU or supporting specific operations.

MODU support vessels generally have up to 15 persons on board (POB). Routine vessel operational discharges at full POB are detailed in Table 3-6.

The vessels will be either stationary using dynamic positioning (DP) or operating at slow speeds while undertaking activities within the Operational Area including:

- Towing the MODU to/from the well location.
- Deployment of retrieval of anchors
- Providing standby for the MODU performing a number of duties such as vessel interaction sentry and standby during helicopter take-off / landing.
- Transferring provisions (food, bulk materials, fuel), equipment and wastes to and from the MODU and shore base.
- Facilitating site and equipment inspections / surveys before and after MODU arrival.
- Assisting in emergency response situations.
- Monitoring the 500m radius PSZ around the MODU and interception errant vessels.

Cement, barite and bentonite are transported as dry bulk to the MODU by support vessels and pneumatically blown to the MODU storage tanks using compressed air. The dry bulk storage tanks on the MODU vent excess compressed air to atmosphere. This venting process carries small amounts of solids, which is discharged below the MODU.

The site surveys will be undertaken using different vessels. The geophysical survey will be undertaken with the vessel similar to the Silver Star and the geotechnical survey undertaken with a vessel similar to the Tech Ocean Spirit or Fugro Mariner.

Vessels will hold position using DP, with no anchoring of vessels planned during the activity. Site survey vessels generally have up to 32 POB. Routine vessel operational discharges at full POB are detailed in Table 3-6. The maximum fuel tank size of any vessel undertaking Petroleum Activities within the Operational Area will be 280 m^3.

3.7.4. ROV Operations

A remotely operated vehicle (ROV) is a tethered underwater vehicle deployed from a vessel. ROVs may be deployed and controlled from either the MODU or support vessel to undertake:

- Pre and post-activity site surveys.
- Equipment deployment, monitoring and retrieval.
- Tool deployment and operation.
- BOP activation under emergency conditions (Semi Sub).

The ROV will be moored on the deck of the vessels or MODU and is unlikely to be temporarily parked on the seabed.

Hydraulics on ROVs are closed system, where hydraulic fluid is circulated to move components and is designed not to release hydraulic fluid.

3.7.5. Helicopter Operations

The MODU is serviced by helicopter, with an expected flight frequency of up to 5 times per week (on average). Helicopters will primarily be used for passenger transfers/crew changes, surveillance and minor supplies but may also be used in the event of an emergency evacuation.

Helicopter operations within the Operational Area are limited to landing and take-off directly to and from the MODU helideck. Offshore refuelling of the helicopters whilst onboard the MODU is not planned.

4. DESCRIPTION OF THE ENVIRONMENT

The physical, biological, socio-economic and cultural environment that may be affected (EMBA) and the region in general are described in this section, together with the values and sensitivities of the region.

4.1. Environment That May Be Affected

The environment that may be affected (EMBA) is defined as an area where a change to ambient environmental conditions has the potential to occur as a result of the activity. This section provides regulatory context, description of the EMBA, regional setting and a summary of the key ecological and social receptors.

The Regulations define 'environment' as the ecosystems and their constituent parts, including people and communities, natural and physical resources, qualities and characteristics of locations, places and areas, the heritage value of places and includes the social, economic and cultural features of those matters. In accordance with the Regulations, this section, describes the physical setting, ecological receptors, and social receptors, of the receiving environment relevant to the described petroleum activity.

A greater level of detail is provided for the following particular values and sensitivities as defined by the Regulations which states that particular relevant values and sensitivities may include any of the following:

a) the world heritage values of a declared World Heritage property within the meaning of the EPBC Act;

b) the national heritage values of a National Heritage place within the meaning of that Act;

c) the ecological character of a declared Ramsar wetland within the meaning of that Act;

d) the presence of a listed Threatened species or listed Threatened Ecological Community within the meaning of that Act;

e) the presence of a listed Migratory species within the meaning of that Act;

f) any values and sensitivities that exist in, or in relation to, part or all of:

   a. Commonwealth marine area within the meaning of that Act; or

   b. Commonwealth land within the meaning of that Act.

EMBA

The description of the environment considers the largest possible extent of potential change and defines the environment, including its values and sensitivities, within. The description of environment for the Judith-2 Exploration Drilling Campaign has been spatially defined by oil spill modelling as detailed in Section 5.6. The largest predicted spatial extent that hydrocarbon could extend may occur during a Loss of Well Control (LOWC) event, referred to as the EMBA. The LOWC EMBA has been defined based on the combined outcomes of stochastic modelling for MDO scenario (i.e. cumulative extent of a total of 100 model simulations per season) and is based on a conservative low threshold for each of the modelled oil components (1 g/m^2 floating, 10 ppb dissolved, 10 ppb entrained, 10 g/m^2 shoreline) to predict an extent.

MDO EMBA

The Marine Diesel Oil (MDO) EMBA has been defined to include the worst-case extent of predicted hydrocarbon exposure from a vessel fuel tank rupture resulting in the total loss of containment of MDO from a fuel tank. The MDO EMBA has been defined based on the combined outcomes of stochastic modelling for MDO scenario (i.e. cumulative extent of a total of 100 model simulations per season) using moderate exposure values for each of the modelled oil components (10 g/m2 floating, 50 ppb dissolved, 100 ppb entrained, 100 g/m2 shoreline).

Light EMBA

A light EMBA has been included to ensure potential light impacts from planned activities extending beyond the immediate Operational Area, are appropriately evaluated.

As outlined in the National Light Pollution Guidelines for Wildlife (DCCEEW, 2023b), habitats within 20 km of an activity can be crucial for the survival and activities of listed species, including foraging, breeding, roosting, and dispersal. Based on observed effects of skyglow on marine turtle hatchlings and fledgling seabirds, which have demonstrated significant impacts up to 15-18 km, and considering the precautionary 20 km threshold used for environmental assessments, the potential impact area from flaring has been determined.

Given the flare rate (20 MMscfd) and indicative flare tip height, the lighting impact area from the MODU location is set at 36 km. This distance accounts for the potential effects on important habitats within this range. Although flaring activities are only expected to occur for 42 hours during well test activities, the conservative 36 km lighting EMBA has been retained for light impacts throughout.

The Operational Area, Light EMBA, MDO EMBA, and EMBA used as spatial extents to describe the environmental relevant to the activity and to support the impact and risk assessments are displayed in Figure 4-1.

The EPBC Protected Matters Report for the Operational Area, light EMBA and EMBA are located in APPENDIX B .

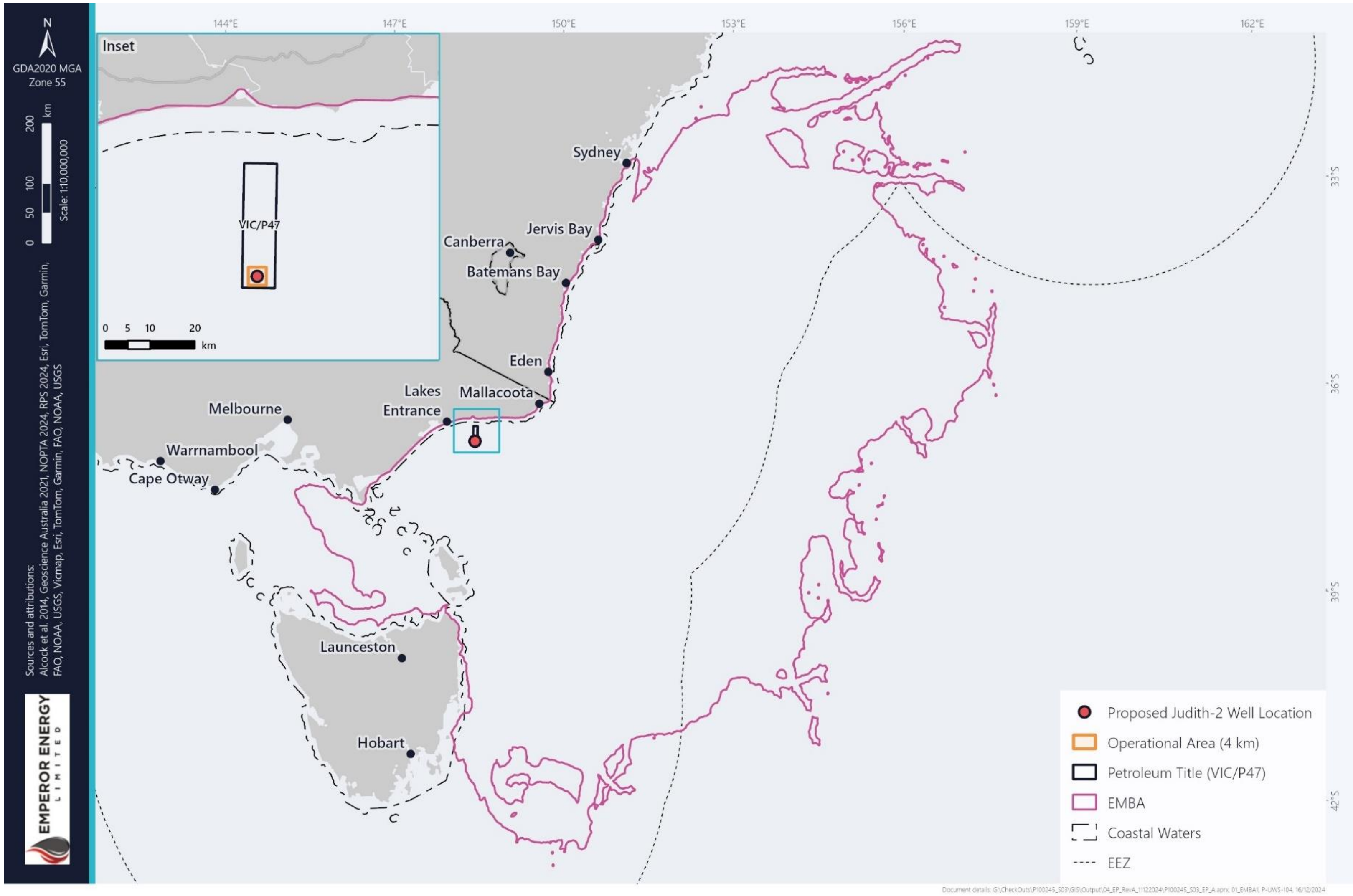

Figure 4-1: Judith-2 Exploration Drilling EMBA

4.2. Regional Geographical Setting

4.2.1. South-east Marine Region

The Operational Area is located within the Southeast Shelf Transition in the commonwealth waters off Victoria's within the South-east Marine Region (Figure 4-2). The South-east Marine Region extends from the far south coast of NSW, around Tasmania, west to Kangaroo Island in South Australia and covers approximately 1.63 million km^2 of temperate waters (CoA 2015). The region is characterised for its low nutrient and primary productivity levels. Significant seafloor features within the region include the continental shelf, rocky reefs, sea-floor canyons and seamounts. These features often result in significant variation in water depth causing localised areas of relatively high productivity in comparison to the broader region (CoA 2015).

Based on the Integrated Marine and Coastal Regionalisation of Australia (IMCRA) Version 4.0, the Operational Area is within the Twofold Shelf Meso-scale Bioregion. This bioregion encompasses the area east of Wilsons Promontory (including south to the Kent Group Islands in Tasmania) and into New South Wales as far north as Tathra (Figure 4-2) (Barton et al. 2012). The continental shelf within the Twofold Shelf Meso-scale Bioregion has a very steep inshore profile (0–20 m), with a less steep inner (20–60 m) to mid (60–120 m) shelf profile, and a generally flatter outer shelf plain (120–160 m) south-west of Cape Howe (IMCRA 1998).

4.2.2. Temperate East Marine Region

The Temperate East Marine region, overlapped by the EMBA, extends from the southern boundary of the Great Barrier Reef Marine Park to Bermagui in southern NSW and covers approximately 1.47 million km^2 of temperate and subtropical waters (DNP, 2018). Significant seafloor features within the region include the continental shelf, slope, and abyssal plain/deep ocean floor, tropical and cold-water reef systems, seamounts and canyons. The East Australian Current is the main oceanographic process influencing the regions productivity and diversity. The water brought down by this current from the Coral Sea results in a mixing of tropical and temperate waters which allow for a range and multitude of species to be supported (DNP 2018). The region supports biologically important behaviours (BIAs) for a variety of fish, whale and seabird species. Species of significance include the critically endangered Grey Nurse Shark, vulnerable White Shark and the Humpback Whale who all migrate through the region.

The temperate east network includes eight marine parks which have been implemented to support the natural, cultural, socio-economic and heritage values of the region. Marine parks intersected by the EMBA are discussed in detail in Section 4.6.1.1.

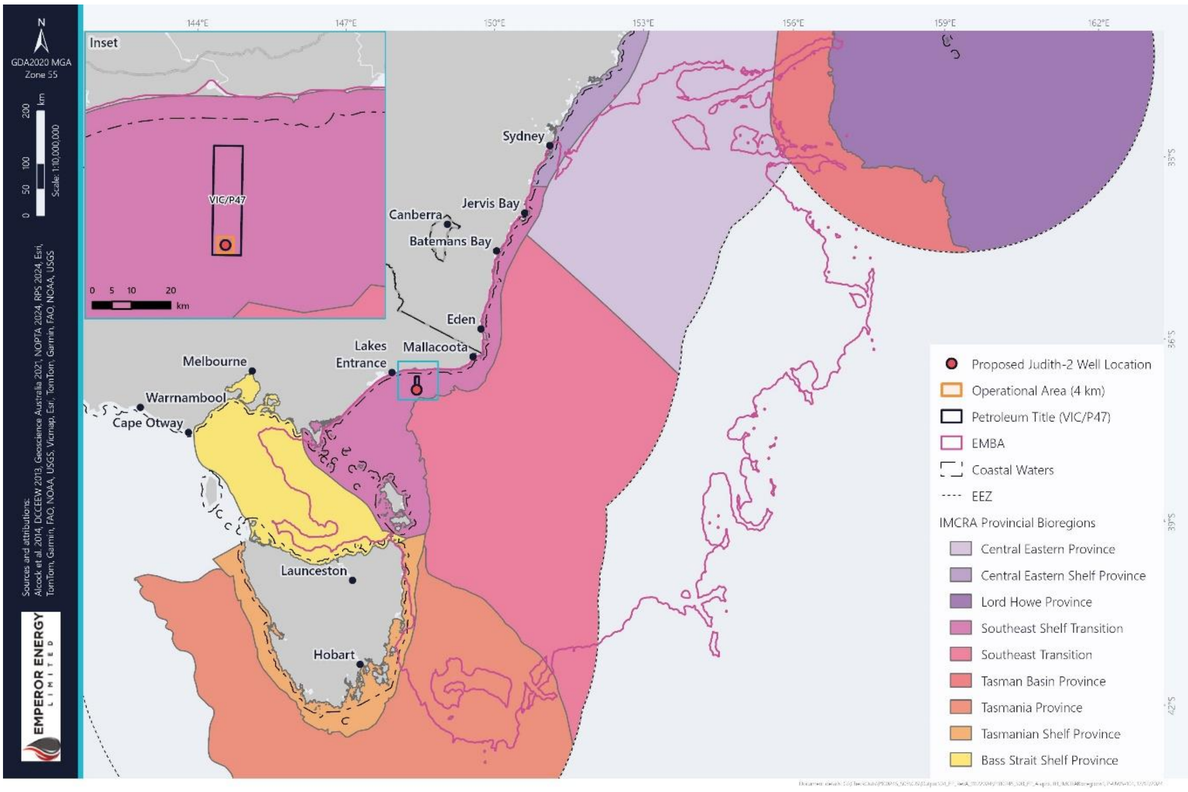

Figure 4-2: IMCRA bioregions within the EMBA

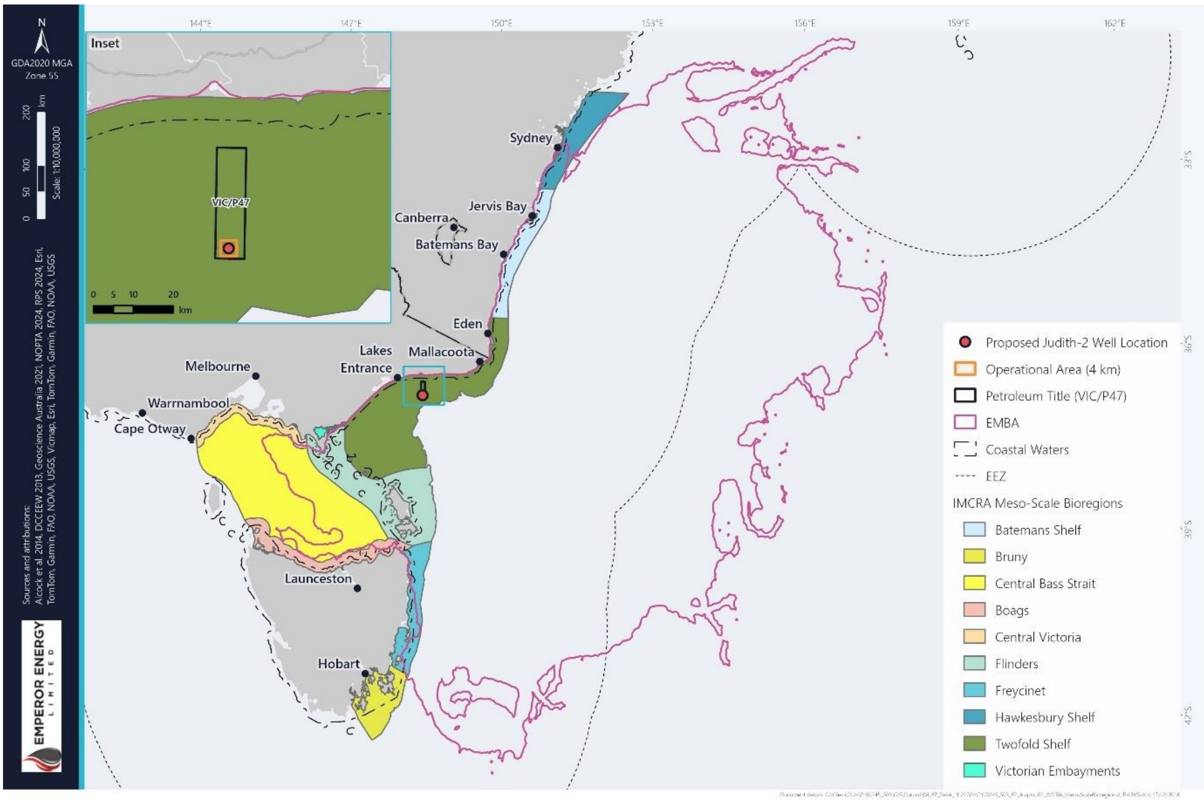

Figure 4-3: IMCRA Meso-scale Bioregions within the EMBA (Commonwealth of Australia 2006).

4.3. Physical Environment

4.3.1. Climate

The Twofold Shelf bioregion is typical of a cool temperate climate with warm summers and tendency for winter-spring rainfall (NOO 2002a). Lakes Entrance is the closest meteorological station positioned approximately 40 km northwest of the Operational Area. Data collected at this station between 2006 and 2022 indicates the mean maximum temperature fluctuates from 15.1°C in June to 24.4°C in January, with the mean minimum temperature being 6°C in July and 14.8°C in February (BoM 2023). Annual rainfall is also recorded at this station with an average of 713.7mm. During this period the lowest mean rainfall occurred in February (41.5mm), and the highest mean rainfall occurred in November (71 mm) (BoM 2023).

Local wind speeds are approximately 10 - 30 km per hour, with maximum gusts reaching 100 km per hour. The predominant wind direction in winter is westerly, which changes to westerly and easterly during both spring and autumn when wind speeds are at their highest and moves to an easterly wind during summer (BOM, 2017). Low pressure systems called 'east coast lows' occur once or twice per year and provide increased potential for generating extreme wave conditions (BOM 2017).

4.3.2. Oceanography

Weather systems passing over the Bass Strait result in wind and pressure driven currents in the Gippsland Basin. These are also caused through the indirect effects of weather systems passing over the Great Australian Bight (GEMS 2005). Local currents are tide and wind driven with a predominantly northeast–southwest tidal movement. Rising tide sees tidal flows from the east and west, with a falling (ebb) tide flowing out to the east and west. Tidal streams have a period of 12.4 hours with a phase variance of three to four hours from east to west.

Water temperatures reflect the influence of warmer waters brought into Bass Strait by the East Australian Current, with the southern section of the Twofold Shelf being considerably warmer in summer than other more southerly Tasmanian regions (NOO 2002a). Along the New South Wales section coastal oceanographic circulation is influenced mainly by northwards settling coastally trapped waves generated in Tasman Sea waters, although inshore a northerly flowing tongue of Bass Strait water is generally present (NOO 2002a).

4.3.3. Water Quality

Marine water quality within the Gippsland region is expected to be representative of the typically pristine and high-water quality found in offshore Victorian waters. Variations to this state (e.g. increased turbidity) may occur in more coastal regions that are subject to large tidal ranges, terrestrial run-off or anthropocentric factors (i.e. ports, industrial discharges, etc.).

The Gippsland Basin is well mixed given it is a higher-energy environment exposed to frequent storms and significant wave activity, although wave energy in the Twofold Shelf bioregion is considered relatively low compared to the Otway and central Bass Strait regions.

4.3.4. Sediment Quality

Marine sediment quality within the Gippsland region is expected to be representative of the typically pristine offshore Victorian waters. Variations to this state (e.g. increased metal concentrations) may occur in more coastal regions that are subject to large tidal ranges, terrestrial run-off or anthropocentric factors (i.e. ports, industrial discharges, etc.).

Sediment on the Twofold Shelf is considered poorly sorted with a median of 92% sand and 8% gravel composition with organic and calcium carbonate material included (IMCRA 1998). The seabed is comprised of fine to coarse sand and areas of shell (CEE Consultants 2003). It is expected that sediment quality within the vicinity of the Operational Area and wider EMBA will be typical of the offshore marine environment in the Gippsland Basin, which is characterised by high sediment quality with low background concentrations of trace metals and organic chemicals.

4.3.5. Air Quality

The Operational Area is located approximately 37 km offshore from Victoria where the air quality is expected to be high. However, anthropogenic sources (e.g. vessels, industry developments) would contribute to local variation in air quality.

Historical air quality data from the Cape Grim Air Pollution Monitoring Station on Tasmania's north-west coast, illustrates that most GHGs have shown continuous increases in concentration since the mid-to-late 1970s (CSIRO 2022). However, those GHGs which are also ozone depleting substance, such as CFCs, are now in decline. Increases are principally caused by human activities such as fossil fuel consumption and various agricultural practices.

It is expected that air quality within the vicinity of the Judith-2 well and wider EMBA will be typical of the offshore marine environment in the Gippsland region.

4.3.6. Ambient Light

Ambient natural light within the offshore Gippsland region is expected to predominantly be from solar / lunar luminance.

Ambient artificial light sources associated with offshore activities exist in the Gippsland region, including both permanent (e.g. offshore developments) and temporary (e.g. vessels) light sources. The Operational Area is located approximately 8.5 km from the nearest facility and approximately 36 km from the nearest coastal town at Marlo, Victoria.

4.3.7. Ambient Noise

Ambient noise within the offshore Gippsland region is expected to be dominated by natural physical (e.g. wind, waves, rain) and biological (e.g. echolocation and communication noises generated by cetaceans and fish) sources.

Anthropogenic noise sources that are also likely to be experienced in the area include low-frequency noise from vessels with the Southeast Marine Region considered one of the busiest shipping regions in Australia. Therefore, the area is likely to be exposed to the occasional sounds generated by mid to large vessels such as tankers and bulk carriers.

4.4. Ecological Environment

4.4.1. Benthic Habitats and Communities

Benthic communities are biological communities that live in or on the seabed. These communities typically contain light-dependent taxa such as algae, seagrass, and hard corals, which obtain energy primarily from photosynthesis (EPA 2016). Other fauna, such as molluscs, crustaceans, sponges, or site-attached fish, also form part of a benthic community in that they obtain their energy by consuming other organisms and organic matter, but they are considered separately under the appropriate fauna receptor: Invertebrates and Fish.

The New Zealand Star Bank is a large reef system within the eastern Bass Strait and lies within the EMBA. Benthic habitat mapping of the New Zealand Star Bank showed that the area featured hard-ground features related to high-relief granite outcrops associated with diverse and abundant sessile and motile fauna. The unconsolidated sediment on the flat seabed is associated with sparse sponges on the inner shelf, while the middle shelf and seaward flat and muddy seabeds support infauna communities. Unconsolidated sediments on the low-relief seabed is associated with an increase in density and sizes of sponges (Beaman et al. 2005).

A 2003 geo-acoustic survey was undertaken by Cooper Energy in the nearby Sole development title (VIC/L32), approximately 30 km from the VIC/P47 title for this activity, to characterise the bathymetry, seabed features, shallow geology, sediments and benthic habitat (OMV 2003). The key survey findings included:

- Bathymetry is generally gentle sloping between water depths of 14.7m approx. 200 m south of the Sole HDD beach crossing and 125.8 m at the Sole-3 location.
- Featureless seabed comprised of clays, silts, sands and gravel and some consolidated bedded sediments.
- Average seabed slopes along the proposed pipeline route do not exceed 0.25° (1:230). From the available bathymetry data, the seabed topography along the proposed pipeline route does not appear to contain significant cross slopes exceeding 10° (1:5.7).
- Poorly to well-defined mega ripples and uneven surfaces were identified in a number of places along the proposed pipeline route. Mega ripples are characterised by wavelength of less than 5 m to approximately 20 m, amplitudes less than 0.30 m and crest generally trending northeast suggesting a northwest to southeast primary current orientation.

A video survey was also undertaken in 2002 along the PB pipeline located in the Gippsland Basin (CEE Consultants 2003). The survey indicated that large epibiota are very sparse and extensive areas of sandy and shell/rubble seabed are devoid of large epibiota except for introduced screw shells and sponges.

Based on the above survey information, it is expected that the benthic habitat in the Operational Area is comprised of sandy substrate, sparse epifauna (e.g. sponges) and infauna.

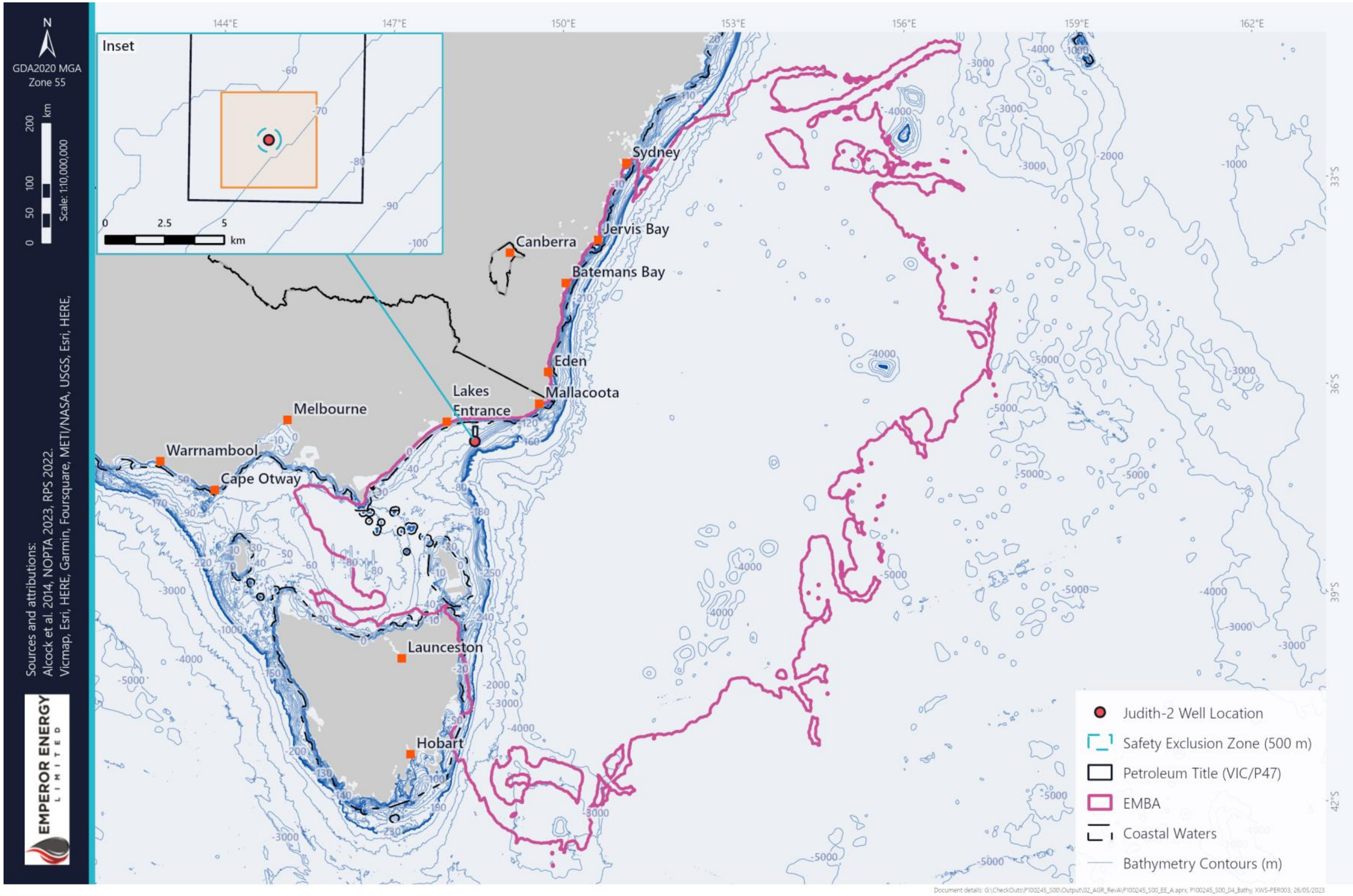

Figure 4-4: Bathymetry within the EMBA and greater Bass Strait

4.4.2. Coastal Habitats and Communities

The coast is dominated by dunes and sandy shorelines, with occasional rock outcrops; and there are extensive areas of inshore and offshore soft sediments (Barton et al. 2012). This region also has occasional low-relief reef immediately beyond the surf zone (7-25m deep) (Parks Victoria 2003). Coastal habitats and communities found within the EMBA are discussed in Table 4-1.

Table 4-1: Coastal Habitats and Communities within the EMBA

COASTAL HABITAT/ COMMUNITY	REPRESENTATION WITHIN THE EMBA	KEY VALUES
Sandy shoreline	Ninety Mile Beach, East Gippsland, Victoria	• Sandy shorelines create a dynamic interface between land and sea • Sandy substrates are often home to a surprising wealth of both microscopic and macroscopic species • Important habitats for tourism and recreational activities
Rocky shoreline	Point Hicks Marine National Park, East Gippsland, Victoria	• Rocky shorelines are composed of rocks (e.g., granite, limestone, basalt) and may be exposed or submerged dependent on the tide • Intertidal shorelines can support a multitude of species which vary across the state depending on the exposure to waves, rock type and the presence of rock pools, crevices or boulders • Rocky shorelines provide important habitat to a variety of invertebrate and marine plant species
Seagrass	Corner Inlet Marine Park, South Gippsland, Victoria	• Distribution is species dependent and can vary between sheltered bays, inlets, intertidal flats or the subtidal zone • Species establish underwater meadows which are important shelter and foraging grounds for many fish and marine mammal species
Saltmarsh	Gippsland Lakes, East Gippsland, Victoria	• Often found on intertidal mudflats these communities are composed of salt-tolerant species which are influenced by daily tides • Saltmarshes provide important rooting and foraging habitat for amphibians and a variety of coastal and wetland bird species

Mangrove	Corner Inlet and Nooramunga Marine and Coastal Park, South Gippsland, Victoria	• Inhabit low energy environments (bays, inlets, estuaries) along the central coast of Victoria • Only one species is present in south eastern Australia: White mangrove (*Avicennia marina*) • Mangroves provide important roosting and foraging habitats for a variety of invertebrate, fish and bird species

Source: Parks Victoria, 2023b

One species of coral (Cauliflower soft coral) is known to occur within the EMBA and is listed as Endangered under the Environment Protection and Biodiversity Conservation Act 1999. Distribution of this species is confined to estuarine environments in NSW where is provides important habitat for a range of fish species (TSSC, 2020).

4.4.3. Plankton

Plankton consists of both flora (phytoplankton) and fauna (zooplankton) and are found throughout nearshore and open waters and are typically more abundant in surface waters. Species distribution is often patchy and is largely dependent on tide driven currents and winds. Plankton's inability to influence their movement patterns results in high natural rates of loss and regeneration (Richardson et al., 2017). Plankton make up a key component of the marine ecosystem food chains, providing a food source for a variety of fauna, including barnacles, sea squirts, large sharks and whales.

The EMBA is located within an area identified as the upwelling east of Eden, a key ecological feature related to eddies which originate from the East Australia Current. These eddies can move into the Gippsland region and drive episodic mixing, nutrient enrichment and blooms of phytoplankton, increased zooplankton and fish.

4.5.Threatened and Migratory Species

To identify threatened and/or migratory listed species that may be affected the planned or unplanned activities, a PMST report was conducted and is presented in APPENDIX B .

Part 13 of the EPBC Act indicates species can be listed as one, or a combination of the following designations:

- Threatened
- Migratory
- Whale or other cetaceans
- Marine.

Threatened or migratory species that are likely or known to occur in the area or have an intercepting BIA with the EMBA are discussed in Table 4-2 - Table 4-8 and discussed in Section 4.5.1 - 4.5.4.

Biologically Important Areas (BIAs) are specific regions of the marine environment, defined spatially and temporally, where protected marine species perform critical life functions (DCCEEW 2024). These areas are identified based on their regular or repeated use by individuals or groups of a single species, stock, or population for activities such as reproduction, feeding, migration, or resting (DCCEEW 2024).

While BIAs are under constant review by the Australian Government to consider the spatial-temporal distribution of species, this EP has used the best available technologies at the time of writing to ensure that all impacts and risks to threatened and/or migratory listed species have been considered. Emperor will ensure any changes to these species is accounted for following the process outlined in Section 8.9.

Biologically Important Areas with the potential to interact with planned activities (within the Operational Area and lighting EMBA) include:

- Foraging habitat for nine seabird species
- Distribution habitat for the white shark
- Migratory and breeding habitat for the southern right whale
- Distribution and foraging habitat for the pygmy blue whale.

Biologically Important Areas that overlap the defined EMBA are listed and discussed in the following sections. There are no Habitats Critical for the Survival of Marine Species with the Operational Area, light EMBA, or EMBA.

4.5.1. Seabirds and shorebirds

Marine ecosystems are one of the most productive and essential ecosystems for a variety of bird species. Seabirds, which are birds that are adapted to life in the marine environment; can be highly pelagic, coastal, or in some cases spend a part of the year at sea entirely. These species include albatrosses, petrels, and shearwaters. Shorebirds (or waders) inhabit the shorelines of coasts and inland water bodies for most of their lives including sandpipers and plovers.

Migratory bird species in Australia are protected under several international treaties and agreements including the Convention on the Conservation of Migratory Species of Wild Animals (Bonn Convention), the Ramsar Convention on Wetlands, the Agreement on the Conservation of Albatrosses and Petrels, and through the East Asian – Australasian Flyway Partnership (the Flyway Partnership). The Australian Government also has bilateral migratory bird agreements with Japan (Japan-Australia Migratory Bird Agreement, JAMBA), China (China-Australia Migratory Bird Agreement, CAMBA), and the Republic of Korea (Republic of Korea-Australia Migratory Bird Agreement, ROKAMBA). In Australia the *Environment Protection and Biodiversity Conservation Act 1999* gives effect to these international obligations.

Some bird species are listed as threatened and/or migratory under the *Environment Protection and Biodiversity Conservation Act 1999*, and these are considered a matter of national environmental significance. Species may also be protected under state and territory environmental legislation. All EPBC Listed threatened and migratory bird species within the EMBA are listed in Table 4-2.

Additionally, within the EMBA there are certain species that exhibit biologically important behaviours, such as foraging, breeding or migrating which are crucial to the species success. There are 24 seabird and migratory shorebird species which have BIAs overlapped by the EMBA. BIAs are listed below in Table 4-2

Several species identified by the PMST to occur within the EMBA are terrestrial species and are not likely to inhabit coastlines or rely on the marine environment for breeding or foraging. These species are not considered to be credibly impacted by the activity and have been excluded from this section and impact assessment. These species are listed in APPENDIX B .

Table 4-2 Listed bird species identified in the Operational and EMBAs

COMMON NAME	SCIENTIFIC NAME	THREATENED STATUS	MIGRATORY	MARINE	OPERATIONAL AREA	LIGHT EMBA	MDO EMBA	EMBA	EPBC MANAGEMENT PLAN
Antipodean Albatross	*Diomedea antipodensis*	V	✓(M)	✓	FLO	FLO	FLO	FLO	National Recovery Plan for albatrosses and petrels 2022
Asian Dowitcher	*Limnodromus semipalmatus*	V	✓(W)	✓	-	-	MO	KO	Conservation Advice for *Limnodromus semipalmatus* (Asian dowitcher)
Australasian Bittern	*Botaurus poiciloptilus*	E	-	-	-	KO	KO	KO	Conservation Advice *Botaurus poiciloptilus* Australasian Bittern Commonwealth Listing Advice on *Botaurus poiciloptilus* (Australasian Bittern) National Recovery Plan for the Australasian Bittern (*Botaurus poiciloptilus)*
Australasian Gannet	*Morus serrator*	-	-	✓	-	-	BKO	BKO	-
Australian Fairy Tern	*Sternula nereis nereis*	V	-	-	FLO	KO	KO	KO	Approved Conservation Advice for *Sternula nereis nereis* (Fairy Tern) Commonwealth Listing Advice on *Sternula nereis nereis* (Fairy Tern) National Recovery Plan for the Australian Fairy Tern (*Sternula nereis nereis*)
Australian Painted Snipe	*Rostratula australis*	E	-	✓	-	LO	KO	KO	Approved Conservation Advice for *Rostratula australis* (Australian painted snipe) Commonwealth Listing Advice on *Rostratula australis* (Australian Painted Snipe) National Recovery Plan for the Australian Painted Snipe (*Rostratula australis*).
Bar-tailed Godwit	*Limosa lapponica*	-	✓(W)	✓	-	KO	KO	KO	-
Black-browed Albatross	*Thalassarche melanophris*	V	✓(M)	✓	FLO	FLO	FLO	FLO	Commonwealth Listing Advice on Black-browed Albatross (*Thalassarche melanopris*) National Recovery Plan for albatrosses and petrels 2022
Black-faced Cormorant	*Phalacrocorax fuscescens*	-	-	✓	-	-	BKO	BKO	-
Black-faced Monarch	*Monarcha melanopsis*	-	-	✓	-	KO	KO	KO	-
Black-tailed Godwit	*Limosa limosa*	E	✓(W)	✓	-	-	KO	RKO	-
Blue Petrel	*Halobaena caerulea*	V	-	✓	MO	MO	MO	MO	Conservation Advice *Halobaena caerulea* blue petrel
Blue-winged Parrot	*Neophema chrysostoma*	V	-	✓	-	KO	KO	KO	Conservation Advice for *Neophema chrysostoma* (blue-winged parrot)
Broad-billed Sandpiper	*Limicola falcinellus*	-	✓(W)	✓	-	-	-	RKO	-
Brown skua	*Stercorarius antarcticus*	-	-	✓	MO	MO	MO	MO	-

COMMON NAME	SCIENTIFIC NAME	THREATENED STATUS	MIGRATORY	MARINE	OPERATIONAL AREA	LIGHT EMBA	MDO EMBA	EMBA	EPBC MANAGEMENT PLAN
Brown Treecreeper (south-eastern)	*Climacteris picumnus victoriae*	V	-	-	-	MO	KO	KO	Conservation Advice for *Climacteris picumnus victoriae* (brown treecreeper (south-eastern)
Buller's Albatross	*Thalassarche bulleri*	V	✓(M)	✓	MO	MO	FLO	FLO	National Recovery Plan for albatrosses and petrels 2022
Campbell Albatross	*Thalassarche impavida*	V	✓(M)	✓	FLO	FLO	FLO	FLO	National Recovery Plan for albatrosses and petrels 2022
Caspian Tern	*Hydroprogne caspia*	-	✓(M)	✓	-	-	BKO	BKO	-
Cattle Egret	*Bubulcus ibis*	-	-	✓	-	MO	MO	MO	-
Chatham Albatross	*Thalassarche eremita*	E	✓(M)	✓	FMO	FMO	FMO	FMO	National Recovery Plan for albatrosses and petrels 2022
Common Diving-Petrel	*Pelecanoides urinatrix*	-	-	✓	-	-	BKO	BKO	-
Common Greenshank	*Tringa nebularia*	E	✓(W)	✓	-	LO	KO	KO	-
Common Noddy	*Anous stolidus*	-	✓(M)	✓	-	-	LO	LO	-
Common Sandpiper	*Actitis hypoleucos*	-	✓(W)	✓	MO	KO	KO	KO	-
Curlew Sandpiper	*Calidris ferruginea*	CE	✓(W)	✓	MO	KO	KO	KO	Conservation Advice *Calidris ferruginea* Curlew Sandpiper
Diamond Firetail	*Stagonopleura guttata*	V	-	-	-	KO	KO	KO	Conservation Advice for *Stagonopleura guttata* (diamond firetail)
Double-banded Plover	*Charadrius bicinctus*	-	✓(W)	✓	-	-	RKO	RKO	-
Eastern Curlew	*Numenius madagascariensis*	CE	✓(W)	✓	MO	KO	KO	KO	Conservation Advice *Numenius madagascariensis* Eastern Curlew
Eastern Hooded Plover	*Numenius madagascariensis*	V	-	✓	-	KO	KO	KO	Conservation Advice *Thinornis rubricollis rubricollis* Hooded Plover (Eastern)
Fairy prion (southern)	*Pachyptila turtur subantarctica*	V	-	-	MO	KO	KO	KO	Conservation advice *Pachyptila turtur subantarctica* fairy prion (southern)
Fairy Prion	*Pachyptila turtur*	-	-	✓	MO	KO	KO	KO	-
Fairy Tern	*Sternula nereis*	-		✓	-	-	BKO	BKO	-
Flesh-footed Shearwater	*Ardenna carneipes*	-	✓(M)	✓	LO	FLO	FLO	FLO	-
Fork-tailed Swift	*Apus pacificus*	-	✓(M)	✓	-	LO	LO	LO	-
Forty-spotted Pardalote	*Pardalotus quadragintus*	E	-	-	-	-	LO	FKO	Conservation Advice *Pardalotus quadraginatus* forty-spotted pardalote National Recovery Plan for the Forty-spotted Pardalote (*Pardalotus quadragintus*)
Gang-gang Cockatoo	*Callocephalon fimbriatum*	E	-	-	-	KO	KO	KO	Conservation Advice for *Callocephalon fimbriatum* (Gang-gang Cockatoo)

COMMON NAME	SCIENTIFIC NAME	THREATENED STATUS	MIGRATORY	MARINE	OPERATIONAL AREA	LIGHT EMBA	MDO EMBA	EMBA	EPBC MANAGEMENT PLAN
Gibson's Albatross	*Diomedea antipodensis gibsoni*	V	-	✓	FLO	FLO	FLO	FLO	National Recovery Plan for albatrosses and petrels 2022
Gould's Petrel	*Pterodroma leucoptera leucoptera*	E	-	-	MO	MO	BKO	BKO	Gould's Petrel (*Pterodroma leucoptera leucoptera*) Recovery Plan
Great Frigatebird	*Fregata minor*	-	✓(M)	✓	-	-	MO	MO	-
Great Knot	*Calidris tenuirostris*	V	✓(W)	✓	-	-	RKO	RKO	Conservation advice *Calidris tenuirostriss* Great knot
Great Skua	*Stercorarius skua*	-	-	✓	MO	MO	MO	MO	-
Great-winged Petrel	*Great-winged Petrel*	-	-	✓			LO	LO	-
Greater Crested Tern	*Thalasseus bergii*	-	✓(W)	✓	-	-	BKO	BKO	-
Greater Sand Plover	*Charadrius leschenaultii*	V	✓(W)	✓	-	KO	KO	KO	Conservation Advice *Charadrius leschenaultii* Greater sand plover
Grey Falcon	*Falco hypoleucos*	V	-	-	-	LO	LO	LO	Conservation Advice *Falco hypoleucos* Grey Falcon
Grey Plover	*Pluvialis squatarola*	V	✓(W)	✓	-	-	KO	RKO	-
Grey-headed Albatross	*Thalassarche chrysostoma*	E	✓(M)	✓	MO	MO	MO	MO	Approved Conservation Advice for *Thalassarche chrysostoma* (Grey-headed Albatross) National Recovery Plan for albatrosses and petrels 2022
Grey-tailed Tattler	*Tringa brevipes*	-	✓(W)	✓	-	-	KO	RKO	-
Herald Petrel	*Pterodroma heraldica*	CE	-	-	-	-	LO	LO	Conservation Advice *Pterodroma heraldica* Herald petrel Commonwealth Listing Advice on *Petrodroma heraldica* (Herald Petrel)
Hooded Plover	*Thinornis cucullatus*	-	-	✓	-	KO	KO	KO	-
Indian Yellow-nosed Albatross	*Thalassarche carteri*	V	✓(M)	✓	LO	LO	LO	LO	National Recovery Plan for albatrosses and petrels 2022
Kelp Gull	*Larus dominicanus*	-	-	✓	-	-	-	BKO	-
Kermadec Petrel (western)	*Pterodroma neglecta neglecta*	V	-	-	-	-	FMO	FMO	Lord Howe Island Biodiversity Management Plan Norfolk Island Region Threatened Species Recovery Plan
Latham's Snipe	*Gallinago hardwickii*	V	✓(W)	✓	-	KO-	KO	KO	-
Lesser Frigatebird	*Fregata ariel*	-	✓(M)	✓	-	-	LO	KO	-
Lesser Sand Plover	*Charadrius mongolus*	E	✓(W)	✓	-	-	KO	RKO	Conservation Advice *Charadrius mongolus* Lesser sand plover
Little Curlew	*Numenius minutus*	-	✓(W)	✓	-	FLO	RLO	RKO	-
Little Penguin	*Eudyptula minor*	-	-	✓	-	-	BKO	BKO	-

COMMON NAME	SCIENTIFIC NAME	THREATENED STATUS	MIGRATORY	MARINE	OPERATIONAL AREA	LIGHT EMBA	MDO EMBA	EMBA	EPBC MANAGEMENT PLAN
Little Tern	*Sternula albifrons*	-	✓(M)	✓	-	BKO	BKO	BKO	-
Long-toed Stint	*Calidris subminuta*	-	✓(W)	✓	-	-	-	RKO	-
Marsh Sandpiper	*Tringa stagnatilis*	-	✓(W)	✓	-	-	KO	RKO	-
Masked Owl (Tasmania)	*Tyto novaehollandiae castanops (Tasmanian population)*	V	-	-	-	-	KO	KO	Approved Conservation Advice for Tyto *novaehollandiae castanops* (Tasmanian Masked Owl) Commonwealth Listing Advice on Tyto *novaehollandiae castanops* (Masked Owl (Tasmanian))
Norther Buller's Albatross	*Thalassarche bulleri platei*	V	-	✓	MO	MO	FLO	FLO	National Recovery Plan for albatrosses and petrel 2022.
Northern Giant Petrel	*Macronectes halli*	V	✓(M)	✓	FLO	FLO	FLO	FLO	Commonwealth Listing Advice on *Macronectes halli* National Recovery Plan for albatrosses and petrels 2022
Northern Royal Albatross	*Diomedea sanfordi*	E	✓(M)	✓	FLO	FLO	FLO	FLO	National Recovery Plan for albatrosses and petrels 2022
Nunivak Bar-tailed Godwit	*Limosa lapponica baueri*	E	-	-	-	KO	KO	KO	Conservation Advice *Limosa lapponica baueri* Bar-tailed godwit (western Alaskan)
Orange-bellied Parrot	*Neophema chrysogaster*	CE	-	✓	-	MO	MO	KO	Commonwealth Listing Advice on *Neophema chrysogaster* National Recovery Plan for the Orange-bellied Parrot, *Neophema chrysogaster*
Oriental Cuckoo	*Cuculus optatus*	-	✓(T)	-	-	-	KO	KO	-
Oriental Plover	*Charadrius veredus*	-	✓(W)	✓	-	-	-	RKO	-
Osprey	*Pandion haliaetus*	-	✓(W)	✓	-	KO	KO	KO	-
Pacific Golden Plover	*Pluvialis fulva*	-	✓(W)	✓	-	-	KO	RKO	-
Pacific Gull	*Larus pacificus*	-	-	✓	-	-	BKO	BKO	-
Pectoral Sandpiper	*Calidris melanotos*	-	✓(W)	✓	MO	MO	LO	KO	-
Pied Stilt	*Himantopus himantopus*	-	-	✓	-	-	FKO	RKO	-
Pilotbird	*Pycnoptilus floccosus*	V	✓(W)	-	-	KO	KO	KO	Conservation Advice for *Pycnoptilus floccosus* (Pilotbird)
Pin-tailed Snipe	*Gallinago stenura*	-	✓(W)	✓	-	FLO	RLO	RLO	-
Rainbow Bee-eater	*Merops ornatus*	-	-	✓	-	MO	MO	MO	-
Red Goshawk	*Erythrotriorchis radiatus*	E	-	-	-	-	-	MO	Conservation Advice for *Erythrotriorchis radiatus* (red goshawk) National recovery plan for the red goshawk *Erythrotriorchis radiatus*
Red Knot	*Calidris canutus*	V	✓(W)	✓	MO	KO	KO	KO	Conservation Advice *Calidris canutus* Red Knot

COMMON NAME	SCIENTIFIC NAME	THREATENED STATUS	MIGRATORY	MARINE	OPERATIONAL AREA	LIGHT EMBA	MDO EMBA	EMBA	EPBC MANAGEMENT PLAN
Red-capped Plover	*Charadrius ruficapillus*	-	-	✓	-	-	RKO	RKO	-
Red-necked Avocet	*Recurvirostra novaehollandiae*	-	-	✓	-	-	KO	RKO	-
Red-necked Stint	*Calidris ruficollis*	-	✓(W)	✓	-	-	RKO	RKO	-
Regent Honeyeater	*Anthochaera phrygia*	CE	-	-	-	KO	KO	KO	Conservation Advice *Anthochaera phrygia* regent honeyeater
Ruddy Turnstone	*Arenaria interpres*	V	✓(W)	✓	-	-	RKO	RKO	-
Ruff (Reeve)	*Philomachus pugnax*	-	✓(W)	✓	-	-	KO	RKO	-
Rufous Fantail	*Rhipidura rufifrons*	-		✓	-	KO	KO	KO	-
Salvin's Albatross	*Thalassarche salvini*	V	✓(M)	✓	FLO	FLO	FLO	FLO	National Recovery Plan for albatrosses and petrels 2022
Sanderling	*Calidris alba*	-	✓(W)	✓	-	-	RKO	RKO	-
Satin Flycatcher	*Myiagra cyanoleuca*	-		✓	-	KO	KO	BKO	-
Sharp-tailed Sandpiper	*Calidris acuminata*	V	✓(W)	✓	MO	KO	RKO	RKO	Conservation Advice for *Calidris acuminata* (sharp-tailed sandpiper)
Short-tailed Shearwater	*Ardenna tenuirostris*	-	✓(M)	✓	-	-	BKO	BKO	-
Shy Albatross	*Thalassarche cauta*	E	✓(M)	✓	FLO	FLO	FLO	FLO	Conservation Advice *Thalassarche cauta* Shy Albatross National Recovery Plan for albatrosses and petrels 2022
Silver Gull	*Chroicocephalus novaehollandiae*	-	-	✓	-	-	BKO	BKO	-
Soft-plumaged Petrel	*Pterodroma mollis*	V	-	✓	-	-	MO	MO	Conservation Advice *Pterodroma Mollis* soft-plumaged petrel
Sooty Albatross	*Phoebetria fusca*	V	✓(M)	✓	MO	MO	LO	LO	National Recovery Plan for albatrosses and petrels 2022
Sooty Shearwater	*Ardenna grisea*	V	✓(M)	✓	MO	MO	BKO	BKO	-
Sooty Tern	*Onychoprion fuscatus*	-	-	✓	-	-	BKO	BKO	-
South-eastern Glossy Black-Cockatoo	*Calyptorhynchus lathami lathami*	V	-	-	-	LO	KO	KO	Conservation Advice for *Calyptorhynchus lathami* lathami (South-eastern Glossy Black Cockatoo)
Southern Giant Petrel	*Macronectes giganteus*	E	✓(M)	✓	MO	MO	FLO	FLO	Commonwealth Listing Advice on *Macronectes giganteus* National Recovery Plan for albatrosses and petrels 2022
Southern Royal Albatross	*Diomedea epomophora*	V	✓(M)	✓	FLO	FLO	FLO	FLO	National Recovery Plan for albatrosses and petrels 2022
Spectacled Monarch	*Symposiachrus trivirgatus*	-	✓(T)	✓	-	-	KO	KO	-

COMMON NAME	SCIENTIFIC NAME	THREATENED STATUS	MIGRATORY	MARINE	OPERATIONAL AREA	LIGHT EMBA	MDO EMBA	EMBA	EPBC MANAGEMENT PLAN
Streaked Shearwater	*Calonectris leucomelas*	-	✓(M)	✓	-	-	LO	KO	-
Swift Parrot	*Lathamus discolor*	CE	-	✓	-	KO	KO	BKO	Conservation Advice *Lathamus discolor* swift parrot National Recovery Plan for the Swift Parrot (Lathamus discolor)
Swinhoe's Snipe	*Gallinago megala*	-	✓(W)	✓	-	FLO	RLO	RLO	-
Tasmanian Azure Kingfisher	*Ceyx azureus diemenensis*	E	-	-	-	-	MO	KO	Approved Conservation Advice for *Ceyx azureus diemenensis* (Tasmanian Azure Kingfisher) Commonwealth Listing Advice on *Ceyx azureus diemenensis* (Tasmanian Azure Kingfisher)
Tasmanian Wedge-tailed Eagle (Tasmanian)	*Aquila audax fleayi*	E	-	-	-	-	BLO	BLO	Threatened Tasmanian Eagles Recovery Plan 2006-2010
Terek Sandpiper	*Xenus cinereus*	V	✓(W)	✓	-	-	KO	RKO	Conservation Advice for *Xenus cinereus* (terek sandpiper) Wildlife Conservation Plan for Migratory Shorebirds
Wandering Albatross	*Diomedea exulans*	V	✓(M)	✓	FLO	FLO	FLO	FLO	National Recovery Plan for albatrosses and petrels 2022
Wandering Tattler	*Tringa incana*	-	✓(W)	✓	-	-	-	RKO	-
Wedge-tailed Shearwater	*Ardenna pacifica*	-	✓(M)	✓	-	-	BKO	BKO	-
Wilsons Storm Petrel	*Oceanites oceanicus*	-	✓(M)	✓			KO	KO	-
Whimbrel	*Numenius phaeopus*	-	✓(W)	✓	-	-	RKO	RKO	-
White-bellied Sea-Eagle	*Haliaeetus leucogaster*	-	-	✓	-	KO	BKO	BKO	-
White-bellied Storm Petrel	*Fregetta grallaria grallaria*	V	-	-	LO	LO	LO	LO	Lord Howe Island Biodiversity Management Plan
White-capped Albatross	*Thalassarche steadi*	V	✓(M)	✓	FKO	FKO	FKO	FKO	National Recovery Plan for albatrosses and petrels 2022
White-face Storm Petrel	*Pelagodroma marina*	-	-	✓	-	-	BKO	BKO	-
White-fronted Tern	*Sterna striata*	-	-	✓	MO	FLO	BKO	BKO	-
White-necked Petrel	*Pterodroma cervicalis*	-	-	✓	MO	MO	BLO	BLO	-
White-tailed Tropicbird	*Phaethon lepturus*	-	✓(M)	✓	-	-	MO	KO	-
White-throated Needletail	*Hirundapus caudacutus*	V	✓(T)	✓	-	KO	KO	KO	Conservation Advice *Hirundapus caudacutus* White-throated Needletail
Wood Sandpiper	*Tringa glareola*	-	✓(W)	✓	-	-	KO	RKO	-
Yellow Wagtail	*Motacilla flava*	-	✓(T)	✓	-	-	MO	KO	-

Threatened Species: Type of presence: Migratory:

COMMON NAME	SCIENTIFIC NAME	THREATENED STATUS	MIGRATORY	MARINE	OPERATIONAL AREA	LIGHT EMBA	MDO EMBA	EMBA	EPBC MANAGEMENT PLAN

V – Vulnerable
E – Endangered
CE – Critically Endangered
CD – Conservation Dependent

MO - Species or species habitat that may occur within the area
LO - Species or species habitat likely to occur within area
KO - Species or species habitat known to occur within area
FMO – Foraging may occur
FLO – Foraging likely to occur
FKO - Foraging known to occur
BKO – Breeding known to occur
RLO – Roosting likely to occur
RKO – Roosting known to occur

(M) – Migratory
(W) – Wetland
(T) – Terrestrial

Table 4-3: Seabird and shorebird BIAs within the EMBA

COMMON NAME	SCIENTIFIC NAME	OPERATIONAL AREA	LIGHT EMBA	MDO EMBA	EMBA
Antipodean Albatross	*Diomedea exulans antipodensis*	-	F	F	F
Black Petrel	*Procellaria parkinsoni*	-	-	F	F
Black-browed Albatross	*Thalassarche melanophris*	F	F	F	F
Black-faced Cormorant	*Phalacrocorax fuscescens*	-	-	F B	F B
Bullers Albatross	*Thalassarche bulleri*	F	F	F	F
Campbell Albatross	*Thalassarche melanophris impavida*	F	F	F	F
Common Diving-Petrel	*Pelecanoides urinatrix*	F	F	F B	F B
Flesh-footed Shearwater	*Ardenna carneipes*	-	-	F	F
Greater Crested Tern	*Thalasseus bergii*	-	-	F B	F B
Great-winged Petrel	*Pterodroma macroptera*	-	-	F	F
Indian Yellow-nosed Albatross	*Thalassarche chlororhynchos bassi*	F	F	F	F
Little Penguin	*Eudyptula minor*	-	-	F B	F B
Northern Giant Petrel	*Macronectes halli*	-	-	F	F
Short-tailed Shearwater	*Ardenna tenuirostris*	-	F	F B	F B
Shy Albatross	*Thalassarche cauta cauta*	F likely	F likely	F likely	F likely
Soft-Plumage Petrel	*Pterodroma mollis*	-	-	F	F
Sooty Shearwater	*Ardenna grisea*	-	-	F B	F B
Southern Giant Petrel	*Macronectes giganteus*	-	-	F	F

Wandering Albatross	*Diomedea exulans*	F	F	F	F
Wedge-tailed Shearwater	*Ardenna pacifica*	-	-	F B	F B
White-capped Albatross	*Thalassarche cauta steadi*	-	-	F	F
White-faced Strom Petrel	*Pelagodroma marina*	-	F	F B	F B
White-fronted Tern	*Sterna striata*	-	-	F	F B
Wilsons Storm Petrel	*Oceanites oceanicus*	-	-	MR	MR

Type of BIA:

F – Foraging

B – Breeding

MR – Migration

4.5.1.1.Seabirds

Albatross and Petrel

A total of 16 albatross and 14 petrel species may be found occurring throughout the EMBA. There are eight different species of albatross that have been identified to have BIAs associated with the EMBA, all of which are for foraging (shown in Figure 4-5 and Figure 4-6). Of these eight species, six of them have also been identified to utilise the Operational Area for foraging; Black-browed Albatross, Buller's Albatross, Campbell Albatross, Indian Yellow-nose Albatross, Shy Albatross and the Wandering Albatross.

Albatross species exhibit a broad range of diets and foraging behaviours; this combined with their ability to cover vast oceanic distances, means all waters within Australian jurisdiction can be considered foraging habitat for this species (CoA, 2022). The most critical foraging habitat is in waters south of 25°S where most species spend most of their foraging time (CoA, 2022). Albatross' typically feed offshore, mainly along the edge of the continental shelf and over open waters, where they catch fish and cephalopods by diving into the water (CoA, 2022).

The black-browed albatross is a key species for conservation in the South-east Marine Region (CoA 2022), and has a circumpolar distribution, ranging across Antarctic, subantarctic, and subtropical seas (CoA 2022). Their annual breeding season begins in September, culminating in the fledging of young between April and May at breeding sites on Macquarie Island, Bishop and Clerk Islets, and the more distant Heard and McDonald Islands (Australian external territory) (Figure 4-5). Outside of breeding, these albatrosses are frequently observed foraging along the southern Australian coastline from Perth to Sydney (Reid et al. 2002). Immature birds, likely from Indian Ocean and South Georgian colonies, are common in south-eastern Australian waters between October and January (Reid et al. 2002), while sub-adults are present year-round. The entire South-east Marine Region is identified as a foraging area BIA for this species, overlapping with the Operational Area and EMBA.

The Buller's albatross has a designated conservation priority within the South-east Marine Region (CoA, 2022), and the species is endemic to New Zealand for breeding. The Buller's albatross has a foraging range extending across the South Pacific Ocean. Typically, adult birds forage between 40–50°S, from the waters east of Tasmania to the Chatham Rise (NZ), whereas juvenile and non-breeding adults undertake broader dispersal throughout the South Pacific, reaching the South American coast (BirdLife International, 2004). The species is most commonly found in the vicinity of Tasmania between January and July (CoA, 2022). Satellite tracking data from New Zealand breeding sites (Stahl and Sagar, 2006) reveal that while breeding adults predominantly forage in New Zealand waters, both breeding and non-breeding segments of the population also utilize foraging grounds around Tasmania. Consequently, a foraging BIA for the Buller's albatross exists within the South-east Marine Region, coinciding with the Operational Area and EMBA (Figure 4-5).

The Campbell albatross is a subspecies of the black-browed albatross and a conservation priority in the South-east Marine Region (CoA, 2022), is endemic to Campbell Island in the New Zealand subantarctic. It breeds annually from early August to May (ACAP, 2023). Juveniles migrate north and disperse through subtropical waters in winter, including along Australia's eastern coast (ACAP, 2023). During winter, adults are widely distributed across the Tasman Sea and the southwestern Pacific east of New Zealand, while in summer their distribution (including non-breeding birds) is more southerly and restricted (32°S to 44°S) (Waugh et al. 1999). Their diet consists of krill, fish, and some cephalopods, salps, and jellyfish. The entire South-east Marine Region is recognized as a foraging Biodiversity Important Area (BIA) for this species, overlapping the Operational Area and EMBA (Figure 4-5).

The Indian yellow-nose albatross is a designated a conservation priority in the South-east Marine Region (CoA, 2022). The Indian yellow-nosed albatross has breeding sites on the French subantarctic islands and

South Africa's Prince Edward Islands (ACAP, 2023). Away from these breeding locations, the species disperses across a broad non-breeding range, frequently occurring off the coasts of southern Africa and Australia (ACAP, 2023). Recent satellite tracking data indicates that during the winter, the Indian yellow-nosed albatross is present throughout the South-east Marine Region, reaching as far south as 45ºS (Delord and Weimerskirch 2011). The foraging BIA for this species within the South-east Marine Region and overlaps the Operational Area and EMBA (Figure 4-6).

The shy albatross is an endemic Australian albatross species, breeding on Albatross Island in Bass Strait, and the Mewstone and Pedra Branca off southern Tasmania within the Tasmanian Wilderness World Heritage Area (Alderman et al. 2010) (Figure 4-6). Their annual breeding cycle involves egg-laying in September and chick fledging in April. In terms of foraging, shy albatrosses differ from many other albatross species by being less pelagic; they are commonly observed over the continental shelf and regularly approach the shorelines of Tasmania and southern Australia (CoA, 2022). The breeding grounds at Albatross Island, Bass Strait, Mewstone, and Pedra Branca are critical habitats, with a foraging BIA established around Albatross Island. Furthermore, the entire South-east Marine Region is recognized as a likely foraging BIA for this endemic species, overlapping the Operational Area and EMBA.

The wandering albatross breeds across six sub-Antarctic Island groups (ACAP, 2023) on a biennial cycle, laying eggs in December and fledging chicks between mid-November and late February. Although a small Australian breeding population is found on Macquarie Island (outside the EMBA) (ACAP, 2023), tracking reveals spatial segregation in foraging: Macquarie Island females forage north towards southern Tasmania, while males venture into the open Southern Ocean south of 50°S. Juvenile distribution is concentrated north and east of Macquarie Island in Pacific waters, off south-eastern Australia and around New Zealand. Their diet in the Southern Ocean consists mainly of squid and fish (Nicholls et al. 1997), supplemented by crustaceans and carrion, with remarkable foraging trips exceeding 15,200 km during incubation. Southern Australia serves as an important wintering ground for non-breeding and juvenile birds originating from Atlantic and Indian Ocean breeding colonies, which stay north of 50°S. During the non-breeding season, females tend to forage at more northerly latitudes than males (Baker and Hamilton 2013). The South-east Marine Region north of 50°S is designated as a foraging BIA for this species, overlapping the Operational Area and EMBA Figure 4-6).

There are eight different species of petrels that have been identified to have BIAs associated with the EMBA which include foraging, breeding and migration (shown in Figure 4-7 and Figure 4-8). Of these eight species, only one of them, Common Diving-Petrel, has been identified to utilise the Operational Area for a BIA, foraging.

The common diving-petrel breeds on islands off south-eastern Australia and Tasmania, with a significant presence of 30 breeding colonies (over 1,000 pairs each) in Tasmania and 12 in Victoria, including key sites like Seal Island, Wilson's Promontory, and Lady Julia Percy Island (DoE, 2022). A foraging BIA has been identified for this species that overlaps with both the Operational Area and EMBA (Figure 4-7).

Petrels have a diverse foraging range, and all waters within Australian jurisdiction can be considered foraging habitat for this species, similar to Albatrosses. Typical diet for petrels includes cephalopods and fish which is predominately caught by surface-seizing (CoA, 2022). Foraging within the region for the Common Diving-Petrel is known to occur. The range runs throughout the Bass Strait, wraps around Tasmania and is considered to be high use.

Many threatened species of petrel breed in Australia's jurisdiction with a high concentration occurring on the offshore islands of Tasmania (Albatross Island, Macquarie Island, the Mewstone and Pedra Branca), the external Territory of Heard Island and McDonald Islands, and the Australian Antarctic Territory (AAT) (CoA 2022). Petrels are extremely site-faithful meaning that individuals are unlikely to change breeding locations each breeding season (CoA 2022). Species with breeding BIAs that occur within the EMBA include the White-faced Strom Petrel and the Common Diving-Petrel.

Additionally, the Herald Petrel is an EPBC Listed Critically Endangered species which may be found within the EMBA. This species forages primarily on cephalopods in waters surrounding islands south of the equator and may be found off the east coast of Australia (DoE 2023). Within Australia the only breeding known to occur is located on Taine Island, Queensland (outside the EMBA) where birds nest on the ground under vegetation.

Figure 4-5: Albatross species Biologically Important Areas within the EMBA

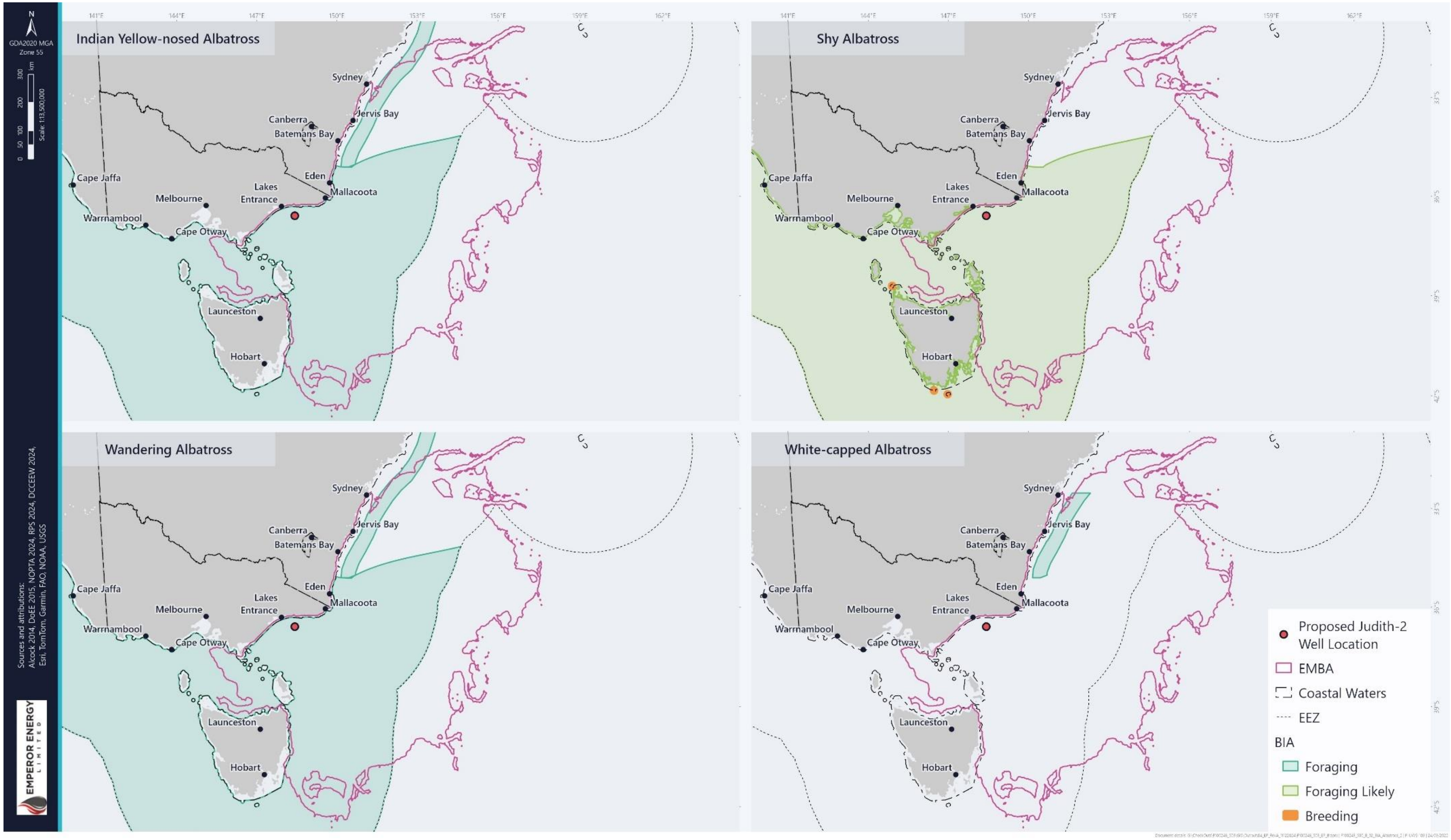

Figure 4-6: Albatross species Biologically Important Areas within the EMBA

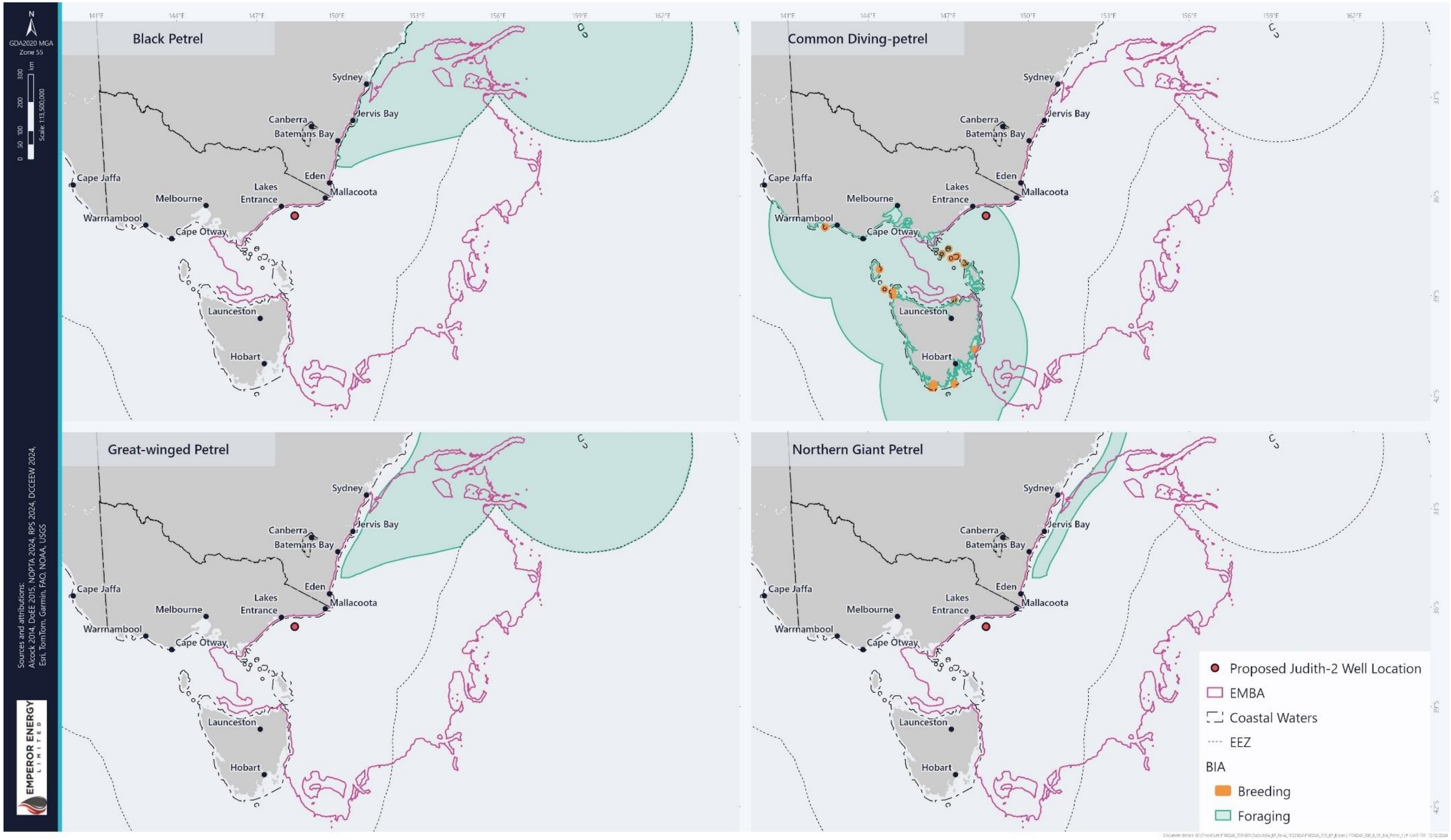

Figure 4-7: Petrel species Biologically Important Areas within the EMBA

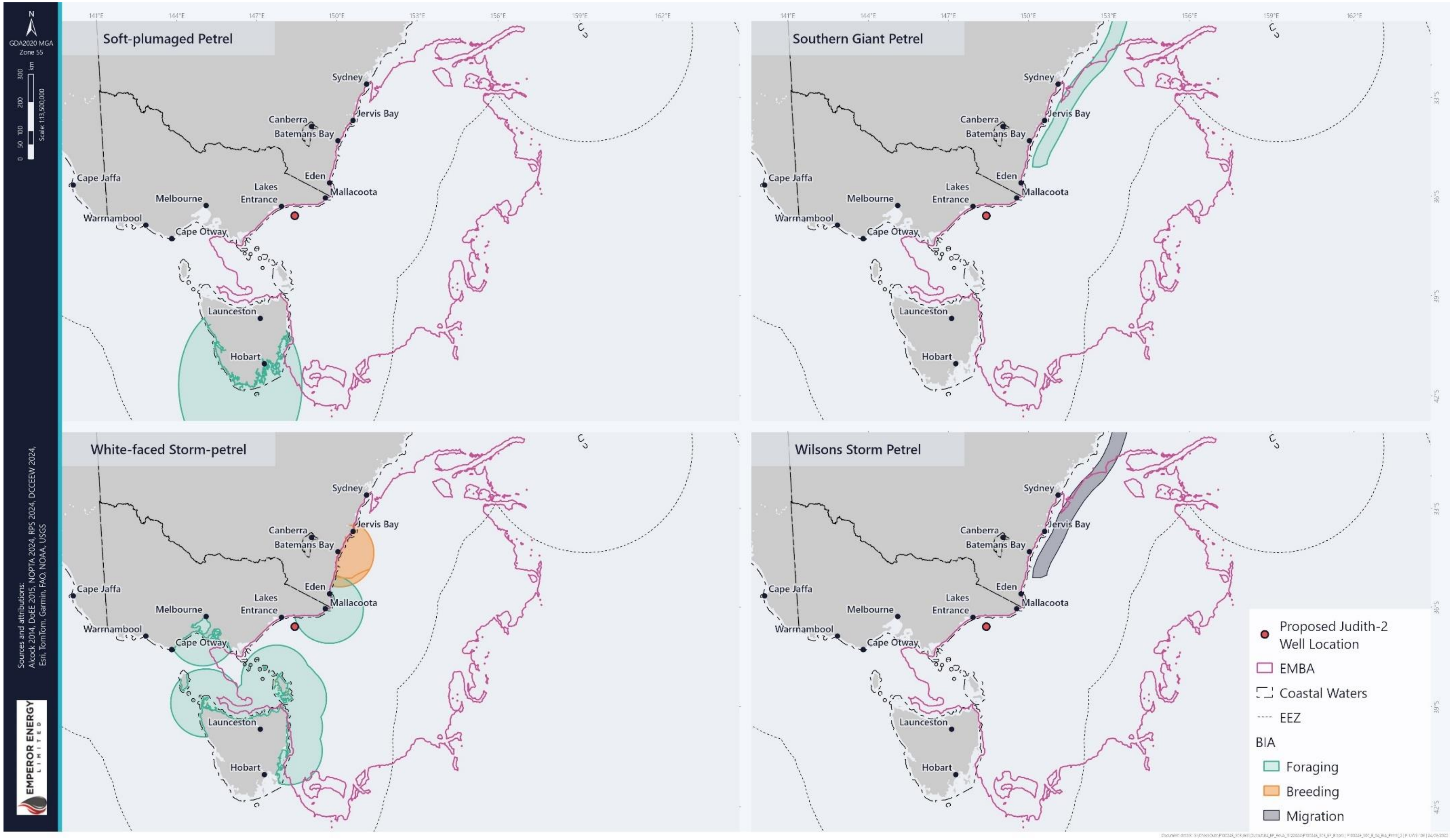

Figure 4-8: Petrel species Biologically Important Areas within the EMBA

Shearwaters

There are five shearwater species within the EMBA, of which one species, the flesh-footed shearwater may occur in the Operational Area. Of these four different species of shearwaters that have been identified to have BIAs associated with the EMBA which include foraging and breeding behaviours (Figure 4-9) and are discussed in detail below. None of these four species have been identified to have a BIA within the Operational Area.

Shearwaters represent the most abundant seabird in Australia. They are typically pelagic species, except during breeding seasons where they are found on remote islands or coastal headlands. Breeding season in south-eastern Australia for shearwaters typically occurs during the summer months. Shearwater nests are usually in burrows or rock crevices. Species with breeding BIAs that occur within the EMBA include the Short-tailed Shearwater, Wedge-tailed Shearwater and the Sooty Shearwater.

Shearwaters are known to forage for a variety of pelagic prey, including krill, cephalopods, fish and crustaceans. Food is usually taken by pursuit-plunging, surface plunging or surface-seizing; however other methods (e.g. hydroplaning, deep plunging) may be used. All Shearwater species with recognised BIAs in the EMBA exhibit foraging behaviours. The Short-tailed Shearwater is one of few native birds that is commercially harvested on the offshore islands of Tasmania (Tasmania Parks & Wildlife Service 2014).

Flesh-footed Shearwater

The flesh-footed shearwater is a trans-equatorial migrant that may forage in the EMBA. During its breeding season (early September to early May), it is widely found in the southwestern Pacific and is a common presence over the continental shelf/slope, occasionally entering inshore waters. This species breeds in burrows on sloping coastal habitats (forest, scrubland, shrubland, or grassland), with the main breeding areas situated off the coast of southern Western Australia, and smaller populations on Smith Island (SA) and Lord Howe Island (NSW). Its diet comprises small fish, a variety of cephalopods (squid, cuttlefish, nautilus, argonauts), crustaceans (barnacles, shrimp), other soft invertebrates like Velella, and offal. Foraging occurs almost exclusively at sea using techniques like surface plunging, pursuit plunging, surface seizing, surface diving, pursuit diving, and pattering. The BIA overlaps with the EMBA.

Short-tailed Shearwater

The short-tailed shearwater, also known as the muttonbird, is a conservation priority in the South-east Marine Region (CoA, 2022). This migratory species is present in Australian waters from September to May, breeding on numerous islands off Victoria and Tasmania. Its breeding and foraging BIAs (September to May) overlap the EMBA (Figure 4-9). During breeding, they employ a bimodal foraging strategy: short local trips for chick provisioning and longer (up to 17 days) trips to the Polar Frontal Zone. Their diet includes fish (mainly myctophids), crustaceans, and squid. They often feed in large flocks of up to 20,000 individuals.

Sooty Shearwater is listed as vulnerable and is a conservation concern in the South-east Marine Region (CoA, 2022). This species breeds in large colonies on islands and headlands, constructing burrows under tussock grass and low scrub. Typically, birds do not return to their natal breeding sites until about four years of age. Their diet is diverse, including fish, crustaceans, and cephalopods, which they capture by diving. Parents undertake both short (1–3 day) and long (5–15 day) foraging trips to provide for their young. The Australian breeding population is estimated to be around 6,500 pairs (CoA, 2022), and their breeding sites within Australian territory are located on offshore islands off the coasts of New South Wales and Tasmania.

Streaked Shearwater

The streaked shearwater is a migratory seabird that visits Australian waters, particularly during its non-breeding season. This species breeds in colonies on islands off the coasts of Japan, Korea, China, and Russia.

Outside the breeding season, streaked shearwaters undertake extensive migrations southwards, commonly occurring in waters off eastern and south-eastern Australia, including the South-east Marine Region. They forage primarily on fish, squid, and crustaceans, which they catch by surface feeding and diving. The streaked shearwater has a foraging and breeding BIA overlapping the EMBA (Figure 4-9).

Wedge-tailed Shearwater

The wedge-tailed shearwater has a breeding and foraging BIA that overlaps the EMBA (Figure 4-9). While their movement patterns are not fully understood, populations at the northern and southern edges of their range are known to be migratory. These birds typically depart their nesting sites between early April and early May, spending the non-breeding season in tropical waters.

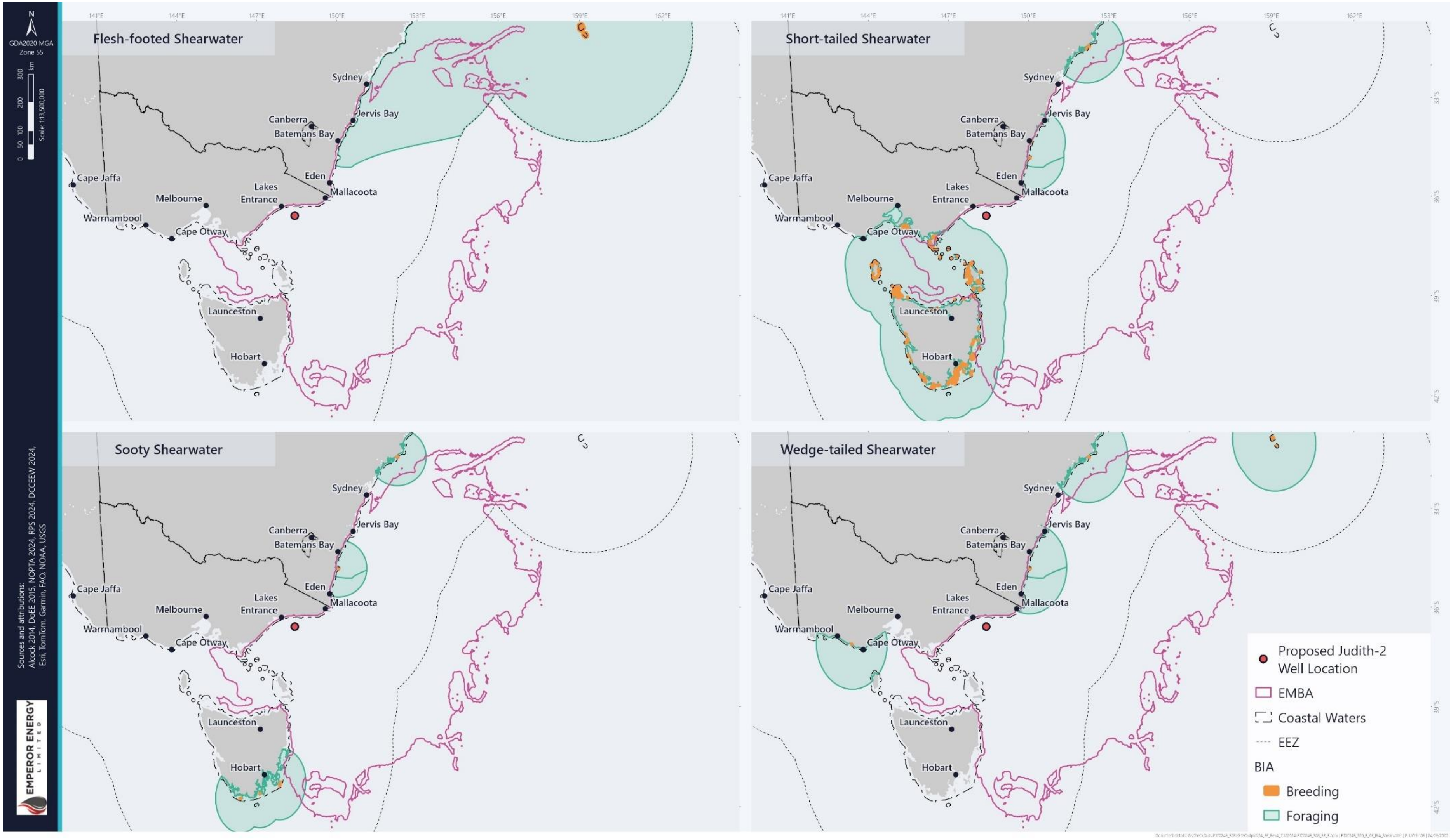

Figure 4-9: Shearwater species Biologically Important Areas within the EMBA

Other Seabirds

Three other species of seabirds have been identified to have BIAs associated with the EMBA which include foraging and breeding (Figure 4-10). None of these species have been identified to have a BIA within the Operational Area.

All species are common in southern Australia and can typically be found along the coast of Tasmania and Victoria. The White-fronted Tern breeds exclusively between October and February each year while the Crested Tern and the Black-faced Cormorant have varied breeding seasons (CoA 2020c). All three of these species breed exclusively along the coastline of rocky islands, or on stacks, slopes, or cliffs in large colonies. Species with breeding BIAs that occur within the EMBA include the White-fronted Tern and the Black-faced Cormorant.

All species forage within the marine environment. The Black-faced Cormorant forages for fish primarily in coastal waters, sheltered bays and islets, while the White-fronted tern and the Crested tern may venture out to the open sea to feed (CoA 2020c). Feeding behaviours between the species vary from shallow and surface plunging to plunge-diving. All three species have foraging BIAs that occur within the EMBA.

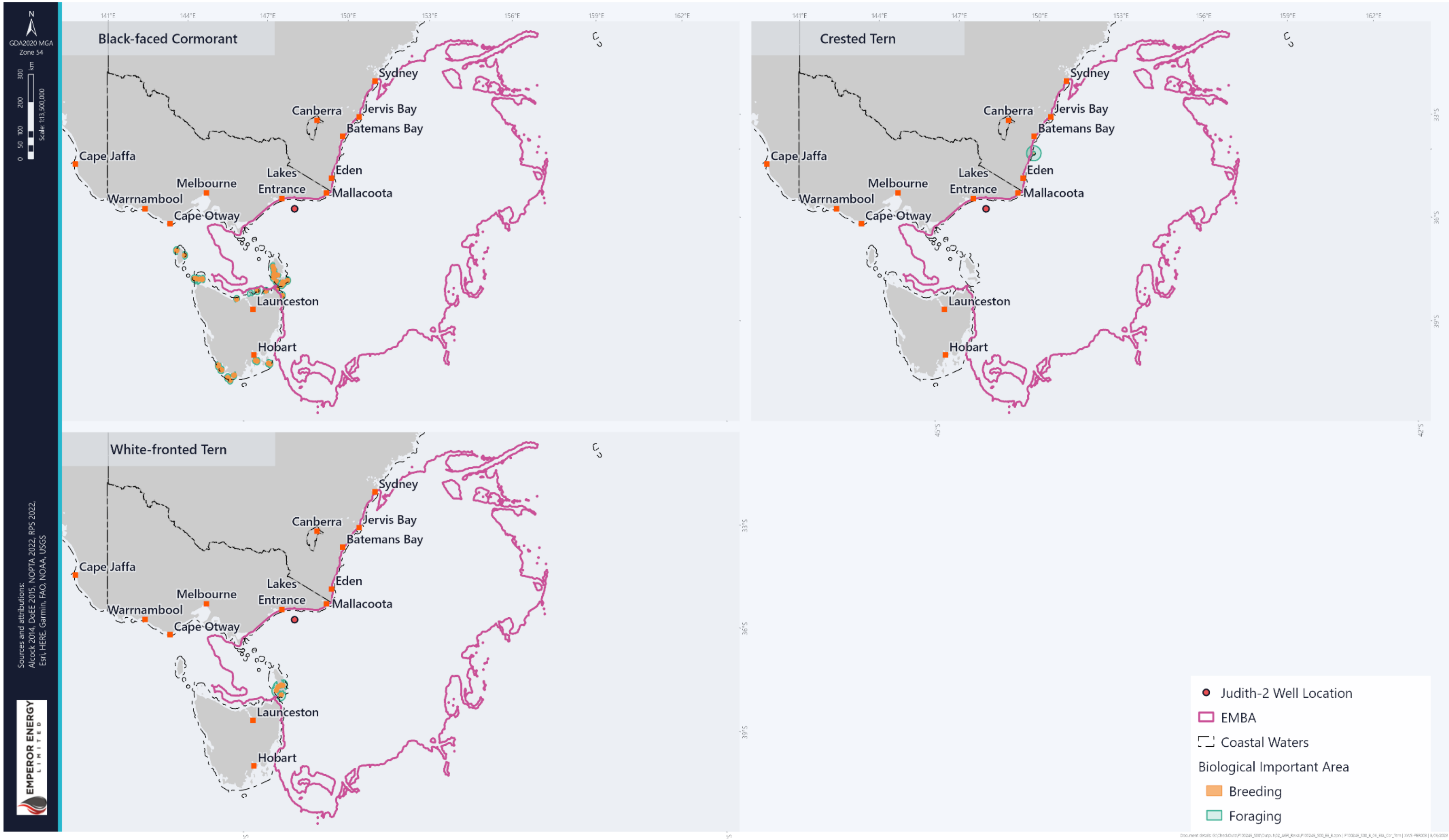

Figure 4-10: Tern and Cormorant Biologically Important Areas within the EMBA

4.5.1.2. Shorebirds

Shorebirds, or waders, are species that frequent the shores or coastal or inland waters typically in search of food during low tide. Many shorebird species are migratory and move between their non-breeding grounds in the southern hemisphere to their northern hemisphere breeding grounds each year. No shorebird species are known to exhibit biologically important behaviours within the EMBA; however some species are EPBC Act Listed Critically Endangered.

The Curlew Sandpiper, Eastern Curlew and the Great Knot are all EPBC Listed Critically Endangered, migratory species which may be found within the EMBA. Each species breeds exclusively in the northern hemisphere and migrate to Australia for the non-breeding season. In Australia these species can be found in each state, typically along the coastline, however the Curlew Sandpipers may be widespread inland (DoE, 2023). These species typically forage during the non-breeding season on their migration towards Australia and once they have arrived. Foraging generally occurs within intertidal mudflats and sandflats, foraging on benthic invertebrates. Foraging may occur over the sea or within wetlands adjacent to the coast. Arrival in Australia occurs as early as July (Eastern Curlew) and as late as September (Curlew Sandpiper and Great Knot) (DoE, 2023).

4.5.1.3. Other Birds

Other species of birds protected under the EPBC Act, but not categorised as shorebirds or seabirds, may also be present within the EMBA. This may include wetland species or terrestrial migratory species who rely on nearshore environments.

The Regent Honeyeater and Swift Parrot are both EPBC Listed Critically Endangered species which may be found within the EMBA. Both terrestrial species inhabit ironbark woodland forest within south-eastern Australia. The Regent Honeyeater is endemic and resident in mainland Australia with no known overseas migrations. Inland movements appear to be governed by the flowering of select eucalypt species (DoE, 2023). The Swift Parrot breeds exclusively within Tasmania during the summer months before migrating north to mainland Australia for winter (DoE, 2023). Coastal regions on mainland Australia typically support the largest number of individuals in NSW when inland habitats are experiencing drought.

Little Penguin

The Little Penguin is an EPBC Listed marine species which has been identified to have BIAs associated with the EMBA which include foraging and breeding (Figure 4-11). Neither BIA has been identified to occur within the Operational Area.

The Little Penguin is a flightless seabird endemic to Australia and New Zealand. In Australia, the species can be found along the coast and adjacent islands from WA to NSW, including Tasmania. The species has become a particularly popular to tourism attraction across Australia. Visitors can visit the species on Penguin Island, WA, Low Head, Tasmania or watch the 'Penguin Parade' on Phillip Island. Little Penguins are nocturnal and will return to land, from sea, after dusk and leave before dawn the following morning (CoA, 2020c). The species typically breeds between autumn and summer months; however, the breeding season tends to vary year to year and between colonies. The Little Penguin creates its nest by burrowing underground (CoA, 2020c). Once eggs are laid both male and females will take turns incubating. The EMBA overlaps multiple known breeding BIAs for the Little Penguin along the southern NSW coastline and Tasmanian offshore islands.

The Little Penguin is considered a generalist feeder who forages utilising pursuit-diving methods typically close to the coastline and subsequent breeding colonies. When feeding chicks their diet seems to consist largely of clupeids, however they may also feed on krill or cephalopods during the breeding season (CoA

2020c). The EMBA overlaps multiple known foraging BIAs for the Little Penguin along the southern NSW coastline and Tasmanian offshore islands.

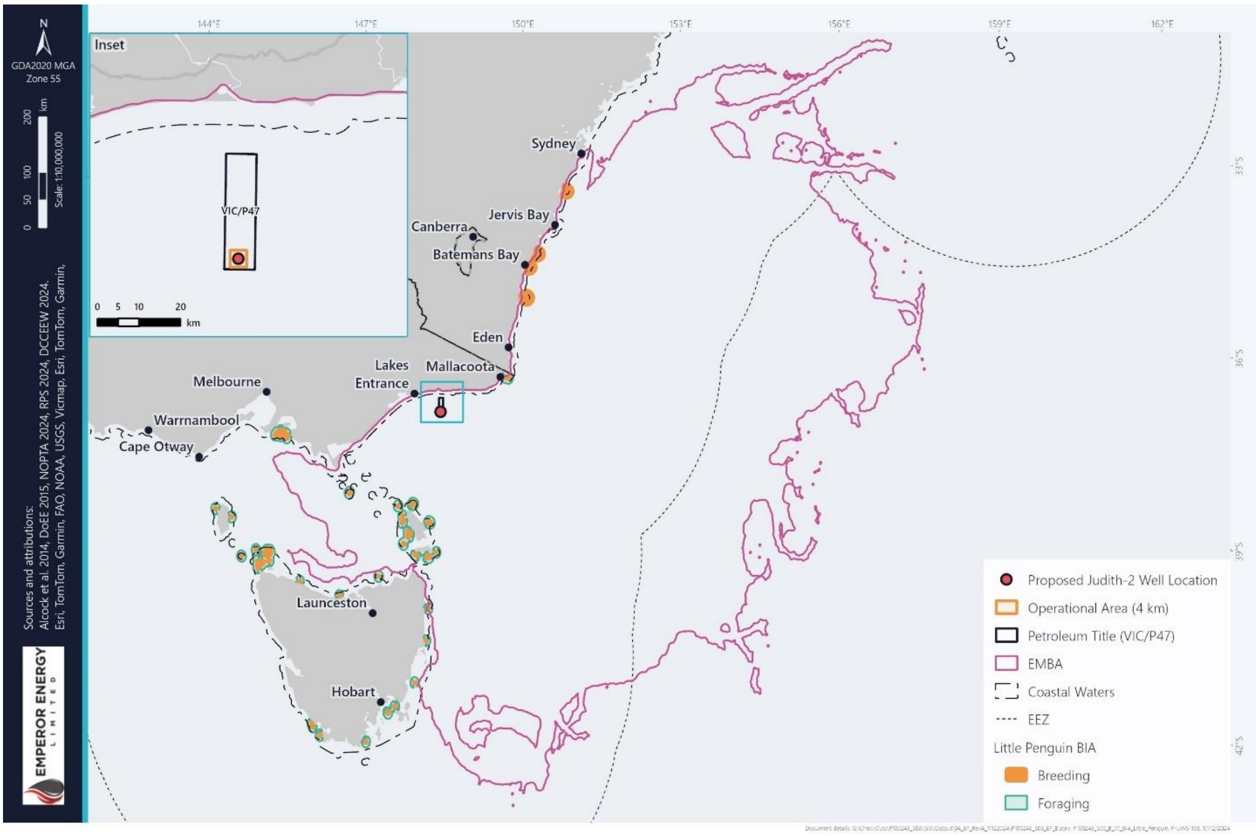

Figure 4-11: Little Penguin Biologically Important Areas within the EMBA

Orange-bellied Parrot

The Orange-bellied Parrot (OBP) is an EPBC Listed Critically Endangered species which may be found within the EMBA. There are no identified BIAs for the Orange-bellied Parrot, however due to the state of the population species distribution and migration routes are strongly considered during the development of offshore activities. The EMBA overlaps probable migration routes over the Bass Strait and potential species distribution along the Victorian and NSW coastline (Figure 4-12).

The OBP is a ground feeding parrot endemic to south-eastern Australia which migrates across the Bass Strait between breeding and non-breeding ranges annually. The only known breeding range for this species occurs in Melaleuca, Tasmania within the Tasmanian Wilderness World Heritage Area (DELWP, 2016). This breeding habitat is considered critical to the survival of the species. Breeding occurs between November and March when the bird's nest in hollows or man-made boxes in Eucalypt forest.

April of each year begins the northern migration from breeding grounds in southern Tasmania to mainland Australia. The OBP sticks close to the coast (within 2 km) as it makes its way up the western coast of Tasmania (NRE Tas, 2023). It has been identified that the passage across the Bass Strait is aided by island hopping through the western Bass Strait Islands (e.g., Kind Island) where individuals are able to feed for days or weeks before continuing across the Strait. Sea Elephant River, King Island, has been considered migratory habitat critical for survival of the species (NRE Tas, 2023). From King Island the OBP will distribute along the non-breeding range the Victorian and South Australian coastline with sightings in NSW considered rare. Non-breeding feeding typically occurs in locations associated with coastal saltmarsh or sand dunes due to the foraging preferences of the species (DELWP, 2016). Roosting habitat is often within kilometres of foraging sites.

November of each year begins the southern migration from non-breeding grounds back across the Bass Strait to Melaleuca, Tasmania. This migration is far more rapid with observations suggesting that the species does not feed during passage, with a transit time from Victoria to Melaleuca as quick as 2 days in some cases (NRE Tas, 2023). It is assumed that the most direct route is taken to aid this and that the use of tail winds is taken advantage of during the passage due to the waves of arrivals that occur (NRE Tas, 2023).

Strict monitoring of this species occurs during the breeding season at Melaleuca by the Orange-bellied Parrot Tasmanian Program, which has committed to the protection, monitoring and management of the species in Tasmania. The Tasmanian state government committed $2.5 million to construct a captive breeding facility at Five Mile Beach which opened in July 2019 which has helped increase the number of captive-bred releases into the wild (NRE Tas, 2023). The latest update by NRE Tas stated that a total of 74 OBPs had safety made the migration back to breeding grounds in Melaleuca, which has made it the second highest number of returns in the past decade (NRE Tas, 2023b).

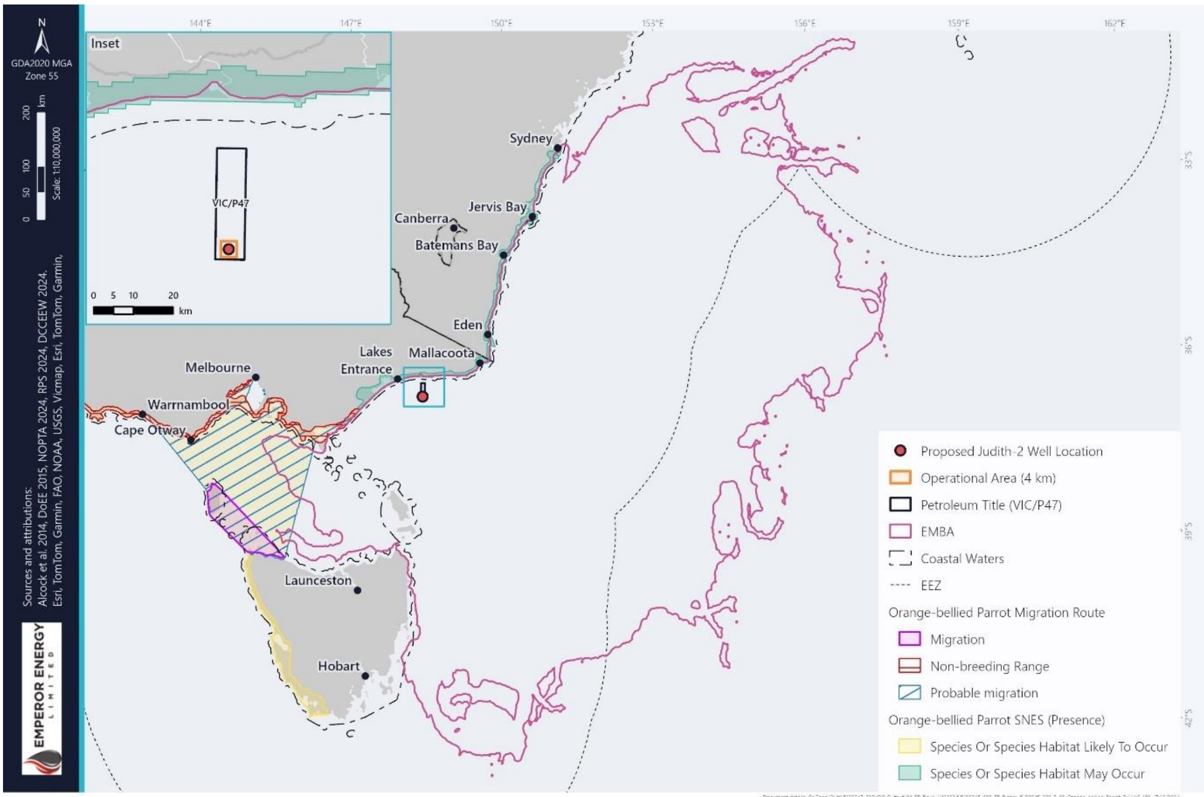

Figure 4-12: Orange-bellied Parrot Distribution and Migration routes

4.5.2. Fish

The term fishes include the primitive jawless fish (hagfishes and lampreys), cartilaginous fish (sharks, rays and chimaeras), and the many and diverse groups of bony fishes (Bray, 2018). Fish habitats in Australia are varied and may include coral or rocky reefs, estuaries, and oceanic and deep-sea habitats beyond the continental slope. Almost a quarter of Australia's fishes are endemic, with 60% of these species living in the cooler southern waters (Hoese et al. 2006). Some fish species are listed as threatened and/or migratory under the Environment Protection and Biodiversity Conservation Act 1999, and these are considered a matter of national environmental significance. Species may also be protected under state and territory environmental legislation. All EPBC Listed threatened and migratory fish species within the EMBA are listed in Table 4-4.

Additionally, within the EMBA there are certain species that exhibit biologically important behaviours, such as foraging, breeding or migrating which are crucial to the species success. There are two shark species which have BIAs overlapped by the EMBA. BIAs for these species are further discussed and listed below in Table 4-5.Several species identified by the PMST to occur within the EMBA are freshwater species and are not likely to inhabit marine habitats or rely on the marine environment for breeding or foraging. These species are not considered to be credibly impacted by the activity and have been excluded from this section and impact assessment. These species are listed in APPENDIX B .

Table 4-4 Listed fish species identified in the Operational Area and EMBAs

COMMON NAME	SCIENTIFIC NAME	THREATENED STATUS	MIGRATORY	MARINE	OPERATIONAL AREA	LIGHT EMBA	MDO EMBA	EMBA	EPBC MANAGEMENT PLAN
Australian Grayling	*Prototroctes maraena*	V	-	-	-	KO	KO	KO	National Recovery Plan for the Australian Grayling Conservation Advice *Prototroctes maraena* Australian Grayling
Australian Smooth Pipefish	*Lissocampus caudalis*	-	-	✓	-	-	MO	MO	-
Beady Pipefish	*Hippichthys penicillus*	-	-	✓	-	-		MO	-
Bentstick Pipefish	*Trachyrhamphus bicoarctatus*	-	-	✓	-	-		MO	-
Big-belly Seahorse	*Hippocampus abdominalis*	-	-	✓	MO	MO	MO	MO	-
Black Rockcod	*Epinephelus daemelii*	V	-	-	-	-	LO	LO	Approved Conservation Advice for *Epinephelus daemelii* (black cod) Commonwealth listing advice on *Epinephelus daemelii* (black rock-cod)
Blue Warehou	*Seriolella brama*	CD	-	-	KO	KO	KO	KO	Listing Advice Seriolella brama blue warehou
Brushtail Pipefish	*Leptoichthys fistularius*	-	-	✓	MO	MO	MO	MO	-
Bullneck Seahorse	*Hippocampus minotaur*	-	-	✓	MO	MO	MO	MO	-
Common Seadragon	*Phyllopteryx taeniolatus*	-	-	✓	MO	MO	MO	MO	-
Crested Pipefish	*Histiogamphelus briggsii*	-	-	✓	MO	MO	MO	MO	-
Deepbody Pipefish	*Kaupus costatus*	-	-	✓	MO	MO	MO	MO	-
Double-end Pipehorse	*Syngnathoides biaculeatus*	-	-	✓	MO	MO	MO	MO	-

COMMON NAME	SCIENTIFIC NAME	THREATENED STATUS	MIGRATORY	MARINE	OPERATIONAL AREA	LIGHT EMBA	MDO EMBA	EMBA	EPBC MANAGEMENT PLAN
Eastern Gemfish	*Rexea solandri*	CD	-	-	LO	LO	LO	LO	Commonwealth Listing Advice on *Rexea solandri*
Giant Manta Ray	*Mobula birostris*	-	✓ (M)	-	-	-	KO	KO	-
Girdled Pipefish	*Festucalex cinctus*	-	-	✓	-	-		MO	-
Grey Nurse Shark	*Carcharias taurus*		✓ (M)			MO	CKO	CKO	Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*)
Grey Nurse Shark (east coast population)	*Carcharias taurus*	CE	-	-	-	-		CKO	Commonwealth Listing Advice on Carcharias taurus, Grey Nurse Shark (East Coast population) Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*)
Hairy Pipefish	*Urocampus carinirostris*	-	-	✓	MO	MO	MO	MO	-
Halfbanded Pipefish	*Mitotichthys semistriatus*	-	-	✓	MO	MO	MO	MO	-
Harrison's Dogfish	*Cetrophorus harrissoni*	CD	-	-	LO	LO	LO	LO	Commonwealth Listing Advice on *Centrophorus harrissoni* (Harrisson's dogfish)
Javelin Pipefish	*Lissocampus runa*	-	-	✓	MO	MO	MO	MO	-
Knifesnout Pipefish	*Hypselognathus rostratus*	-	-	✓	MO	MO	MO	MO	-
Leafy Seadragon	*Phycodurus eques*	-	-	✓	-	-	MO	MO	-
Little Gulper Shark	*Cantrophorus uyato*	CD	-	-	LO	LO	LO	LO	Commonwealth Listing Advice on *Centrophorus zeehaani* (southern dogfish
Longfin Mako	*Isurus paucus*	-	✓ (M)	-	-	-		LO	-
Longsnout Pipefish	*Vanacampus poecilolaemus*	-	-	✓	MO	MO	MO	MO	-
Lorde Howe Pipefish	*Cosmocampus howensis*	-	-	✓	-	-	MO	MO	-

COMMON NAME	SCIENTIFIC NAME	THREATENED STATUS	MIGRATORY	MARINE	OPERATIONAL AREA	LIGHT EMBA	MDO EMBA	EMBA	EPBC MANAGEMENT PLAN
Mollison's Pipefish	*Mitotichthys mollisoni*	-	-	✓	-	-	MO	MO	-
Mother-of-pearl Pipefish	*Vanacampus margaritifer*	-	-	✓	MO	MO	MO	MO	-
Oceanic Whitetip Shark	*Carcharhinus longimanus*	-	✓ (M)	-	MO	MO	MO	LO	-
Orange Roughy	*Hoplostethus atlanticus*	CD	-	-	LO	LO	LO	LO	-
Ornate Ghostpipefish	*Solenostomus paradoxus*	-	-	✓	-	-		MO	-
Porbeagle	*Lamna nasus*	-	✓ (M)	-	LO	LO	LO	LO	-
Port Phillip Pipefish	*Vanacampus phillipi*	-	-	✓	MO	MO	MO	MO	-
Pugnose Pipefish	*Pugnaso curtirostris*	-	-	✓	-	-	MO	MO	-
Red Handfish	*Thymichthys politus*	CE	-	-			MO	MO	Approved Conservation Advice for *Thymichthys politus* (red handfish)
Red Pipefish	*Notiocampus ruber*	-	-	✓	MO	MO	MO	MO	-
Reef Manta Ray	*Mobula alfredi*	-	✓ (M)	-	-	-		KO	-
Rhino Pipefish	*Histiogamphelus cristatus*	-	-	✓	MO	MO	MO	MO	-
Ringback Pipefish	*Stipecampus cristatus*	-	-	✓	MO	MO	MO	MO	-
Robust Ghostpipefish	*Solenostomus cyanopterus*	-	-	✓	-	-	MO	MO	-
Robust Pipehorse	*Solegnathus robustus*	-	-	✓	MO	MO	MO	MO	-
Sawtooth Pipefish	*Maroubra perserrata*	-	-	✓	MO	MO	MO	MO	-
Scalloped Hammerhead	*Sphyrna lewini*	CD	-	-	-	-	MO	LO	Listing Advice *Sphyrna lewini* scalloped hammerhead

COMMON NAME	SCIENTIFIC NAME	THREATENED STATUS	MIGRATORY	MARINE	OPERATIONAL AREA	LIGHT EMBA	MDO EMBA	EMBA	EPBC MANAGEMENT PLAN
School Shark (eastern)	*Galeorhinus galeus*	CD	-	-	LO	LO	LO	LO	Commonwealth Listing Advice on *Galeorhinus galeus*
Shortfin Mako	*Isurus oxyrinchus*	-	✓ (M)	-	LO	LO	LO	LO	-
Short-head Seahorse	*Hippocampus breviceps*	-	-	✓	MO	MO	MO	MO	-
Shortpouch Pygmy Pipehorse	*Acentronura tentaculata*	-	-	✓	-	-	MO	MO	-
Spiny Pipehorse	*Stipecampus cristatus*	-	-	✓	MO	MO	MO	MO	-
Spotted Pipefish	*Stigmatopora argus*	-	-	✓	MO	MO	MO	MO	-
Tiger Pipefish	*Filicampus tigris*	-	-	✓	-	-		MO	-
Trawl Pipefish	*Kimblaeus bassensis*	-	-	✓	MO	MO	MO	MO	-
Tucker's Pipefish	*Mitotichthys tuckeri*	-	-	✓	MO	MO	MO	MO	-
Upside-down Pipefish	*Heraldia nocturna*	-	-	✓	MO	MO	MO	MO	-
Whale Shark	*Rhinocodon typus*	V	✓ (M)	-	MO	MO	MO	MO	Conservation Advice Rhincodon typus whale shark Commonwealth Listing Advice on *Rhincodon typus* (Whale shark)
White Shark	*Carcharodon carcharias*	V	✓ (M)	-	MKO	MKO	BKO	BKO	Recovery Plan for the White Shark (*Carcharodon carcharias*)
White's Seahorse	*Hippocampus whitei*	E	-	✓	-	-	KO	KO	Conservation Advice *Hippocampus whitei* White's Seahorse
Widebody Pipefish	*Stigmatopora nigra*	-	-	✓	MO	MO	MO	MO	-
Ziebell's Handfish	*Brachiopsilus ziebelli*	V	-	-	-	-	MO	MO	Recovery Plan for Three Handfish Species: Spotted handfish

COMMON NAME	SCIENTIFIC NAME	THREATENED STATUS	MIGRATORY	MARINE	OPERATIONAL AREA	LIGHT EMBA	MDO EMBA	EMBA	EPBC MANAGEMENT PLAN
									Brachionichthys hirsutus, Red handfish *Thymichthys politus* and Ziebell's handfish *Brachiopsilus ziebelli*

Threatened Species:
V – Vulnerable
E – Endangered
CE – Critically Endangered
CD – Conservation Dependent

Type of presence:
MO - Species or species habitat that may occur within the area
LO - Species or species habitat likely to occur within area
KO - Species or species habitat known to occur within area
FMO – Foraging may occur
FLO – Foraging likely to occur
FKO - Foraging known to occur
BKO – Breeding known to occur

Migratory:
(M) – Migratory
(W) – Wetland

Table 4-5 Shark BIAs within the EMBAs

COMMON NAME	SCIENTIFIC NAME	OPERATIONAL AREA	LIGHT EMBA	MDO EMBA	EMBA
White Shark	*Carcharodon carcharias*	D	D	D F B	D F B
Grey Nurse Shark	*Carcharias taurus*	-	-	F MR	F MR

Type of BIA:
D – Distribution
F – Foraging
B – Breeding
MR – Migration

4.5.2.1. Handfish

Handfish belong to the *Brachionichthyidae* family and are endemic to Australia, predominately found in Tasmania. These benthic species are characterised by their means of locomotion, propelling themselves by crawling, utilising hand like appendages, over the seafloor.

The Red handfish is an EPBC Listed Critically Endangered species which may be found within the EMBA. This species is endemic to south-east Tasmania and are currently only known to occur in Primrose Sands Reef in Frederick Henry Bay (DoE, 2015c). The species diet consists of crustaceans and polychaete worms which the Red Handfish reaches by crawling over the seafloor.

4.5.2.2. Sharks

White Shark

The White Shark is an EPBC protected species, listed as Vulnerable and migratory, and the only known fish or shark whose BIA has been identified to occur within the Operational Area (Figure 4-13). Great White Sharks are active, fast-swimming harks that have counter current heat-exchangers in their circulatory system which allow them to maintain a body temperature up to 14 °C above that of the surrounding seawater. This enables individuals to tolerate a wide range of temperatures (Goldman 1997). They are highly mobile species and widely distributed throughout temperate and sub-tropical regions in the northern and southern hemispheres. The white shark is primarily found in coastal and offshore areas of the continental shelf and islands, generally observed between the coast and the 100 m depth contour (Bruce et al. 2006).

White sharks are frequently encountered in areas near seal colonies, particularly when juveniles are present, as these are a main food source (CoA 2015). Variety of other prey including fish, other sharks and rays, marine mammals, squid, and crustaceans are included in the White Shark diet (CoA 2015). Juvenile White Sharks feed on finfish, rays and other sharks and shift to include marine mammals when they reach approximately 3.4 m (CoA 2015). A recent study has found that the energy requirements of adult White Sharks may be several times higher than previously estimated, and that seasonal feeding on seal colonies is important in meeting these energy needs (CoA 2015).

Studies of White Sharks sighted at pinniped colonies indicate the sharks appear to be largely transient with only a few longer-term residents (Milankovic et al. 2021). The location of shark pupping areas in Australia is not known, however juveniles aggregate seasonally in certain areas such as Goolwa (SA), Corner Inlet-Lakes Entrance (Vic), Newcastle-Foster (NSW), Fraser Island (Qld) and Portland (Vic) (161 km northwest) (DoE 2014). White Sharks appear to return on a seasonal basis and appear to have a degree of fidelity to certain areas (Bruce and Bradford 2008) They are known to make excursions into the open ocean and cross ocean basins with exchange between Australia and both South Africa and New Zealand recorded (CoA 2020b).

The South-West Commonwealth Marine Reserves Network Management Plan 2013 – 2023 (DNP 2013) recognises that White Sharks forage in the Apollo and Zeehan Commonwealth Marine Reserve. The known distribution BIA identified by National Conservation Atlas reflects areas used by White Sharks as they move between nursery areas particularly for juvenile White Sharks during autumn/winter/spring (DAWE 2020). The White Shark may transit the Operational Area and EMBA to nursery and foraging locations during the activity.

Grey Nurse Shark (east coast population)

The Grey Nurse Shark (east coast population) is an EPBC protected species, listed as Critically Endangered and has been identified to exhibit biologically important behaviours within the EMBA (Figure 4-14). In Australia, there are two distinct Grey Nurse Shark populations; one on the west coast and the other on the east coast. The Grey Nurse Shark typically inhabits inshore coastal regions in cool temperate to sub-tropical waters on the continental shelf (CoA, 2014). The east coast population, whose distribution is overlapped by the EMBA, spans from the Capricornia coast, QLD to Narooma, NSW. Within this region the species completes a migration movement, likely in response to water temperature, up and down the coast (DoE, 2023). This movement is, at times, dependent on the sex of individuals. Males are common in southern QLD over winter months while females are found off the central coast of NSW over the same season (DoE, 2023). The EMBA overlaps a portion of the migration BIA for the Grey Nurse Shark along the southern NSW coastline.

Grey Nurse Sharks tend to aggregate in groups at specific locations along their coastal range. These aggregation sites are considered to be habitat critical to the survival of the species in the Recovery Plan for the Grey Nurse Shark (2014). Key aggregation sites have been defined as being locations where five or more grey nurse sharks were consistently found throughout the year, 13 of which occur within NSW waters (Otway and Burke, 2004). It is thought that sites may play an important role in pupping and/or mating activities.

The diet of the Grey Nurse Shark includes a variety of species, typically of commercial interest. This includes a wide range of fish, other sharks and rays, squids, and invertebrates (DoE, 2023). The EMBA overlaps a portion of the foraging BIA for the species along the southern NSW coastline.

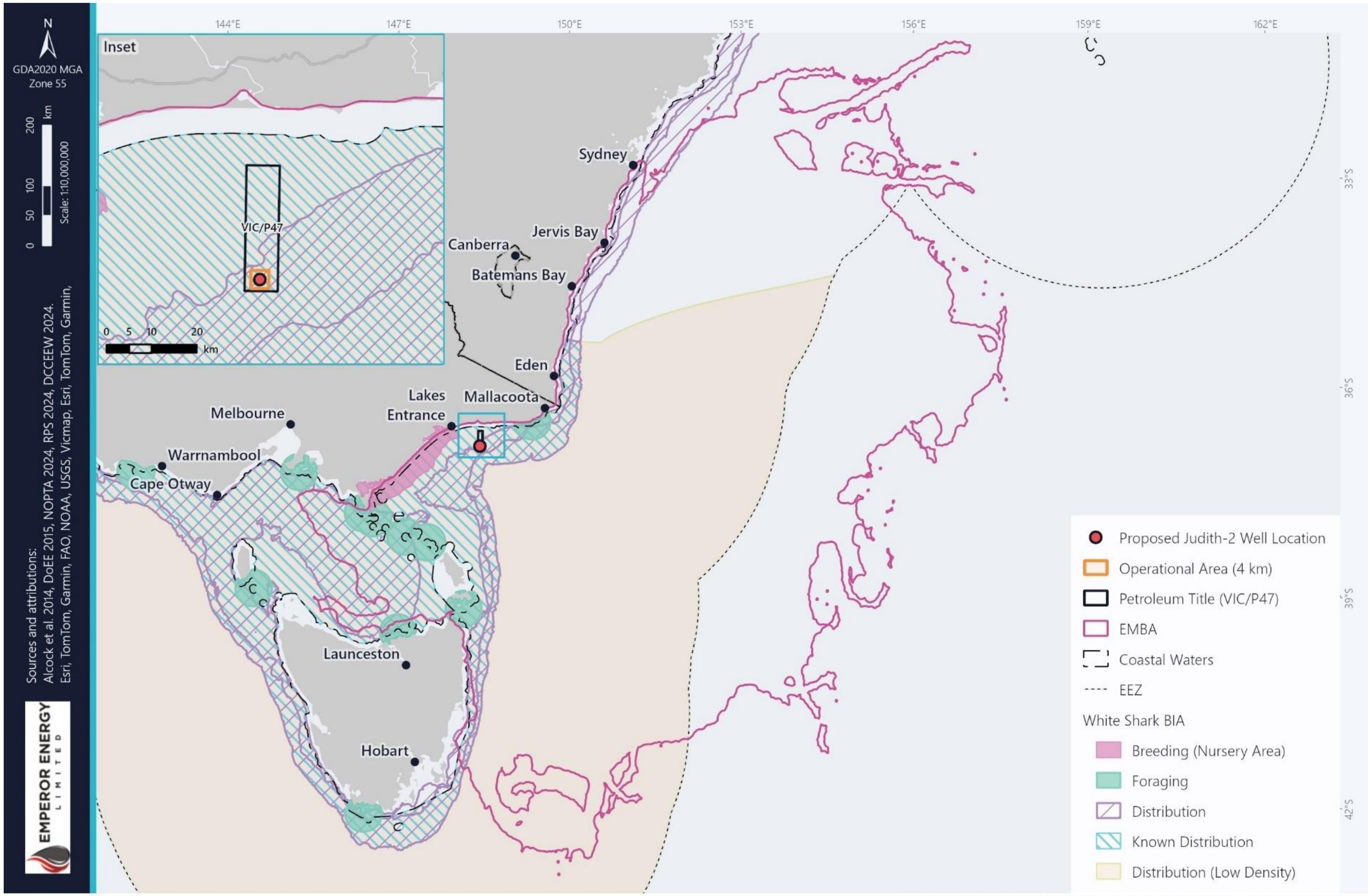

Figure 4-13: White Shark Biologically Important Areas within the EMBA

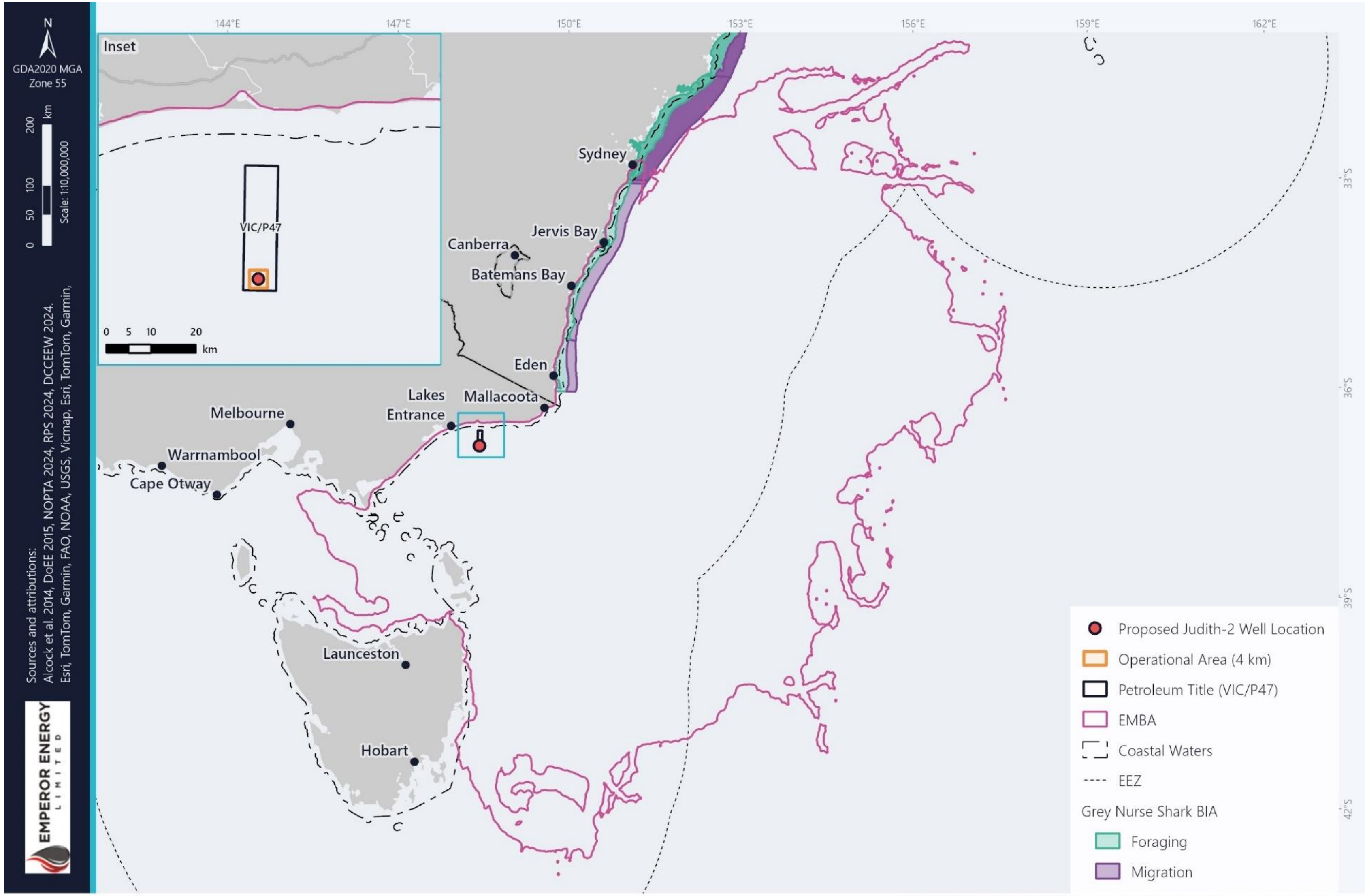

Figure 4-14: Grey Nurse Shark Biologically Important Areas within the EMBA

4.5.3. Marine Mammals

Marine mammals are warm blooded, breathe air through lungs, produce milk to nurse their young and live in the marine environment for all or part of their life. Marine mammal taxonomic groups found in Australian waters include cetaceans (whales, dolphins, porpoises), pinnipeds (seals and sea lions,) and sirenians (dugongs). Some marine mammals are listed as threatened and/or migratory under the *Environment Protection and Biodiversity Conservation Act 1999*, and these are considered to be a matter of national environmental significance (MNES). Species may also be protected under state and territory environmental legislation. All EPBC Listed threatened and migratory marine mammal species within the EMBA are listed in APPENDIX B .

Thirteen species of marine mammals have been listed in the PMST search, as having likely or known presence in the EMBA and are discussed further below. Additionally, within the EMBA there are certain species that will exhibit biologically important behaviours, such as foraging, breeding or migrating which are crucial to the species success. Of these 13 species within the EMBA, four species including the southern right, pygmy blue and humpback whale, and the Indo-Pacific bottlenose dolphin have BIAs within the EMBA. Only the southern right and pygmy blue whale have BIAs overlapping the Operational Area, for migration and distribution/foraging behaviours respectively. These species are discussed further below, and their BIAs are listed in Table 4-7.

Several species identified by the PMST to occur within the EMBA are terrestrial species and are not likely to inhabit coastlines or rely on the marine environment for breeding or foraging. These species are not considered to be credibly impacted by the activity and have been excluded from this section and impact assessment. These species are listed in APPENDIX B .

Table 4-6 Listed marine mammal species identified in the Operational and EMBAs

COMMON NAME	SCIENTIFIC NAME	THREATENED STATUS	MIGRATORY	MARINE	OPERATIONAL AREA	LIGHT EMBA	MDO EMBA	EMBA	EPBC MANAGEMENT PLAN
Andrew's Beaked Whale	*Mesoplodon bowdoini*	-	-	-	MO	MO	MO	MO	-
Antarctic Minke Whale	*Balaenoptera bonaerensis*	-	✓(M)	-	LO	LO	LO	LO	-
Arnoux's Beaked Whale	*Berardius arnuxii*	-	-	-	MO	MO	MO	MO	-
Australian Fur-seal	*Arctocephalus pusillus*	-	-	✓	MO	MO	BKO	BKO	-
Blainville's Beaked Whale	*Mesoplodon densirostris*	-	-	-	MO	MO	MO	MO	-
Blue Whale	*Balaenoptera musculus*	E	✓(M)	-	LO	LO	LO	LO	Conservation Management Plan for the Blue Whale
Bottlenose Dolphin	*Tursiops truncatus s. str.*	-	-	-	MO	MO	MO	MO	-
Bryde's Whale	*Balaenoptera edeni*	-	✓(M)	-	MO	MO	LO	LO	-
Common Dolphin	*Delphinus delphis*	-	-	-	MO	MO	MO	MO	-
Cuvier's Beaked Whale	*Ziphius cavirostris*	-	-	-	MO	MO	MO	MO	-
Dugong	*Dugong dugon*	-	✓(M)	✓	-	-	MO	MO	-
Dusky Dolphin	*Lagenorhynchus obscurus*	-	✓(M)	-	LO	LO	LO	LO	-
Dwarf Sperm Whale	*Kogia sima*	-	-	-	MO	MO	MO	MO	-
False Killer Whale	*Pseudorca crassidens*	-	-	-	LO	LO	LO	LO	-
Fin Whale	*Balaenoptera physalus*	V	✓(M)	-	FLO	FLO	FLO	FLO	Conservation Advice Balaenoptera physalus fin whale
Gingko-toothed Beaked Whale	*Mesoplodon ginkgodens*	-	-	-	-	-	MO	MO	-
Gray's Beaked Whale	*Mesoplodon grayi*	-	-	-	-	MO	MO	MO	-
Hector's Beaked Whale	*Mesoplodon hectori*	-	-	-	MO	MO	MO	MO	-
Humpback Whale	*Megaptera novaeangliae*	-	✓(M)	-	KO	KO	FKO	FKO	-
Indo-Pacific Spotted Bottlenose Dolphin	*Tursiops aduncus*	-	-	-	-	LO	LO	LO	-

COMMON NAME	SCIENTIFIC NAME	THREATENED STATUS	MIGRATORY	MARINE	OPERATIONAL AREA	LIGHT EMBA	MDO EMBA	EMBA	EPBC MANAGEMENT PLAN
Killer Whale	*Orcinus orca*	-	✓(M)	-	LO	LO	LO	LO	-
Long-finned Pilot Whale	*Globicephala melas*	-	-	-	MO	MO	MO	MO	-
Long-nosed Fur-seal	*Arctocephalus forsteri*	-	-	✓	MO	MO	MO	MO	-
Long-snouted Spinner Dolphin	*Stenella longirostris*	-	-	-	-	-		MO	-
Melon-headed Whale	*Peponocephala electra*	-	-	-	-	-	MO	MO	-
Minke Whale	*Balaenoptera acutorostrata*	-	-	-	MO	MO	MO	MO	-
Pygmy Killer Whale	*Feresa attenuata*	-	-	-	-	-	MO	MO	-
Pygmy Right Whale	*Caperea marginata*	-	✓(M)	-	FLO	FLO	FLO	FLO	-
Pygmy Sperm Whale	*Kogia breviceps*	-	-	-	MO	MO	MO	MO	-
Risso's Dolphin	*Grampus griseus*	-	-	-	MO	MO	MO	MO	-
Rough-toothed Dolphin	*Steno bredanensis*	-	-	-	-	-	MO	MO	-
Sei Whale	*Balaenoptera borealis*	V	✓(M)	-	FLO	FLO	FLO	FLO	[Conservation Advice Balaenoptera borealis sei whale]
Shepherd's Beaked Whale	*Tasmacetus shepherdi*	-	-	-	-	-	MO	MO	-
Short-finned Pilot Whale	*Globicephala macrorhynchus*	-	-	-	MO	MO	MO	MO	-
Southern Bottlenose Whale	*Hyperoodon planifrons*	-	-	-	-	-	MO	MO	-
Southern Right Whale	*Eubalaena australis*	E	✓(M)	-	KO	KO	BKO	BKO	National Recovery Plan for the Southern Right Whale (DCCEEW 2024)
Southern Right Whale Dolphin	*Lissodelphis peronii*	-	-	-	MO	MO	MO	MO	-
Sperm Whale	*Physeter macrocephalus*	-	✓(M)	-	MO	MO	MO	MO	-
Spotted Dolphin	*Stenella attenuata*	-	-	-	-	-		MO	-
Strap-toothed Beaked Whale	*Mesoplodon layardii*	-	-	-	MO	MO	MO	MO	-
Striped Dolphin	*Stenella coeruleoalba*	-	-	-	-	-		MO	-

COMMON NAME	SCIENTIFIC NAME	THREATENED STATUS	MIGRATORY	MARINE	OPERATIONAL AREA	LIGHT EMBA	MDO EMBA	EMBA	EPBC MANAGEMENT PLAN
True's Beaked Whale	*Mesoplodon mirus*	-	-	-	MO	MO	MO	MO	-

Threatened Species:
V – Vulnerable
E – Endangered
CE – Critically Endangered
CD – Conservation Dependent

Type of presence:
MO - Species or species habitat that may occur within the area
LO - Species or species habitat likely to occur within area
KO - Species or species habitat known to occur within area
FMO – Foraging may occur
FLO – Foraging likely to occur
FKO - Foraging known to occur
BKO – Breeding known to occur
RLO – Roosting likely to occur
RKO – Roosting known to occur

Migratory:
(M) – Migratory
(W) – Wetland

Table 4-7: Marine mammal BIAs within the EMBAs

COMMON NAME	SCIENTIFIC NAME	OPERATIONAL AREA	LIGHT EMBA	MDO EMBA	EMBA
Southern Right Whale	*Eubalaena australis*	MR	MR B	MR B	MR B
Pygmy Blue Whale	*Balaenoptera musculus brevicauda*	D F	D F	D F	D F
Humpback Whale	*Megaptera novaeangliae*	-	-	F	F MR
Indo Pacific Spotted Bottlenose Dolphin	*Tursiops aduncus*	-	-	B	B

Type of BIA:
D – Distribution
F – Foraging
B – Breeding
MR – Migration

4.5.3.1. Whales

Pygmy Blue Whale

The Pygmy Blue Whale (PBW), a subspecies of the blue whale, is an EPBC protected species, listed as Endangered and has been identified to exhibit biologically important behaviours within the EMBA and Operational Area (Figure 4-17). In Australia, PBW can be found throughout the Indian Ocean and usually north of 54° S at lower latitudes, with individuals migrating between Australian waters and Indonesia along the Western Australian coastline (Figure 4-15) (DoE, 2023). However, much of the Australian continental shelf and coastal waters have no particular significance to the whales and are used only for migration and opportunistic feeding (Figure 4-16) (DoE, 2023).

The pygmy blue whale has the highest known prey requirements of any predator, requiring foraging grounds to be areas of high productivity that can support sufficient densities of krill, such as oceanographic upwelling or frontal systems (CoA, 2015a). Within Australia, known areas of significance to the species coincide with seasonal foraging grounds which are located at the Perth Canyon, WA and at the Bonney Upwelling System, VIC and SA, both of which are outside of the EMBA (Figure 4-16). Individuals' frequent locations between November and May in high densities. Outside of these seasonal feeding grounds the species is known to forage within the greater region around the Perth Canyon, off Exmouth and Scott Reef in WA, in the Bass Strait off Victoria and diving and presumably feeding off the west coast of Tasmania (CoA, 2015a).

Blue whales are classified as "constant foragers," continuously searching for patchily distributed krill, preferentially targeting high-reward patches (Torres et al. 2020). While physically capable of rapid transit between distant foraging areas (Woodward et al. 2006), their search strategy within potential krill habitats involves area-restricted searches (ARS), characterized by zig-zagging movements (Abrahms et al. 2019). This pattern continues until prey is located or local resources are deemed insufficient, at which point the whales are presumed to relocate to other potential foraging grounds based on prior experience. Therefore, it is assumed that once feeding is complete, blue whales will depart the current feeding area to initiate a search for new resources.

Studies have documented the diving behaviour of blue whales while foraging at depth. Gill & Morris (2003) observed blue whales in the Otway region diving steeply for 1-4 minutes before resurfacing. More recently, tagging of a pygmy blue whale in the Perth Canyon (Owen et al., 2016) recorded an impressive 1,677 dives over a 7.6-day period. Dive times and behaviours observed were:

- Feeding - mean of 7.6 minutes, maximum of 17.5 minutes.
- Migratory – mean of 5.2 minutes, maximum of 26.7 minutes.
- Exploratory – mean of 8.6 minutes, maximum of 22.05 minutes.

McCauley et al. (2018) suggests that acoustic detection of pygmy blue whales indicate they predominantly occur west of Bass Strait, these detections of pygmy blue whales off Portland Victoria, indicate that PBW presence could be seasonally attributed to upwelling indicators in the Bonney coast upwelling (~600km from the Operational Area) in late summer to autumn (February-April). Tagging studies of pygmy blue whales in the Bonney upwelling (Möller et al., 2015) revealed that while whales primarily engaged in shallow, short dives consistent with area-restricted searching (likely foraging), they exhibited deeper dives at night. These dives were mostly square-shaped, reaching a maximum depth of 492m (mean 59.5m) and a maximum duration of 112 minutes (mean 6.1 minutes). Despite the maximum recorded dive time, the average dive duration of just over 6 minutes suggests that typical dives are likely less than 30 minutes. Although the EMBA does not overlap with known significant foraging areas it does overlap with foraging grounds within the Bass Strait and off the Tasmanian coast (Figure 4-17).

Similar to other baleen whales the blue whale migrates between (low-latitude) breeding grounds in the winter to (high-latitude) foraging grounds in the summer. Pygmy blue whales have three migratory stages around Australia; the "southbound migration" stage where predominantly between October to December (sometimes into January) whales travel from Indonesian waters down to the WA coast, the "southern Australian stage" where between January and June whales spread across the southern Australian waters, and the "northbound migration stage where whales travel back up to Indonesia between April and August.

Photo identification, genetics and telemetry studies of pygmy blue whale along migratory pathways, suggest population exchange between the two feeding grounds of the Bonney coast upwelling and the Perth Canyon (Attard et al. 2018). Overall numbers of blue whales are expected to be low in the Gippsland region at any time of year with Gippsland being outside of predominant feeding grounds for any population of blue whales (Barlow, et al. 2023). Known and likely migratory paths of the pygmy blue whale are not overlapped by the EMBA.

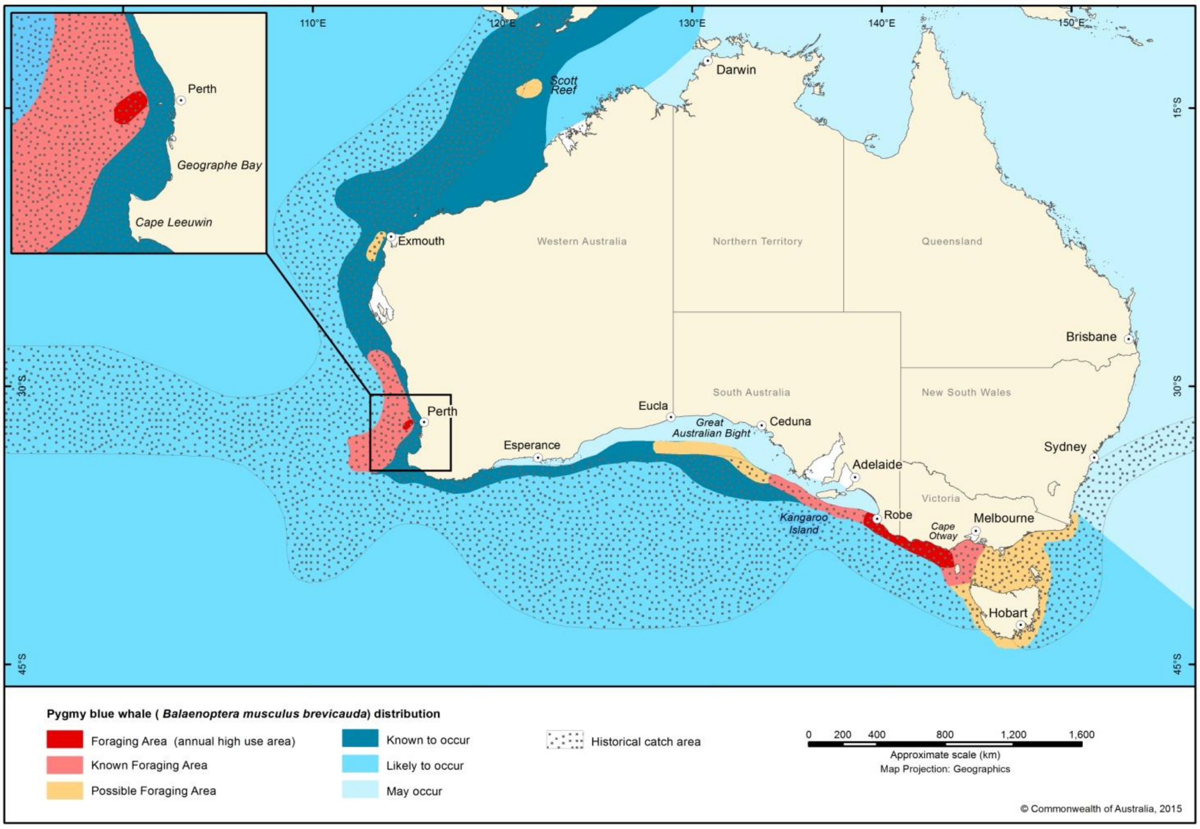

Figure 4-15: Pygmy Blue Whale distribution around Australia (CoA, 2015a)

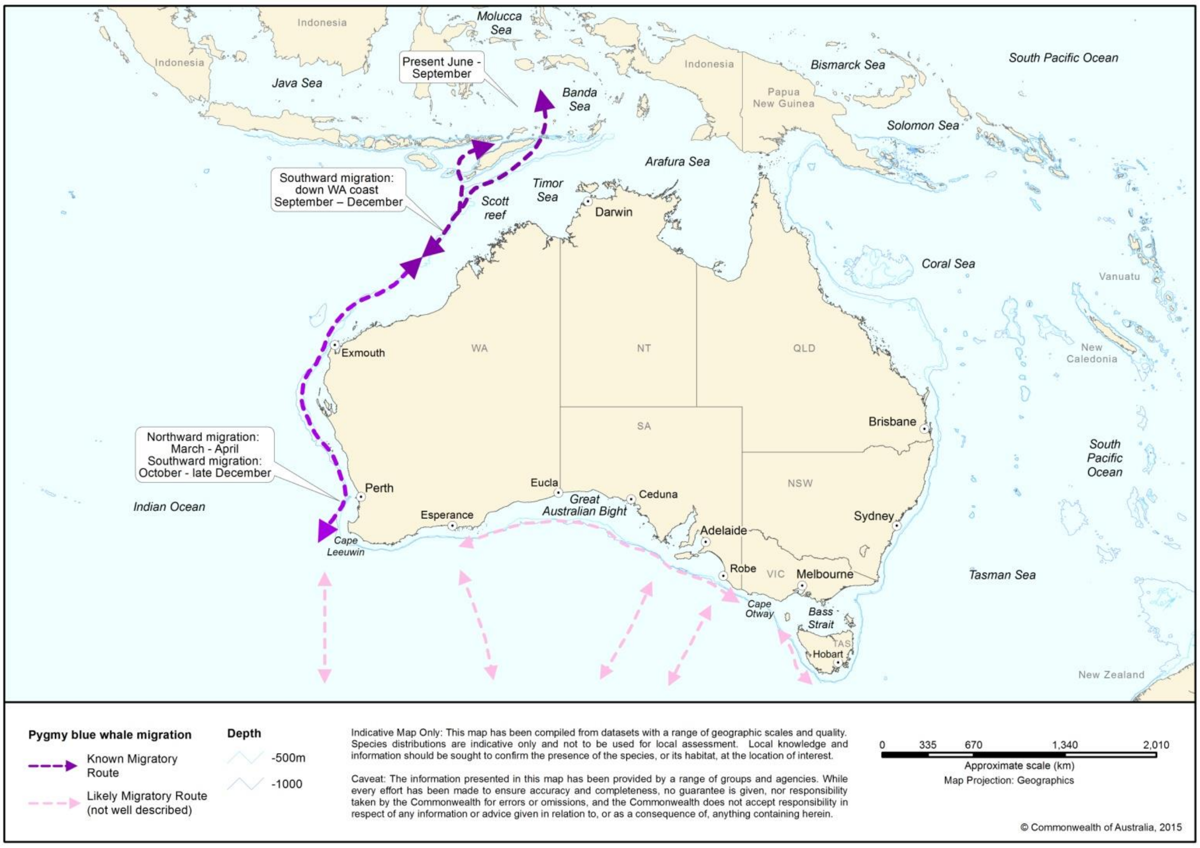

Figure 4-16: Pygmy Blue Whale migration routes (CoA, 2015a)

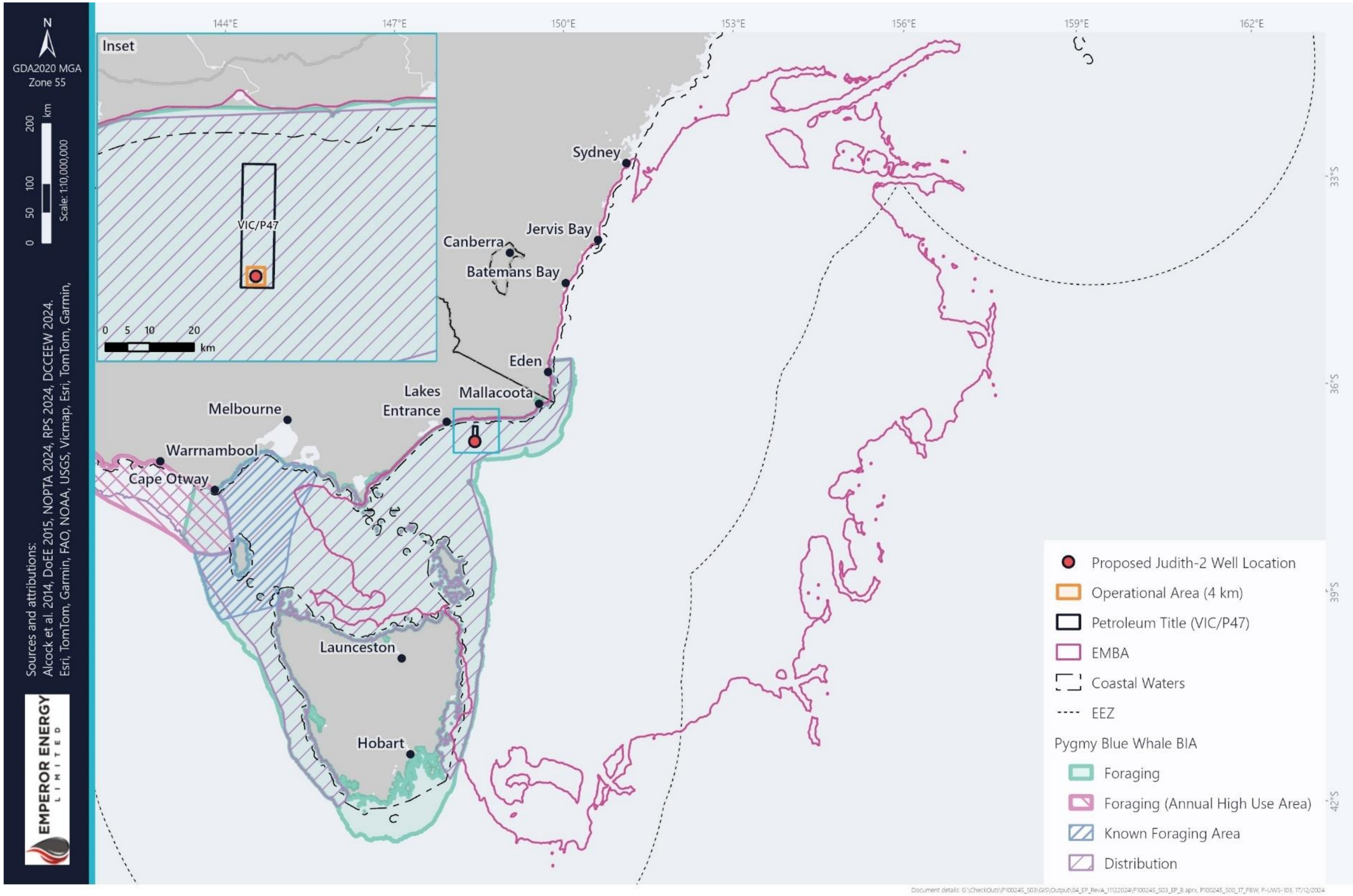

Figure 4-17: Pygmy Blue Whale Biologically Important Areas within the EMBA

Southern Right Whale

The Southern Right Whale (SRW) is an EPBC protected species, listed as Endangered and has been identified to exhibit biologically important behaviours within the Operational Area and EMBA (Figure 4-18). In Australia, the SRW is present seasonally between April and October and can be found within coastal waters of all state waters (DCCEEW, 2024c). They occur in Australian coastal waters along the southern coastline, from Exmouth, Western Australia to Hervey Bay, Queensland, including Tasmania (Smith et al., 2024). Southern right whales in Australian waters, primarily occupy shallow waters (<10m) within 1km of the shoreline, occurring in aggregations where they calve and nurse their young from May – October (Smith et al., 2022). The Operational Area overlaps the migratory BIA for the SRW, with the reproduction BIA (at the Victorian coast) ~33km from the closest point of the Operational Area.

Within the reproduction BIA, the SRW exhibits a high degree of long-term site fidelity with individuals returning to the same breeding site each year, demonstrating a high-degree of spatial and temporal dependence. Migratory BIAs are areas known, or likely to be used for movement between regions that support biologically important behaviours (e.g. foraging and reproduction).

The distribution of the SRW outside of Australian coastal waters is largely unknown, however foraging and feeding occurs in a similar latitudinal range as breeding behaviours, particularly in offshore areas associated with large-scale features such as the Sub-Tropical and Polar Fronts (DCCEEWW, 2022).

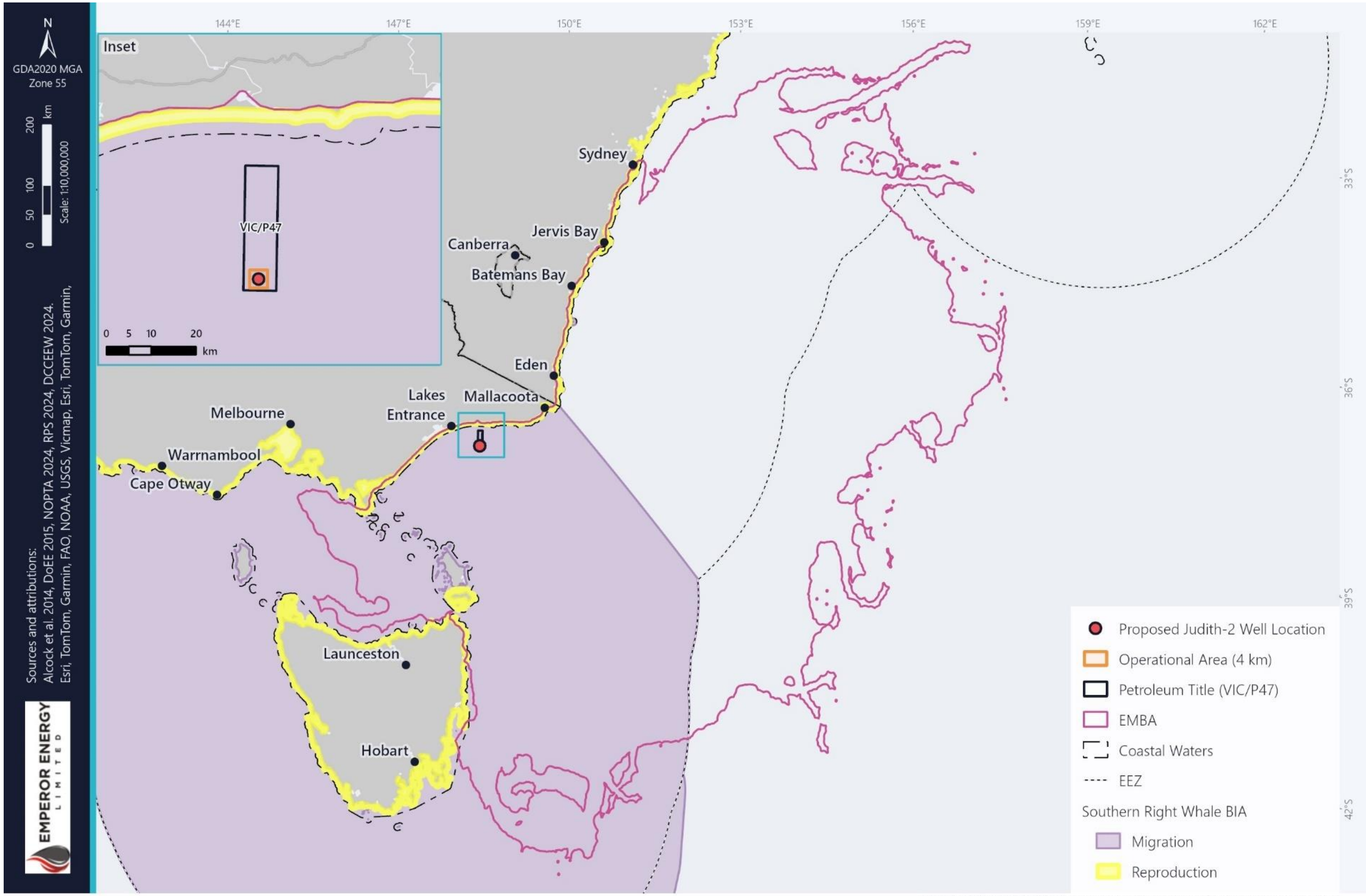

Figure 4-18: Southern Right Whale Biologically Important Areas within the EMBA

Humpback Whale

The Humpback Whale is an EPBC protected species which has been identified to exhibit biologically important behaviours within the EMBA (Figure 4-20). In Australia, there are two populations of Humpback Whale (east and west coast) who make their annual migrations along their respective coastlines each year. The eastern population migration occurs between May and November from foraging grounds in the higher latitudes, around the east coast of Tasmania and Eden, NSW north along the coastline to breeding grounds in the Great Barrier Reef (DoE, 2023). Individuals tend to migrate within 50 km of the coastline of mainland Australia during these travels (TSSC, 2015d). The migratory route of the eastern Humpback Whale includes other biologically important areas such as resting areas (outside the EMBA) and feeding areas (within the EMBA) that are essential for the species during migration (Figure 4-19). Further, there is likely to be considerable individual site fidelity in migratory routes, and changes in usage of migratory routes may be dependent on yearly changes in primary productivity at feeding aggregations (TSSC, 2015d). The EMBA overlaps a migration BIA for the eastern Humpback Whale which runs along the southern NSW coastline.

Humpback Whales forage primarily on krill, although feeding has been observed in Australia's coastal waters this is thought to primarily be opportunistic (TSSC, 2015d). The EMBA overlaps a foraging BIA for the eastern Humpback Whale which runs from the NSW/QLD border to Eden.

Note, the foraging BIA is not represented in Figure 4-20 as it is not recognised by the National Conservation Values Atlas (NCVA). The NCVA (DAWE 2022) details a migration BIA along the east coast of Australia. Feeding primarily occurs in summer in Antarctic waters south of about 55° S with krill (in particular *Euphausia superba*) forming the major part of their diet (Chittleborough 1965). Some feeding has been observed in Australia's coastal waters but this is thought to primarily be opportunistic and forms only a small portion of their nutritional requirements (Thiele et al. 2004).

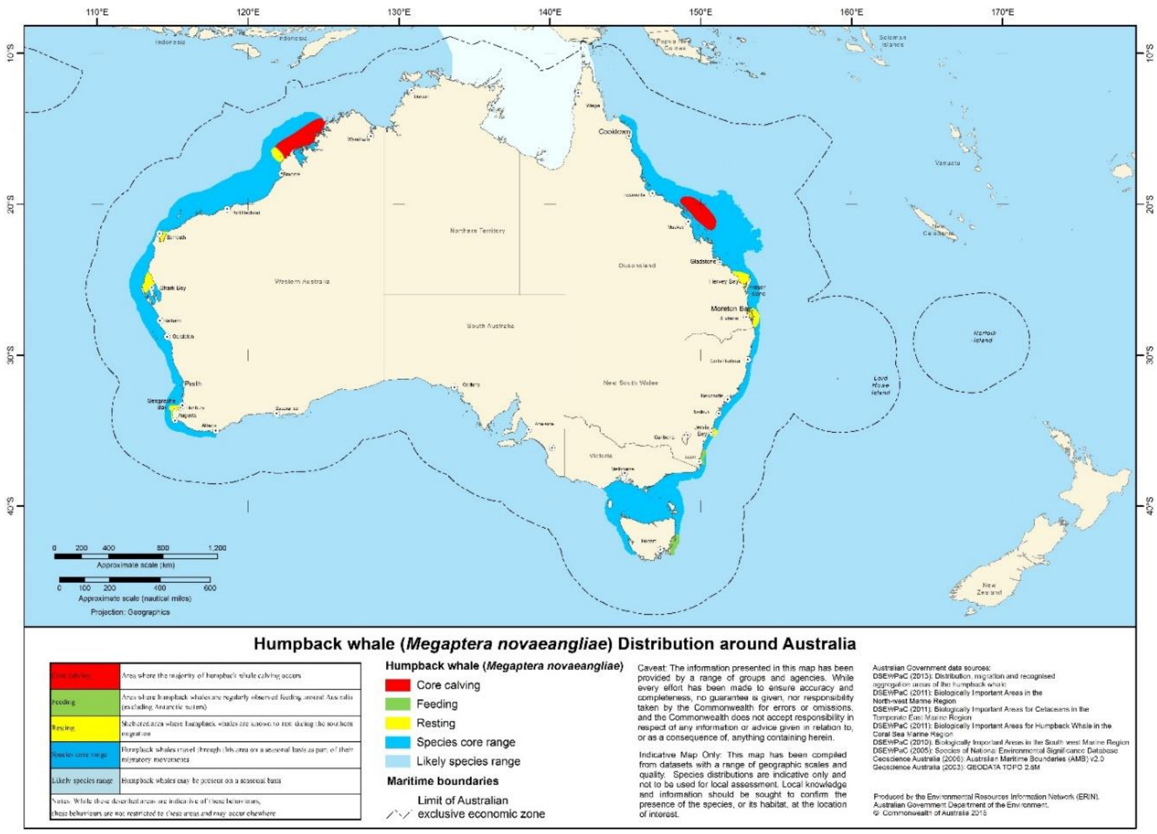

Figure 4-19: Distribution of the Humpback Whale in waters off the Australian Mainland (TSSC, 2015d)

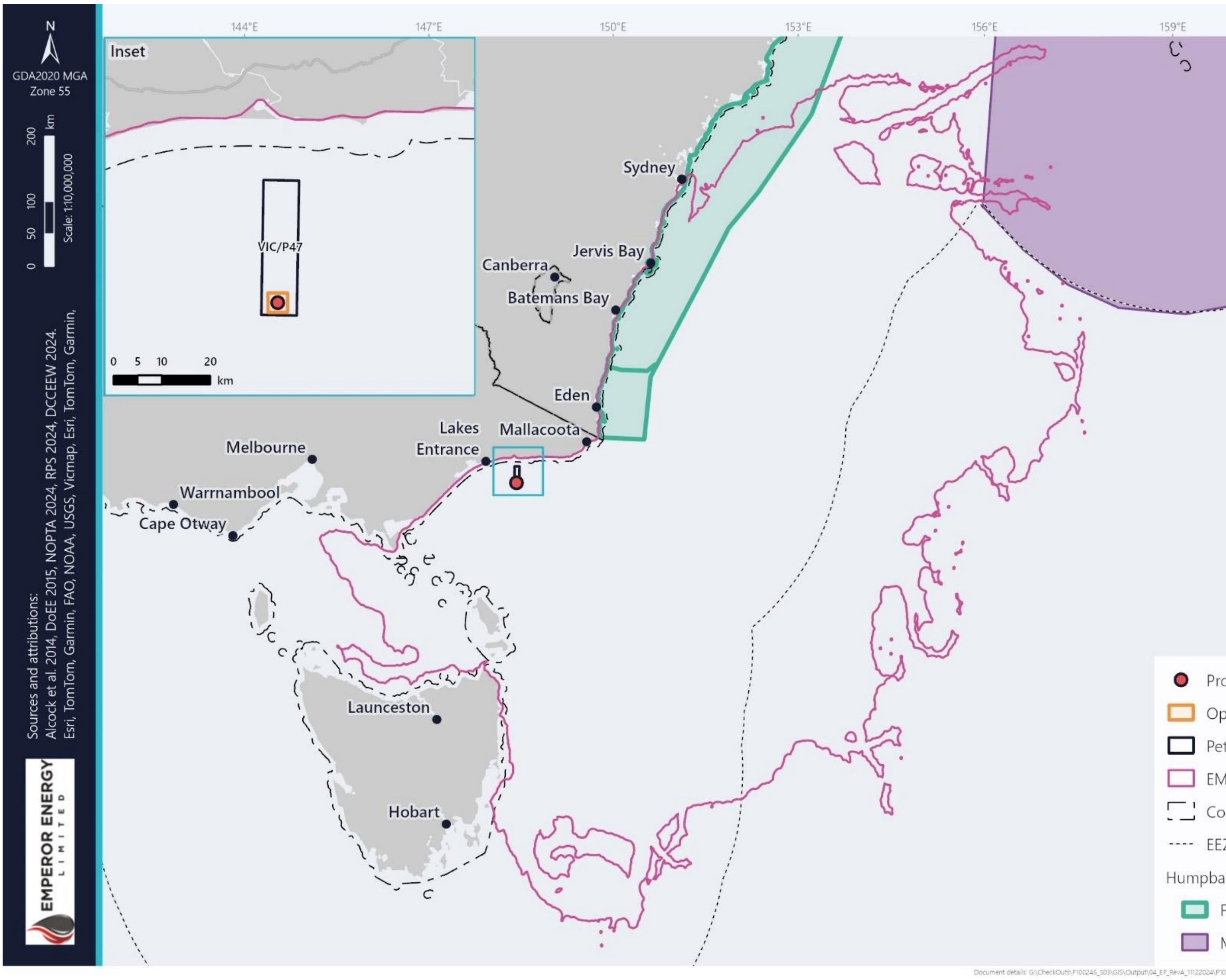

Figure 4-20: Humpback Whale Biologically Important Areas within the EMBA

Antarctic Minke Whales

The Antarctic minke whale (Balaenoptera bonaerensis) is an EPBC protected species, listed as migratory. While no BIAs or critical habitats were identified, the PSMT identified that the Antarctic minke whale was likely occur within the EMBA. The Antarctic minke whale has been found in all state waters except the Northern Territory and occupies temperate to Antarctic offshore and pelagic habitats (Bannister et al. 1996). These whales are typically not social and tend to swim alone or in pairs, although large feeding groups of up to 400 individuals can form in higher latitudes (DoE 2024c). In summer the species is found in pelagic waters, and during winter the species retreat to breeding grounds occupying oceanic waters exceeding 600 m depth and beyond the continental shelf break (DoE 2024c). Mating occurs from June through December, and calving occurs during late May and early June in warmer waters north of the Antarctic Convergence (DoE 2024c). The species primarily feeds in the Antarctic during summer on Antarctic krill (DoE 2024c.

Bryde's Whale

The Bryde's whale (Balaenoptera edeni) is an EPBC protected species, listed as migratory. While no BIAs or critical habitats were identified, the PSMT identified that the Bryde's whale may occur within the EMBA.

Bryde's whales are distributed throughout tropical and temperate Australian waters, except for the Northern Territory (Bannister J. L., 1996). There are no population estimates for Bryde's whales, in Australia or globally, and no documented migration patterns throughout Australian waters (DoE, 2018). Bryde's whales are considered to be opportunistic feeders, with coastal and offshore populations being distinguished by their prey preferences. The smaller coastal form typically feeds on schooling fish, such as pilchard, anchovy, sardine, mackerel, herring and others. While larger offshore form feeds on small crustaceans, such as euphausiids, copepods, pelagic red crabs and cephalopods (DoE, 2018).

False Killer Whale

The False killer whale (Pseudorca crassidens) is an EPBC protected species. While no BIAs or critical habitats were identified, the PSMT identified that the False killer whale is likely to occur within the EMBA. False Killer Whales are widely recorded and distributed throughout Australia, in each of the coastal states. No population estimates are available for False Killer Whales in Australian waters, however, they occur in low abundance (Reeves et al. 2003). These whales show a preference for tropical to temperate oceanic waters. Considering the extensive distribution of False Killer Whales, and the large variety of habitats that they would use for foraging, these species would exhibit adaptable foraging behaviours. The movement patterns of these whales in Australia are primarily inferred from stranding patterns. The trends in strandings suggest there is a seasonal movement inshore or along the continental shelf on the southern and south-eastern coasts (Bannister et al. 1996; Nicol 1987).

Fin Whale

The fin whale (Balaenoptera physalus) is an EPBC protected species, listed as migratory and vulnerable. While no BIAs or critical habitats were identified, the PSMT identified that foraging behaviours are likely to occur within the EMBA. Fin whales are distributed from polar to tropical waters and are rarely in inshore waters, they show well defined migratory routes. Unlike blue and minke whales, fin whales are rarely seen close to ice, although recent sightings have occurred near the ice edge of Antarctica (TSSC, 2015b). There are stranding records of this species from most state waters, but they are still considered rare around Australia (Bannister et al. 1996). Fin whales have been sighted in the proximity of the Bonney coast upwelling, Victoria, along the continental shelf in summer and autumn months (Gill et. al, 2015). Fin whales typically lunge or skim feed, at or near the water's surface, on planktonic crustacea, fish and cephalopods (TSSC, 2015b). These whales have also been detected acoustically south of Portland, Victoria (Erbe, 2016). While the area may not be a defined migratory route, calls recorded in July may be from whales migrating northward towards the east coast of NSW. Calls detected in late August and September may be indication of the presence of whales on their migration route back to Antarctic waters (Aulich et al. 2019). The record of a fin whale calf in the Bonney coast upwelling in April 2000 and the stranding of two calves in South Australia suggest that this area may be important to the species' reproduction (Morrice et al. 2004). However, there are no mating or calving areas in Australia waters.

Pygmy Right Whale

The pygmy right whale (Caperea marginata) is an EPBC protected species, listed as migratory and vulnerable. While no BIAs or critical habitats were identified, the PSMT identified that foraging behaviours are likely to occur within the EMBA. These whales are found in temperate and sub-Antarctic oceanic and inshore waters. Distribution appears limited by the surface water temperature as they are typically found in waters with temperatures ranging from 5° to 20°C (Baker 1985), remaining north of the Antarctic Convergence. There are few confirmed sightings of pygmy right whales (Reilly et al. 2008), with the largest reported group sighted (100+) just south-west of Portland in 2007 (Gill et al. 2008). Areas of coastal upwelling appear to be an important component that regulates pygmy right whale distribution (DoE, 2023).

Key locations include south-east Tasmania, Kangaroo Island (SA) and southern Eyre Peninsula (SA) close to upwelling habitats rich in marine life and zooplankton upon which it feeds (Bannister et al. 1996).

Sei Whale

Sei whales (Balaenoptera borealis) is an EPBC protected species, listed as migratory and vulnerable. While no BIAs or critical habitats were identified, the PSMT identified that foraging behaviours are likely to occur within the EMBA. These whales rang from polar to tropical waters, although they are typically found more offshore than other large whales. Sei whales have a well-defined migratory route, which are north-south with little longitudinal dispersion (Horwood 1987). Sei whales migrate between Australia water to Antarctic and subantarctic feeding areas, and the tropical and subtropical breeding areas (TSSC, 2015e). They feed between the Antarctic and subtropical convergences, on planktonic crustaceans, particularly copepods and amphipods. After the Antarctic convergency they feed on Antarctic krill (Euphausia superba) (TSSC, 2015e). In Australian waters, sei whales occur within Antarctic Australian Territory waters and Commonwealth waters. They have been infrequently recorded off Tasmania, NSW, Queensland, the Great Australian Bite, Northern Territory and Western Australia (Parker 1978; Bannister et al. 1996).

4.5.3.2. Seals

Australian Fur Seal

Australian fur-seals (A. pusillus) EPBC protected species, listed as marine. While no BIAs or critical habitats were identified, the PSMT identified that the Australian fur-seals may occur within the operational area and breeding behaviour is known to occur within the EMBA. Australian fur-seals are endemic to south-eastern Australian waters and they are distributed throughout waters off the coasts of South Australia, Tasmania, Victoria, and NSW. Australian fur-seals are present in the region all year, with breeding taking place during November and December, on offshore islands in the Bass Strait. Population numbers of this species are believed to be increasing as the population recovers from historic hunting (Hofmeyr et al. 2008). During the summer months, Australian fur-seals travel between northern Bass Strait islands and southern Tasmanian waters, however, lactating female fur-seals and some territorial males are restricted to foraging ranges within Bass Strait waters. Lactating female Australian fur-seals forage primarily within the shallow continental shelf of the Bass Strait and the Otway at depths of between 60–80 m, within 100–200 km of the breeding colony. Male Australian fur-seals are bound to colonies during the breeding season, outside of this time they forage at further distances and are away for longer periods (Kirkwood et al. 2009; Hume et al. 2004).

4.5.3.1. Dolphins

Indo-Pacific Spotted Bottlenose Dolphin

The Indo-Pacific Spotted Bottlenose Dolphin is an EPBC protected species which has been identified to exhibit biologically important behaviours within the EMBA. In Australia, this species is known to occur within estuarine and coastal waters of the eastern Indian Ocean, Tasman Sea, Coral Sea and the Arafura/Timor Sea (DoE, 2023). The Indo-Pacific Spotted Bottlenose Dolphin exhibit a seasonal migration likely associated with the movement of prey. Breeding occurs between spring and autumn months and gestation lasts for 12 months (DoE, 2023). The EMBA overlaps a portion of a breeding BIA for the species along the southern NSW coastline (Figure 4-21).

Dusky Dolphin

The Dusky dolphin (*Lagenorhynchus obscurus*) is an EPBC protected species, listed as migratory. While no BIAs or critical habitats were identified, the PSMT identified that the Dusky dolphin is likely to occur within the EMBA. They are considered to be primarily an inshore species, although they can also be oceanic when cold currents are present (Gill P. R., 2000). This dolphin occurs across southern Australia from Western Australia to Tasmania. No key localities or critical habitats in Australian waters have been identified (Bannister J. L., 1996). They are considered to be primarily an inshore species but can also be oceanic when cold currents are present (DoE 2024a).

Killer Whale

The killer whale (Orcinus orca) is an EPBC protected species, listed as migratory. While no BIAs or critical habitats were identified, the PSMT identified that the Killer whale is likely to occur within the EMBA. The Killer whale is the largest member of the dolphin family, it is thought to be the most cosmopolitan of all marine mammals. They occur more commonly in cold, deeper waters, although they often been observed along the continental slope and shelf, particularly near seal colonies (Bannister J. L., 1996). The killer whale is widely distributed from polar to equatorial regions and has been recorded in all Australian waters with concentrations around Tasmania. The habitat of killer whales includes oceanic, pelagic and neritic, in both warm and cold waters (DoE 2024b). The breeding season is variable, and the species moves seasonally to areas of food supply (Bannister J. L., 1996) (Morrice M., 2004).

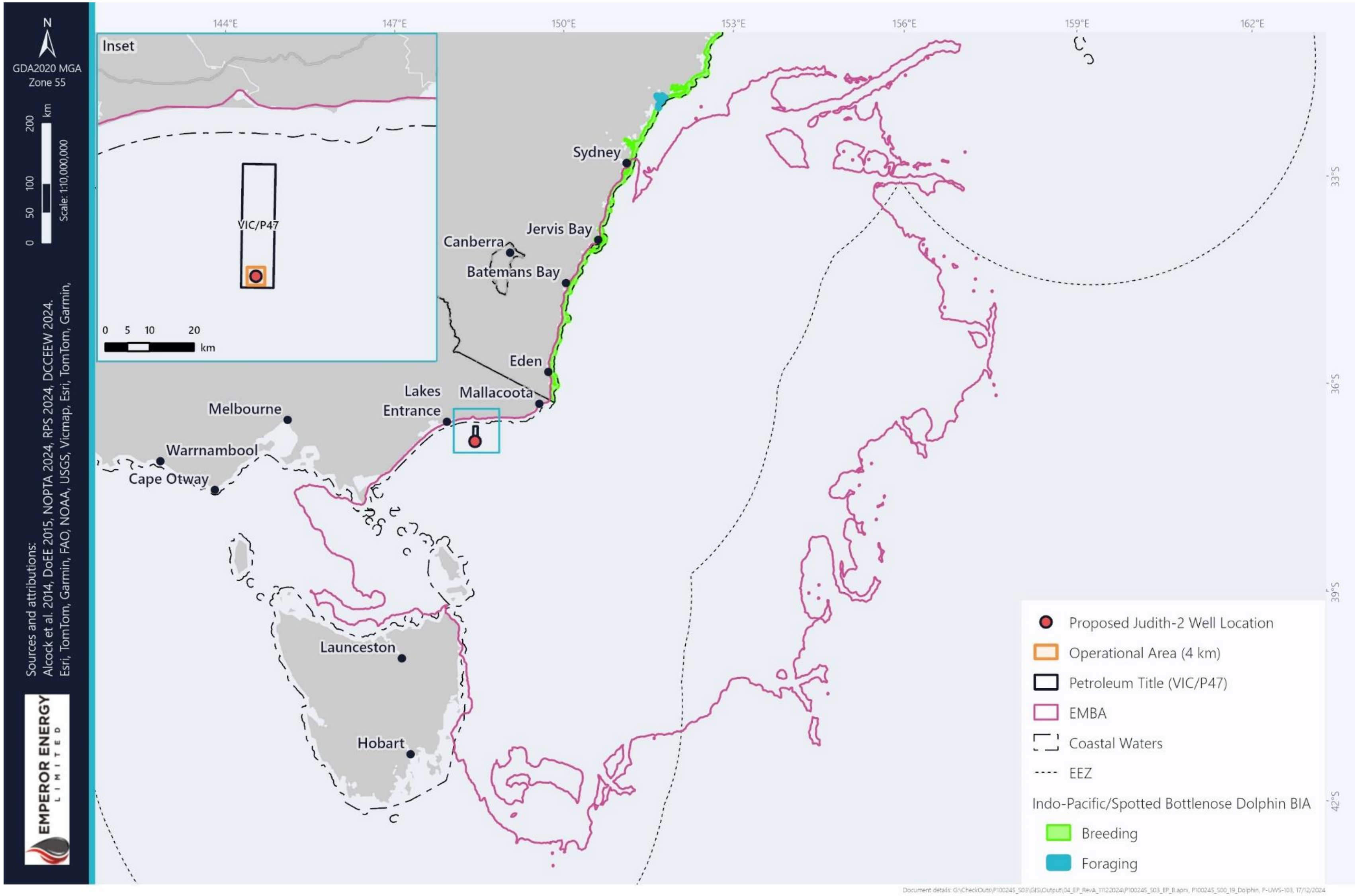

Figure 4-21: Indo Pacific Spotted Dolphin Biologically Important Areas within the EMBA

4.5.4. Marine Reptiles

Marine reptiles are a group of reptiles that have become secondarily adapted to life wholly or partially in the marine environment. Species from three marine reptile groups (marine turtles, sea snakes, saltwater crocodiles) are found in Australian waters. Some reptile species are listed as threatened and/or migratory under the *Environment Protection and Biodiversity Conservation Act 1999*, and these are considered a matter of national environmental significance. Species may also be protected under state and territory environmental legislation. No threatened or migratory marine reptiles have been identified to have BIAs overlapping the Operational Area or EMBA.

Five species of marine reptile have been listed in the PMST search, as having likely or known presence in the EMBA and are discussed further below. No marine reptile was identified as having designated BIAs within the Operational Area or EMBA.

Several species identified by the PMST to occur within the EMBA are terrestrial species and are not likely to inhabit coastlines or rely on the marine environment for breeding or foraging. These species are not considered to be credibly impacted by the activity and have been excluded from this section and impact assessment. These species are listed in APPENDIX B .Table 4-8 Listed reptile species identified in the Operational and EMBAs

COMMON NAME	SCIENTIFIC NAME	THREATENED STATUS	MIGRATORY	MARINE	OPERATIONAL AREA	LIGHT EMBA	MDO EMBA	EMBA	EPBC MANAGEMENT PLAN
Flatback Turtle	*Natator depressus*	V	✓(M)	✓	-	-	FKO	FKO	Recovery Plan for Marine Turtles in Australia 2017-2027
Elegant Sea snake	*Hydrophis elegans*	V	-	✓	-	-		MO	-
Green Turtle	*Chelonia mydas*	V	✓(M)	✓	MO	KO	FKO	FKO	Recovery Plan for Marine Turtles in Australia 2017-2027
Hawksbill Turtle	*Eretmochelys imbricata*	V	✓(M)	✓	-	LO	FKO	FKO	Recovery Plan for Marine Turtles in Australia 2017-2027
Leatherback Turtle	*Dermochelys coriacea*	E	✓(M)	✓	LO	BLO	FKO	FKO	Approved Conservation Advice for Dermochelys coriacea (Leatherback Turtle) Recovery Plan for Marine Turtles in Australia 2017-2027 Commonwealth Listing Advice on Dermochelys coriacea
Loggerhead Turtle	*Caretta caretta*	E	✓(M)	✓	LO	BLO	KO	FKO	Recovery Plan for Marine Turtles in Australia 2017-2027
Yellow-bellied sea snake	*Pelamis platurus*	-	-	✓	-	-		MO	-

Threatened Species:
V – Vulnerable
E – Endangered
CE – Critically Endangered
CD – Conservation Dependent

Type of presence:
MO - Species or species habitat that may occur within the area
LO - Species or species habitat likely to occur within area
KO - Species or species habitat known to occur within area
FMO – Foraging may occur
FLO – Foraging likely to occur
FKO - Foraging known to occur
BLO – Breeding likely to occur
BKO – Breeding known to occur

Migratory:
(M) – Migratory
(W) – Wetland

4.5.4.1. Marine Turtles

Flatback Turtle

The flatback turtle (Natator depressus) is an EPBC protected species, listed as vulnerable. Although no nesting or internesting, critical habitat, or BIAs, have been identified for the flatback turtle within the EMBA, foraging behaviours are known to occur within the EMBA. Flatback turtles are found in the tropical waters of northern Australia and is one of only two species of sea turtle that is not distributed globally (DoE, 2023d). All known nesting locations for this species are within Australia (DoE, 2023d). Flatback turtles are primarily carnivorous, feeding on soft bodied carnivorous, feeding on soft-bodies invertebrates, with juveniles feeding on gastropods, molluscs, squid and siphonophores. There is limited data to indicated that their diet includes cuttlefish, hydroids, soft corals, crinoids, molluscs and jellyfish (DoE, 2023d).

Green Turtle

Green Turtles (Chelonia mydas) are an EPBC protected species, listed as migratory and vulnerable. Although no nesting or internesting, critical habitat, or BIAs, have been identified for the Green turtle within the EMBA, the species may occur within the Operational area and foraging behaviour is known to occur within the EMBA. Green turtles are distributed across tropical northern Australian waters. They usually occur between the 20°C isotherms, although individuals can stray into temperate waters (Limpus 2008; CoA 2017a). The Australian population of Green Turtles is approximately 70,000 individuals, predominantly found off the Northern Territory, Queensland, and Western Australian coastlines, with limited numbers in NSW, Victoria and South Australia. Green turtles spend their first 5-10 years drifting on ocean currents. During this pelagic phase, they are often found in association with drift lines and floating rafts of sargassum. Adult Green Turtles mainly feed on seagrass and algae, although they will occasionally eat mangroves, fish-egg cases, jellyfish, and sponges; juvenile green turtles are typically more carnivorous and will also consume plankton during their pelagic stage (DoE, 2008).

Hawksbill Turtle

The hawksbill turtle (Eretmochelys imbricata) is an EPBC protected species, listed as migratory and vulnerable. Although no nesting or internesting, critical habitat, or BIAs, have been identified for the Hawksbill turtle within the EMBA, foraging behaviours are known to occur within the EMBA. Hawksbill turtles are found in tropical, subtropical and temperate globally (DoE, 2017). Hawksbill turtles are omnivorous, typically feeding on sponges, hydroids, cephalopods, gastropods, cnidarians, seagrass and algae (CoA, 2017a; DoE, 2017). During their pelagic phase, juvenile hawksbill turtles feed on plankton (DoE, 2017). Hawksbill turtles that forage on the Great Barrier Reef migrate and neighbouring countries including Papua New Guinea, Vanuatu, and the Solomon Islands (CoA, 2017a).

Leatherback Turtle

The leatherback turtle (Dermochelys coriacea) is an EPBC protected species, listed as migratory and endangered. Although no critical habitat, or BIAs, have been identified for the leatherback turtle, foraging behaviours are known to occur, and breeding is likely to occur within the EMBA. Leatherback turtles are widely distributed throughout tropical, sub-tropical and temperate waters of Australia (CoA, 2017a; Limpus, 2008). The leatherback turtle is most commonly reported foraging along the coastal waters of central eastern Australia, south-east Australia, southwestern WA and along the east coast and in Bass Strait (CoA, 2017a; Limpus, 2008). Leatherbacks feed on soft-bodied invertebrates, including jellyfish (Limpus, 2008). No major nesting has been recorded in Victoria or Tasmania, with isolated nesting recorded in the Northern Territory, Queensland, and northern NSW (CoA, 2017a).

Loggerhead Turtle

The loggerhead turtle (Caretta caretta) is an EPBC protected species, listed as migratory and endangered. Although no critical habitat, or BIAs, have been identified for the loggerhead turtle, foraging behaviours are known to occur, and breeding is likely to occur within the EMBA. Loggerhead turtles are globally distributed throughout tropical, sub-tropical and temperate waters. In Australia they typically occur in the waters of coral and rocky reefs, seagrass beds, or muddy bays throughout eastern, northern, and western Australia (DoE, 2016). The main Australian breeding areas for loggerhead turtles are typically confined to southern Queensland and WA (Cogger et al. 1993). Loggerhead turtles are carnivorous and feed predominantly on benthic invertebrates up to 55 m offshore. Loggerhead turtles forage in all coastal states and the Northern Territory, but are uncommon in South Australia, Victoria, and Tasmania (CoA, 2017a). Although loggerhead turtles will migrate over distances in excess of 1,000 km, they show a strong preference to their feeding and breeding areas (Limpus 2008). While the species has a broad foraging range throughout Australian waters, nesting is known to occur on sandy beaches on the central western and eastern coasts (DoE, 2016).

4.5.5. Species Recovery Plans and Conservation Advice

Table 4-9 Recovery Plans, Threat Abatement Plans and Species Conservation Advices relevant to Judith-2 Exploration Drilling EP

SPECIES OR GROUP	RELEVANT PLAN / CONSERVATION ADVICE	OPERATIONAL AREA	EMBA	RELEVANT THREATS	RELEVANT CONSERVATION ACTION	ADDRESSED IN THE EP
All vertebrate fauna	Threat Abatement Plan for the impacts of marine debris on vertebrate wildlife of Australia's coasts and oceans (DoEE, 2018)	✓	✓	Ship-sourced marine debris as a risk to vertebrate marine life through entanglement or ingestion	No explicit management actions for non-fisheries related industries (note that management actions in the plan relate largely to management of fishing waste (for example 'ghost' gear), and State and Commonwealth management through regulation.	Section 5.2.2 Section 5.6
SEABIRD AND SHOREBIRD						
Seabirds and migratory shorebirds	National Light Pollution Guidelines for Wildlife, including marine turtles, seabirds and migratory shorebirds (DoEE, 2020)	✓	✓	Light Pollution	Best practice lighting design incorporates the following design principles: Start with natural darkness and only add light for specific purposes. Use adaptive light controls to manage light timing, intensity and colour. Light only the object or area intended – keep lights close to the ground, directed and shielded to avoid light spill. Use the lowest intensity lighting appropriate for the task. Use non-reflective, dark-coloured surfaces. Use lights with reduced or filtered blue, violet and ultra-violet wavelengths.	Section 5.2.1
All Migratory Shorebirds	Wildlife Conservation Plan for Migratory Shorebirds (CoA, 2015)	✓	✓	Habitat degradation and modification	No explicit relevant management actions; habitat degradation identified as a threat.	Section 5.6
				Anthropogenic disturbance	Investigate the significance of cumulative impacts on migratory shorebird habitat and populations in Australia. Ensure all areas important to migratory shorebirds in Australia continue to be considered in development assessment processes (specifically for coastal developments).	Section 5.6
All Seabirds	Draft Wildlife Conservation Plan for Seabirds (Commonwealth of Australia 2019)	✓	✓	Pollution (marine debris, light, water)	Enhance contingency plans to prevent and / or respond to environmental emergencies that have an impact on seabirds and their habitats.	Section 5.2.2 Section 5.6
				Habitat loss and degradation from pollution	No explicit relevant management actions; identified as a threat.	Section 5.2.1 Section 5.2.2 Section 5.6
				Anthropogenic disturbance	Ensure all areas of important habitat for seabirds are considered in the development assessment process. Manage the effects of anthropogenic disturbance to seabird breeding and roosting areas.	Section 5.2.1 Section 5.2.2 Section 5.4 Section 5.5 Section 5.6
				Invasive species	Ensure seabirds are protected from the adverse effects of invasive species.	Section 5.2.2
	National recovery plan for threatened albatrosses and giant petrels (2022	✓	✓	Marine pollution	Where feasible, population monitoring programs also monitor, in a standardised manner, the incidence of oiled birds at the nest.	Section 5.2.1 Section 5.2.2

SPECIES OR GROUP	RELEVANT PLAN / CONSERVATION ADVICE	OPERATIONAL AREA	EMBA	RELEVANT THREATS	RELEVANT CONSERVATION ACTION	ADDRESSED IN THE EP
All threatened Albatrosses and Giant Petrels						Section 5.6
				Parasites and disease	No explicit management actions; parasites and disease recognised as a threat.	Section 5.2.2
FISH AND SHARK						
Australian Grayling	Conservation Advice Australian Grayling *Prototroctes maraena* (TSSC 2021)	✓	✓	Introduced species, disease and parasites	No explicit relevant management actions; introduced species, disease and pathogens identified as threats.	Section 5.2.2
Black Rockcod	Approved Conservation Advice for *Epinephelus daemelii* (black cod)		✓	None identified	No explicit relevant management actions to Petroleum activities	-
Grey Nurse Shark	Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*)		✓	Habitat modification	No explicit relevant management actions to Petroleum activities	Section 5.2.1 Section 5.2.2 Section 5.6
Red Handfish; Ziebell's Handfish	Australian national Recovery Plan for Three Handfish Species: spotted handfish (*Brachionichthys hirsutus*), red handfish (*Thymichthys politus*) and Ziebell's handfish (*Brachiopsilus ziebelli*) (DoEE, 2015)		✓		No explicit relevant management actions to Petroleum activities	-
Whale Shark	Approved Conservation Advice for *Rhincodon typus* (whale shark) (2015)	✓	✓	Boat strike	Minimise offshore developments and transit time of large vessels in areas close to marine features likely to correlate with Whale Shark aggregations along the northward migration route that follows the northern Western Australian coastline along the 200 m isobath (as set out in the Conservation Values Atlas, DoE, 2014).	Section 5.2.2
				Habitat disruption from mineral exploration, production and transportation	Implement measures to reduce adverse impacts of habitat degradation and/or modification.	Section 5.2.1 Section 5.2.2 Section 5.6
				Marine debris	No explicit relevant management actions; marine debris identified as a threat.	Section 5.2.2 Section 5.6
White Shark	Recovery plan for the White Shark (*Carcharodon carcharias*) (2013)	✓	✓	Habitat modification	No explicit relevant management actions; habitat modification identified as threats.	Section 5.2.1 Section 5.2.2 Section 5.6
MARINE MAMMALS						
Blue Whale	Conservation Management Plan for the Blue Whale	✓	✓	Noise interference	Assess the effect of anthropogenic noise on the blue whale; and anthropogenic noise is managed such that any blue whale continues to utilise the area without injury and is not displaced from a foraging area.	Section 5.4 Section 5.5
				Habitat modification from marine debris or chemical discharge	No explicit relevant management actions; identified as a threat.	Section 5.2.1 Section 5.2.2 Section 5.6

SPECIES OR GROUP	RELEVANT PLAN / CONSERVATION ADVICE	OPERATIONAL AREA	EMBA	RELEVANT THREATS	RELEVANT CONSERVATION ACTION	ADDRESSED IN THE EP
				Vessel strike	Any vessel strikes are reported in the National Vessel Strike Database; and 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.	Section 5.2.2
Fin Whale	Conservation Advice for *Balaenoptera physalus* (fin whale)			Noise interference	Evaluate risk of noise impacts to cetaceans and if required, implement appropriate mitigation measures.	Section 5.4 Section 5.5
				Pollution (persistent toxic pollutants)	No explicit relevant management actions; identified as a threat.	Section 5.2.1 Section 5.2.2 Section 5.6
				Vessel strike	Any vessel strikes are reported in the National Vessel Strike Database	Section 5.2.2
Sei Whale	Conservation Advice for *Balaenoptera borealis* (sei whale)	✓	✓	Noise interference	Evaluate risk of noise impacts to cetaceans and if required, implement appropriate mitigation measures.	Section 5.4 Section 5.5
				Habitat modification from marine debris or chemical discharge	No explicit relevant management actions; identified as a threat.	Section 5.2.1 Section 5.2.2 Section 5.6
				Pollution (persistent toxic pollutants)	No explicit relevant management actions; identified as a threat.	Section 5.2.1 Section 5.2.2 Section 5.6
				Vessel strike	Any vessel strikes are reported in the National Vessel Strike Database	Section 5.2.2
Southern Right Whale	National Recovery Plan for the Southern Right Whale (DCCEEW 2024)	✓	✓	Vessel strike	Manage, minimise and mitigate the threat of vessel strike	Section 5.2.2
				Vessel disturbance	Evaluate risk of vessel strikes and, if required, appropriate mitigation measures are implemented.	Section 5.2.2
				Anthropogenic underwater noise/noise interference	Evaluate risk of noise impacts to cetaceans and, if required, appropriate mitigation measures are implemented.	Section 5.4 Section 5.5
				Habitat degradation from coastal and offshore development	Address habitat degradation impacts from coastal and offshore marine infrastructure developments	Section 5.2.2
MARINE REPTILES						
All marine turtle species	Recovery Plan for Marine Turtles in Australia, 2017-2027	✓	✓	Marine debris	No explicit relevant management actions; identified as a threat.	Section 5.2.2
				Chemical discharge	Ensure spill risk strategies and response programs adequately include management for marine turtles and their habitats, particularly in reference to 'slow to recover habitats'; and quantify the accumulation and effects of anthropogenic toxins in marine turtles, their foraging habitats and subsequent stock viability.	Section 5.2.1 Section 5.2.2 Section 5.6

SPECIES OR GROUP	RELEVANT PLAN / CONSERVATION ADVICE	OPERATIONAL AREA	EMBA	RELEVANT THREATS	RELEVANT CONSERVATION ACTION	ADDRESSED IN THE EP
				Light pollution	Artificial light within or adjacent to habitat critical to the survival of marine turtles will be managed such that marine turtles are not displaced from these habitats; and identify the cumulative impact on turtles from multiple sources of onshore and offshore light pollution.	Section 5.2.1
				Habitat modification	No explicit relevant management actions; identified as a threat.	Section 5.2.1 Section 5.2.2 Section 5.6
				Vessel disturbance	No explicit relevant management actions; identified as a threat.	Section 5.2.2
				Noise interference	No explicit relevant management actions; identified as a threat.	Section 5.4 Section 5.5
Leatherback Turtle	Approved Conservation Advice for Dermochelys coriacea (Leatherback Turtle)	✓	✓	As above	As above	As above

4.6. Conservation Values and Sensitivities

4.6.1. Protected Marine Areas

4.6.1.1. Australian Marine Parks

No AMPs are located within the Operational Area. However, there are seven AMPs identified within the EMBA which are detailed in Table 4-10 and displayed in Figure 4-22.There are 62 Australian Marine Parks (AMP) located around Australia. AMPs are managed by the Commonwealth Government and have been established to conserve marine habitats and the species that live within and rely on these habitats.

Table 4-10: Australian Marine Parks intersected by the EMBA

AMP	MARINE REGION	ZONE	KEY VALUES	DISTANCE TO OPERATIONAL AREA
Beagle	South east	Multiple Use zone (VI) National Park Zone (IUCN Zone II)	Protects 2,928 km^2 Waters in the park are quite shallow (50-70 m) and support many rocky reef habitats. The AMP is an important foraging area for seabirds that breed on the Bass Strait islands The park was once dry land which made up part of the land bridge connecting Tasmania to mainland Australia. First Nations people lived on this land and have a strong connection to it despite the sea level rise There are two known shipwrecks located within the AMP: *SS Cambridge* (1940) and the *Eliza Davies* (1924)	160 km southwest
Flinders	South east	National Park (II) Multiple Use zone (VI)	Protects 27,043 km^2 The park spans from the coastal waters off Tasmanians offshore islands out into the deep sea. Seafloor features located within the park include a steep slope, canyons, rocky outcrops and a large seamount The AMP is an important foraging location for species such as orcas, the white shark and a variety of albatross and petrel species	244 km south

East Gippsland	South east	Multiple Use zone (VI)	Protects 4,137 km^2 The park is located off the Victorian coast and is within the Upwelling East of Eden KEF. Seafloor features located within the park include the continental shelf, canyons and escarpments The AMP is an important foraging location for oceanic seabirds such as the wandering albatross and overlapped by the Humpback Whale migration route	134 km east
Jervis	Temperate east	Habitat Protection zone (IV) Special Purpose zone (VI)	Protects 2,473 km^2 The park is located 20 km from the coast in NSW. Seafloor features located within the park include rocky reefs and a shallow continental shelf which links to the deep sea within the protected area The East Australian Current influences ecosystems within the park and created important foraging habitat for the humpback whale, grey nurse shark and a variety of seabird species The Traditional Custodians of the Jervis Bay region are the Koori people of the Wreck Bay Aboriginal Community who have relied on the resources of the coast and ocean for centuries There is one known shipwreck located within the AMP: *HMAS Tattoo* (1939)	376 km northeast
Freycinet	South east	National Park (II) Habitat Protection zone (IV)Recreational Use zone (IV)	Protects 57,942 km^2 The park spans from the continental shelf out to the deep sea. Seafloor features located within the park include seamounts, canyons, granite reefs and deep-sea plains The AMP is an important foraging site for a variety of seabirds as well as resting habitat for Southern Right Whale during its migration	393 km south

Hunter	Temperate east	Habitat Protection zone (IV)	Protects 6,257 km^2 The park extends from shallow shelf waters out to the deep sea. Seafloor features located within the park include shelf rocky reefs and canyons The AMP is home to ~50 endemic fish species and is a known foraging ground for the humpback whale and grey nurse shark The Worimi people are the Traditional Custodians of the Port Stephens area and have strong cultural ties to the Sea Country within the AMP There is one known shipwreck located within the AMP: *India* (1884)	692 km southeast
Central Eastern	Temperate east	Habitat Protection zone (IV)	Protects 70, 054 km^2 The park links the continental shelf to the Tasmantid Seamounts which are an offshore chain of undersea volcanoes. Seafloor features located within the park include deep seafloor plains, undersea canyons, slopes and pinnacles The AMP is an important foraging ground for seabirds and is within known migration pathways for a variety of whales and the grey nurse shark Currently there is limited information on the cultural significance of this AMP however Sea Country is a value for First Nations peoples cultural identify, heritage and wellbeing There are two known shipwrecks located within the AMP: *Amelia* (1816) and *Illagong* (1872)	825 km northeast

Source: Parks Australia 2023; DNP 2018; DNP 2013

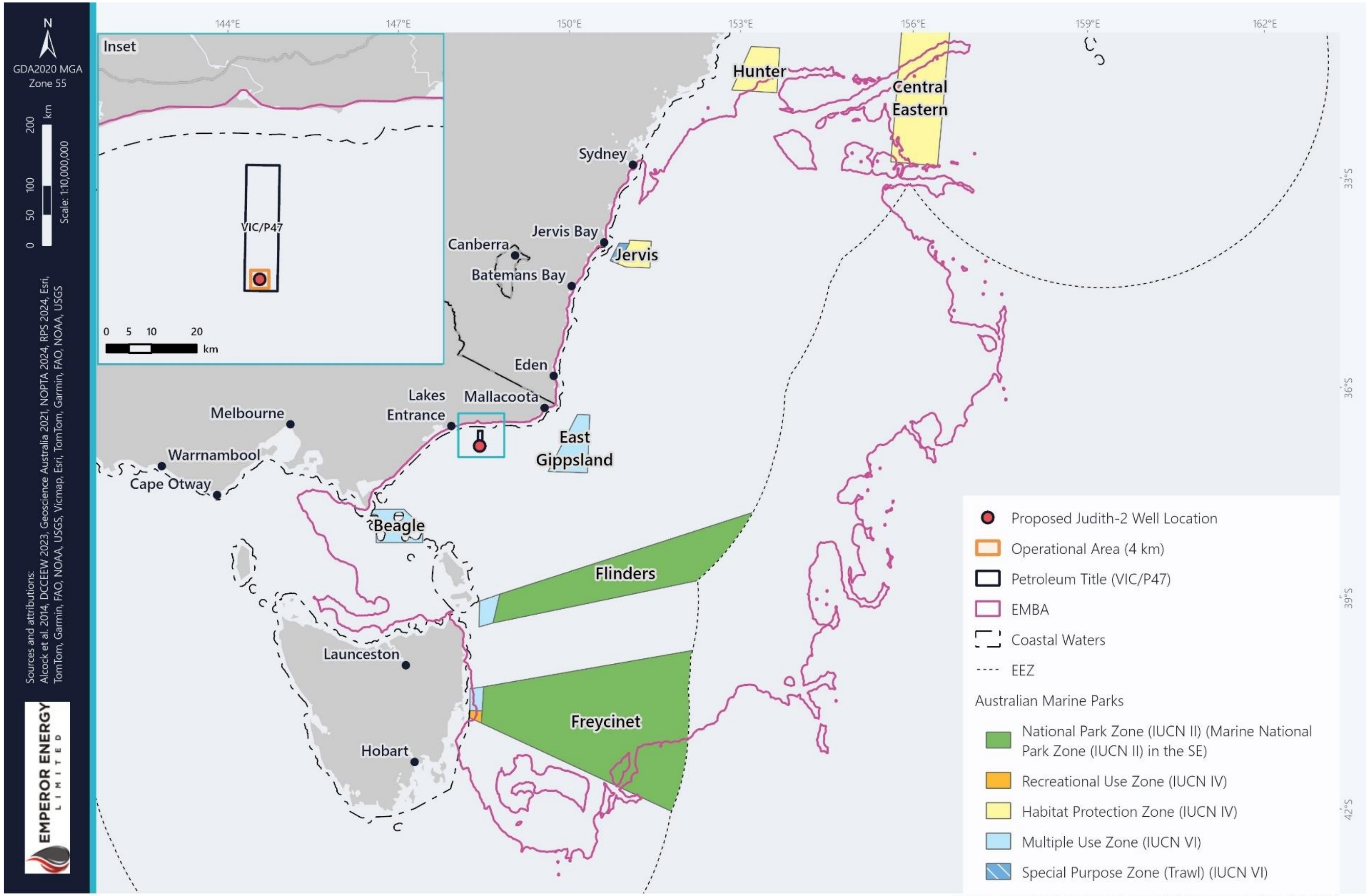

Figure 4-22: Australian Marine Parks within the EMBA

4.6.1.2. State Marine Protected Areas

There are no state protected marine areas within the Operational Area. However, there are multiple sites located within the EMBA which are detailed in Table 4-11.

In addition to Commonwealth protected marine areas, individual states have the ability to protect and managed offshore areas of biological and ecological importance through state governments.

Table 4-11: State Marine Protected Areas within the EMBA

MPA	STATE	PROTECTION STATUS	KEY VALUES
North Sydney Harbour	NSW	Aquatic Reserve (IV)	• Protects ~260 ha, with habitats including rocky shores, sandy beaches, nearshore reefs, sandy seabed and harbour waters up to around 20 m deep • Seagrass habitats and nearshore reefs support kelp habitats that are used by many species, including seahorses and sea dragons
Bronte-Coogee	NSW	Aquatic Reserve (IV)	• Protects ~40 ha, extending 100 m offshore and 4,000 m across the coastline • Habitats include extensive rocky shores and nearshore reefs which support a variety of invertebrate and fish species
Cape Banks	NSW	Aquatic Reserve (IV)	• Protects ~20 ha and extends 100 m offshore from the mean low water mark • Habitats include rocky intertidal like platforms, crevices and rock pools resulting in a diversity of intertidal marine plant and animal communities
Towra Point	NSW	Aquatic Reserve (IV)	• Protects ~1,400 ha and is divided into two zone types, a refuge zone and a sanctuary zone • It is one of the largest and most diverse wetland complexes remaining in the Sydney region • Important nursery area for fish and invertebrates and provides important habitat for migratory seabirds
Boat Harbour	NSW	Aquatic Reserve (IV)	• Protects ~ 70 ha and extends 100 m offshore from the mean low water mark • Habitats include subtidal reefs interspersed with areas of sandy seabed • Important feeding ground form a number of shorebird species

Batemans	NSW	Marine Park (IV)	• Protects ~85,000 ha extending from the three-nautical-mile offshore limit of NSW waters to the mean high-water mark • Habitats include rocky shores, offshore rocky reefs, kelp beds, seagrasses, mangroves, sponge gardens, sandy beaches, estuaries and open waters • Important breeding place for many seabirds as well a nesting location for the Little Penguin
Jervis Bay	NSW	Marine Park (IV)	• Protects ~21,500 ha and includes over 100 km of coastline and adjacent oceanic, embayment and estuarine waters • The area experiences periodic upwellings of cold, nutrient-rich waters from the nearby Continental Shelf, completely flushing it every couple week resulting in the clear waters • Habitats include deep water cliffs, exposed and sheltered sandy beaches, rock platforms, rocky reefs, soft-sediment bottoms, kelp forests, small estuaries, expansive seagrass meadows, mangrove forests and open ocean
Cape Howe	VIC	Marine National Park (II)	• Protects ~4,060 ha, with habitats including shallow and deep subtidal reefs interspersed with large areas of soft sediment • Unique due to the assortment of warm and cool water fish species • Located within a humpback whale migration route between the tropics and Antarctic waters
Point Hicks	VIC	Marine National Park (II)	• Protects ~4,000 ha, with habitats including granite subtidal reef, intertidal rock platforms and offshore sands • Is the furthest western range for many species, as the water becomes too cold to the west • A popular location for recreational divers, with two shipwrecks located within its boundaries
Beware Reef	VIC	Marine Sanctuary (II)	• Protects ~220 ha and extends ~500 m from the edge of the exposed reef • A known haul-out site for Australian and New Zealand Fur-seals.

			• Forests of Bull kelp, seahorses, leafy sea dragons and the remains of a shipwreck also occur within the sanctuary
Ninety Mile Beach	VIC	Marine National Park (II)	• Protects ~2750 ha of vast sand plains with few ribbons of reef • Has one of the highest species diversity on Earth, with 860 species found within 10 m^2 • A popular location for swimming, snorkelling and diving
Nooramunga Marine and Coastal Park	VIC	National Parks Act (VI)	• Protects ~30,170 ha, with habitats including isolated granite islands, intertidal mudflats and a complex of sand barrier islands • A popular location for fishing, boating and camping
Wilsons Promontory	VIC	Marine National Park (II)	• Protects ~15,500 ha, with habitats including sea caves, rock ledges and kelp forests • Offshore islands support colonies of Australian and New Zealand Fur-seals and many oceanic birds • A popular location for nature viewing, snorkelling and diving
Kent Group	TAS	Marine National Park (II)	• Protects a group of islands and islets (~31,257 ha) within the Bass Strait • Convergence of three ocean currents brings a richness of nutrients and diversity of marine life • Over 20 recorded shipwrecks surround the shallow waters of the Islands
Marriott Reef	TAS	Conservation Area (VI)	• Protects ~12 ha and is composed of a small group of islands off the coast of Flinders Island which belongs to the Furneaux island group within the Bass Strait
Arthur Bay	TAS	Conservation Area (VI)	• Protects ~733 ha and is located on Flinders Island which belongs to the Furneaux island group within the Bass Strait
Chappell Islands	TAS	Nature Reserve (IA)	• Protects ~200 km and is part of the Furneaux island group within the Bass Strait • Important habitat for a variety of seabirds
Moriarty Rocks	TAS	Nature Reserve (IA)	• Protects ~2km of rock and reef formations within the Bass Strait • Breeding colony for the Australian Fur seal

Source: Parks Victoria 2023; Tasmanian Parks and Wildlife Service 2022; DPI 2023

4.6.2. Threatened Ecological Communities

No TECs are located within the Operational Area. However, there are multiple sites located within the EMBA. Of these sites only those with coastal features which are located within the EMBA are detailed in Table 4-12 and displayed in Figure 4-23.

Ecological communities are naturally occurring groups of flora, fauna and other organisms which interact in a unique habitat. Threatened Ecological Features (TECs) are communities at the risk of extinction due to a depletion of natural composition and function across the full range.

Table 4-12: Threatened Ecological Communities within the EMBA

COMMUNITY	THREATENED STATUS	KEY VALUES
Giant kelp marine forests of south east Australia	Endangered	• Within Australia giant kelp forests are found in temperate south eastern waters on rocky reefs where conditions are cool and nutrient rich. • This TEC is defined by giant kelp that grows at depths >8 m below sea level on rocky substrate, forming a closed or semi-closed surface or sub-surface canopy. • Provides valuable habitat for a range of marine species by providing vertical habitat to the water column. • Particularly important as settlement habitat for juvenile life stages of many commercially important species.
Assemblages of species associated with open-coast salt-wedge estuaries of western and central Victoria	Endangered	• Located along the western and central coastlines of Victoria between the SA border and South Point of Wilsons Promontory. • This TEC is defined by the dynamic salt-wedge estuary systems that occur within the temperate climate microtidal regime (<2 m), high wave energy coastline. • The dynamic nature of the TEC results in unique physical and chemical parameters which in turn results in unique biological and ecological functions. • Taxa within the TEC may be coastal, estuarine, brackish or freshwater.

Posidonia australis seagrass meadows of the Manning-Hawkesbury ecoregion	Endangered	• Located within sheltered environments of permanently open estuaries along the warm temperate NSW coastline. • This TEC is defined by *Posidona australis* which is a sub-tidal meadow-forming seagrass species that can be found in depths between <1 m to 10 m on sand and silt mud substrate. • Provides habitat, shelter and food resources for a variety of fauna species.
.Eastern suburbs banksia scrub of the Sydney region	Critically Endangered	• Located along the coastline of Sydney's eastern and south-eastern suburbs on low nutrient sands. • This TEC is defined by temperate heath and shrubland on headlands, sandplains or dunes near the coast. • Provides habitat and a range of food resource for fauna, including seeds and nectar.
Coastal swamp sclerophyll forest of New South Wales and south east Queensland	Endangered	• Located in low-lying coastal areas on mainland Australia in NSW and south QLD and islands surrounding. • This TEC is defined by forested palustrine wetlands or swamp forests in coastal valleys. • Provides feeding, breeding and roosting habitat for water-dependent, arboreal and ground dwelling species.
Subtropical and temperate coastal saltmarsh	Vulnerable	• Located within the subtropical and temperate climatic zones south of the South-east QLD IBRA bioregion. • This TEC is characterised by soft substrate shore of estuaries and embayment's as well as some open, low wave energy coasts. • Provides important nursery habitat for fish and prawn species with benthic invertebrates being the dominant marine residents.
River-flat eucalypt forest on coastal floodplains of southern New South Wales and east Victoria	Critically Endangered	• Located on alluvial landforms associated with coastal floodplains in southern NSW and eastern Victoria. • This TEC is characterised by tall forest, woodland structure with canopy dominated by eucalypts.

	• Provides a variety of habitats suitable for fauna species exhibiting important behaviour such as foraging, nesting and roosting.

Source: DoE 2023c

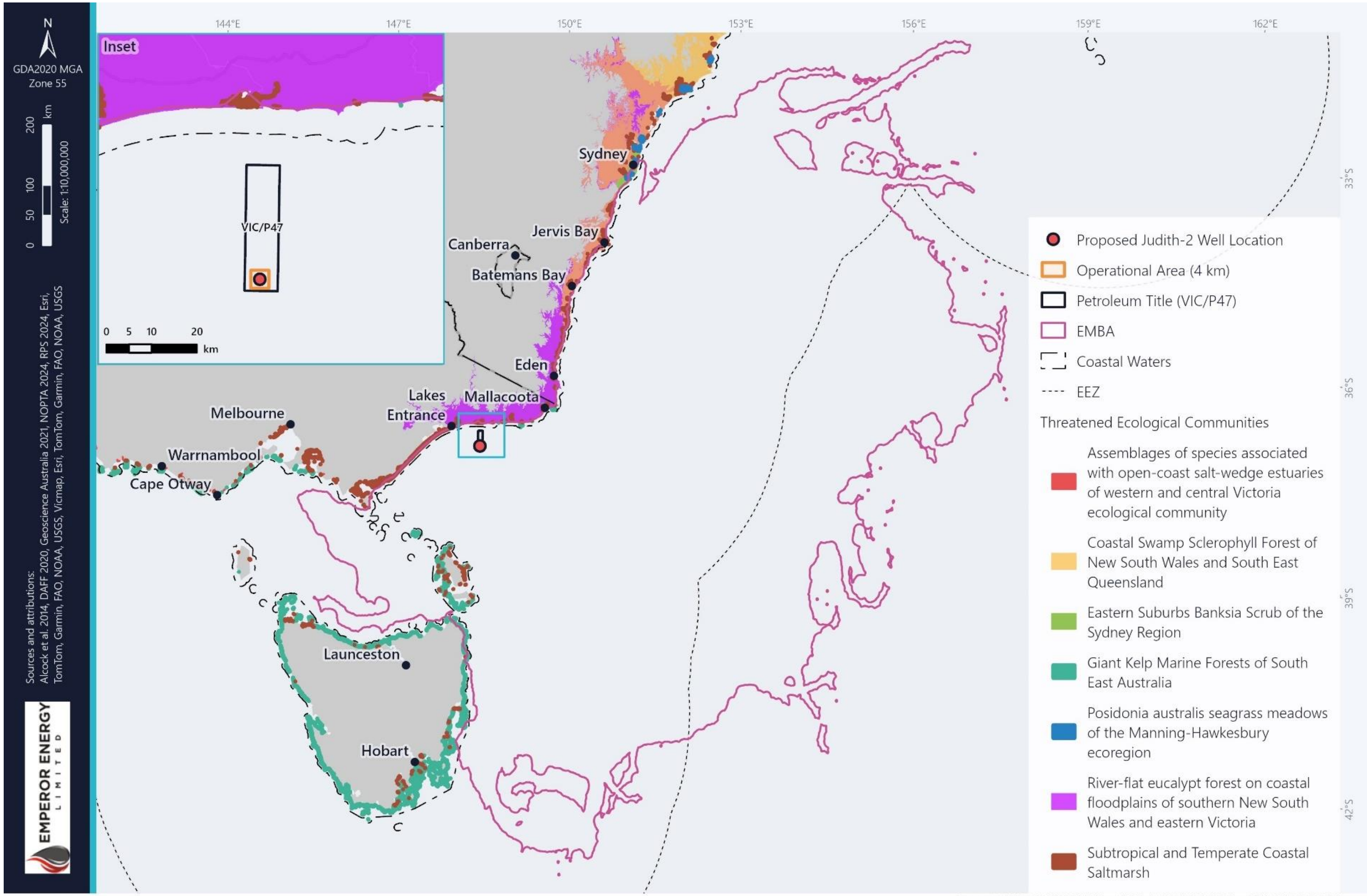

Figure 4-23: Threated Ecological Communities within the EMBA

4.6.3. Key Ecological Features

Key Ecological Features (KEFs) are elements of the marine environment, based on current scientific understanding, are considered to be of regional importance for either the region's biodiversity or ecosystem function and integrity of a Commonwealth Marine Area. There is one KEF, the Upwelling East of Eden, overlapped by the Operational Area and an additional five located within the EMBA which are detailed in and Table 4-13 displayed in Figure 4-24.

Table 4-13: Key Ecological Features within the EMBA

KEF	MARINE REGION	KEY VALUES
Upwelling East of Eden	South east	• This KEF is located within the Operational Area and extends from the southern coast of NSW towards the south eastern coast of Victoria. • Considered an area of high productivity and aggregations of marine life due to the interaction between the East Australian Current and the continental shelf and headlands which result in periodic events of productivity. • The upwelling supports regionally productivity in turn supporting fisheries, top order predators, marine mammals, and seabirds. • This area is one of two feeding areas for blue whales and humpback whales, known to arrive when significant krill aggregations form.
Seamounts South and East of Tasmania	South east	• Located approximately 200 km from the southern and eastern shores of Tasmania. • A chain of seamounts rising from the abyssal plain, continental rise or plateau. • Considered an area of high productivity and aggregations of marine life due to their ability to influence currents, creating localised upwelling and turbulent mixing. • Hard substrates provide attachment points for sessile invertebrates.
.Big Horseshoe Canyon	South east	• Located off the southern coast of eastern Victoria. • Is the eastern most arm of the Bass Canyon Systems and is composed of steep and rocky slopes. • Considered an area of high productivity and aggregations of marine life due to the hard substrate habitat provided for fauna species. • Sponges and other habitat forming species provide structural refuges for benthic fishes, including the commercially important species.

Canyons on the Eastern Continental Slope	Temperate east	• Subsea canyons are located around Australia however, the eastern continental slope feature a significant number of canyons. • Considered a unique seafloor feature with enhanced ecological functioning and integrity and biodiversity due to their ability to influence currents, creating localised upwelling and turbulent mixing. • Support a diverse range of benthic, demersal and pelagic species as well as a high degree of endemism
Shelf Rocky Reefs	Temperate east	• Located along the continental shelf, south of the Great Barrier Reef • Species distributions strongly influenced by the East Australian Current. • Considered a unique seafloor feature which is associated with ecological properties of regional significance due to the overlap of temperate and tropical species. • Hard substrate provides a range of complex benthic habitats which in turn support diverse communities
Tasman Front and Eddy Field	Temperate east	• The front is located across the southern portion of the Temperate East Marine Region, separating the Coral Sea and Tasman Sea • Formed by a current located between 27° S and 33° S that moves to the north in winter and to the south in summer. • Considered an area of high productivity and biodiversity, endemism and aggregations of marine life due to the dynamic oceanographic process which result in transient patches of enhanced productivity and in turn attract aggregations of species. • Increased productivity is important for species such as turtles and top fish predators

Source: DoE 2023b

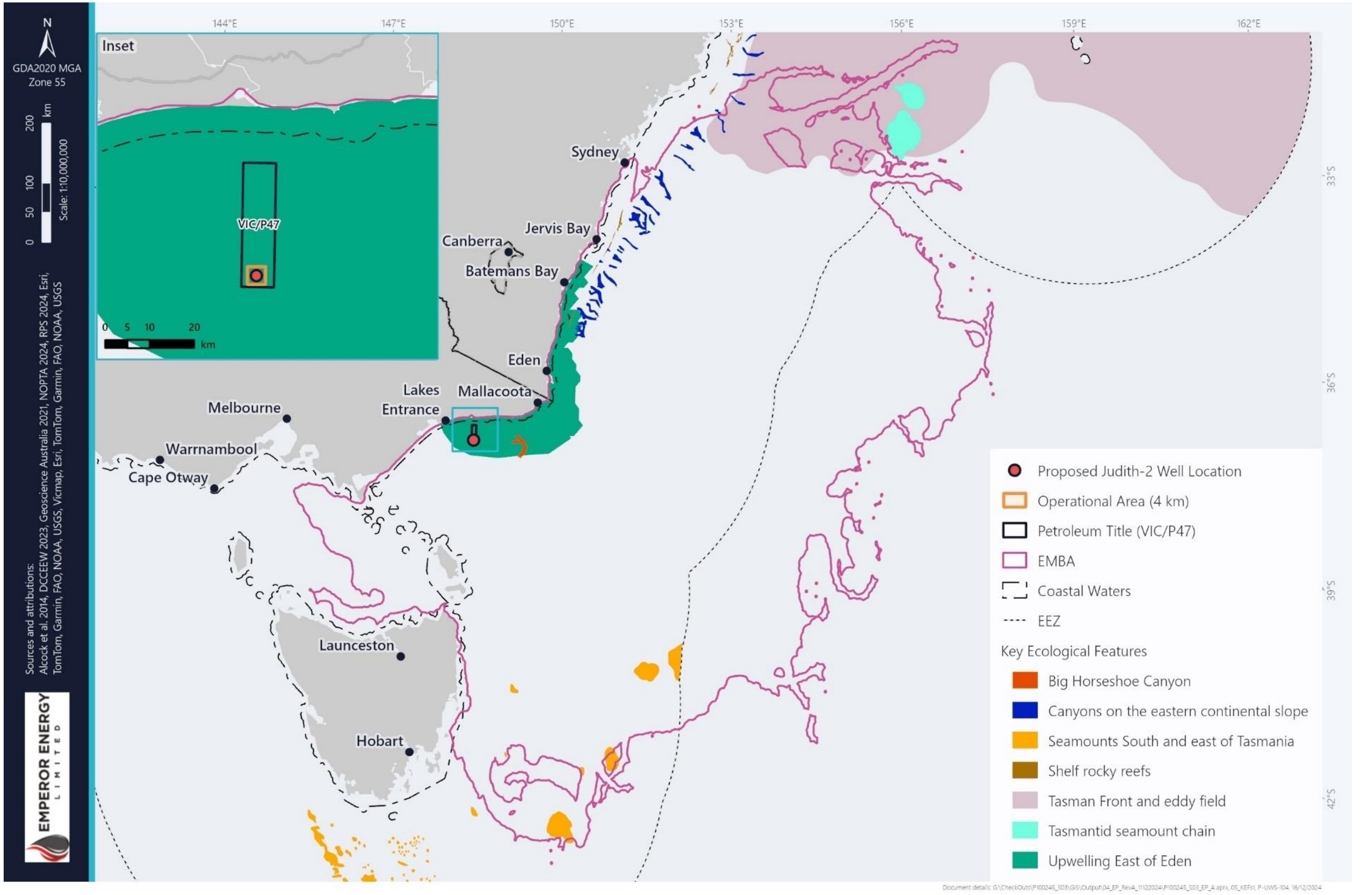

Figure 4-24: Key Ecological Features overlapping the Operational Area and within the EMBA

4.6.4. Wetlands of International Importance

Wetlands of International Importance are identified as Ramsar-listed wetlands which are representative, rare or unique or are important for conserving biological diversity. There are no Wetlands of International Importance within the Operational Area. However, there are five sites located within the EMBA which are detailed in Table 4-14 and displayed in Figure 4-25.

Table 4-14: Ramsar-listed wetlands within the EMBA

RAMSAR WETLAND	STATE	KEY VALUES
Corner Inlet	Victoria	Protects 67,186 ha on the south-east Gippsland coast in Victoria Composed of a series of barrier islands and sand splits separates by narrow entrances to the marine environment. Coastal island vegetation is composed of mangroves, and saltmarsh Species of significance which utilised this ecosystem include the Orange-bellied Parrot, Australian Grayling and the Swift Parrot
Gippsland Lakes	Victoria	Protects 60,015 ha on the south-east coastal plain bioregion of the Gippsland coast in Victoria. Separated from the ocean by sand dunes the Gippsland Lakes form the largest navigable inland waterway in Australia, and create a distinctive regional landscape of wetlands and flat coastal plains. Brackish wetland vegetation is dominated by various saltmarsh communities. Species of significance which utilised this ecosystem include the Red Knot, Curlew Sandpiper and the Shy Albatross.
Logan Lagoon	Tasmania	Protects 2,257 ha on the south-east corner of Flinders Island in the Bass Strait, Tasmania. A low lying coastal estuarine wetland system with the water table very close to the soil surface. Dominant vegetation communities include saline aquatic herbland, saline sedgeland and rush land as well as coastal grass and scrub. Species of significance which utilised this ecosystem include the Eastern Curlew, Bar-tailed Godwit and the Little Tern.
East Coast Cape Barron Island Lagoon	Tasmania	Protects 4,473 ha on the east coast of Cape Barren Island, one of the Furneaux Group of islands in the Bass Strait, Tasmania. The site is composed of a complex of freshwater, brackish and sometimes hypersaline lagoons, wetlands and estuaries. There are 13 different Tasmanian wetland vegetation communities found within the site. Characteristic vegetation includes coastal wattle, many species of aquatic herbland and saline sedgeland/rushland. Species of significance which utilised this ecosystem include the Hooded Plover and the White-bellied Sea Eagle.

Towra Point Nature Reserve	NSW	Protects 603.7 ha on the northern coast of the Kurnell Peninsula, forming the southern and eastern shores of Botany Bay. The site is an estuarine complex composed of a mixture of spits, bars, mudflats, dunes and beaches. The site is composed of a variety of vegetation communities, including, seagrass meadows, mangroves and saltmarsh. Species of significance which utilised this ecosystem include the Eastern Curlew and the Little Tern.

Source: CoA 2023a

4.6.4.1. Wetlands of National Importance

Wetlands of National importance are wetlands that are a good example of a wetland type, provide important habitat for native species, or are of outstanding heritage or cultural significance. There are no Wetlands of National Importance within the Operational Area. However, there are a large number of sites located within the EMBA which are displayed in Figure 4-25.

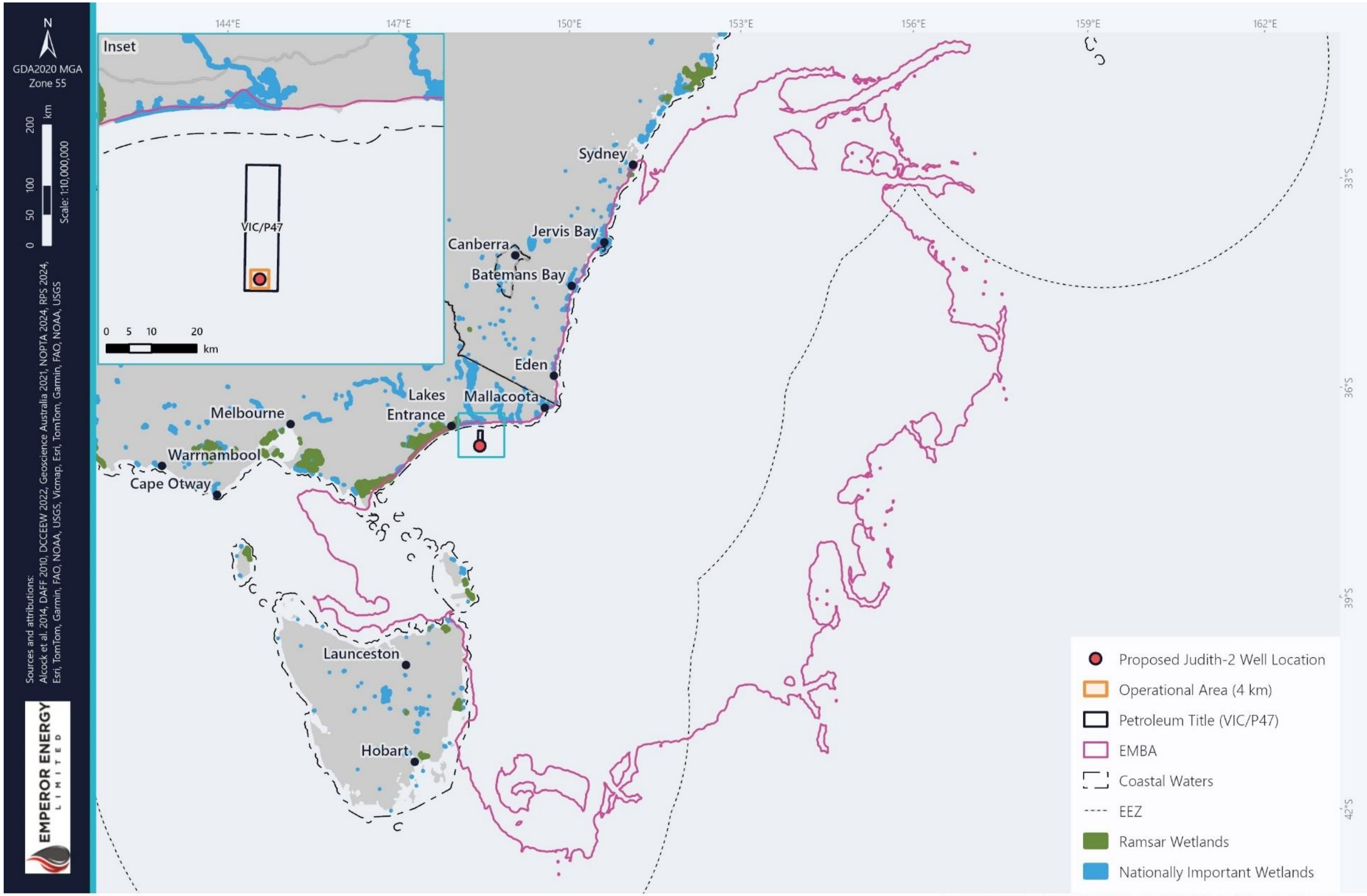

Figure 4-25: Listed Wetlands within the EMBA

4.6.5. Heritage Places

4.6.5.1. World

No World Heritage places are overlapped by the Operational Area or the EMBA (Figure 4-26). However, there are a number of sites, Sydney Opera House, Australian Convict Sites (Darlington Probation Station and Hyde Park Barracks) within 10 km of the EMBA.

4.6.5.2. National

No National Heritage places are located with the Operational Area. However, there are multiple sites located within the EMBA and various others within 10 km of the EMBA (Figure 4-26). Of these sites only those with coastal features which are located within the EMBA are detailed below (CoA 2023b):

- Royal National Park and Garawarra State Conservation area – contains more than one thousand species making it one of the highest concentrations of plant species in temperate Australia. The Royal National Park was the second National Park to be established in the world and is one of only four coastal national parks in NSW which protect land below the high water mark and associated estuarine habitats.
- Kamay Botany Bay: botanical collection sites – the location where Sir Joseph Banks and Dr Daniel Solander first collect plant specimens in 1770 as part of the first landing. The collection included a large number of iconic plant species and represent the symbolic and integration of Australian flora into western science.
- Kurnell Peninsula Headland – the peninsula is known to be the first recorded site of contact in eastern Australia between First Nations people and the Europeans in 1770. There is strong evidence of First Nations peoples occupation and value at the watering place and the landing stage.
- Bondi Beach and Surf Pavilion – significant in Australia's cultural history as the site of Australia's first recognised surf lifesaving club. Bondi Beach is now one of the most famous beaches in the world and draws thousands of visitors each year.
- North Head Sydney – played an important role in the cultural and military of NSW as the northern expression of the seaward entrance to Sydney Harbour. There is further association of North Head with the establishment of a Quarantine Station which was essential in Australia's development as an island-nation.

4.6.5.3. Commonwealth

Commonwealth Heritage Listed Places include Indigenous, historic and natural heritage places owned or controlled by the Australian Government. No Commonwealth Heritage places are located with the Operational Area. However, there are multiple sites located within the EMBA and various others within 10 km of the EMBA (Figure 4-26). Of these sites only those with coastal features which are located within the EMBA are detailed below (CoA 2023b):

- Malabar Headland – contains two remanent bushland sections of significance (coastal and western) which support over seven distinct plant communities. The Headland contains rare coastal communities which grow on Pleistocene sand deposits and includes the Eastern Suburbs Banksia Scrub TEC.
- Beecroft Peninsula – contains the best example of a Permian cliffed coast in the state which supports a high diversity of vegetation communities such as mangroves, saltmarshes, swamp and rainforest.
- Crocodile Head Area – an indigenous listing which encompasses approximately 20 ha and is located on Beecroft Peninsular near Crocodile Head. Limited information is available on the listing.

- Jervis Bay Territory - supports a high number of indigenous plant species as well as well-preserved vegetation communities of mangrove, saltmarsh and rainforest. The territory has strong cultural ties to the Koori people of Wreck Bay which is evident in the number of prehistoric First Nations sites and the ancestral and creation stories relating to the area.

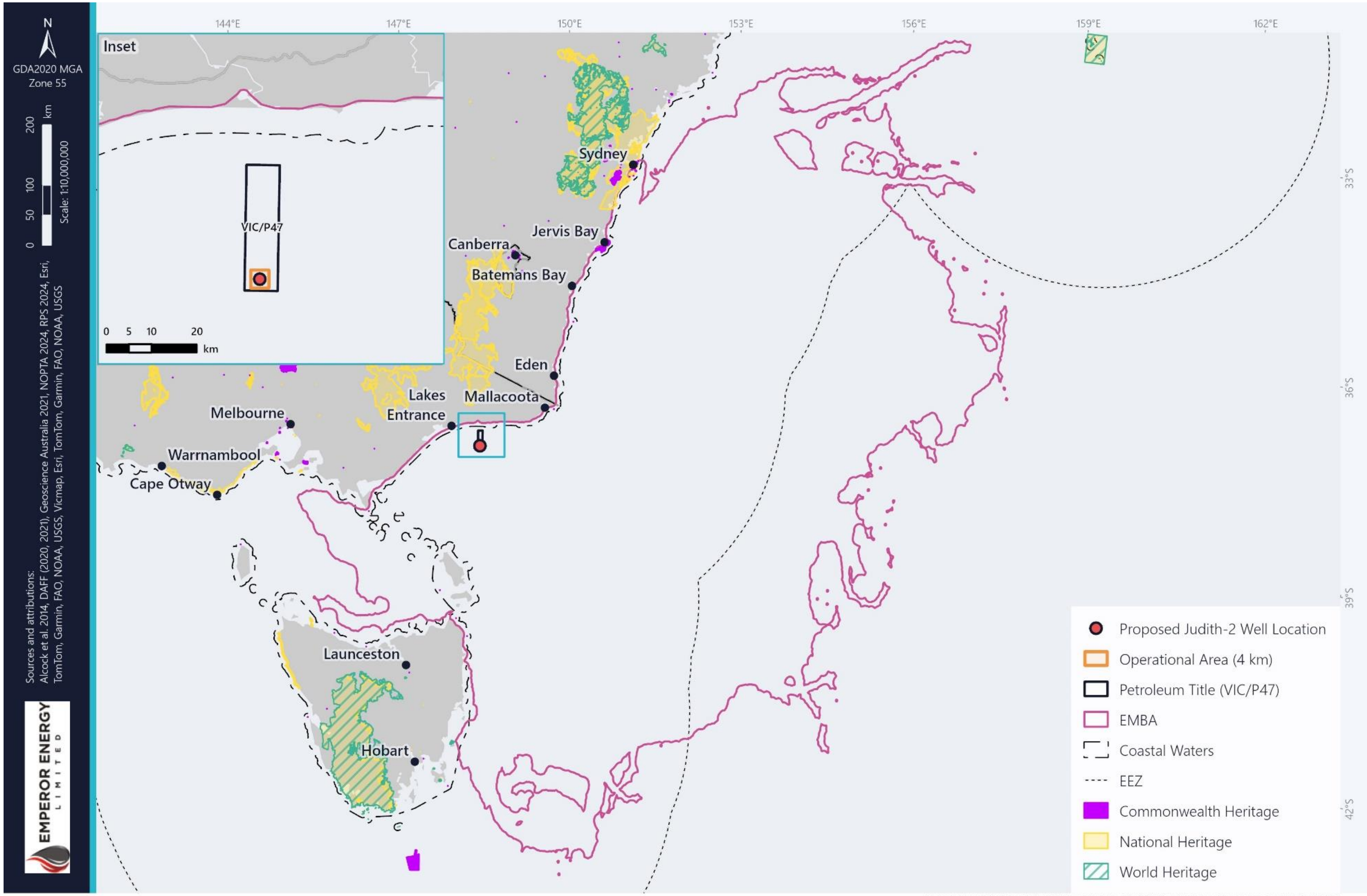

Figure 4-26: Heritage Listed Places within the EMBA

4.7. Socio-Economic Environment

4.7.1. Commonwealth-managed Commercial Fisheries

Commonwealth fisheries are managed by the Australian Fisheries Management Authority (AFMA) under the *Fisheries Management Act 1991* (Cth). AFMA jurisdiction covers the area of ocean from 3 nm from the coast out to the 200 nm limit (the Australian Fishing Zone (AFZ)).

Nine Commonwealth-managed fisheries have management areas that intersect the Operational Area and the EMBA. To identify Commonwealth-managed fisheries that could be potentially impacted by the activity a review of fisheries data supplied by the Australian Bureau of Agricultural and Resource Economics and Sciences (ABARES) from data collected by the Australian Fisheries Management Authority (AMFA) was conducted. This review identified three Commonwealth-managed fisheries with activity within the Operational Area between 2016 to 2022. An additional five within the EMBA, are described in Table 4-15. Those considered active within the Operational Area and therefore having a potential to interact with planned activities include the:

- Southern and Eastern Scalefish and Shark Fishery (SESSF) – Gillnet Hook and Trap Sector (Shark Gillnet sub-sector).
- Southern and Eastern Scalefish and Shark Fishery (SESSF) – Commonwealth Trawl Sector (Otter-board trawl sub-sector).
- Southern and Eastern Scalefish and Shark Fishery (SESSF) – Commonwealth Trawl Sector (Danish-seine sub-sector).

The Eastern Skipjack Tuna Fishery has been inactive since the 2008-2009 fishing season and is not discussed further. The other fisheries include the following and details of these fisheries are provided in Table 4-15.

Table 4-15: Description of Commonwealth-managed Fisheries with management areas overlapping Operational Area and EMBA

FISHERY	KEY TARGET / INDICATOR SPECIES	LICENCE AREA DESCRIPTION	FISHERY DESCRIPTION	SUMMARY OF MOST RECENT FISHING ACTIVITY	MANAGEMENT AREA OVERLAP		POTENTIAL FOR INTERACTION IN THE OPERATIONAL AREA
					OPERATIONAL AREA	EMBA	
Commonwealth Managed Fisheries[1]							
Bass Strait Central Zone Scallop Fishery	Commercial scallop (*Pecten fumatus*)	Operates in the Bass Strait above Tasmania and extends from the Victoria / New South Wales border, around southern Australia to the Victoria / South Australia border.	Method: Towed dredges. Licences: 43 permits for 2020 and 48 in 2019 season and individual transferrable quotas. Season: July to 31 December.	There were nine active vessels in the 2023 fishing season and 10 active vessels in the fishery in the 2022 season with fishing concentrated on beds in both the eastern and western Bass Strait.	✓	✓	× Although there is potential for overlap of fishing activity within the Operational Area, reported fishing intensity between 2016-2020 has been concentrated on the eastern sides of King Island and Flinders Island (Figure 4-27).
Eastern Tuna and Billfish Fishery	Striped marlin (*Kajikia audax*), south-west Pacific Swordfish (*Xiphias gladius*), south-west Pacific Albacore (*Thunnus alalunga*), south Pacific Bigeye tuna (*Thunnus obesus*), western and central Pacific Yellowfin tuna (*Thunnus albacares*), western and central Pacific	Operates in the Exclusive Economic Zone and adjacent high seas, from Cape York to the Victoria – South Australia border, including waters around Tasmania and the high seas of the Pacific Ocean.	Method: mostly longlines but minor line permitted. Licences: 81 longline boat permits and 83 minor line boat permits in 2020. In 2019 there were 81 longline boat permits and 84 minor line permits. Season: 12 months beginning 1 January.	There were 46 active vessels in the 2023 fishing season and 40 active vessels in the 2022 season.	✓	✓	× No overlap of fishing activity is expected within the Operational Area as effort is concentrated along the eastern states. However, the EMBA overlaps an area of low to high fishing intensity recorded between 2017-2022 (Figure 4-28).
Small Pelagic Fishery	Australian sardine (*Sardinops sagax*) Blue mackerel, east (*Scomber australasicus*) Blue mackerel, west (*Scomber australasicus*) Jack mackerel, east (*Trachurus declivis*) Jack mackerel, west (*Trachurus declivis*) Redbait, east (*Emmelichthys nitidus*) Redbait, west (*Emmelichthys nitidus*)	Extends from southern Queensland to southern Western Australia. The fishery has 3 subareas (east, west and sardine), each with separate stock-level total allowable catches.	Method: purse-seine and midwater trawl. Licences: 31 entities in 2019-20 season and 33 entities in 2020-21 season. Season: 12 months beginning 1 May	There were five active vessels in the 2023-2024 season and four active vessels in the 2022-2023 season.	✓	✓	× No overlap of fishing activity is expected within the Operational Area as effort is concentrated along the eastern coastline of Tasmania and NSW (Figure 4-29).
SESSF – Commonwealth Trawl and Scalefish Hook sectors	Blue-eye trevalla (*Hyperoglyphe antarctica*) Blue warehou (*Seriolella brama*)	The Commonwealth trawl sector extends south from Barrenjoey Point in northern New South Wales to east of	Method: otter-board trawl, Danish-seine, hook (dropline, demersal longline), trap (minor).	There were 24 trawl, 18 Danish-seine, and 13 scalefish hook vessels active during the 2023-24 season and then 30 trawl, 18 Danish-seine, and 21 scalefish	✓	✓	✓ Commonwealth Trawl Sector The Operational Area overlaps an area of reported low to medium fishing intensity for the otter-board trawl sub-sector (Figure 4-32).

FISHERY	KEY TARGET / INDICATOR SPECIES	LICENCE AREA DESCRIPTION	FISHERY DESCRIPTION	SUMMARY OF MOST RECENT FISHING ACTIVITY	MANAGEMENT AREA OVERLAP		POTENTIAL FOR INTERACTION IN THE OPERATIONAL AREA
					OPERATIONAL AREA	EMBA	
	Deepwater sharks, eastern zone (up to 18 species) Eastern school whiting (*Sillago flindersi*) Flathead (*Neoplatycephalus richardsoni* and 4 other species) Gemfish, eastern zone (*Rexea solandri*) Gulper sharks (*Centrophorus harrissoni, C. moluccensis, C. zeehaani*) Jackass morwong, eastern zone (*Nemadactylus macropterus*) John dory (*Zeus faber*) Mirror dory (*Zenopsis nebulosa*) Ocean jacket (*Nelusetta ayraud*) Ocean perch (*Helicolenus barathri, H. percoides*) Orange roughy (*Hoplostethus atlanticus*) Smooth oreodory, (*Pseudocyttus maculatus*) Other oreodories (*Allocyttus niger, Neocyttus rhomboidalis, A. verrucosus, Neocyttus spp.*) Pink ling (*Genypterus blacodes*) Redfish (*Centroberyx affinis*) Ribaldo (*Mora moro*) Royal red prawn (*Haliporoides sibogae*) Silver trevally (*Pseudocaranx georgianus*) Silver warehou (*Seriolella punctata*)	Kangaroo Island off of South Australia. The Scalefish Hook sector extends around south-eastern Australia to the border between South Australia and Western Australia.	Licences: 57 trawl and 21 scalefish hook fishing rights permissible during both the 2020-21 season and the 2021-22 season. Season: 12 months beginning 1 May.	hook vessels active during the 2022-23 season.			The Operational Area overlaps an area of reported high fishing intensity for the danish-seine sub-sector (Figure 4-33) × Scalefish Hook Sector Although there is potential for overlap of fishing activity within the Operational Area reported fishing intensity between 2016-2020 has been concentrated off the eastern coast of Tasmania (Figure 4-34).

FISHERY	KEY TARGET / INDICATOR SPECIES	LICENCE AREA DESCRIPTION	FISHERY DESCRIPTION	SUMMARY OF MOST RECENT FISHING ACTIVITY	MANAGEMENT AREA OVERLAP		POTENTIAL FOR INTERACTION IN THE OPERATIONAL AREA
					OPERATIONAL AREA	EMBA	
SESSF – Gillnet Hook and Trap Sector	Elephantfish (*Callorhinchus milii*) Gummy shark (*Mustelus antarcticus*) Sawsharks (*Pristiophorus cirratus, P. nudipinnis*) School shark (*Galeorhinus galeus*)	Most fishing using nets occurs in Bass Strait, while most fishing using hooks occurs off South Australia.	Method: demersal gillnet, demersal longline, and auto-longline. Licenses: 61 gillnet permits, and 13 shark hook permits during the 2020-21 season and 60 gillnet and 13 shark hook during the 2021-22 season. Season: 12 months beginning 1 May.	There were 31 gillnet and 68 shark hook vessels active in the 2023-24 season and 30 gillnet and 57 shark hook vessels active in the 2022-23 season.	✓	✓	✓ Shark Gillnet sub-sector The Operational Area overlaps an area of reported low to medium fishing intensity (Figure 4-30). × Shark Hook sub-sector Although there is potential for overlap of fishing activity within the Operational Area reported fishing intensity between 2016-2020 has been concentrated around the Furneaux Island group in Tasmania (Figure 4-31).
Southern Bluefin Tuna Fishery	Southern bluefin tuna (*Thunnus maccoyii*)	Spans the Australian Fishing Zone.	Method: purse-seine and longline. Licences: 82 permits for the 2019-20 season and 85 permits for the 2020-21 season. Season: 12 months beginning 1 December.	There were six active purse-seine vessels and 24 longline vessels active in the 2023-24 season. There were eight purse-seine vessels and 22 longline vessels active in the 2022-23 season.	✓	✓	× No overlap of fishing activity is expected as effort is concentrated along the eastern states. However, the EMBA overlaps an area of low to high fishing intensity recorded between 2017-2022 (Figure 4-35).
Southern Squid Jig Fishery	Gould's squid (*Nototodarus gouldi*)	Located off New South Wales, Victoria, Tasmania and South Australia, and in a small area of oceanic waters off southern Queensland.	Method: Squid jig with high-powered lamps set to attract squid. Vessels typically operate at night in continental-shelf waters between depths of 60 m and 120 m. Licences: No detail on licences. Season: 12 months beginning 1 January.	There were eight active vessels in the 2023 season and six active vessels in the 2022 season.	✓	✓	× Although there is potential for overlap of fishing activity within the Operational Area reported fishing intensity between 2016-2020 has been concentrated off the eastern coast of Tasmania and south of Warrnambool (Figure 4-36)

[1] ABARES 2024 and AFMA 2022

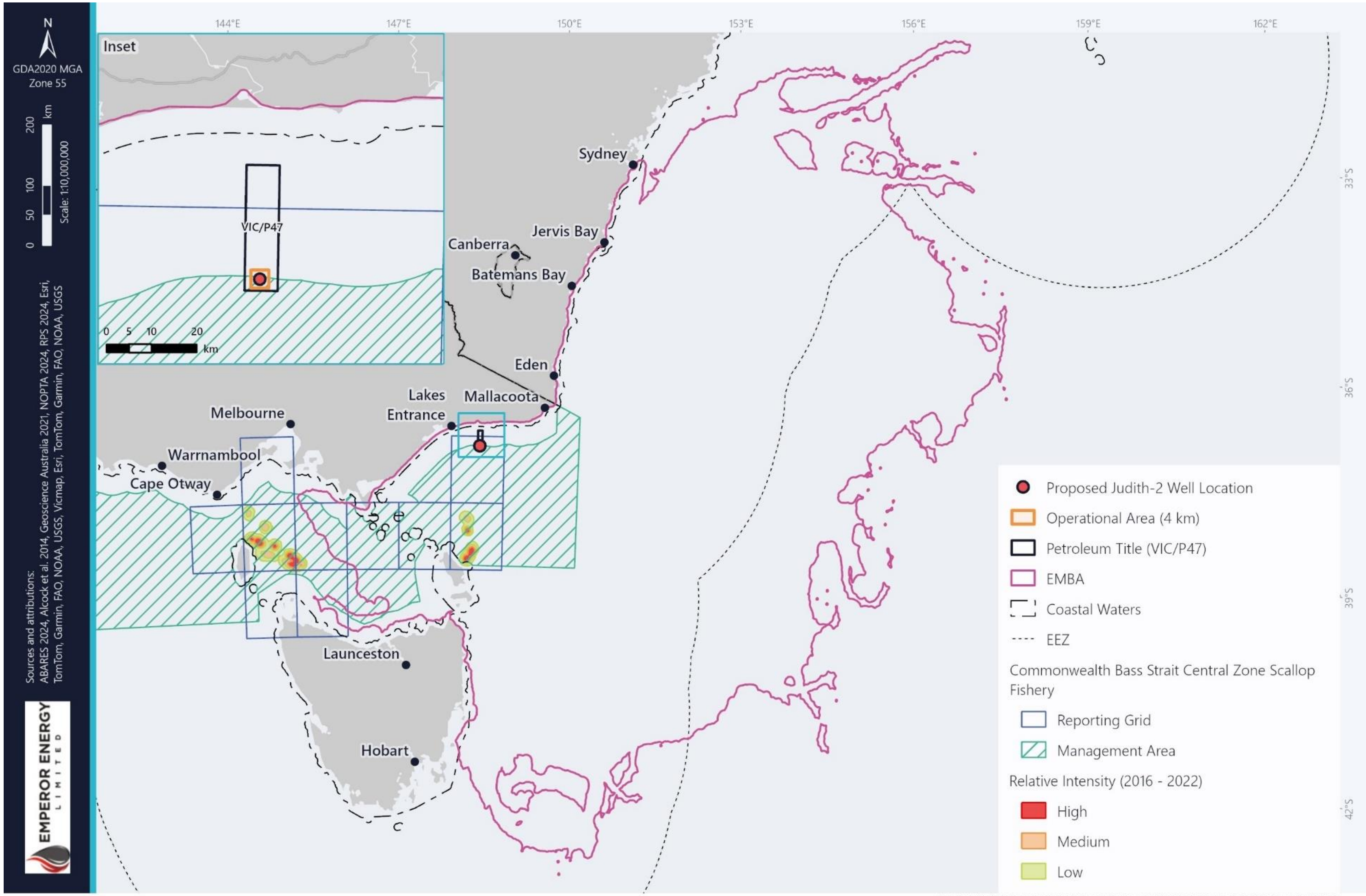

Figure 4-27: Management area and relative fishing intensity of the Bass Strait Central Zone Scallop Fishery within the EMBA

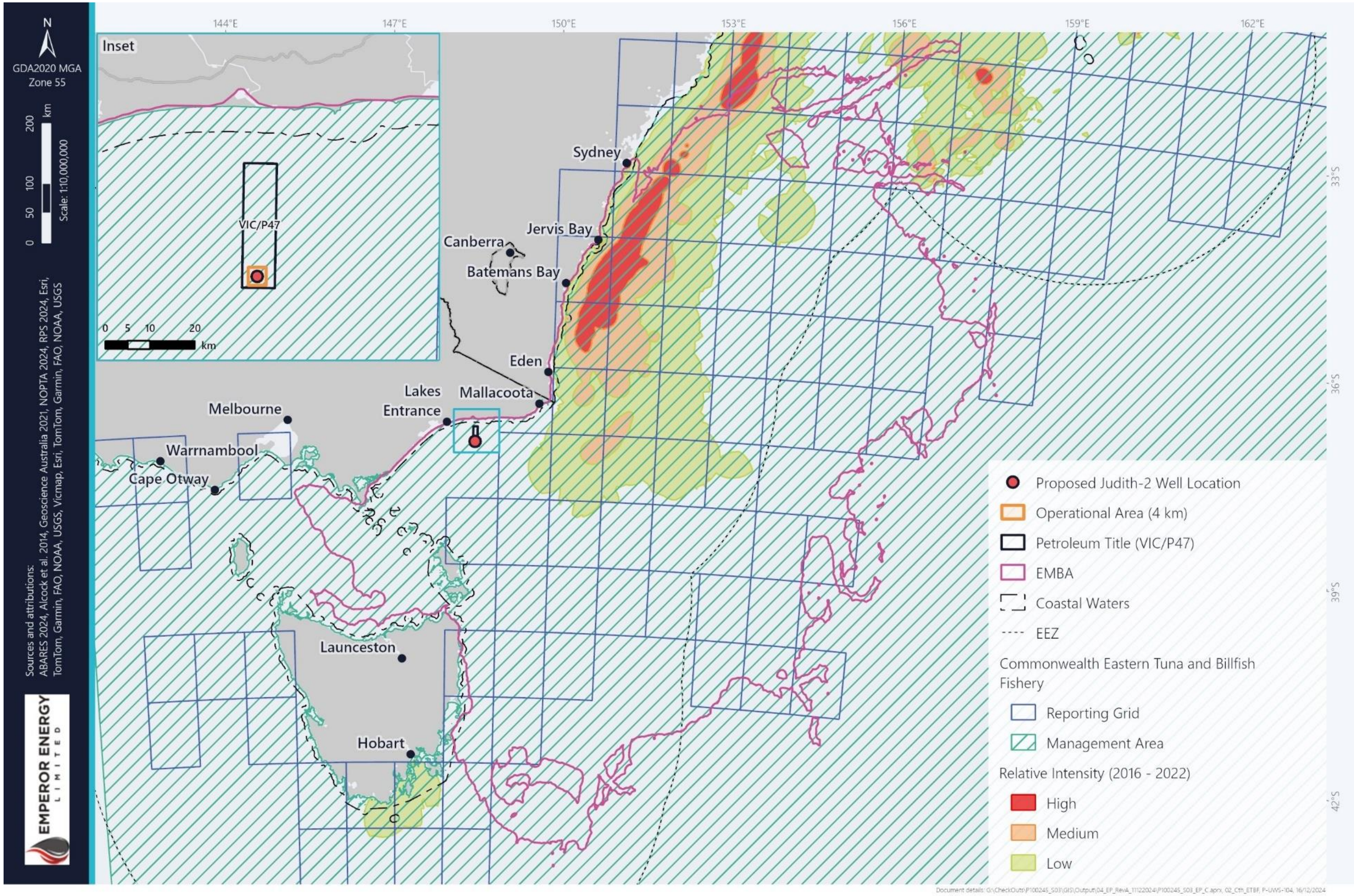

Figure 4-28: Management area and relative fishing intensity of the Eastern Tuna and Billfish Fishery within the EMBA

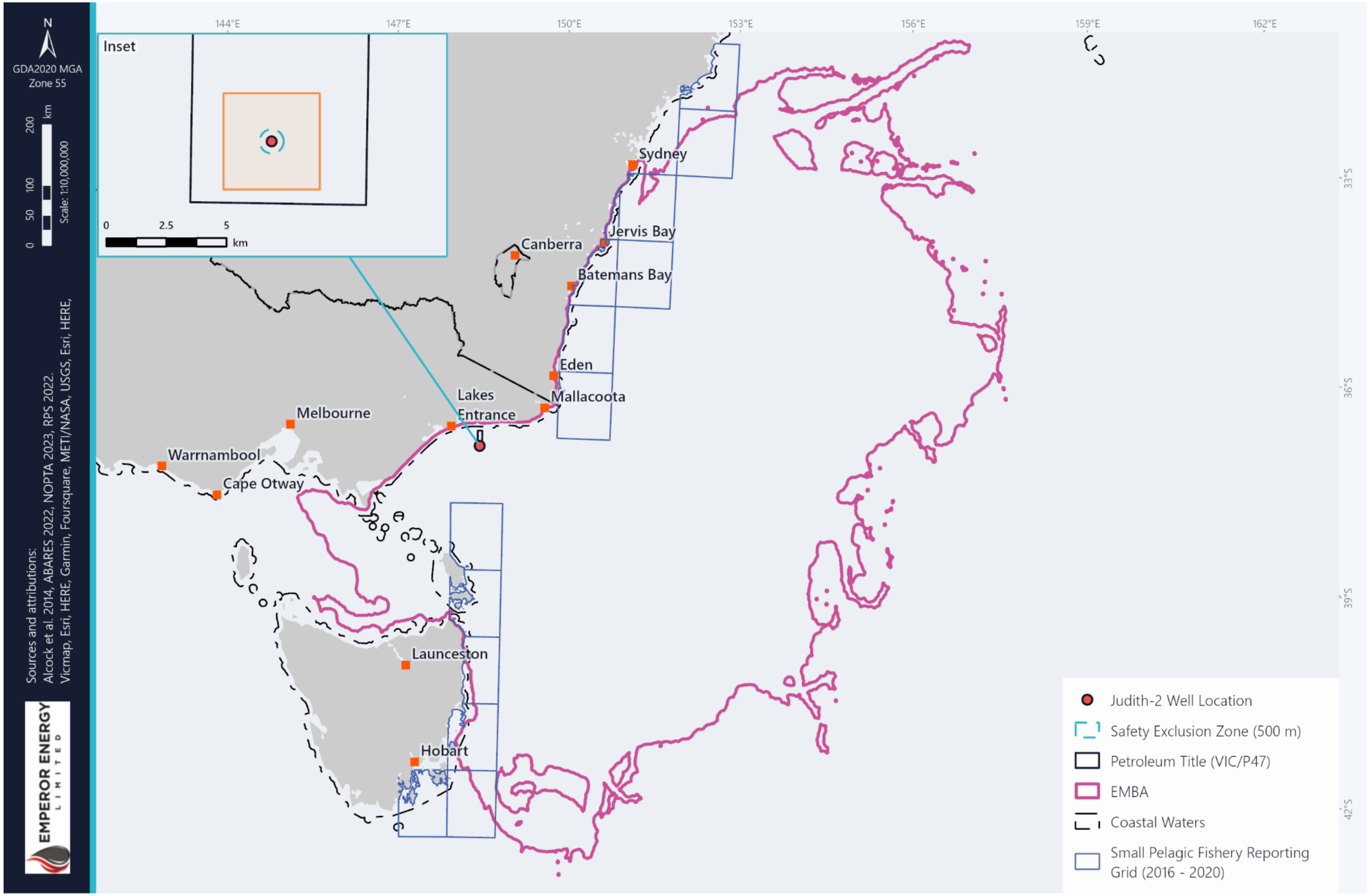

Figure 4-29: Management area and relative fishing intensity of the Small Pelagic Fishery within the EMBA

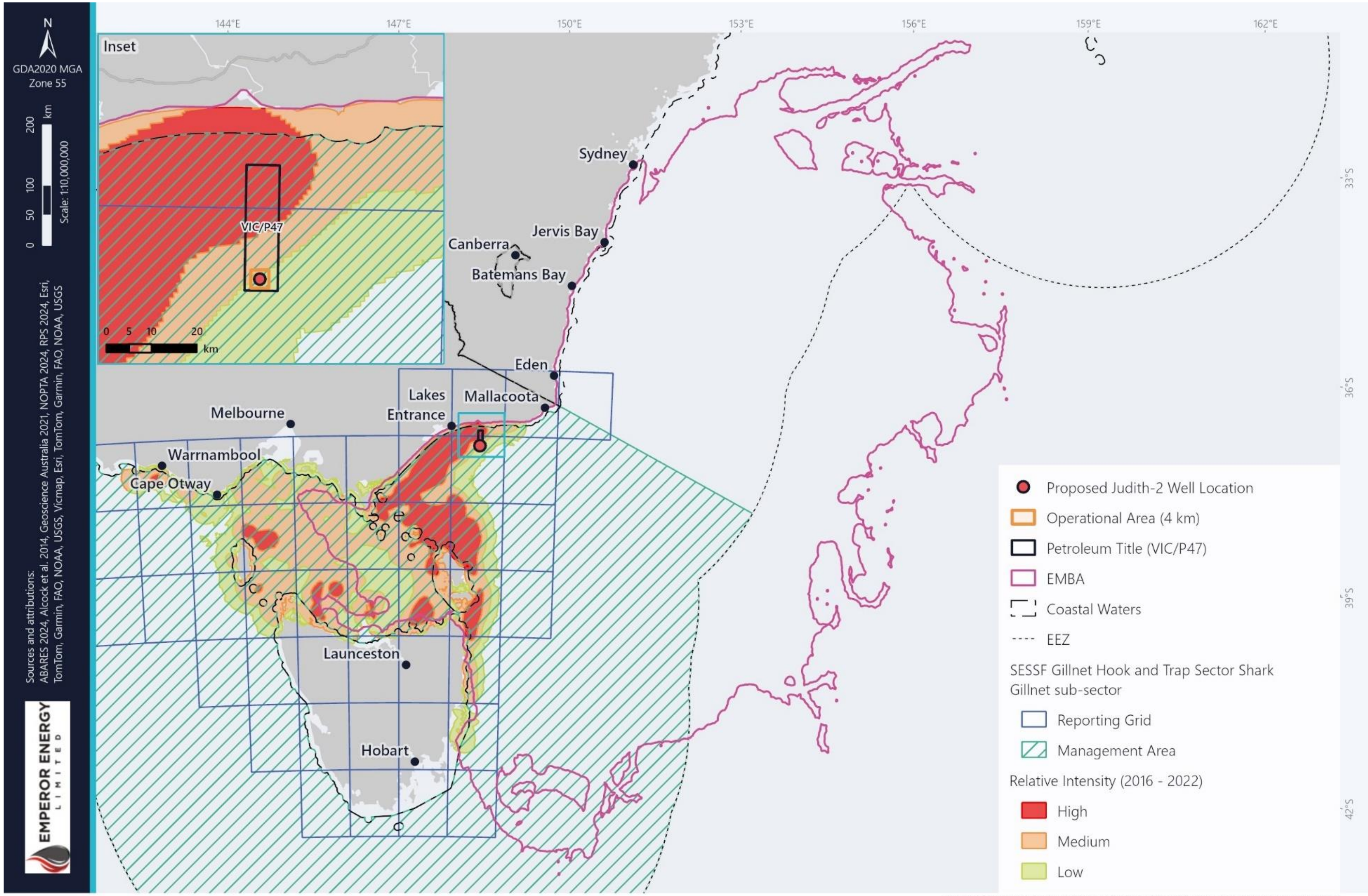

Figure 4-30: Management area and relative fishing intensity of the SESSF – Gillnet Hook Trap Sector (Shark Gillnet sub-sector) within the EMBA

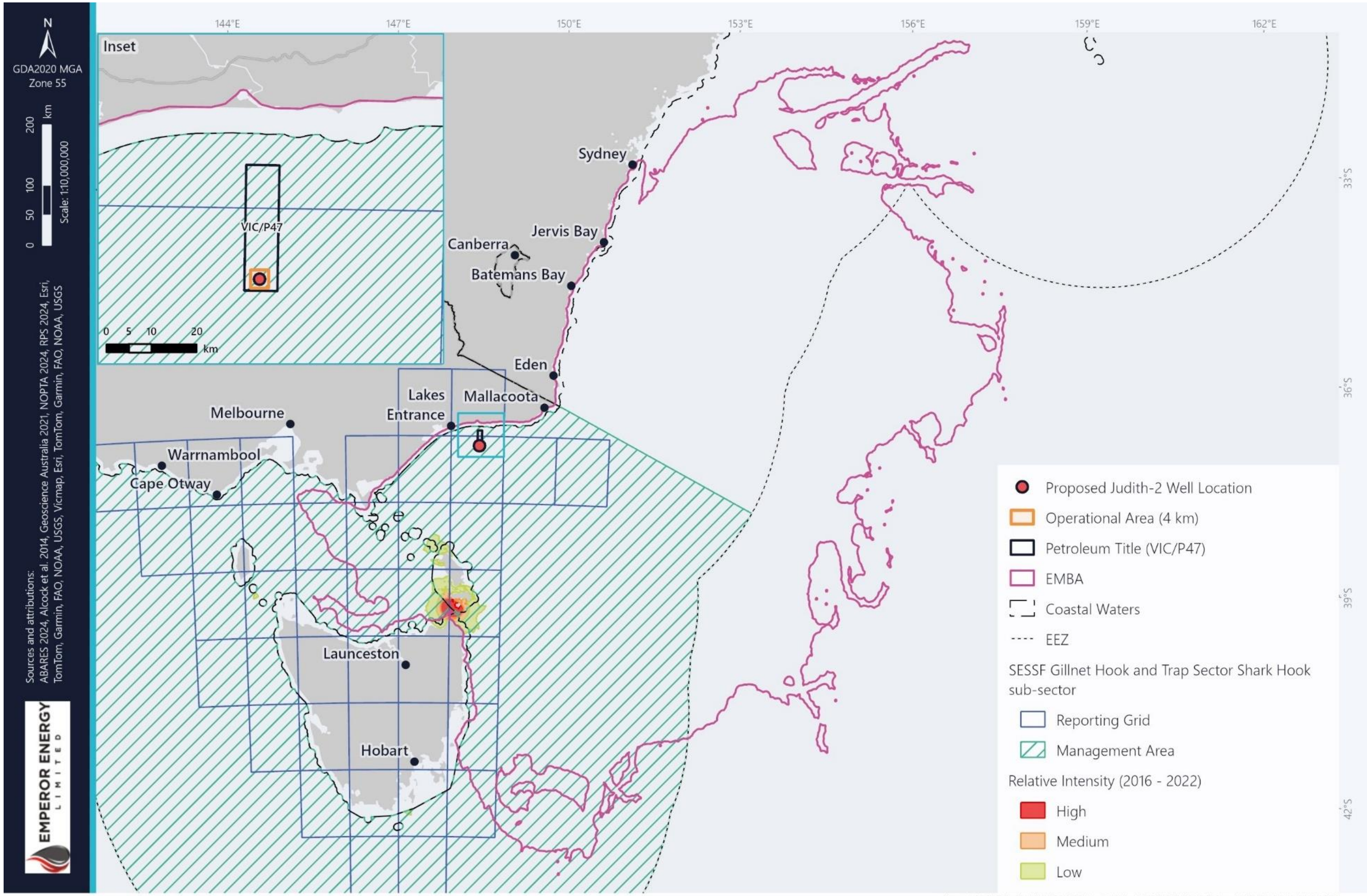

Figure 4-31: Management area and relative fishing intensity of the SESSF – Gillnet Hook Trap Sector (Shark Hook sub-sector) within the EMBA

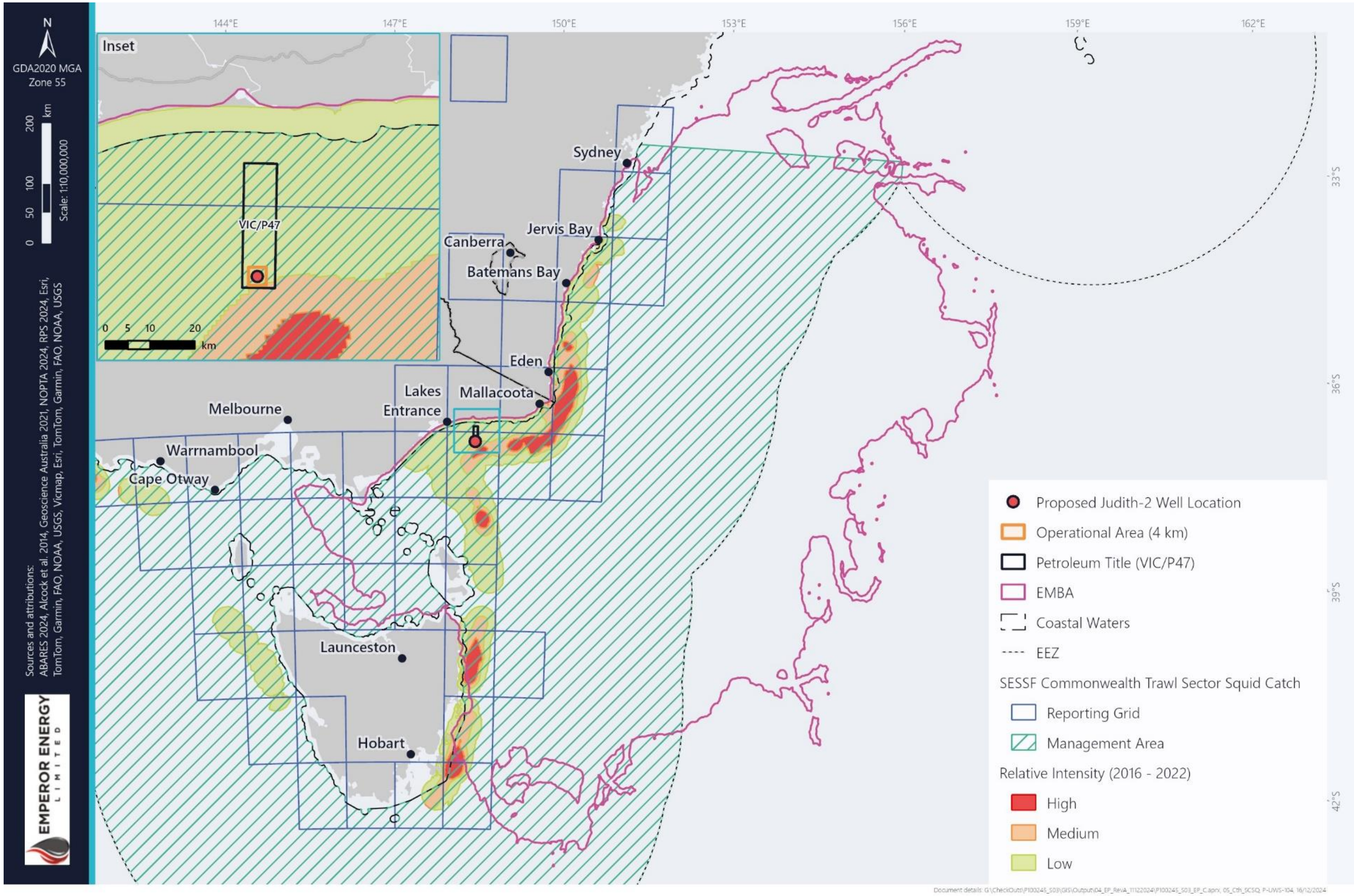

Figure 4-32: Management area and relative fishing intensity of the SESSF – CTS Otter-board trawl sub-sector within the EMBA

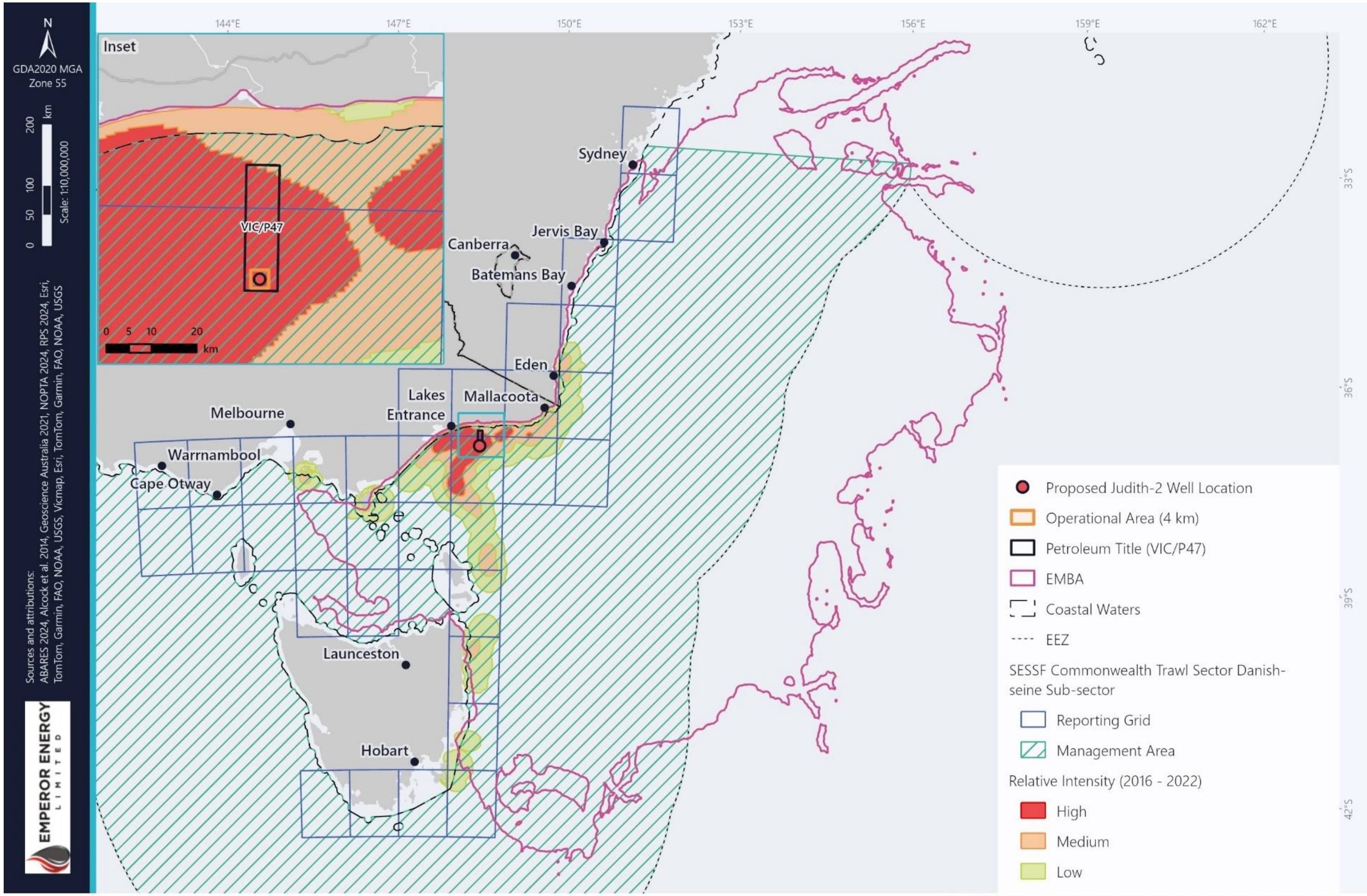

Figure 4-33: Management area and relative fishing intensity of the SESSF – CTS Danish-seine sub-sector within the EMBA

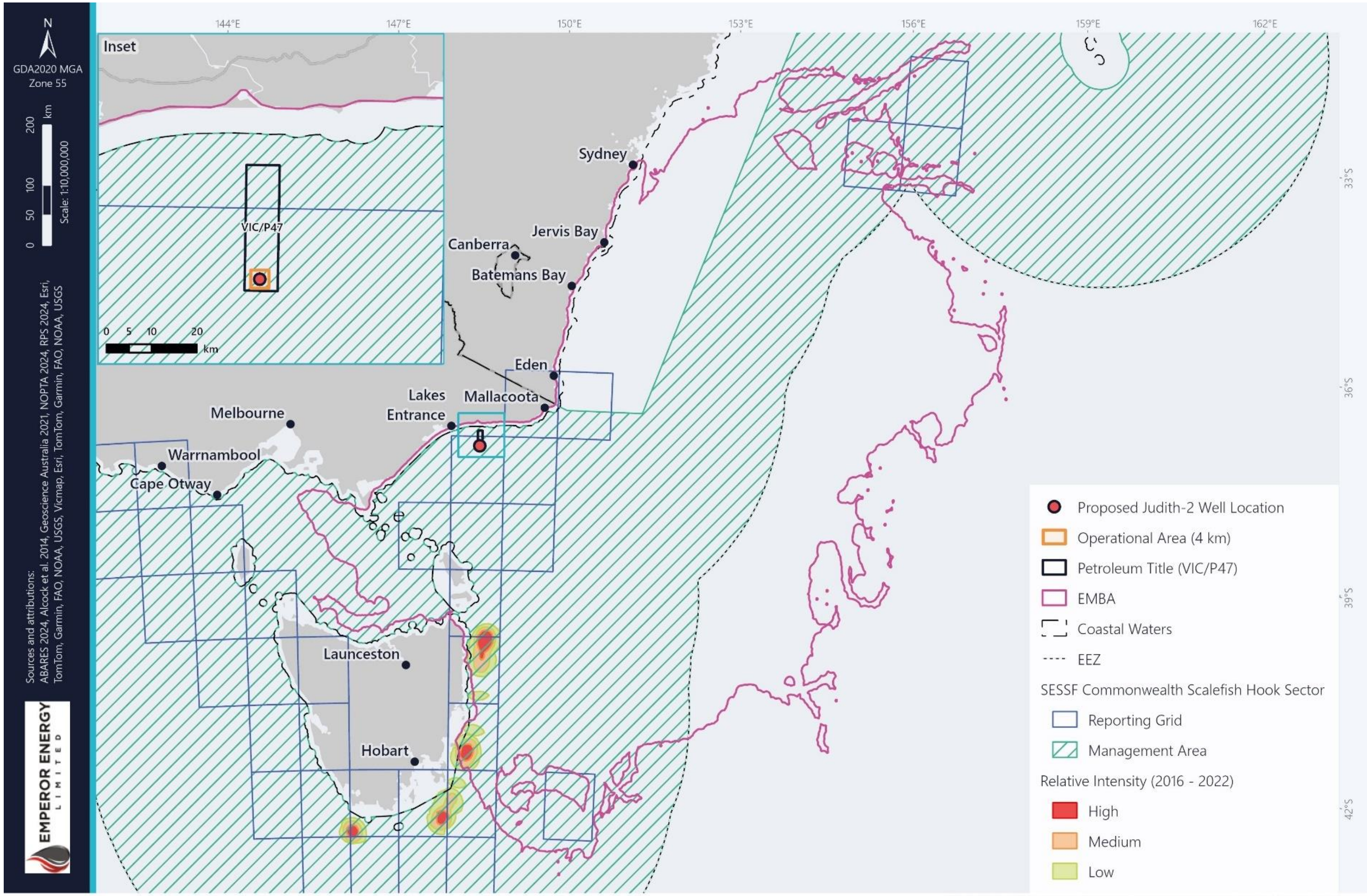

Figure 4-34: Management area and relative fishing intensity of the SESSF - Scalefish Hook Sector within the EMBA

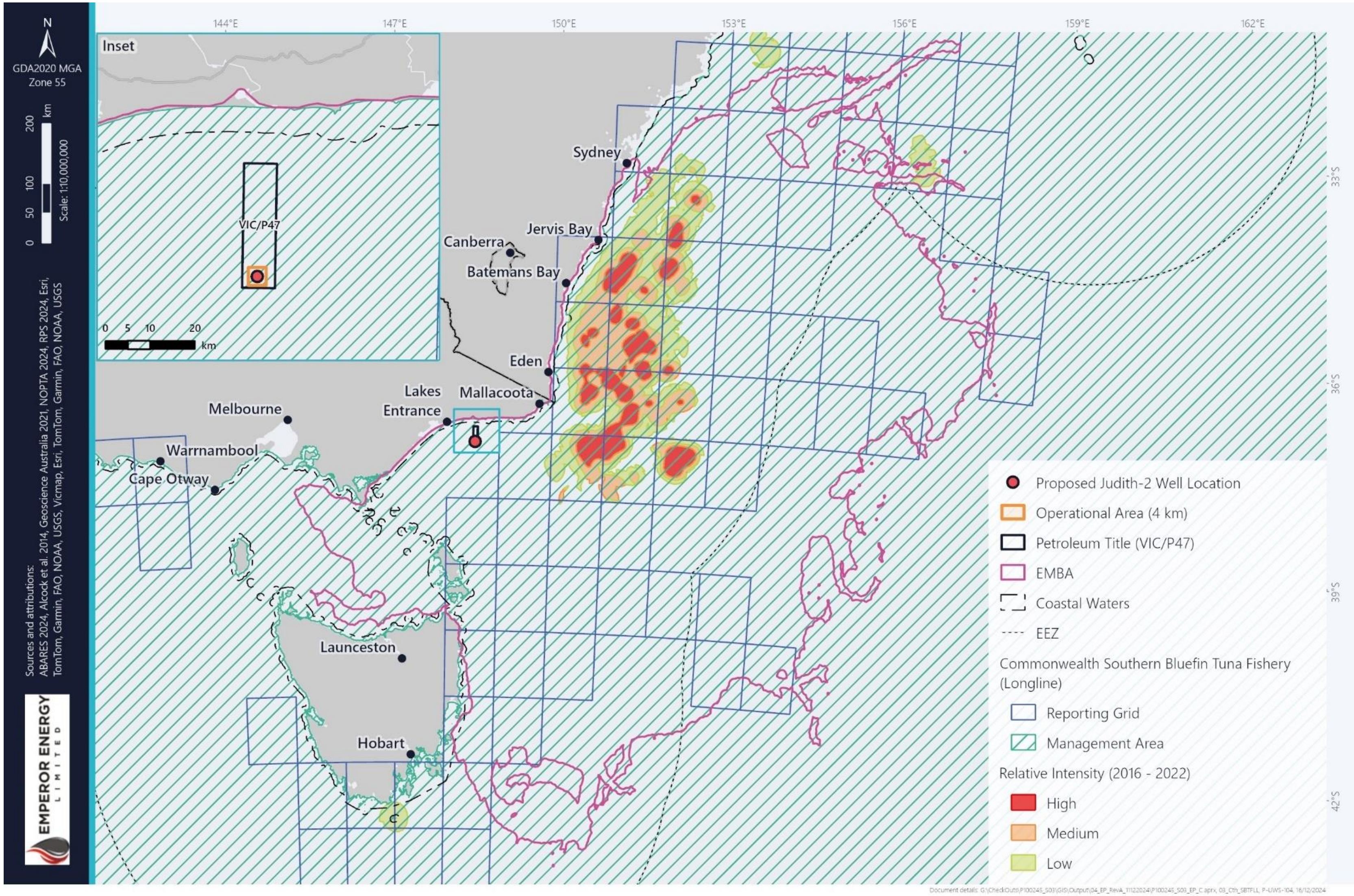

Figure 4-35: Management area and relative fishing intensity of the Southern Bluefin Tuna Fishery within the EMBA

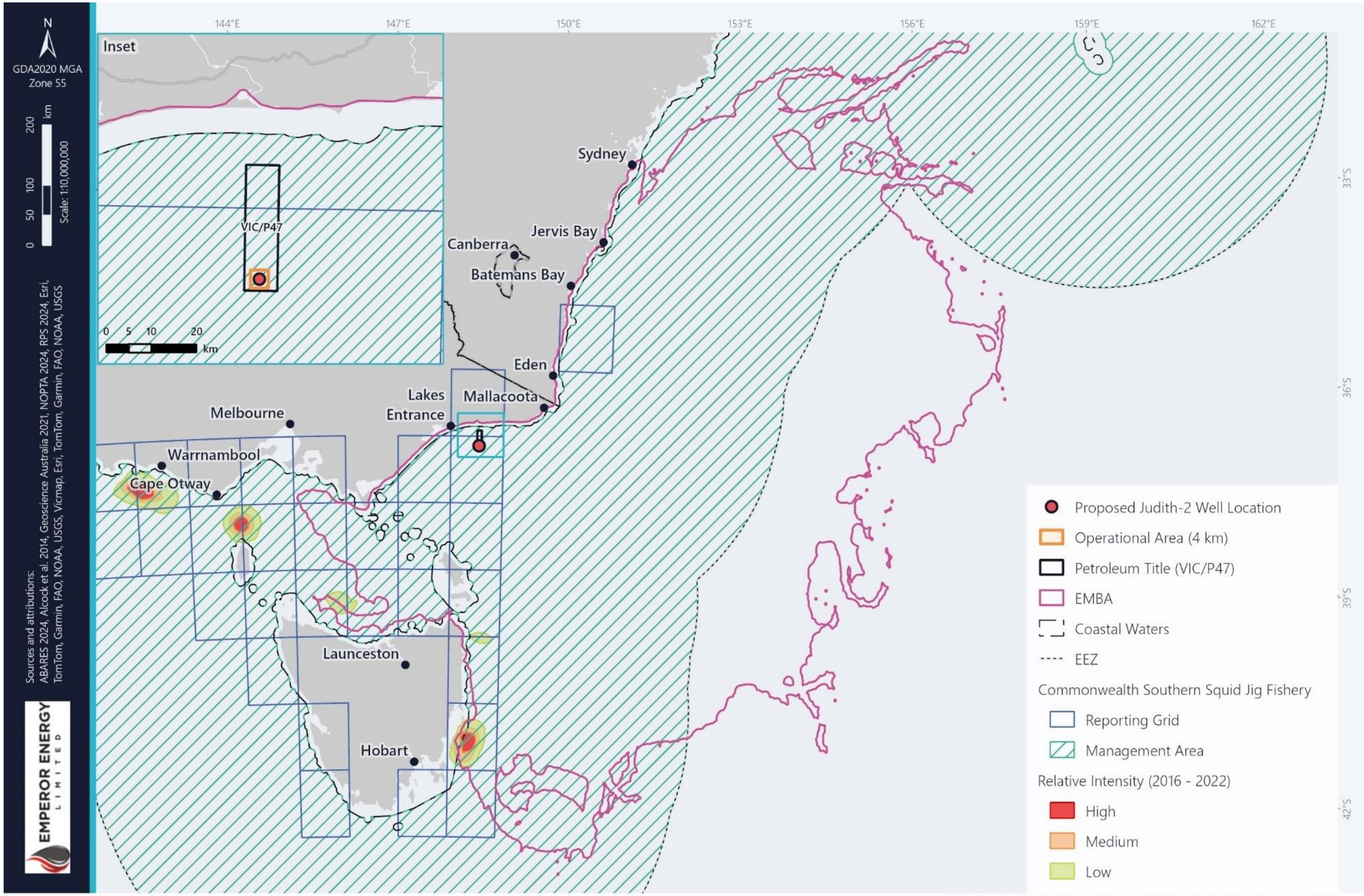

Figure 4-36: Management area and relative fishing intensity of the Southern Squid Jig Fishery within the EMBA

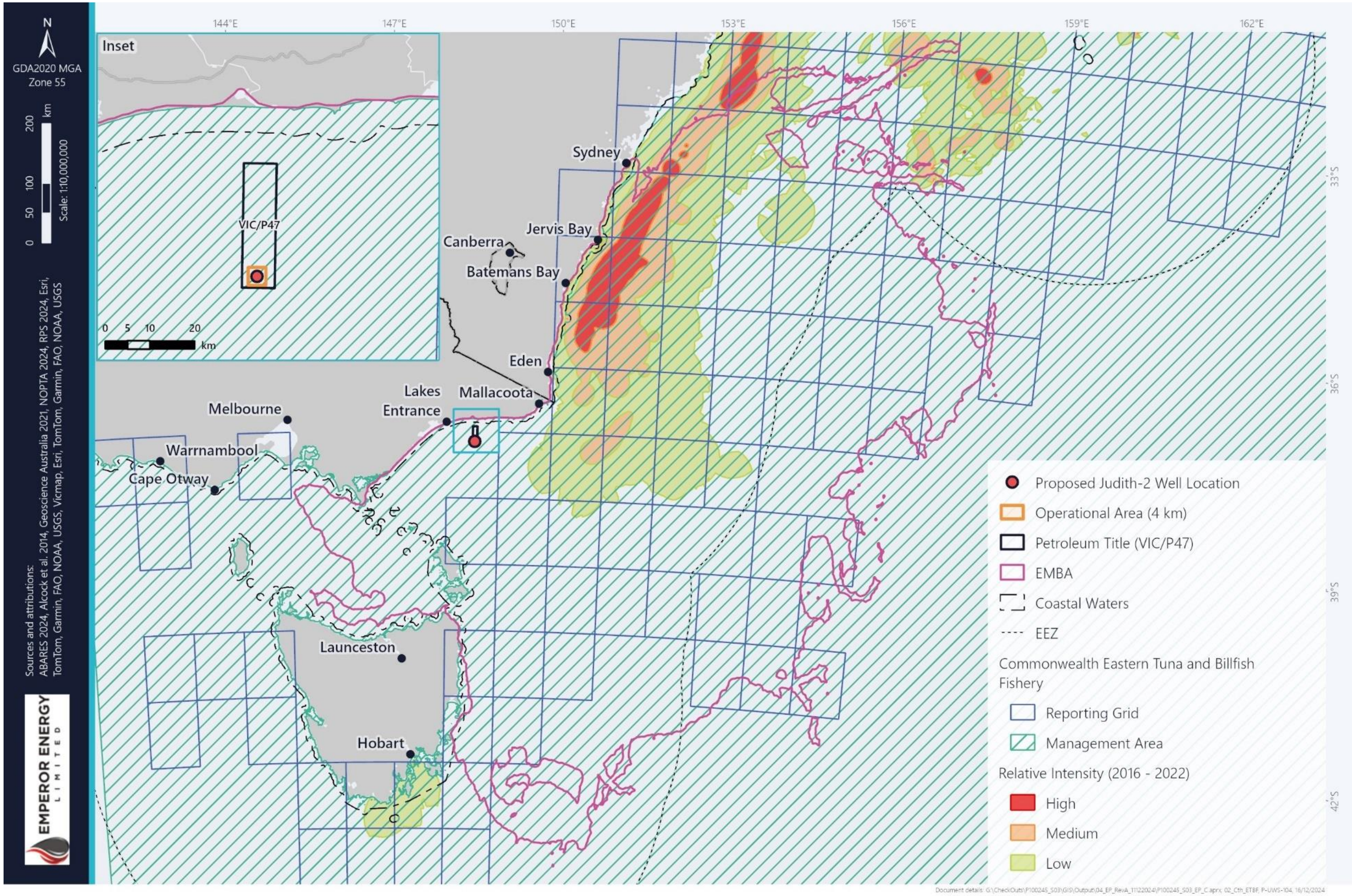

Figure 4-37: Management area and relative fishing intensity of the Eastern Tuna and Billfish Fishery within the EMBA

4.7.2. State-managed Commercial Fisheries

The EMBA extends across multiple state-managed commercial fisheries management areas, including Victoria, Tasmania and New South Wales (NSW).

4.7.2.1. Victoria

Victorian state fisheries are managed by the Victorian Fisheries Authority (VFA) under the State Fisheries Act 1995. VFA jurisdiction extends offshore to 3 nm with additional offshore constitutional settlements for specific fisheries beyond state boundaries into Commonwealth waters.

Seven Victorian-managed fisheries have management areas that intersect with the EMBA (Table 4-16). The Ocean Scallop Fishery has been identified to be active within the Operational Area between 2013 and 2023, with an additional four to have known activity within the EMBA.

Table 4-16: Description of Victorian-managed Fisheries with management areas overlapping Operational Area or EMBA

FISHERY	KEY TARGET / INDICATOR SPECIES	LICENCE AREA DESCRIPTION	FISHERY DESCRIPTION	SUMMARY OF MOST RECENT FISHING ACTIVITY1	MANAGEMENT AREA OVERLAP		POTENTIAL FOR INTERACTION IN THE OPERATIONAL AREA2
					OPERATIONAL AREA	EMBA	
Victorian Managed Fisheries[3]							
Abalone Fishery	Blacklip abalone (*Haliotis rubra*) Greenlip abalone (*H. laevigata*)	Abalone are caught along the majority of the Victorian coastline and is split into three management zones; eastern, central and western	Methods: Hookah gear (air is supplied through an air-hose connected to an air compressor on the vessel) Licences: 71 access licences Season: 12-month season beginning 1st April	Overlap occurs between the fishery management area and the EMBA. However, no recorded catch within the overlap between the 2013 and 2023 seasons.	-	✓	✗ Abalone diving occurs close to shoreline, in waters <30m depth. Therefore, interaction within the Operational Area at ~ 70 m depth is highly unlikely. Therefore, interactions with the fishery would be limited to activities within the EMBA.
Giant Crab Fishery	Giant crab (*Pseudocarcinus gigas*)	The fishery extends from the Victorian coastline to latitude 40°S (between 140°57.9'S and 143°40' E) and	Methods: Baited pots Licences: 11 access licences Season: Males – 16th November – 16 September	Overlap occurs between the fishery management area and the EMBA. However, there has been no recorded catch within the overlap between the 2013 - 2023 seasons.	-	✓	✗ Since 2013 there has been no catch and effort reported within the Operational Area. Given this, interactions with the fishery would be limited

[1] *Information for most recent fishing activity data provided by Monique Nelis (personal communication, 27 October 2022)*
[2] *Information for most recent fishing activity data provided by Monique Nelis (personal communication, 27 October 2022)*
[3] *Information for Victorian-managed fisheries sourced from VFA 2022*

		39°12'S (between 143°40'E and 150°20'E)	Females – 16th November – 31st May	All catch was recorded in the western zone.			to activities within the EMBA.
Multi-species Ocean Fishery	Pale Octopus (*Octopus pallidus* Maori octopus (*Macroctopus maorum*) Gloomy octopus (*Octopus tetricus*)	This fishery is comprised of three sub-sectors: Ocean fishery, Commercial permit fishery and the Octopus fishery (central and western zone).	Methods: Variety Licences/permits: confidential Season: Year-round	Overlap occurs between the fishery management area and the EMBA. Since 2013 there has been recorded catch and effort reported within fishing blocks intersected by the EMBA (Figure 4-38). Fishing effort shows up to 6 vessels active and an average total of 44 days fished between 2013 and 2023.	-	✓	✗ The Operational Area is located within the management area, however, no previous fishing effort has been recorded since 2013. Given this, interactions with the fishery would be limited to activities within the EMBA.
Octopus Fishery	Pale Octopus (*Octopus pallidus* Maori octopus (*Macroctopus maorum*) Gloomy octopus (*Octopus tetricus*)	There are three management zones for the fishing of octopus in Victoria. The fishery only authorises take from the eastern zone while the central and western zones are managed through the VFA	Methods: Pots Licences: 11 licences Season: Year-round.	Overlap occurs between the fishery management area and the EMBA. Since 2013 there has been recorded catch and effort reported within fishing blocks intersected by the EMBA (Figure 4-39). Between 2013-2023 up to 7 active vessels and an average total of 13 days were fished within blocks overlapped by the EMBA.	-	✓	✗ The Operational Area is located within the management area, however, no previous fishing effort has been recorded since 2013. Given this, interactions with the fishery would be limited to activities within the EMBA.

		through exploratory, temporary permits.					
Rock Lobster Fishery	Southern Rock Lobster (*Jasus edwardsii*)	The fishery extends from the Victorian coastline to latitude 40ºS (between 140°57.9'S and 143°40' E) and 39°12'S (between 143°40'E and 150°20'E)	Methods: Baited pots Licences: 71 licences Season: Males – 16th November – 16 September Females – 16th November – 31st May	Overlap occurs between the fishery management area and the EMBA. Since 2013 there has been recorded catch and effort reported within fishing blocks intersected by the EMBA (Figure 4-40). Between 2013-2023 up to 7 active vessels and an average total of 51 days were fished within blocks overlapped by the EMBA.	✓	✓	× The Operational Area is located within the management area. However, no previous fishing effort is recorded within the Operational Area between 2013-2023 seasons. Given this, interactions with the fishery would be limited to activities within the EMBA.
Ocean Scallop Fishery	Commercial Scallop (*Pecten fumatus*)	The fishery includes Victorian state waters out to 20 nautical miles from the high tide water mark but excludes the bays and inlets along the coast where commercial fishing for	Methods: Towed scallop dredges Licences: 91 licences Season: Year-round.	Overlap occurs between the fishery management area and the EMBA. Since 2013 there has been recorded catch and effort reported within fishing blocks intersected by the EMBA (Figure 4-41). Between 2013-2023 up to 11 active vessels and an average total of 10 days	✓	✓	✓ One block within the Operational Area have reported catch in effort since 2013. In 2019, one vessel was active in the Operational Area for 1 day. There has been no fishing effort since 2019. Therefore, although unlikely, it is considered there is potential for

		scallops is prohibited.		were fished within blocks overlapped by the EMBA.			interaction within the Operational Area.
Sea Urchin Fishery	White sea urchin (*Heliocidaris erythrogramma*) Black, long-spined sea urchin (*Centrostephanus rodgersii*)	The fishery has been operating as a 'developing fishery' under permits since 1998. There are four management zones where commercial sea urchin divers can fish in Victoria.	Methods: Harvest by hand through diving Licences: 17 licences Season: Year-round	There is no overlap between the fishery management area and the EMBA. Therefore, no recorded catch and effort has been reported within the EMBA.	-	✓	✗ No data or published management zones provided as data cannot be reported on a spatial level due to confidentially (Baker P. pers. Comm. 2024). There are 4 management zones where commercial sea urchin divers can fish in Victoria. Recently the Port Phillip Bay zone and the Eastern zone have been allocated a total allowable catch TACC to better manage stock status and ensure long term sustainability. The eastern zone extends from Lakes Entrance to the New South Wales border. Given the water depth in the Operational Area, the potential for interaction with the fishery is not considered

							likely. Given this, interactions with the fishery would be limited to activities within the EMBA.
Wrasse Fishery	Blue-Throat Wrasse (*Notolabrus tetricus*) Saddled Wrasse (*N. fucicola*) Orange-Spotted Wrasse (*N. parilus*)	The fishery extends along the entire length of the Victorian coastline and out to 20 nautical miles offshore, except for marine reserves.	Methods: Primarily hook and line Licences: 22 access licences Season: Year-round.	Overlap occurs between the fishery management area and the EMBA. Since 2013 there has been recorded catch and effort reported within fishing blocks intersected by the EMBA (Figure 4-42). Between 2013-2023 up to 4 vessels were active and an average total of 48 days were fished within blocks overlapped by the EMBA.	-	✓	✗ The Operational Area is located within the management area. However, no previous fishing effort is recorded within the Operational Area between 2013-2023 seasons. Given this, interactions with the fishery would be limited to activities within the EMBA.

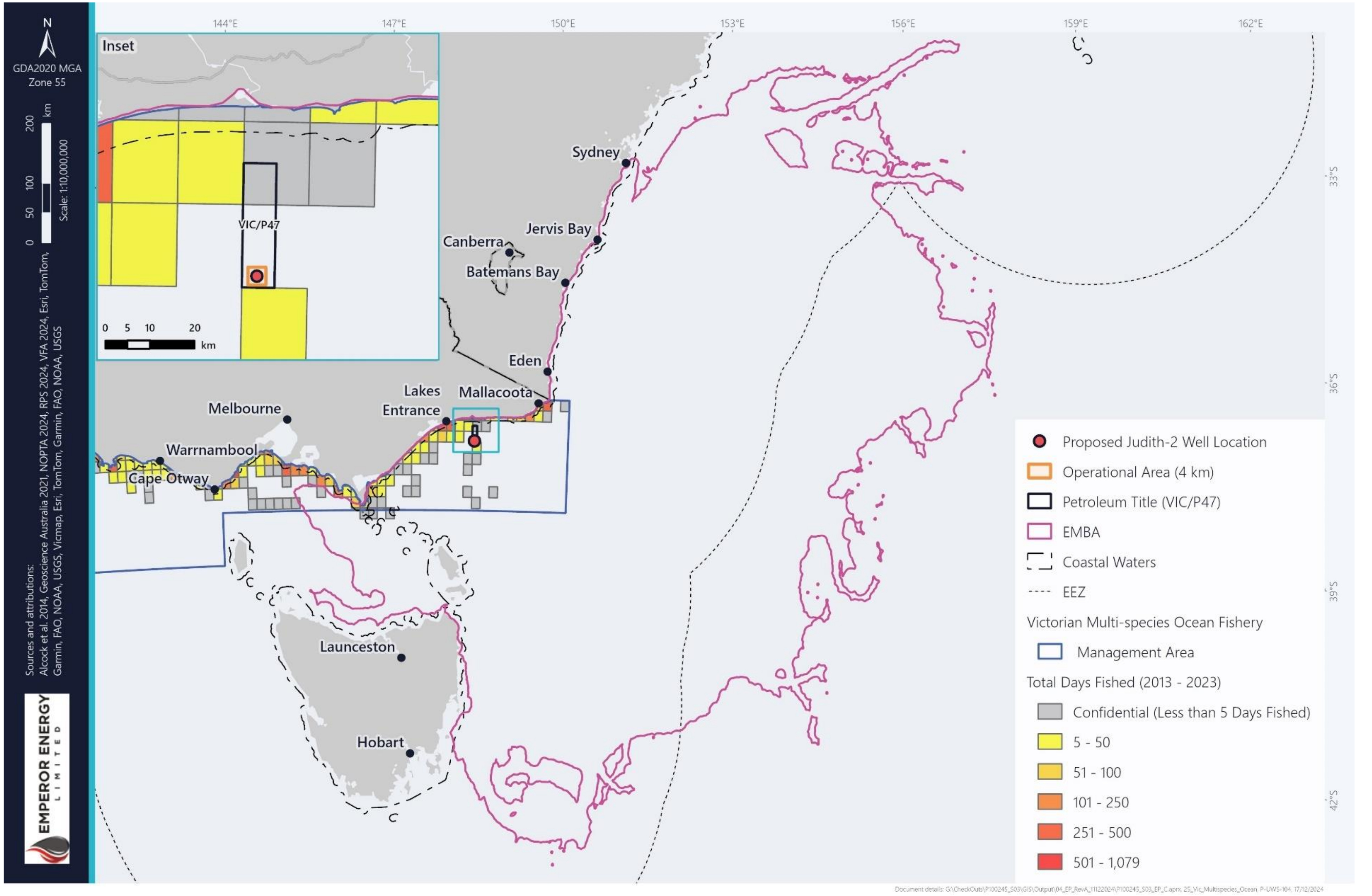

Figure 4-38: Management area and relative fishing effort for the Victorian Multi-species Ocean Fishery and overlap with EMBA

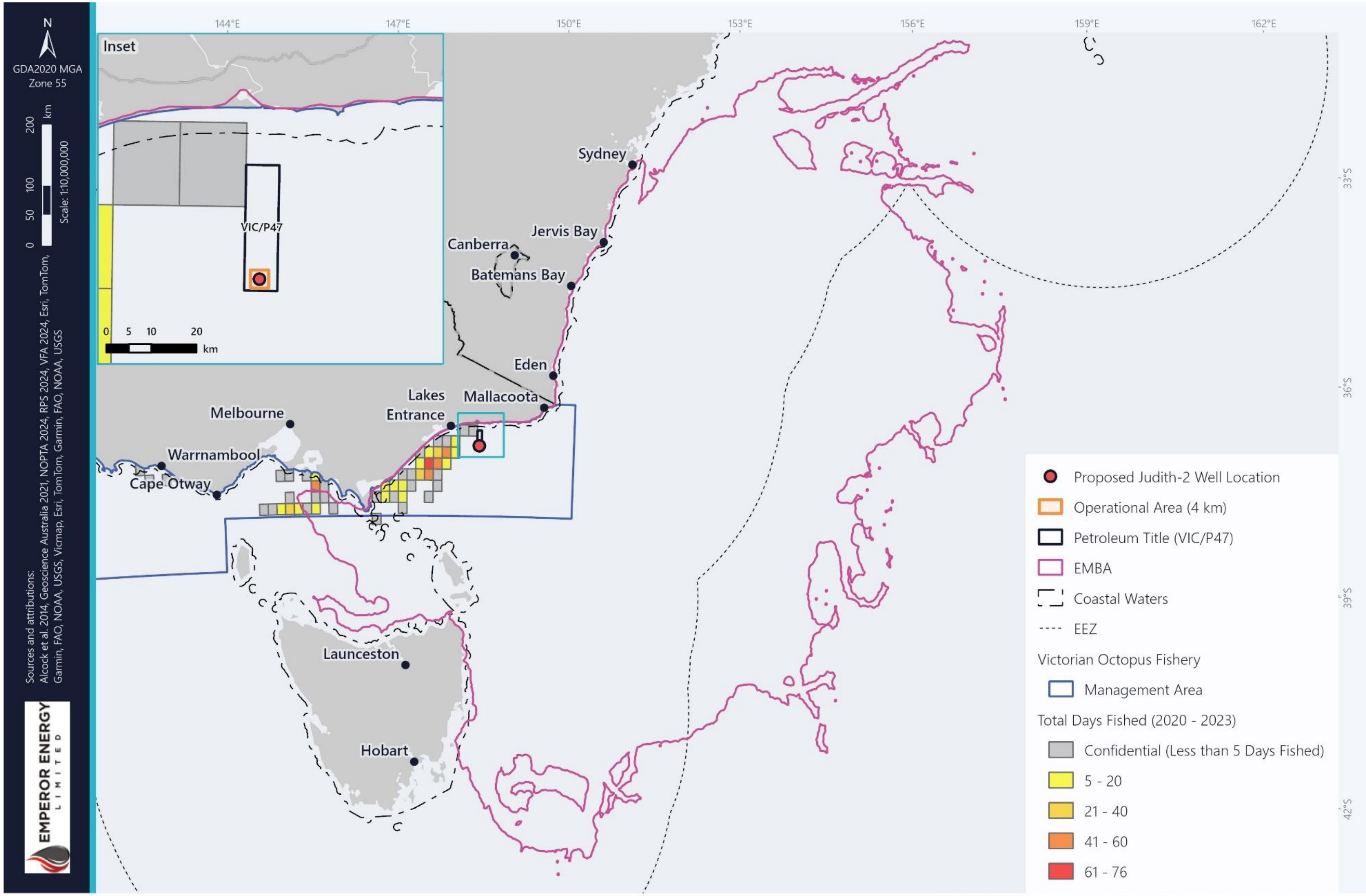

Figure 4-39: Management area and relative fishing effort for the Victorian Octopus Fishery and overlap with EMBA

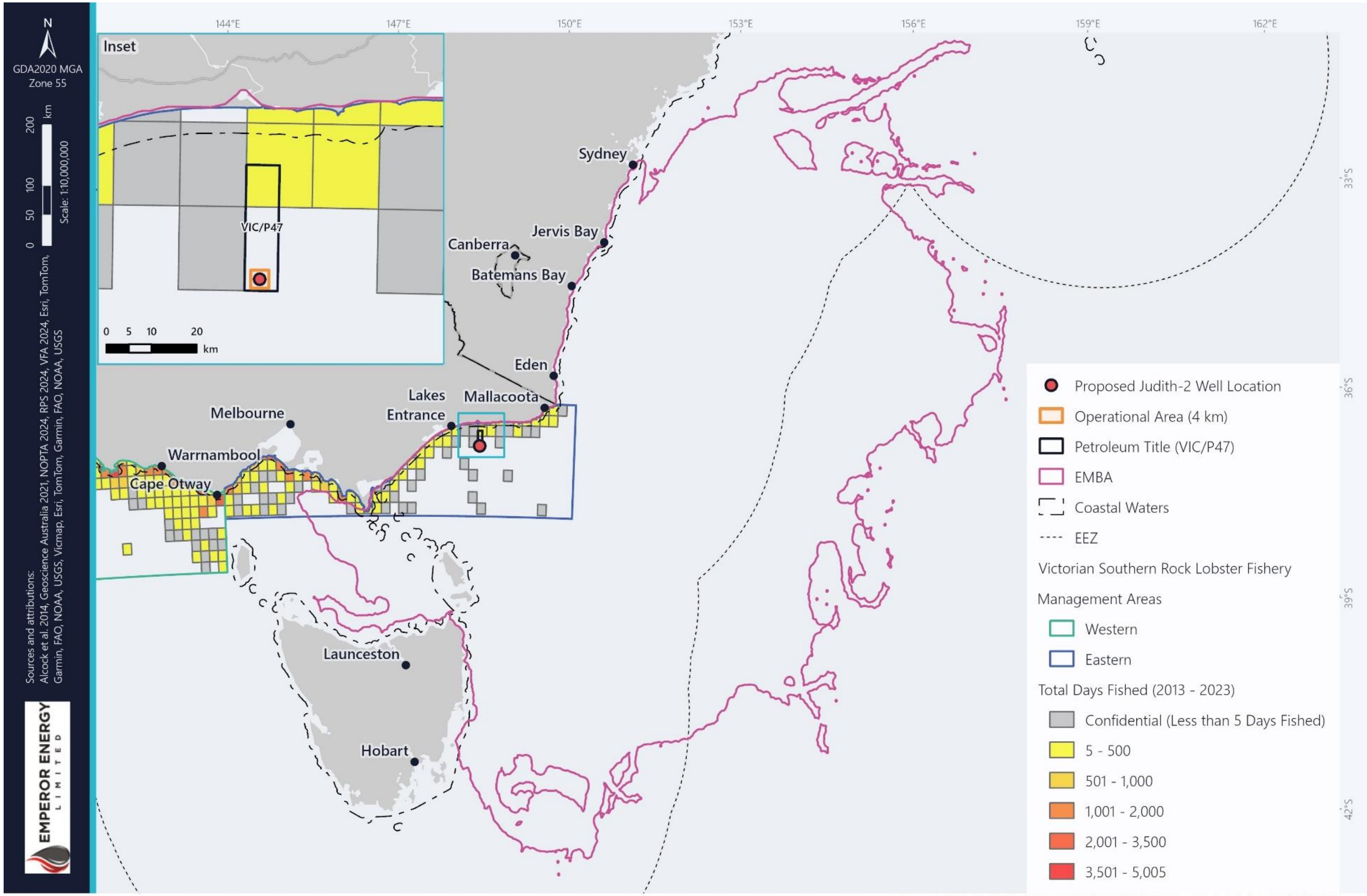

Figure 4-40: Management area and relative fishing effort for the Victorian Rock Lobster Fishery and overlap with EMBA

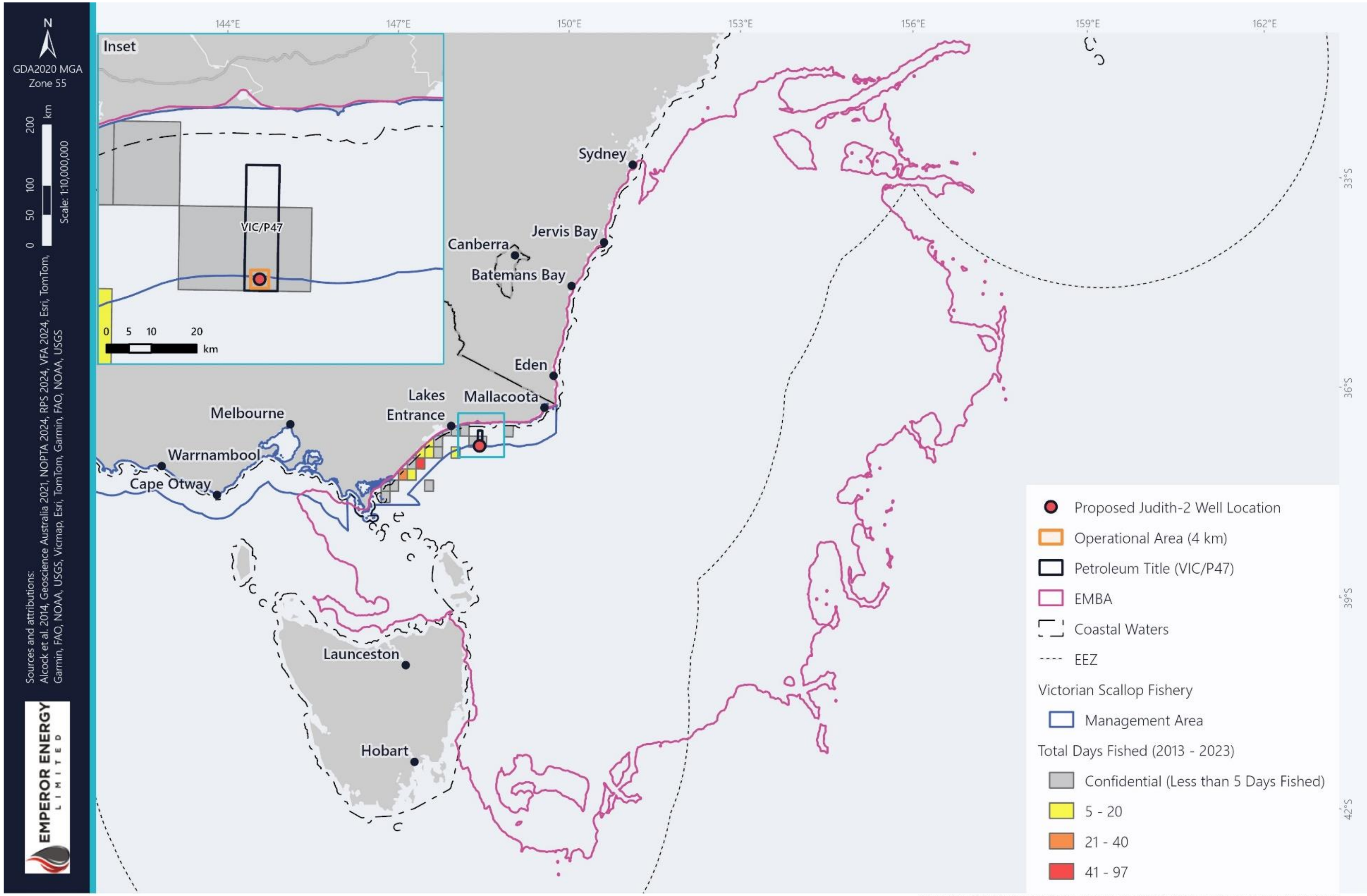

Figure 4-41: Management area and relative fishing effort for the Victorian Scallop Fishery and overlap with EMBA

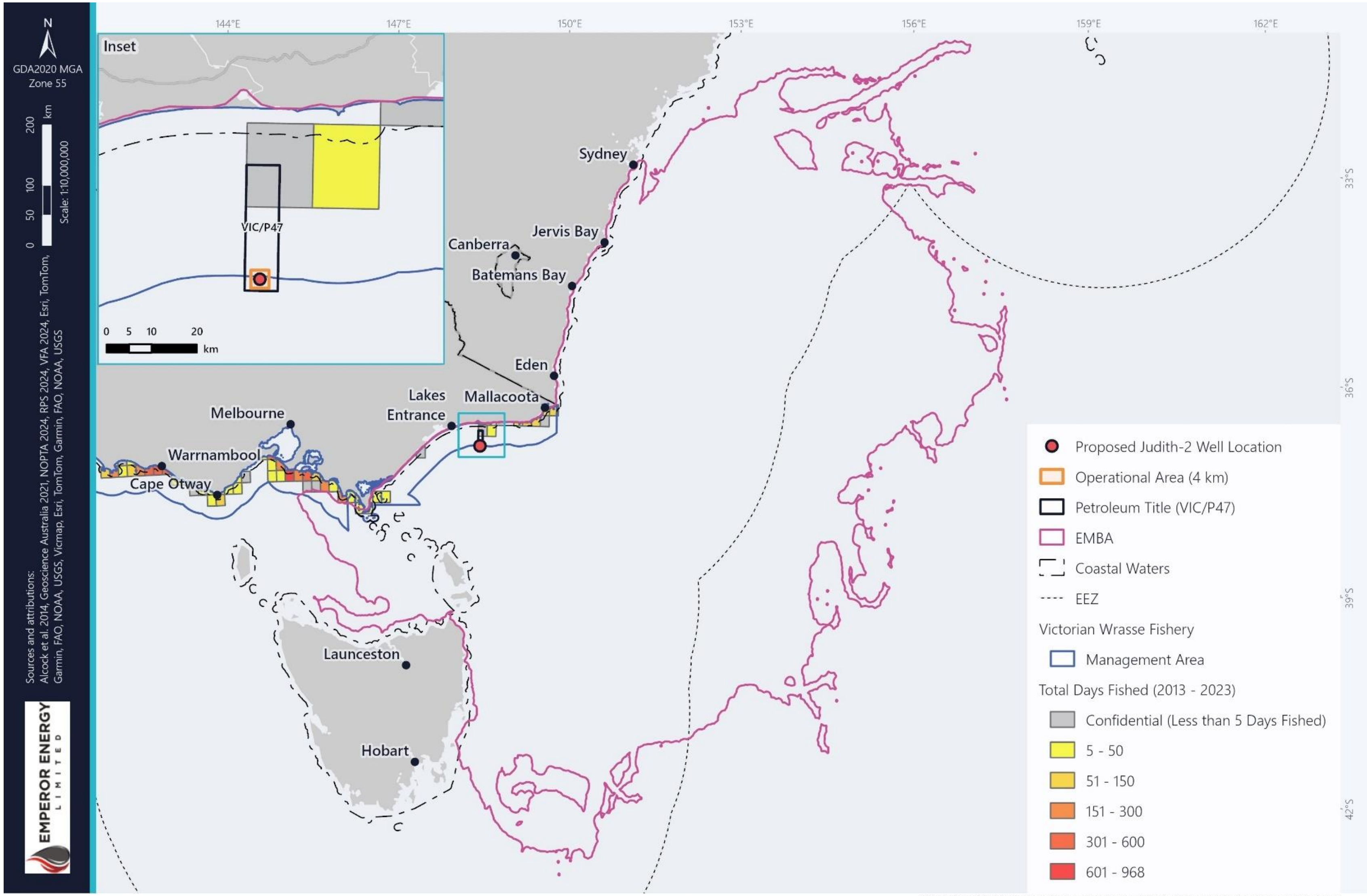

Figure 4-42: Management area and relative fishing effort for the Victorian Wrasse Fishery and overlap with EMBA

4.7.2.2. Tasmania

Tasmanian state fisheries are managed by the Department of Natural Resources and Environment Tasmania (DNRET) under the Living Marine Resources Management Act 1995. DNRET jurisdiction covers all waters that are within the limits of the state with additional offshore constitutional settlements for specific fisheries beyond state boundaries into Commonwealth waters. Nine Tasmanian-managed fisheries have management areas that intersect the EMBA (Table 4-17), therefore any potential interaction would be limited to unplanned activities within the EMBA.

Table 4-17: Description of Tasmanian-managed Fisheries with management areas overlapping the Operational Area or EMBA

FISHERY	KEY TARGET / INDICATOR SPECIES	LICENCE AREA DESCRIPTION	FISHERY DESCRIPTION	SUMMARY OF MOST RECENT FISHING ACTIVITY	MANAGEMENT AREA OVERLAP		POTENTIAL FOR INTERACTION IN THE OPERATIONAL AREA
					OPERATIONAL AREA	EMBA	
Tasmanian State Fisheries[4]							
Abalone Fishery	Blacklip abalone (*Haliotis rubra*) Greenlip abalone (*H. laevigata*)	The fishery is divided into five commercial zones; eastern blacklip, western blacklip, northern blacklip, Bass Strait blacklip and greenlip (state-wide)	Methods: Hand collection through diving. Licences: 121 dive entitlements. Season: Year-round however zones closures may be in place due to stock structure	In 2021 the total estimated landings were 749 t of blacklip and 84 t of greenlip, fulfilling the total allowable commercial catch of 833 t. The 2024 season has a total allowable catch (TAC) of 668.5 t blacklip and 87.5 t greenlip.	-	✓	× There is no potential for interaction in the Operational Area as the Operational Area lies outside Tasmanian state waters.
Commercial Dive Fishery	Short spined sea urchin (*Heliocidaris erythrogramma*), Long spined sea urchin (*Centrostephanus rodgersii*) Periwinkles	The fishery is divided into five commercial dive zones; Northern, north-eastern, central-eastern, south-eastern and western.	Methods: Hand collection through diving. Licences: 53 dive licences. Season: Year-round.	Long spined sea urchin: In the 2023/24 season the total estimated landings were 385 t. Currently there have been 7.6 t of recorded catch in the 2024/25 season. There is no set TAC for this species. Short spined sea urchin: Overlap between the fishery and the EMBA occurs in the northern	-	✓	× There is no potential for interaction in the Operational Area as the Operational Area lies outside

[4] *Information for Tasmanian-managed fisheries sourced from DNRET 2024 and IMAS Publications and Resources 2020*

	(*Lunella undulata*).			zone and the north eastern zone. Total allowable commercial catches of 19.5 t and 18.5 t respectively, have been set for these zones for the 2024/25 season. Currently there has been no recorded catch in the northern zone and 10.6 t has been recorded in the north-eastern zone. Periwinkle: Overlap between the fishery and the EMBA may occur in the northern zone and the north eastern zone. Total allowable commercial catches of 8.1 t and 5.5 t respectively, have been set for these zones for the 2024/25 season. Currently there has been no recorded catch in the northern zone and no data recorded for the north eastern zone.			Tasmanian state waters.
Giant Crab Fishery	Giant crab (*Pseudocarcinus gigas*)	The fishery has 8 management areas which are split into two regions, east and west, and cover the Tasmanian coastline and state waters.	Methods: baited pots. Licences: 84 licences in 2013/14. Season: Males – Year-round.	Overlap between the fishery and the EMBA may occur in the east assessment region (Figure 4-44). The 2024/25 season has set a TAC of 20.7 t. As of 1st of August, 2024, 9.7 t has been recorded.	-	✓	× There is no potential for interaction in the Operational Area as the Operational Area lies outside Tasmanian state waters.

			Females – 16th November – 31st May.				
Octopus Fishery	Pale Octopus (*Octopus pallidus* Maori octopus (*Macroctopus maorum*) Gloomy octopus (*Octopus tetricus*)	The fishery operates off the north coast of Tasmania and in the Bass Strait, covering the entire Tasmanian coastline.	Method: unbaited shelter pots. Licences: 2 active licences. Season: Year-round.	Overlap between the fishery and the EMBA may occur in the Bass Strait zone, specifically the Flinders Island east and west, and the eastern section of the Tasmanian Shelf which covers the remainder of state waters. In 2023 total recorded catch of the pale octopus (key target species) was 101 t with 313,348 recorded pot-lifts.	-	✓	There is no potential for interaction in the Operational Area as the Operational Area lies outside Tasmanian state waters.
Scalefish Fishery	Banded morwong (*Cheilodactylus spectabilis*) Southern calmari (*Sepioteuthis australis*) Southern garfish (*Hyporhamphus melanochir*) Wrasse (*Notolabrus sp.*) Tiger flathead (*Neoplatycephalus richardsoni*) Southern school whiting (*Sillago flindersi*)	The fishery operates across the Tasmanian coastal waters and is managed as one area.	Methods: Include, but are not limited to, drop-line, Danish seine, fish trap, hand-line and spear. Licences: 106 active licences in 2020. Season: Year-round.	Overlap between the fishery and the EMBA may occur in the eastern blocks of the management area. In 2022/23 the species with the highest recorded catch were: Gould's squid – 670 t Southern calamari – 84.2 t Australian sardine – 62.1 t Tiger flathead – 50.5 t	-	✓	✗ There is no potential for interaction in the Operational Area as the Operational Area lies outside Tasmanian state waters.

	East Australian salmon (*Arripis trutta*) Barracouta (*Thyrsites atun*), Bastard trumpeter (*Latridopsis forsteri*) Blue warehou (*Seriolella brama*) Golud's squid (*Nototodarus gouldi*)						
Scallop Fishery	Commercial scallop (*Pecten fumatus*)	The fishery extends 200 nautical miles from the Tasmanian coast, with the exception of Bass Strait, where its jurisdiction covers 3-20 nautical miles offshore.	Methods: Benthic scallop dredge Licences: 11 active licences in 2015. Season: 24 June 2022 – 31 December 2022.	Overlap between the fishery and the EMBA may occur in the north east. The fishery was open to fishing in 2024. The fishery closed in 2016 due to low stock numbers however was approved to reopened for the 2022 season. As of 9 December 2024: 2,404.6 t (60.1% of the TAC) had been landed.	-	✓	× There is no potential for interaction in the Operational Area as the Operational Area lies outside Tasmanian state waters.
Marine Plant Fishery	Bull kelp (*Nereocystis luetkeana*) Wakame (*Undaria pinnatifida*).	The fishery operates in Tasmanian coastal waters. Seaweed can only be harvested onshore however,	Methods: Beach harvesting, hand collect or dive. Licences: 70 licence holders as of 2017. Season: Year-round.	Overlap between the fishery and the EMBA may occur in the undaria zone as well as the unzoned area. The majority of onshore seaweed collection occurs on King Island, Marrawah and Granville Harbour all outside the EMBA.	-	✓	× There is no potential for interaction in the Operational Area as the Operational Area lies outside

		Undaria is an exception as it is an invasive species and divers can hand collect.					Tasmanian state waters.
Shellfish Fishery	Pacific oysters (*Crassostrea gigas*) Native oysters (*Ostrea angasi*) *Venerupis* Clams *Katelysia* cockles	The fishery operates in restricted areas which were once historically identified through research and a permitting process.	Methods: Harvest by hand, either by diving or wading Licences: 2 – native oysters 2 – clams 1 – cockles.	Overlap between the fishery and the EMBA may occur in Georges Bay and Anson's Bay where oysters, clams and cockles are targeted. TAC for the 2024/25 season: Pacific oysters (state-wide) – NA Native oyster – 20, 046 dozen Clams – 840 kg.	-	✓	✗ There is no potential for interaction in the Operational Area as the Operational Area lies outside Tasmanian state waters.
Southern Rock Lobster	Southern Rock Lobster (*Jasus edwardsii*)	The fishery operates in state and Commonwealth waters surrounding Tasmania.	Methods: Baited pots Licences: 164 licenced vessels in 2020/21 Season: Males – 16th November – 31st September Females – 16th November – 31st April	Overlap between the fishery and the EMBA may occur in the east assessment region. Specifically, over blocks 3 and 4 (Figure 4-43). The 2024/25 season has set a TAC of 1050.7 t. As of 31 October 2024, 520.5 t of the catch has been landed.	-	✓	✗ There is no potential for interaction in the Operational Area as the Operational Area lies outside Tasmanian state waters.

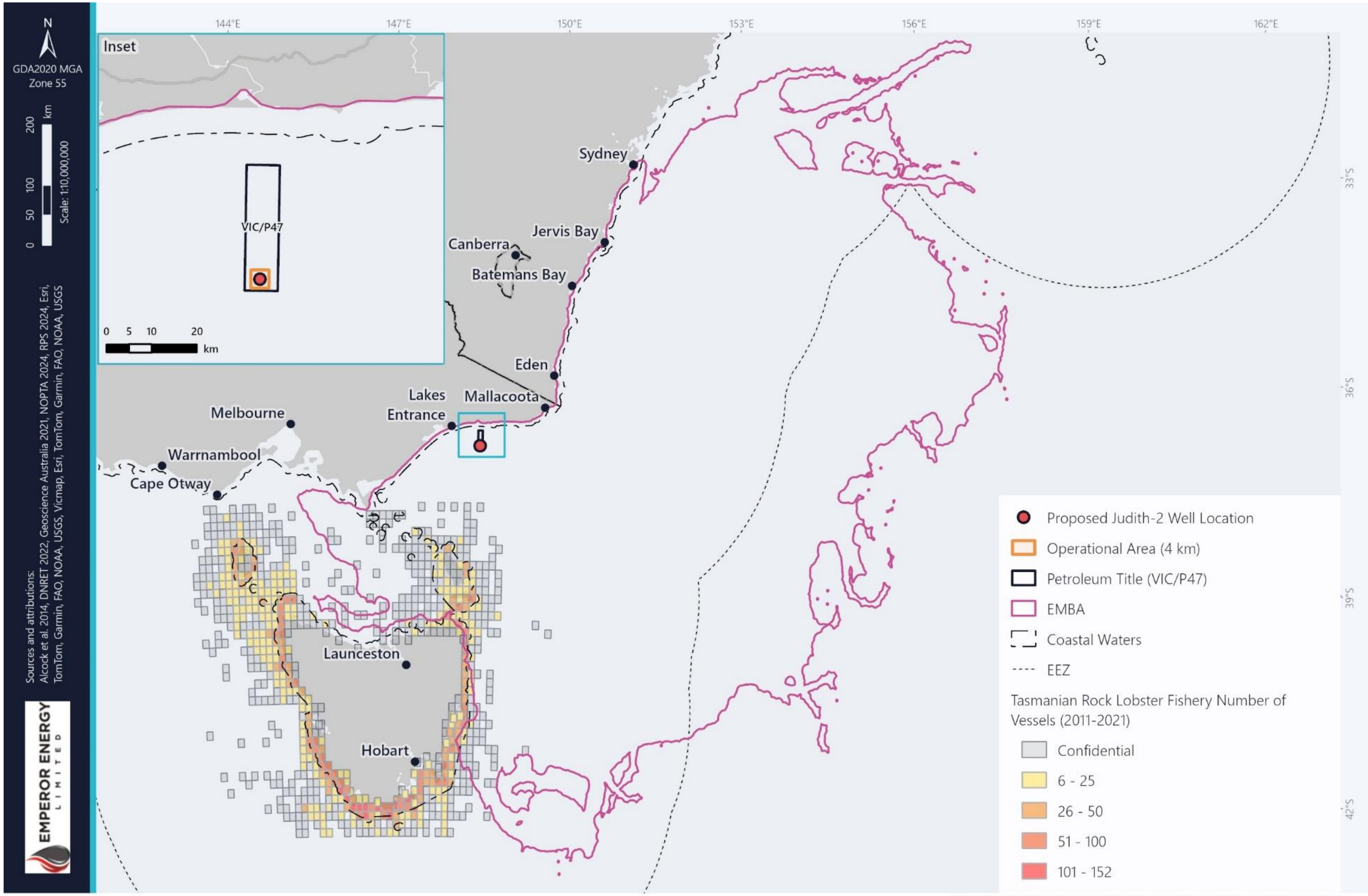

Figure 4-43: Tasmanian Rock Lobster Fishery overlap with EMBA

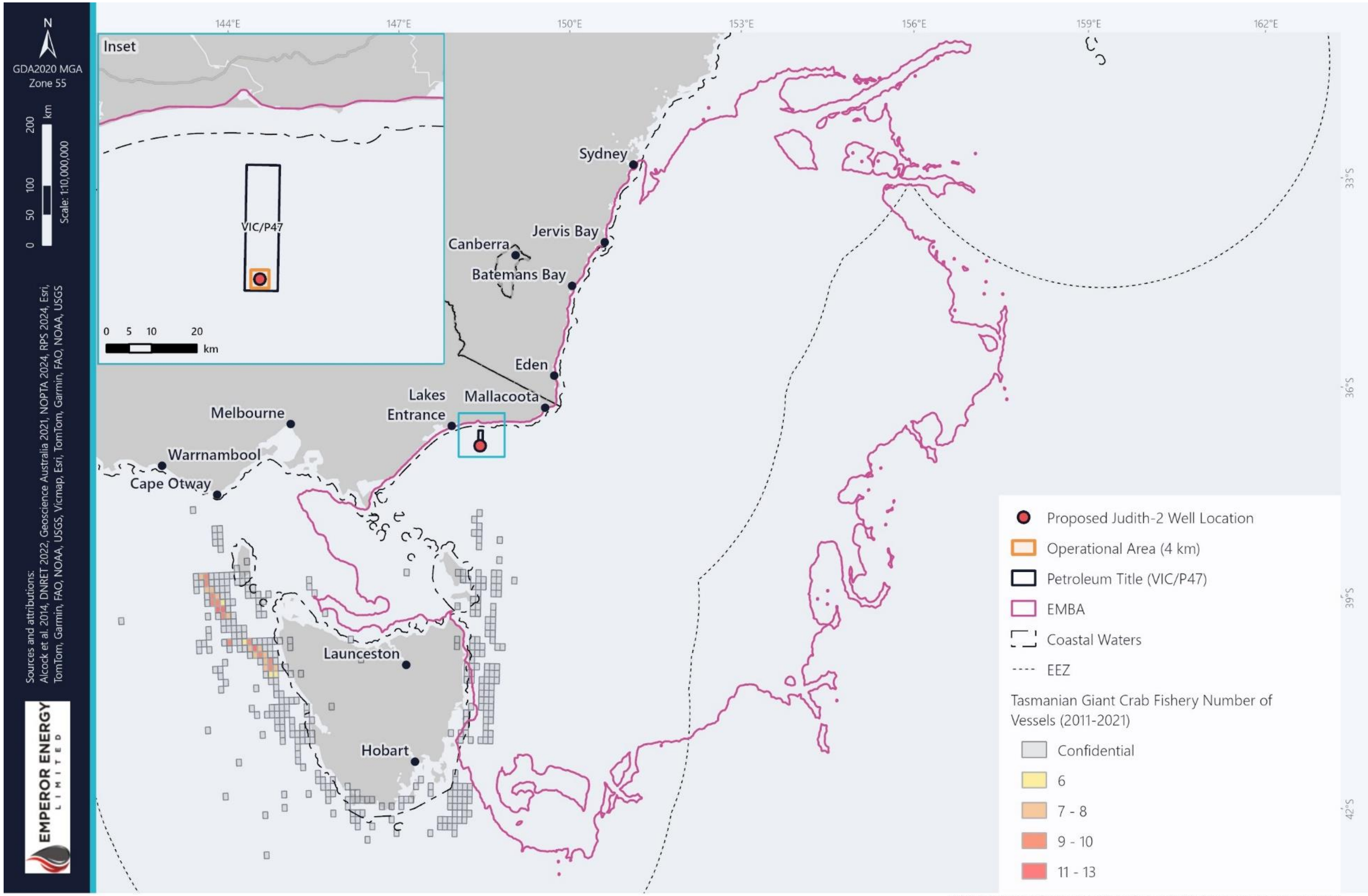

Figure 4-44: Tasmanian Giant Crab Fishery overlap with EMBA

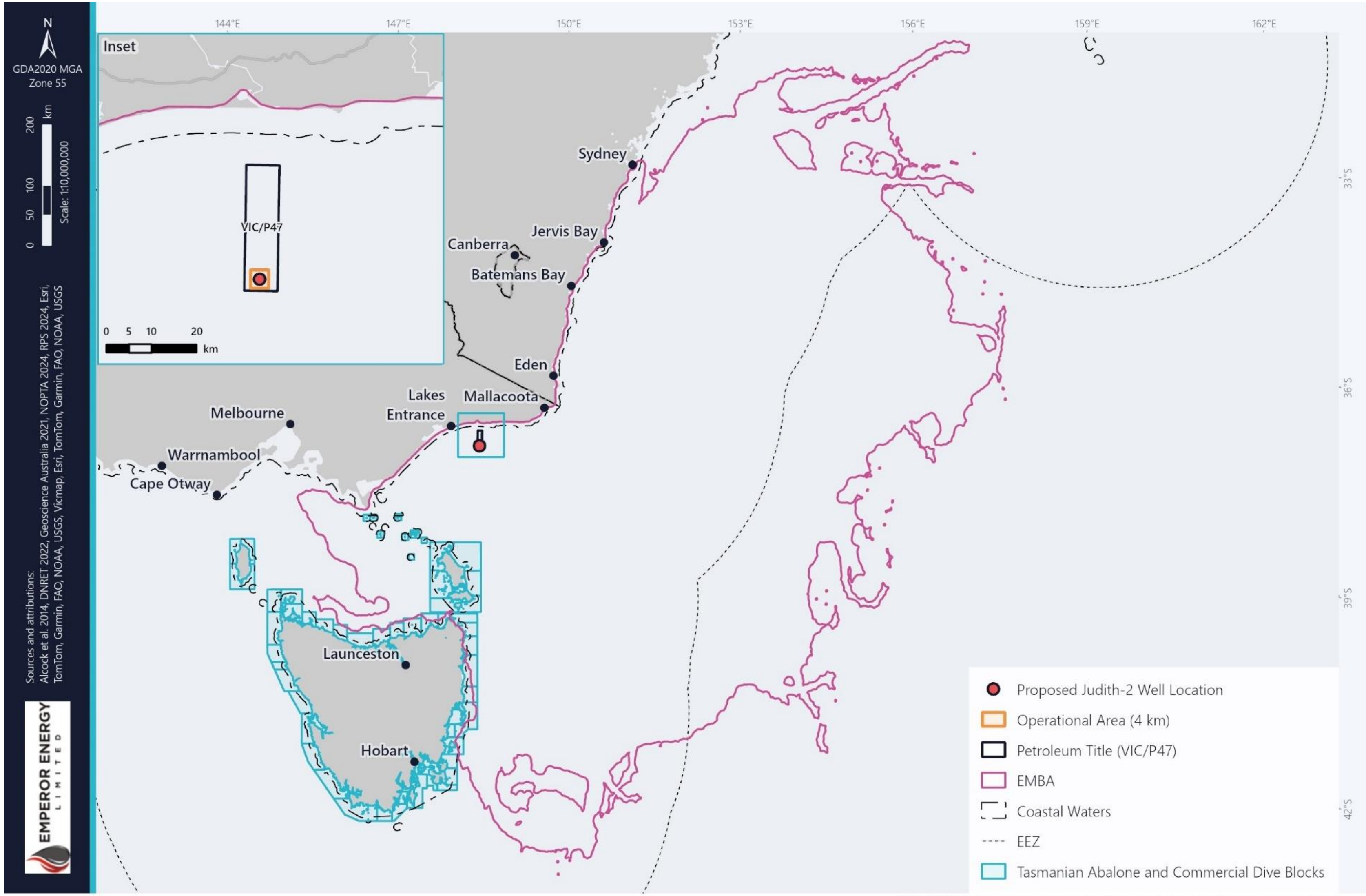

Figure 4-45 Tasmanian Abalone Fishery overlap with EMBA

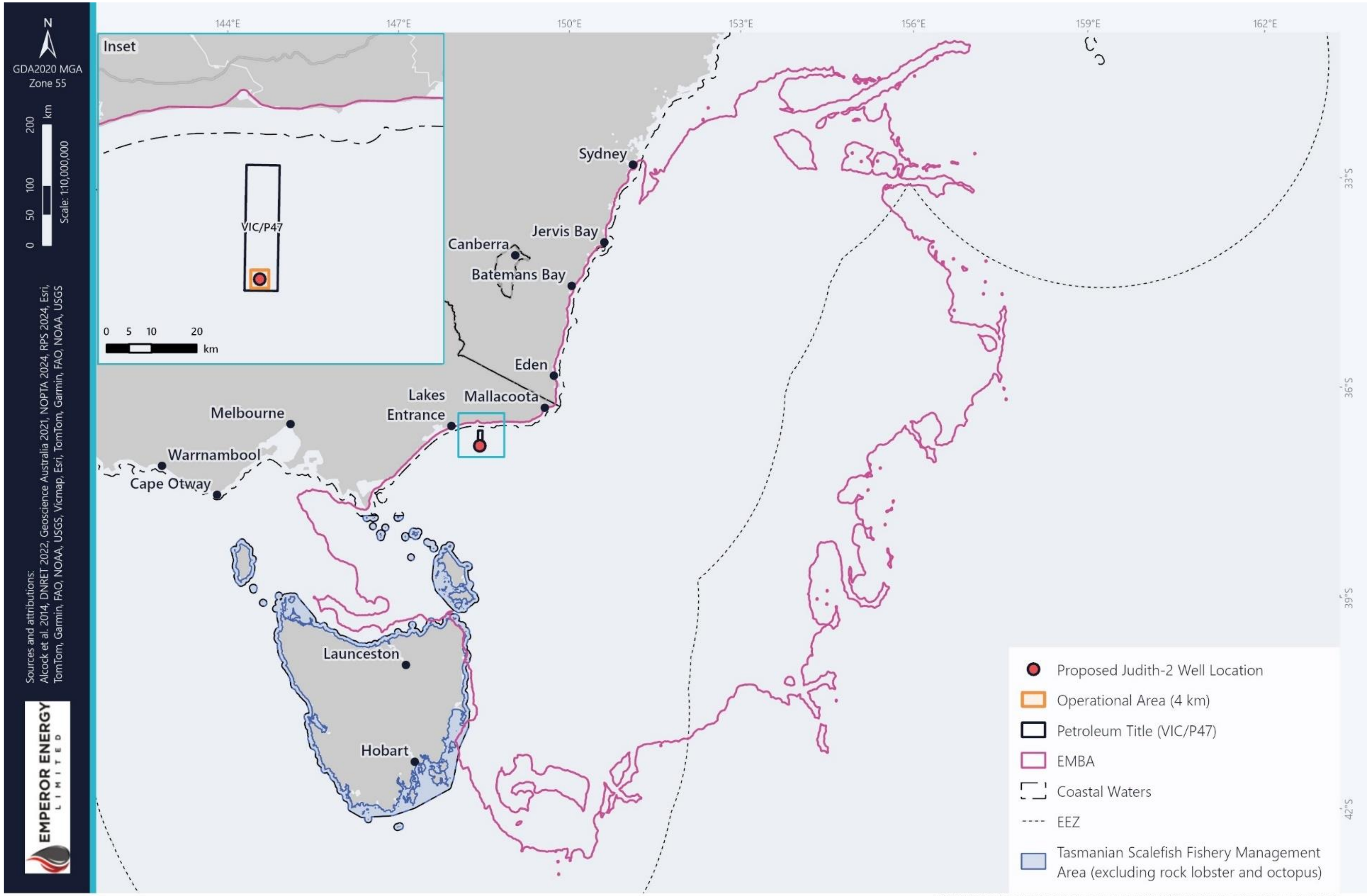

Figure 4-46 Tasmanian Scalefish Fishery overlap with EMBA

4.7.2.3. New South Wales

NSW state fisheries are managed by the Department of Primary Industries (DPI) under the State Fisheries Management Act 1994. DPI jurisdiction covers all waters that are within the limits of the state with additional offshore constitutional settlements for specific fisheries beyond state boundaries into Commonwealth waters.

Eight NSW-managed fisheries have management areas that intersect the EMBA (Table 4-18). Of these fisheries none have been identified to be active within the Operational Area between 2016 and 2021 with all nine known to be active within the EMBA.

Table 4-18: Description of NSW-managed Fisheries with management areas overlapping the Operational Area or EMBA

FISHERY	KEY TARGET / INDICATOR SPECIES	LICENCE AREA DESCRIPTION	FISHERY DESCRIPTION	SUMMARY OF MOST RECENT FISHING ACTIVITY	MANAGEMENT AREA OVERLAP		POTENTIAL FOR INTERACTION IN THE OPERATIONAL AREA
					OPERATIONAL AREA	EMBA	
NSW Managed Fisheries							
Lobster fishery	Eastern rock lobster (Sagmaraisus verreauxi)	The fishery extends from the Queensland border to the Victorian border and includes all waters under jurisdiction of NSW to around 80 miles from the coast.	Method: Large rectangular traps Licence: 99 shareholders Season: August 1st – May 3rd	Between 2019 and 2023 a total of 907 t was landed within the EMBA (Figure 4-47).	-	✓	✗ There is no potential for interaction in the Operational Area as the Operational Area lies outside NSW state waters.
Ocean Trap & Line fishery	Snapper (*Chrysophrys auratus*) Yellowtail kingfish (*Seriola lalandi*) Leatherjackets, Bonito (*Sarda australis*) Silver trevally (*Pseudocaranz georgianus*), Rubberlip (grey)	The fishery operates along the entire NSW coast, in continental shelf and slope waters.	Method: Variety of traps and lines with hooks Licence: 211 active businesses Season: Year-round	Between 2019 and 2023 a total of 5,884.7 t was landed within the EMBA (Figure 4-48).	-	✓	✗ There is no potential for interaction in the Operational Area as the Operational Area lies outside NSW state waters.

	morwong (*Nemadactylus douglasii*) Blue-eye trevalla (*Hyperoglyphe antarctica*) Sharks Bar cod (*Epinephelus ergastularius* Yellowfin bream (*Acanthopagrus australis*) Spanner crabs (*Ranina ranina*).						
Ocean Trawl fishery	Stout whiting (*Sillago robusta*) Red spot whiting (*Sillago flindersi*) Eastern king prawn (*Melicertus plebejus*) Eastern school prawn (*Metapenaeus macleayi*) Royal red prawn (*Hailporpides sibogae*) Tiger flathead (*Platycephalus richardsoni*)	There are two sectors to the fishery: the prawn trawl sector and the fish trawl sector which operate along the entire NSW coast, in continental shelf and slope waters.	Method: Otter trawl net Licence: 96 active businesses Season: Year-round	Between 2019 and 2023 a total of 11,606.4 t was landed within the EMBA (Figure 4-49).	-	✓	× There is no potential for interaction in the Operational Area as the Operational Area lies outside NSW state waters.

	Silver trevally (*Pseudocaranz georgianus*) Various species of sharks and rays, squid and octopus.						
Abalone fishery	Blacklip abalone (*Haliotis rubra*)	The fishery operates along the entire NSW coast between QLD and VIC	Method: hand collection Licence: 28 active businesses Season: Year-round	Between 2019 and 2023 a total of 6,223 t was landed within the EMBA (Figure 4-50).	-	✓	✗ There is no potential for interaction in the Operational Area as the Operational Area lies outside NSW state waters.
Estuary General fishery	Sea mullet (*Mugil cephalus*), Luderick (*Girella tricuspidata*), Yellowfin bream (*Acanthopagrus australis*), School prawn (*Metapenaeus macleayi*), Blue swimmer crab (*Portunus pelagicus*), Dusky flathead (*Platycephalus fuscus*),	The fishery operates along the entire NSW coast and is divided into seven regions	Method: Multi-method Licence: 600 fishing businesses Season: Year-round	Between 2019 and 2023 a total of 13,827,733.5 t was landed within the EMBA (Figure 4-51).	-	✓	✗ There is no potential for interaction in the Operational Area as the Operational Area lies outside NSW state waters.

	Sand whiting (*Sillago ciliata*), Pipi (*Donax deltoides*), Mud crab (*Scylla serrata*) and Silver biddy (*Gerres subfasciatus*)						
Estuary Prawn Trawl	School prawns and eastern prawns	The fishery operates in three main estuaries in NSW, the Clarence, Hawkesbury, and the Hunter River	Method: otter trawl nets Licence: capped at 309 active licences Season: October-May	Between 2019 and 2013 a total of 2,208.5 t was landed within the EMBA.	-	✓	✗ There is no potential for interaction in the Operational Area as the Operational Area lies outside NSW state waters.
Ocean Hauling fishery	Pilchards (*Sardinops sagax*), Sea mullet (*Mugil cephalus*), Australian salmon (*Arripis trutta*), Blue mackerel (*Scomber australasicus*), Yellowtail Scad (*Trachurus novaezelandiae*) and Yellowfin bream	The fishery operates in NSW state waters within 3 nautical miles of the NSW coast	Method: commercial hauling and purse seine nets Licence: 69 active businesses Season: Year-round	Between 2019 and 2023 a total of 13,879,372.1 t was landed within the EMBA (Figure 4-53).	-	✓	✗ There is no potential for interaction in the Operational Area as the Operational Area lies outside NSW state waters.

	(*Acanthopagrus australis*)						
Sea urchin and turban shell fishery	Black sea urchin (*Centrostephanus rodgersii*), Purple sea urchin (*Heliocidaris erythrogramma*), Red sea urchin (*Heliocidaris tuberculate*) and a variety of turban shells (*Turbo torquatus, Turbo militaris* and *Turbo undulatus*)	The fishery operates along the coast of NSW and is divided into five regions each with their own catch limits	Method: Hand collected Licence: 37 fishing businesses Season: Year-round	Between 2019 and 2023 a total of 798.9 t was landed within the EMBA (Figure 4-54).	-	✓	✗ There is no potential for interaction in the Operational Area as the Operational Area lies outside NSW state waters.
S37 Permit	Includes: -collection of marine vegetation -aquarium collection -scientific collection -oyster collection	All miscellaneous permits are managed under Section 37. The fishery can operate along the coast of NSW	N/A	Between 2019 and 2023 a total of 1,118.9 t was landed within the EMBA (Figure 4-56).	-	✓	✗ There is no potential for interaction in the Operational Area as the Operational Area lies outside NSW state waters.

Source: DPI 2023 (personal communications, 24 May 2023); DPI 2023b

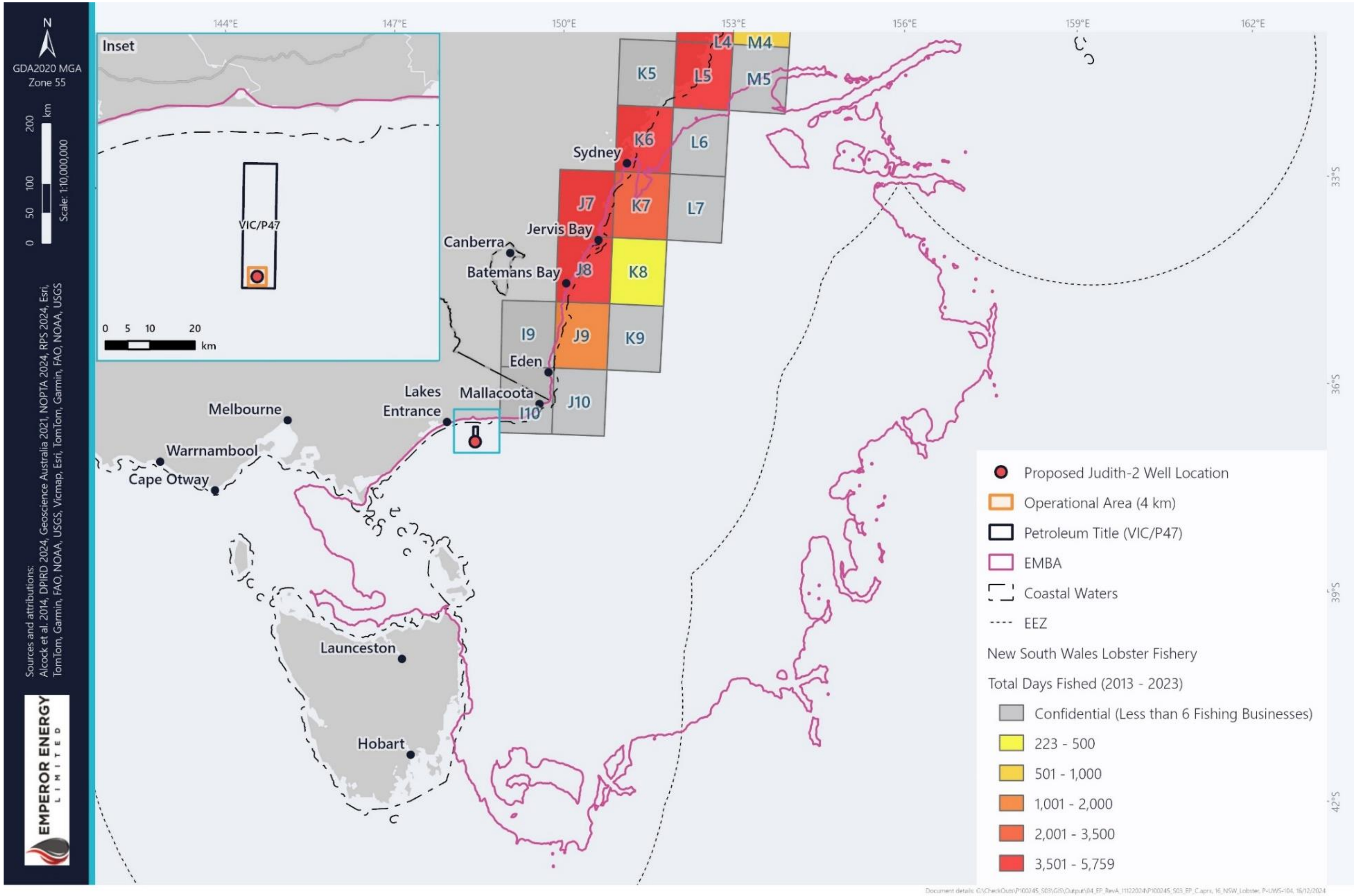

Figure 4-47: NSW Lobster Fishery and overlap with EMBA

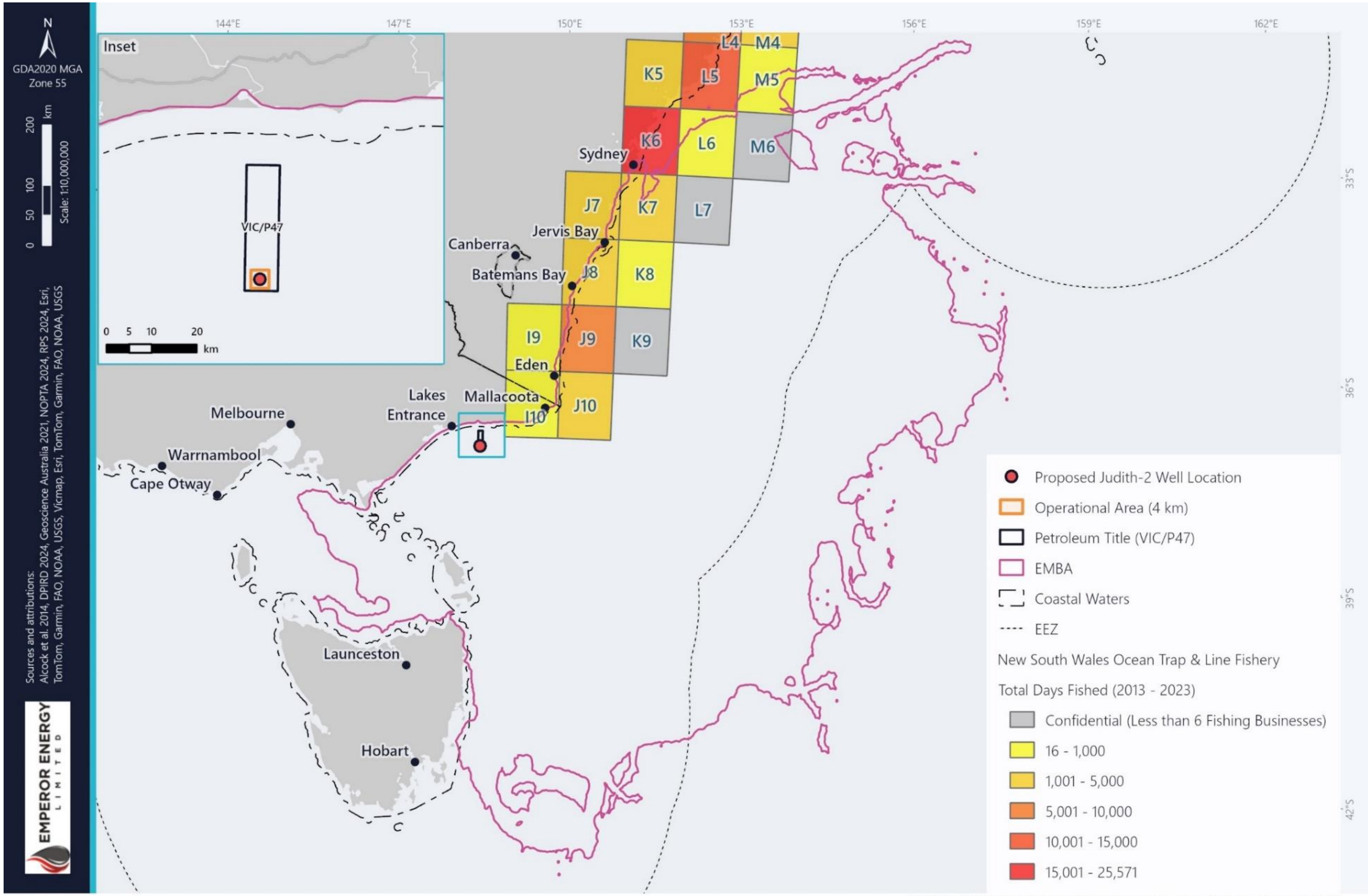

Figure 4-48: NSW Ocean Trap & Line and overlap with EMBA

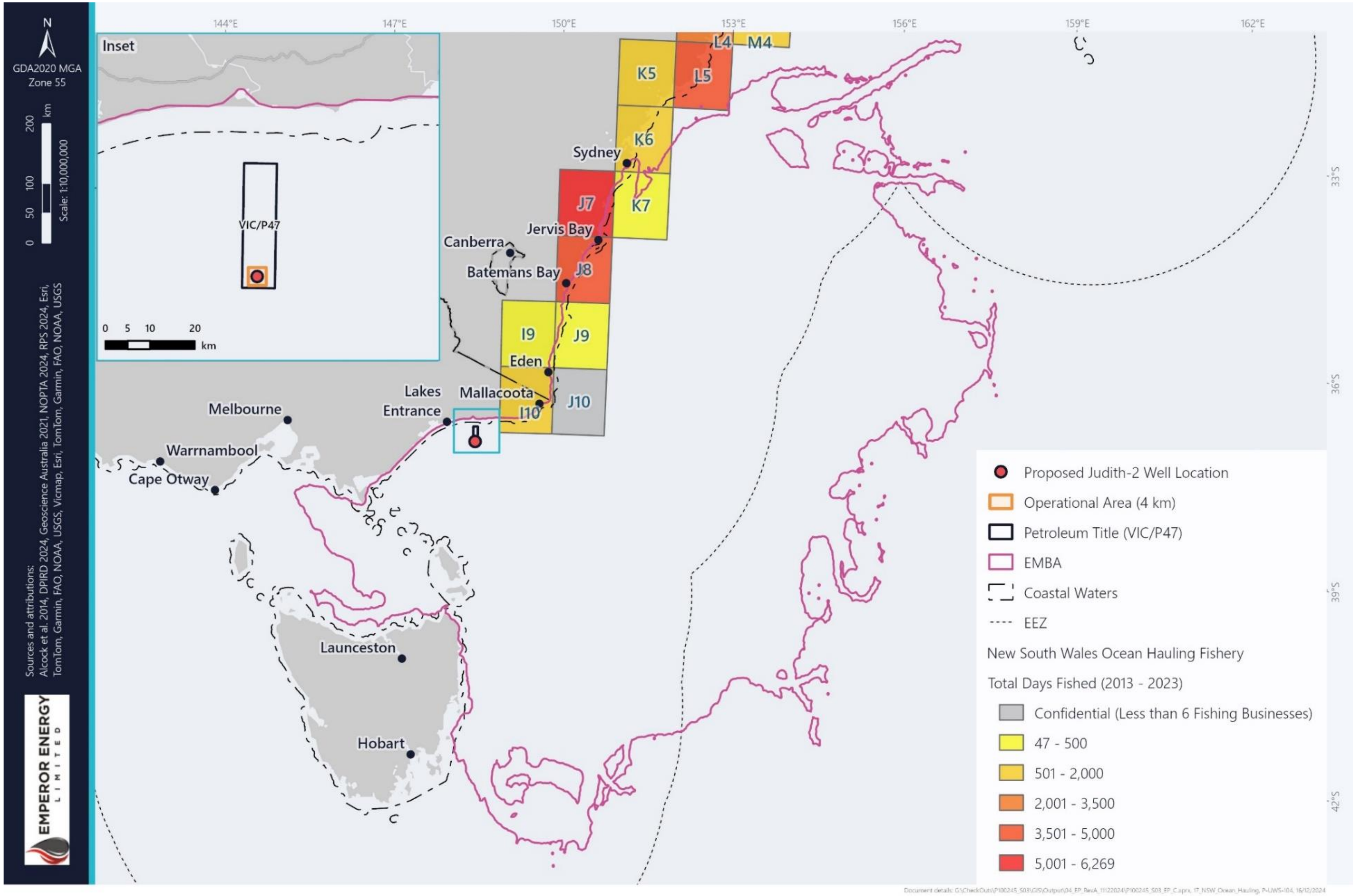

Figure 4-49: NSW Ocean Trawl Fishery and overlap with EMBA

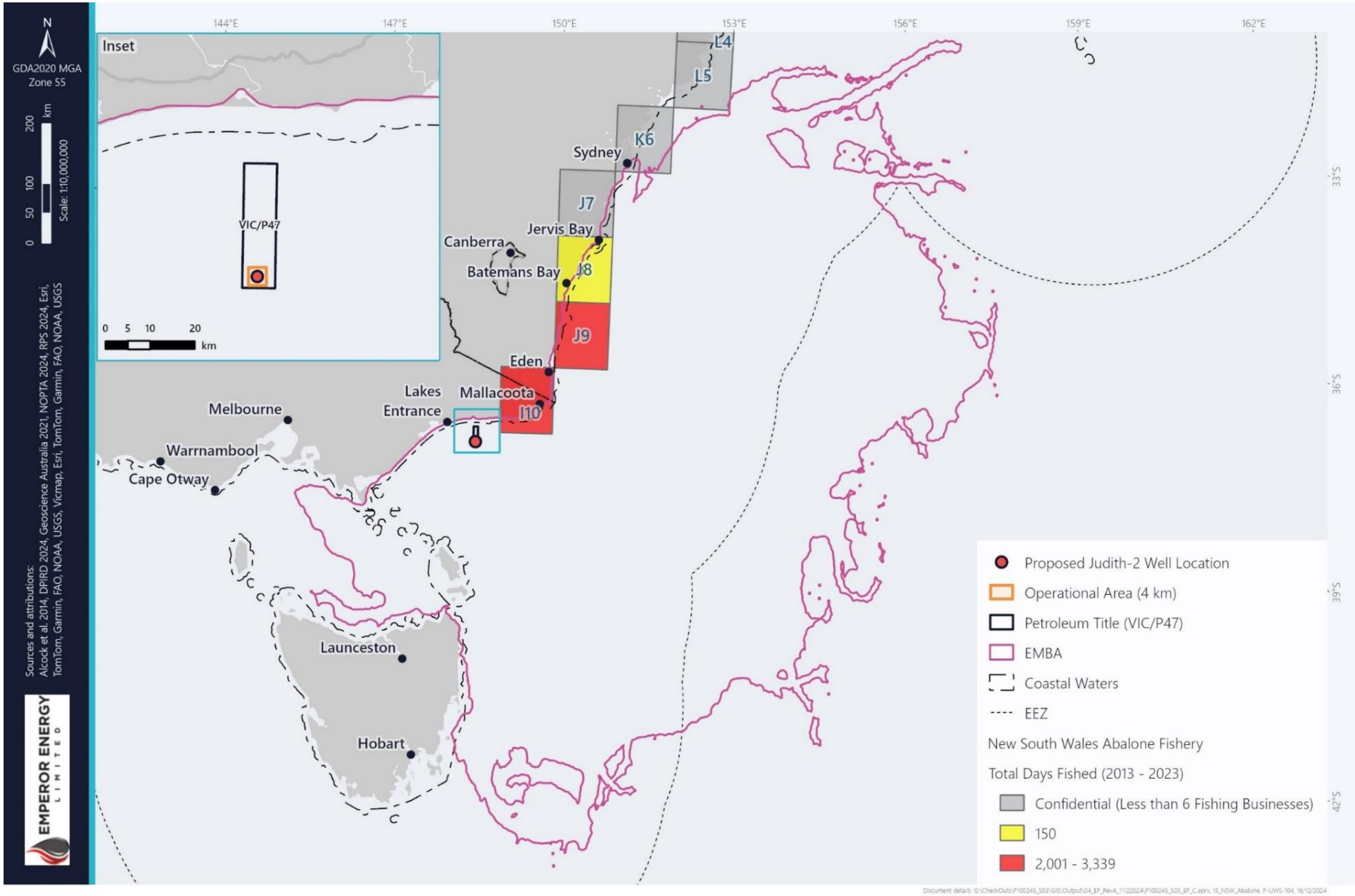

Figure 4-50: NSW Abalone Fishery and overlap with EMBA

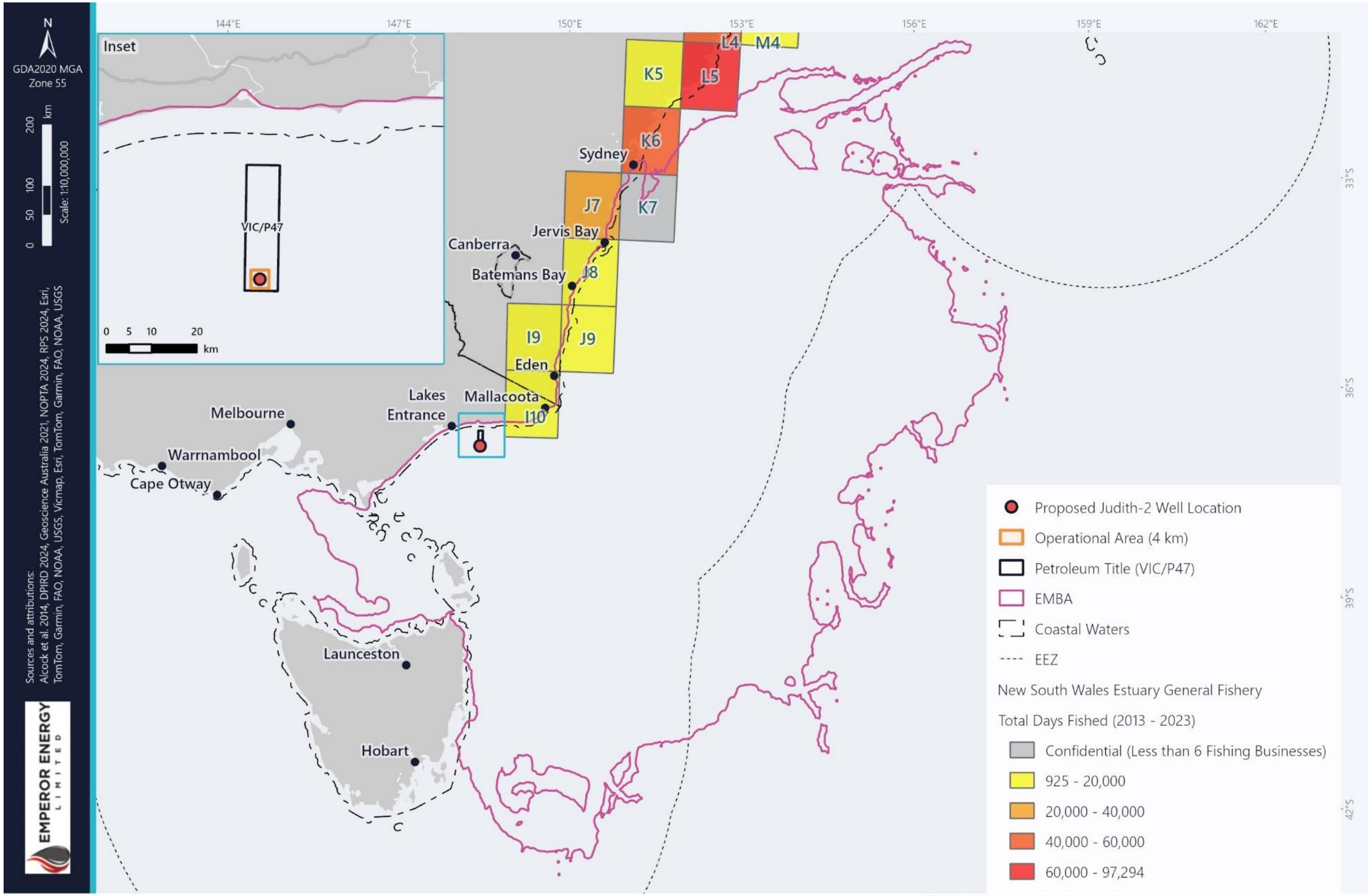

Figure 4-51: NSW Estuary General Fishery and overlap with EMBA

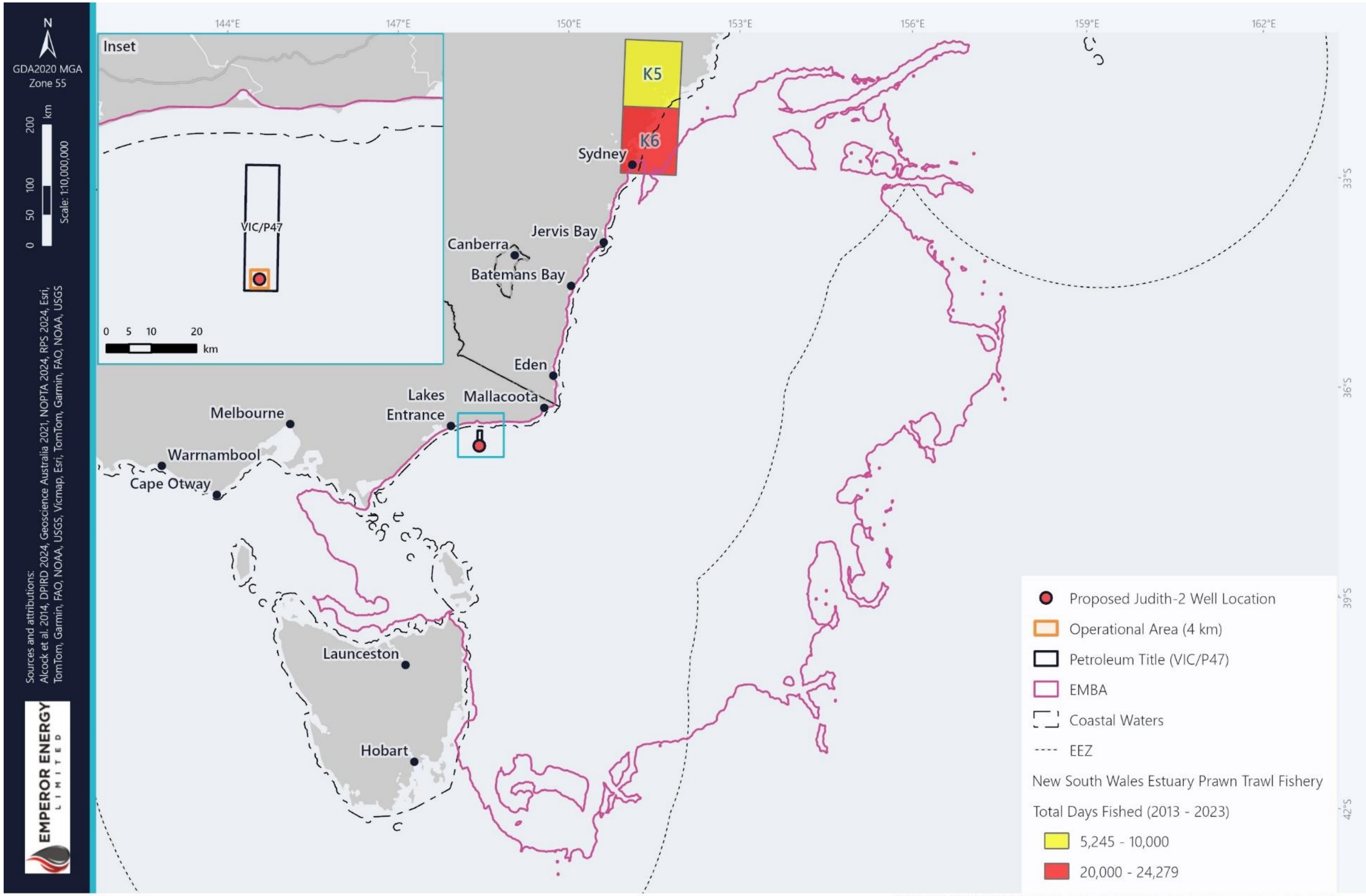

Figure 4-52 NSW Estuary Prawn Trawl Fishery and overlap with EMBA

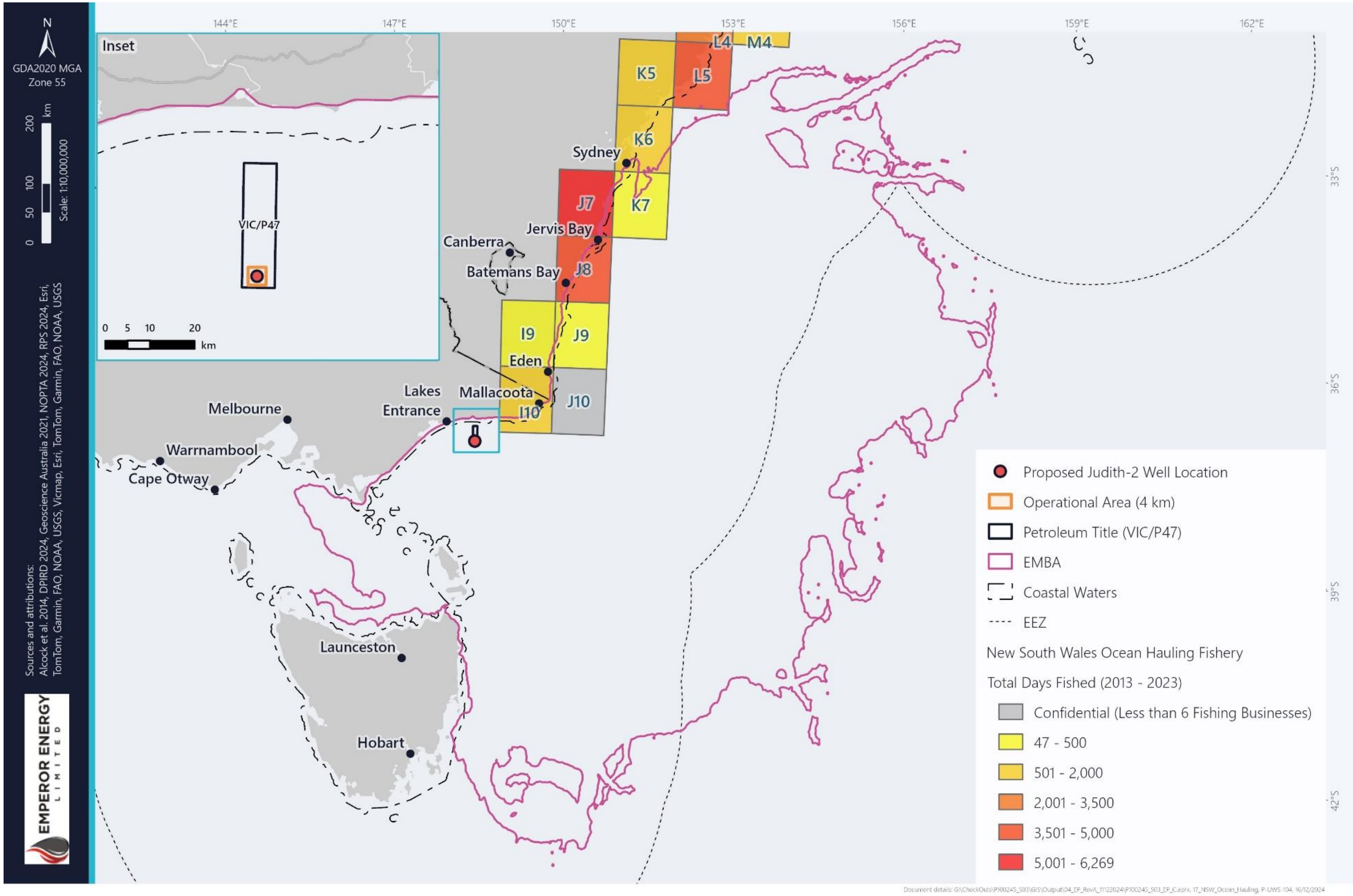

Figure 4-53: NSW Ocean Hauling Fishery and overlap with EMBA

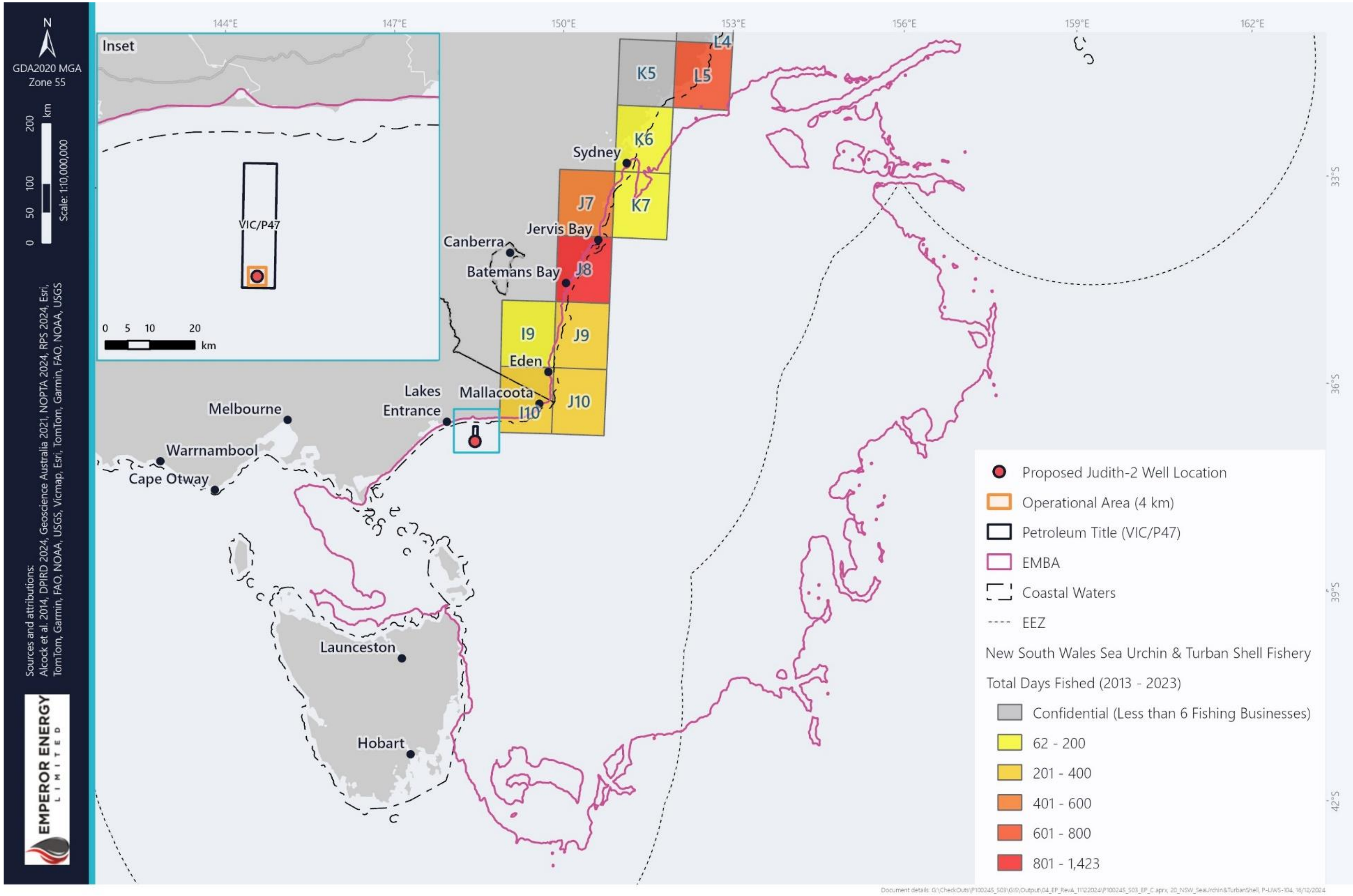

Figure 4-54: NSW Sea Urchin & Turban Shell Fishery and overlap with EMBA

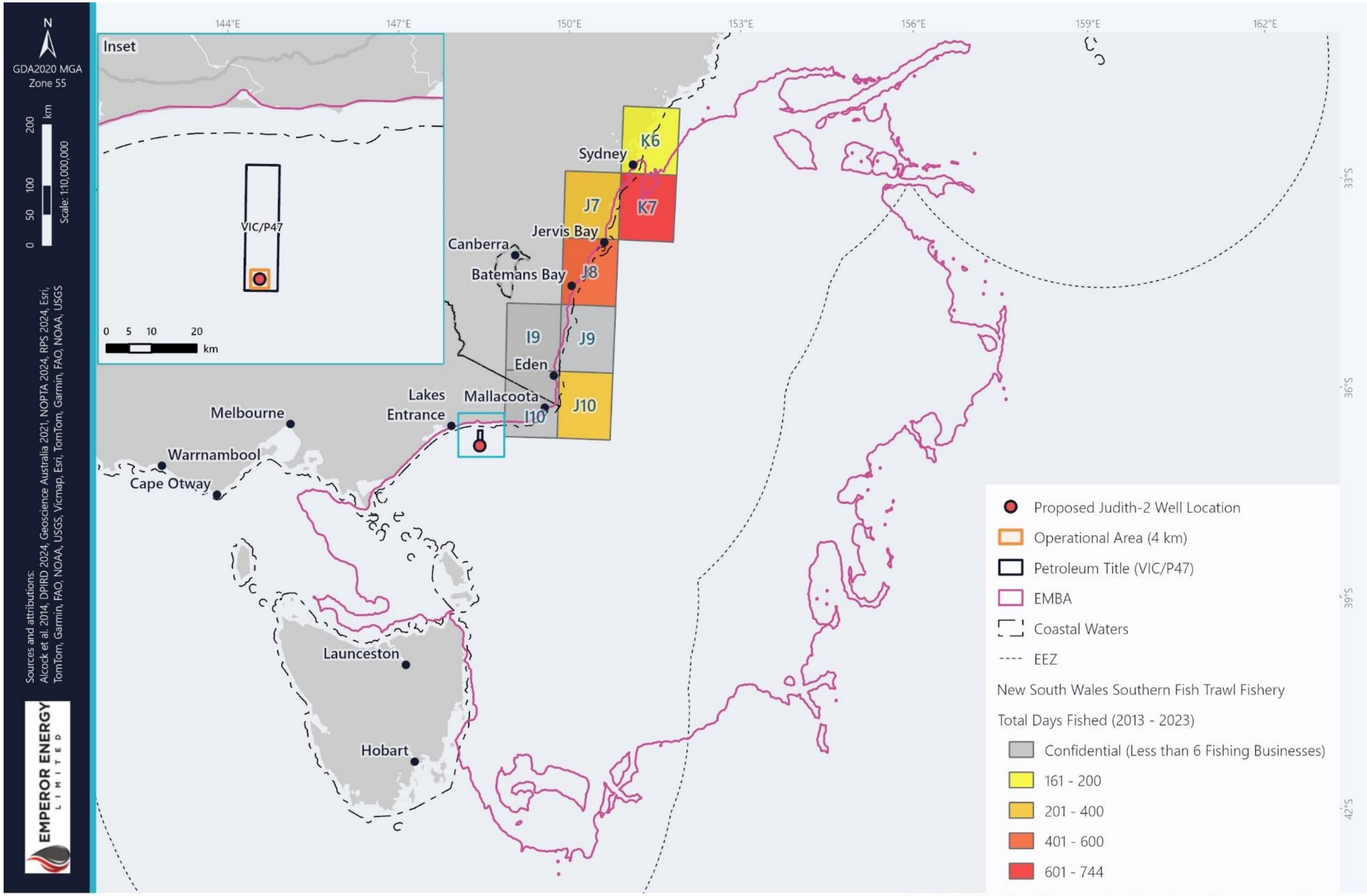

Figure 4-55: NSW Southern Trawl Fishery and overlap with EMBA

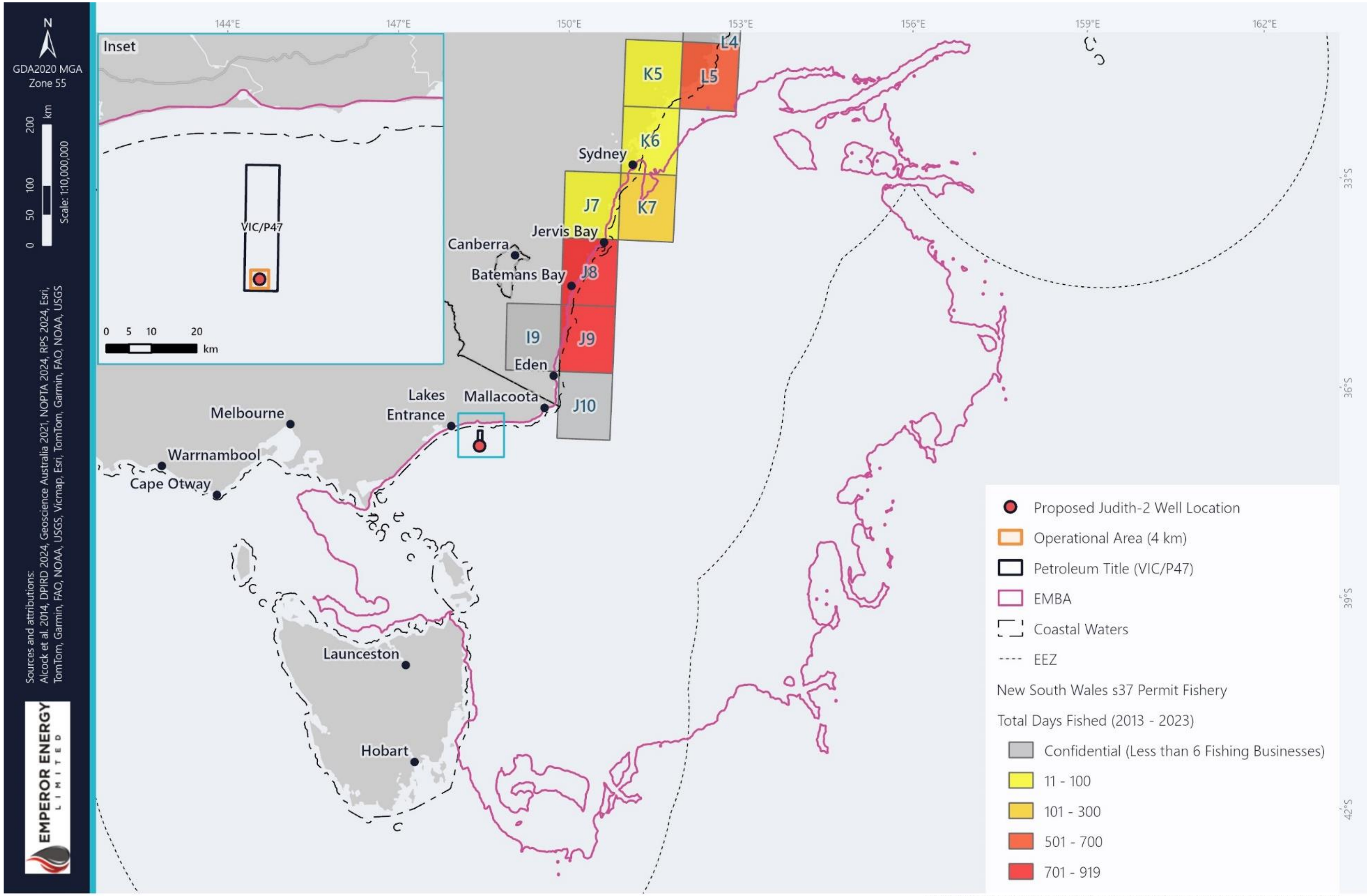

Figure 4-56: NSW s37 Permit Fishery and overlap with EMBA

4.7.3. Marine and Coastal Industry

4.7.3.1. Shipping

The south-eastern coast of Australia is one of the countries busiest in terms of shipping activity and volumes. There are no main commercial shipping routes located within the Operational Area, however there is high vessel activity within the EMBA, particularly along the NSW coastline (Figure 4-57). Two main ports, Port Kembla and Port Botany, are located within the EMBA. These ports provide essential services such as automotive vehicle imports and household goods which are supplied to Sydney residents. Other minor ports occur closer to the Operational Area, in Victoria, include the Port of Gippsland Lakes and the Port of Snowy River. These ports support commercial and recreational fishing industries as well as the tourism industry.

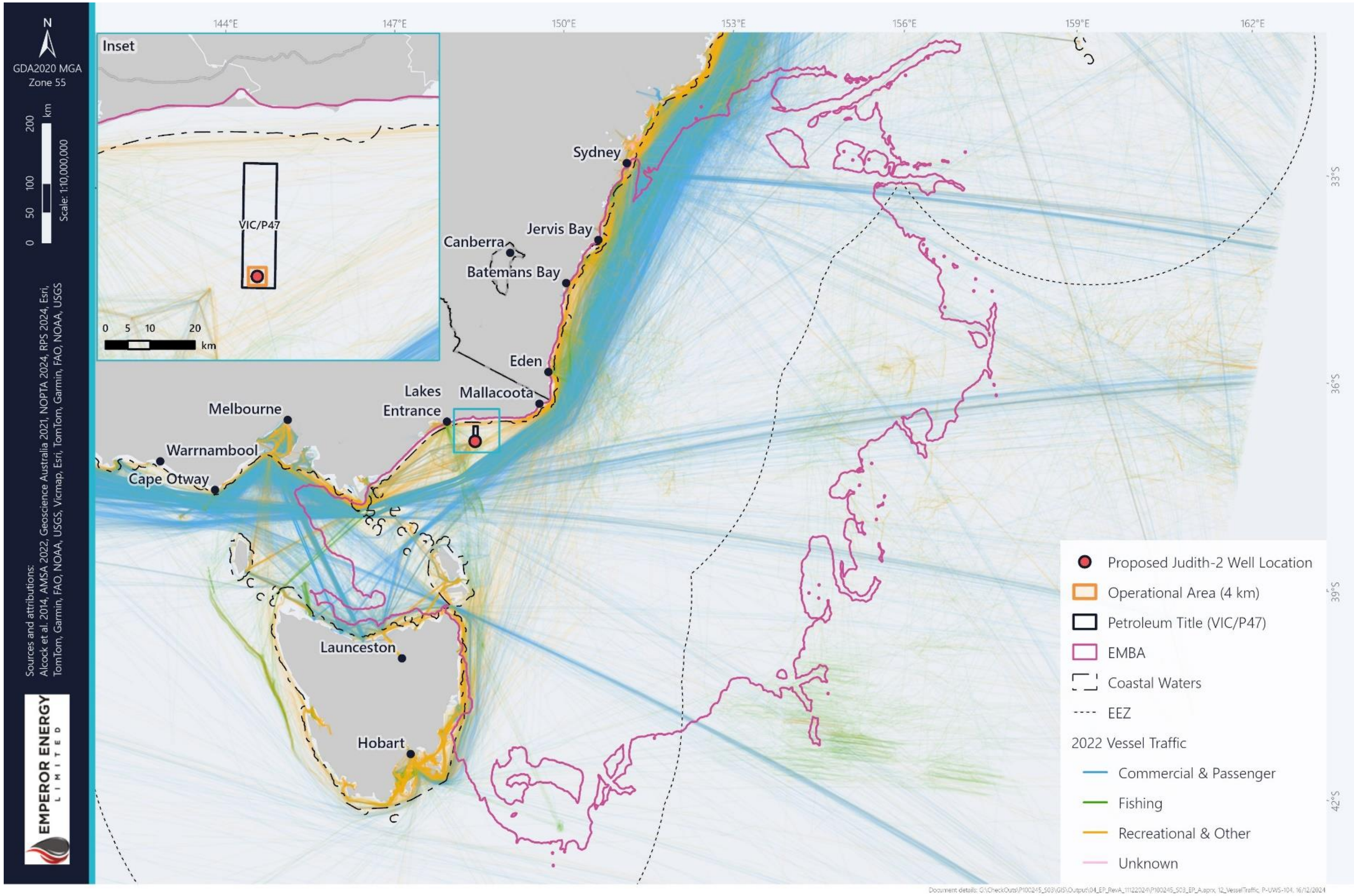

Figure 4-57: Commercial shipping activity within the EMBA

4.7.3.2. Offshore Energy Infrastructure

Oil and Gas

Petroleum infrastructure in Gippsland Basin is well developed, with a network of pipelines transporting hydrocarbons produced offshore to onshore petroleum processing facilities at Longford and Orbost. There is currently no oil and gas infrastructure located within the Operational Area. However, there is one abandoned well (Judith-1), located in the south-east corner of the Operational Area which was drilled for exploration by The Shell Company of Australia in 1989 (NOPIMS 2023). The closest manned platform is Tuna operated by Esso Australia Pty Ltd and located 8 km southwest of the Operational Area.

Various oil and gas developments are located within the EMBA, primarily within the Gippsland Basin (Figure 4-58). These include developments owned and operated by titleholders include Cooper Energy Limited and Esso Australia Pty Ltd.

Renewable Energy

The *Offshore Electricity Infrastructure Bill* was introduced in Australia in 2021 and was shortly followed (August 2022) by an announcement from the Federal Government proposing six different areas for offshore renewable energy projects in Australian Commonwealth waters.

The first area declared suitable for development is located offshore Victoria and covers ~15,000 km^2 in the Bass Strait Gippsland region. The area runs from the south of Wilsons Promontory to Lakes Entrance. The Australian Government granted 12 feasibility licences for offshore wind projects in the declared offshore wind area in Gippsland in 2024 (DCCEEW, 2024b).

The Operational Area overlaps the eastern border of the Part 1 declared offshore wind area in Gippsland. Licence holders within Part 1 of the declared area include:

- Navigator North Project Pty Ltd
- Iberdrola Australia OW 2 Pty Ltd (Aurora Green)
- Blue Mackerel North Pty Ltd
- Gippsland Dawn OWP Project Pty Ltd (Gippsland Dawn)
- Great Eastern Offshore Wind Farm project Co Pty Ltd
- Star of the South Wind Farm Pty Ltd (SOTS)

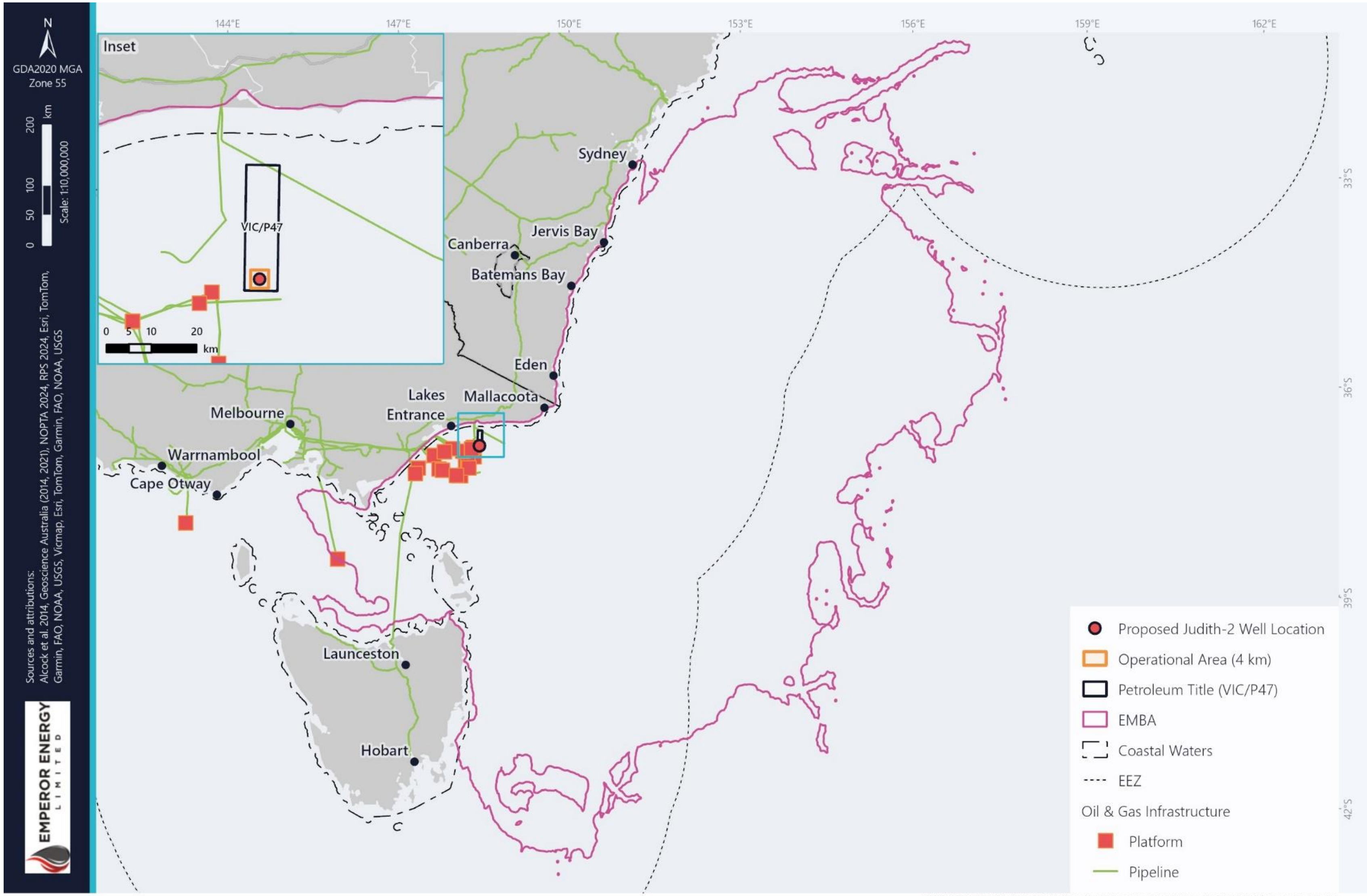

Figure 4-58: Oil and gas infrastructure within the EMBA

4.7.3.3. Defence

The south-east marine region has a rich history in the maritime defence of colonies, particularly in the second half of the nineteenth century. To this day the region is still important for a range of defence activities primarily associated with training exercises (CoA 2015). There are no practice, training or protected area located within the Operational Area. However, there are 9 restricted and prohibited defence sites and 30 UXO sites located within the EMBA (Figure 4-59). These range from sites with potential for interaction with unexploded ordinance to areas where sea dumping has occurred.

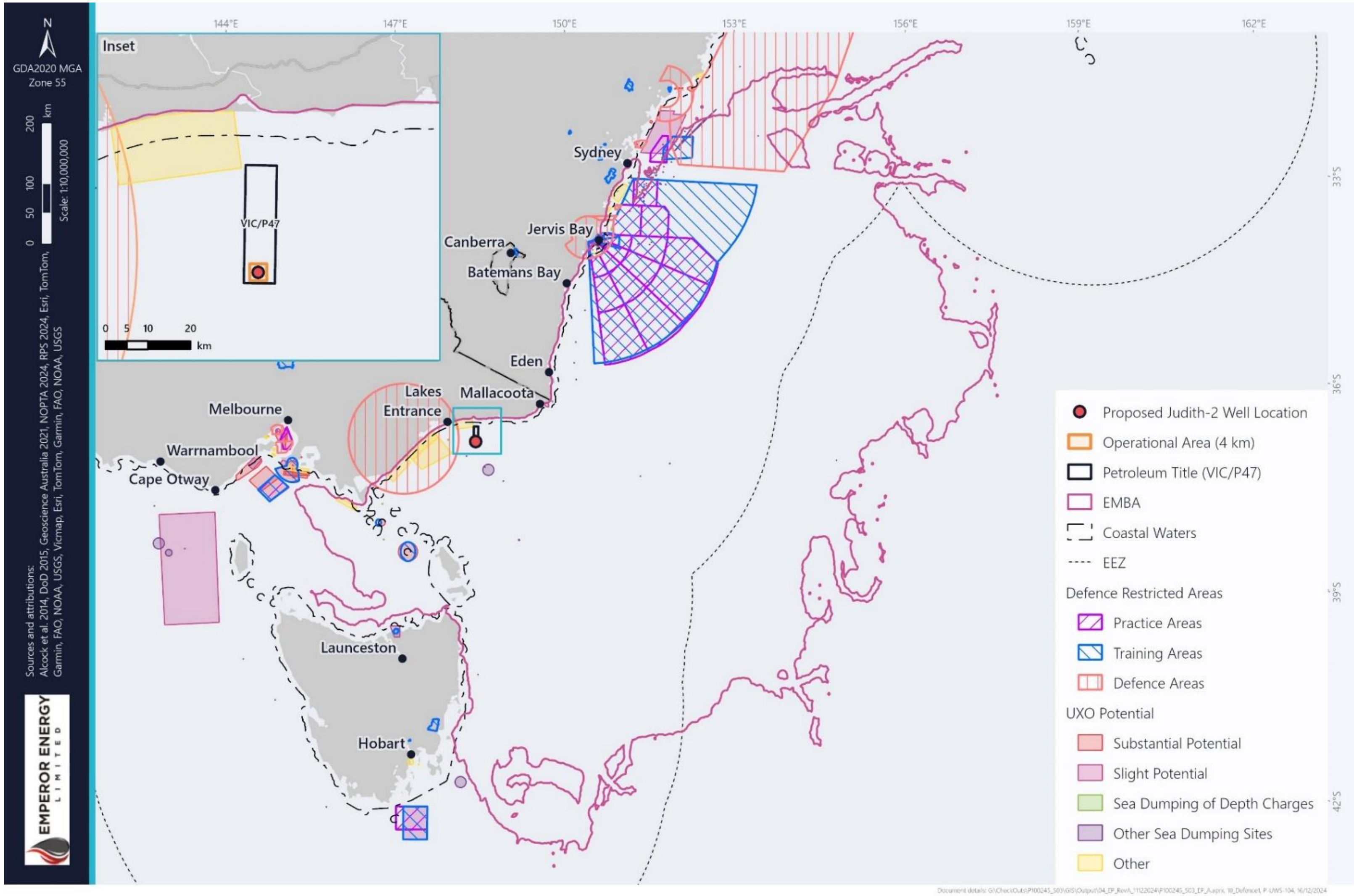

Figure 4-59: Defence activities within the EMBA

4.7.4. Tourism and Recreation

The Australian coast provides a diverse range of recreation and tourism opportunities, including scuba diving, charter boat cruises, and surfing. The Gippsland region is well known for its national parks which expand across region and cover a variety of landscapes which allow for a range of activities such as hiking, skiing, swimming and riding. In 2021 Destination Gippsland put in place a strategic plan which set a goal for the region to reach 9 million total overnight visitors and $1.3 billion in visitor expenditure by 2024. In 2022 the Gippsland region supported 5.63 million visitors which resulted in a total visitor expenditure of $1.57 billion (Destination Gippsland 2022).

In East Gippsland, primary coastal tourism locations include Marlo, Cape Conran, Ninety Mile Beach, Lakes Entrance and Mallacoota. The area is renowned for its nature-based marine tourism, recreational fishing, surfing, boating and sailing, scuba diving, and kayaking (East Gippsland, 2025). Water-based marine activities will intersect with the EMBA. However, marine-based tourism and recreation is unlikely to occur within the Operational Area given the depth of the Operational Area, lack of seabed features, and distance from the shore

4.7.5. Underwater Cultural Heritage

The *Underwater Cultural Heritage Act 2018* covers the protection of Australians underwater cultural heritage including shipwrecks, sunken aircraft, relics as well as other forms of underwater cultural heritage. A search of the Australian Underwater Cultural Heritage Database identified no items within the Operational Area. However, over 100 items were identified within the EMBA, all of which are shipwrecks, the majority of which are considered historic (>75 years old). 19 Historic shipwrecks within 50 km of the Operational Area are listed in Table 4-19.

Table 4-19: Shipwrecks within 50 km of the Operational Area

SHIPWRECK	YEAR	LOCATIONS
Leven Lass	1854	Bass strait, off Gippsland Coast
Talark	Unknown	58km SSE Lakes Entrance
Result	1880	Bass Strait
Favourite	1852	Bass Strait
Neptune	1889	Peral Point
General	1890	Pearl Point, East Gippsland Coast
Sydney Cove Longboat	1797	Ninety Mile Beach west of Cape Everard
Rostrevor	1919	West of Pearl Point
Albert San	1926	East Coast, Cape Conran, Beware Reef
Ridge Park	1881	Beware Reef, Cape Conran
Lady of the Lake	1880	Snowy River Entrance

Glengarry	1898	Marlo
Curlip	1919	Mouth of Snowy River at Marlo
Bogong	1896	West of the Snowy River Mouth
Wongrabell	1912	Snowy River Bar, Marlo
Falcon	1903	Snowy River Entrance, Marlo
Pomona	1866	Between Lake Tyers and Snowy River
Anne and Mary	1887	Bass Strait, off Lake Tyres
Unidentified: Lakes Entrance	1870	Eastern Beach, Lakes Entrance

Source: DCCEEW 2023

4.7.6. First Nations Cultural Heritage

4.7.6.1. History of Sea Country

First Nations people hold strong connections to the south-east marine region and have occupied coastal land and waters for over 40,000 years (CoA, 2015). During recent ice age periods, with the last approximately 12,000 years ago, sea levels were significantly lower, and the coastline extended a significant distance seaward of its present location which enabled occupation and travel across a land bridge between Tasmania and the mainland that are now submerged (National Museum Australia 2022). However, after the last ice age approximately 12,000 years ago this land became submerged underwater and has since been a barrier between the two landforms (National Museum Australia 2022). This barrier is now known as the Bass Strait. Although the land is now deep underwater First Nations people's relationship and responsibility to the land continues.

The coastal areas were amongst the most densely populated regions of pre-colonial Australia due to the richness and convenience of both terrestrial and marine resources (Gunaikurnai Land and Waters Aboriginal Corporation [GLaWAC] 2023). First Nations communities believe there is no distinction between the land and sea and consider it all to be a part of Country. Coastal waters were essential gathering places for people to live as well as launching places for expeditions to sea to gather resources GLaWAC 2023). Through cultural traditions, First Nations people maintain culturals connection to ancestral lands and waters, termed Country and Sea Country and use coastal areas and waters for food resources and cultural practices and traditions and maintain cultural obligations to care for Country (GLaWAC 2015). The Gunaikurnai, Monero and the Bidhawel (Bidwell) First Nations people are recognised as the traditional custodians of the Country and Sea Country within the East Gippsland Shire. The Gunaikurnai people have an approved non-exclusive native title area extending from West Gippsland in Warragul, east to the Snowy River and north to the Great Dividing Range; and 200 m offshore.

In 2022 the Gunaikurnai Land and Waters Aboriginal Corporation signed an agreement with the Federal Government to begin the process of establishing a Sea Country Indigenous Protection Area (IPA) from Nanjet, east of Wilsons Promontory, to Mallacoota, on the Vic/NSW border (GLAWAC 2023). This voluntary agreement would see that the management of the sea, or land and sea, occurs in partnership with First Nations people and others in order to protect cultural and environmental values.

4.7.6.2. Native Title

In 1993 the *Native Title Act* was passed by the Commonwealth Government. This act provides recognition of the rights and interests Aboriginal and Torres Strait Islander peoples have for Country and Sea Country. No native title claims, or determinations have been registered within the Operational Area. However, there are two registered claims and one determination (Figure 4-60) within the EMBA which are listed in Table 4-20.

Table 4-20: Native title claims and determinations within the EMBA

APPLICANT	STATE	STATUS	DETAIL
South Coast People (NC2017/003)	NSW	Active	Claim covers 16,807.7 km^2 of the southern NSW coast from Eden to Sydney Claim was accepted for registration (01/2018)
Gunaikurnai People (VCD2010/001)	VIC	Determined	Determination covers 13,842 km^2 of the eastern Victorian coastline in the Gippsland region. The native title was granted in 2010

			Includes 200 m offshore along the coastline
Boonwurrung People (VC2020/001)	VIC	Active	Claim covers 13,077.8 km^2 of the southern coast of Victoria, generally in the coastal district of Melbourne, including Wilson's Promontory Claim was denied registration (07/2020) Claim was sent for reconsideration and denied again (03/2021)
There are no registered claims or determinations in Tasmania			

Source: NNTT 2023

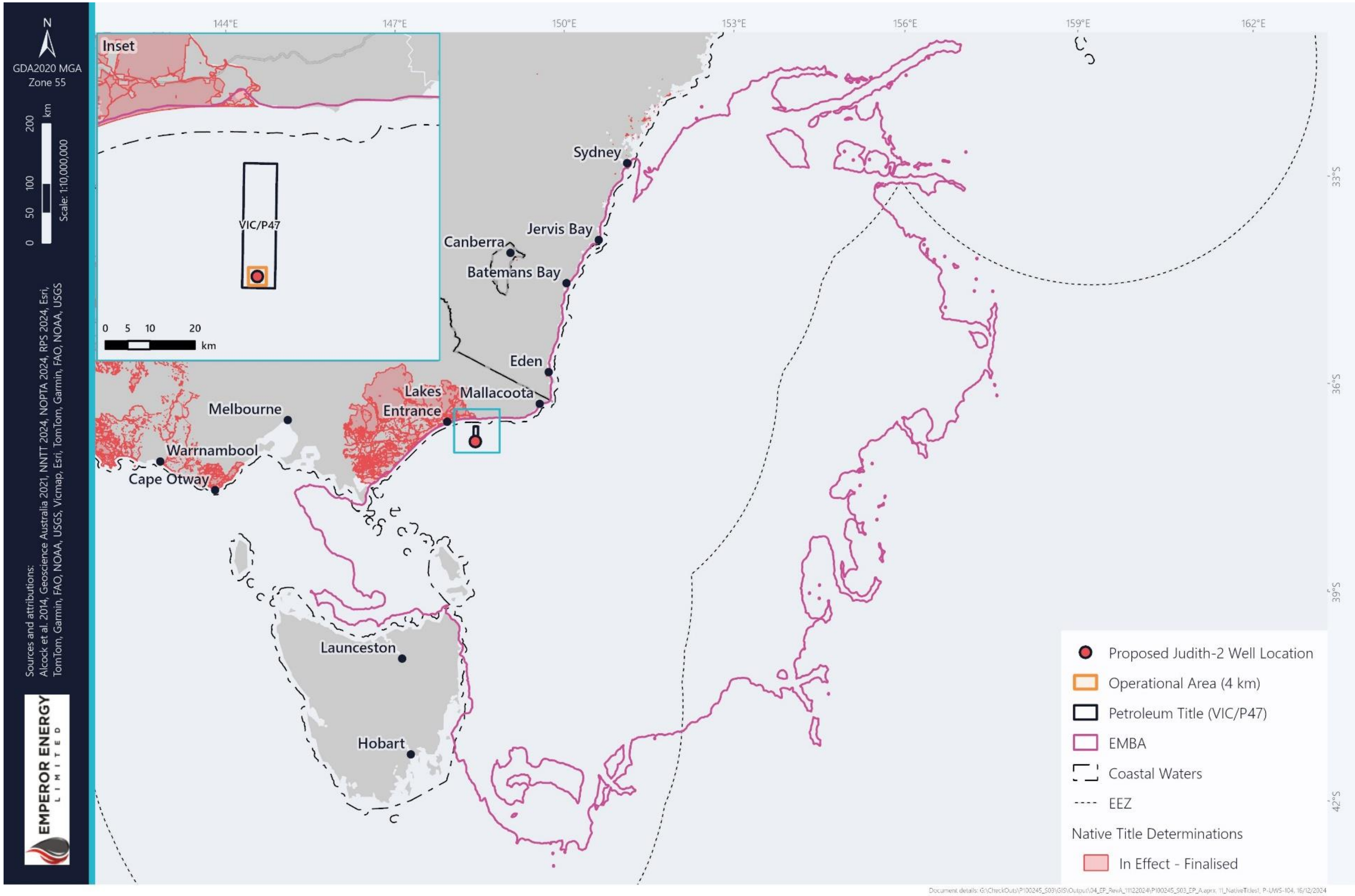

Figure 4-60: Native Title Determinations within the EMBA

4.7.6.3. Indigenous Land Use Agreements

Indigenous Land Use Agreements (ILUAs) are voluntary agreements between native title parties and other bodies about the use and management of areas of land and/or waters. No ILUAs have been registered within the Operational Area. However, there are three registered ILUAs within the EMBA which are detailed in Table 4-21.

Table 4-21: Indigenous Land Use Agreements within the EMBA

NAME	STATE	STATUS	DETAIL
Twofold bay (NI2001/003)	NSW	Registered	ILUA covers 38 km^2 south of Eden partially overlapping Twofold Bay on the southern NSW coast
Gunaikurnai Settlement ILUA (VI2010/003)	VIC	Registered	ILUA covers 13,401 km^2 of the eastern Victorian coastline in the Gippsland region from Corner Islet to Orbost
Gunaikurnai and Icon Energy ILUA (VI2013/008)	VIC	Registered	ILUA covers 855 km^2 of the eastern Victoria coastline in the Gippsland region from Langsborough to Ninety Mile Beach
There are no registered ILUAs in Tasmania			

Source: NNTT 2023

4.7.6.4. Indigenous Protected Areas

Indigenous Protected Areas (IPAs) represent more than 50% of Australia's Natural Reserve System and are areas of land and sea that are managed for biodiversity and conservation. IPAs deliver environmental, cultural, social and economic benefits through agreed management plans. In 2022, the Australian Government committed to extending the Sea Country IPAs program and announced 10 successful Sea Country IPA consultation projects which will support Indigenous led management of Sea Country (DCCEEW, 2022b). Two IPA consultation projects are located within the EMBA (Figure 4-61) and are described below.

Nanjit to Mallacoot Sea Country IPA Consultation Project

The Nanjit to Mallacoot Sea Country IPA consultation project, managed by the Gunaikurnai Land and Waters Aboriginal Corporation is located within the Gippsland region of Victoria within the EMBA. Conservation values within the area comprises of coastal parks and includes the Ramsar listed Gippsland Lakes and Raymond Island which are culturally significant sites (Section 4.6.4). This proposed IPA includes areas and resources of cultural significance which continue to be maintained by First Nations people of the area (DCCEEW, 2022b).

tayaritja Sea Country IPA Consultation Project

The tayaritja Sea Country IPA consultation project, managed by the Tasmanian Aboriginal Centre, is located in the north-east Tasmanian waters and will link 5 existing island IPAs and other islands. RANSAR wetlands and ecologically significant coastal habitats are located within the project. The IPA staff will rehabilitate, restore, monitor and evaluate significant marine ecosystems to help protect threatened marine animals, seabirds and over 120 plant species (DCCEEW, 2022b).

Figure 4-61: Sea Country Indigenous Protected Areas Program – Consultation Projects (DCCEEW, 2022b)

4.7.6.5. First Nations People's Values and Sensitivities

First Nations cultural values may include heritage sites and values that relate to First Nations people's traditional culture and customs. Cultural heritage refers to the knowledge, lore, practices, objects, places and people that are valued, culturally significant and connected to the identity of Country. Cultural heritage has been passed down from Ancestors to future generations and shapes identity and is fundamental to the wellbeing of First Nations people and connecting communities. Traditional Owners are custodians of culturally significant values that govern cultural practices, systems of belief, and maintain holistic relationships with Country (Victorian Aboriginal Heritage Council, 2021).

Values for First Nations groups within the EMBA are outlined in Table 4-22

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Table 4-22: First Nations people's heritage values within the EMBA

FIRST NATIONS PEOPLE'S HERITAGE VALUES	DEFINITION	GUNAIKURNAI (GUNAIKURNAI LAND AND WATERS ABORIGINAL CORPORATION 2015)	BUNURONG (BUNURONG LAND COUNCIL ABORIGINAL CORPORATION 2024A; BIOSIS 2023)
Connection to Sea Country	First Nations people maintain strong connections to traditional lands, waters, and culture (Biosis, 2023). Sea Country is an intrinsic value for First Nations who have managed Sea Country for thousands of years. Sea Country includes coastal waters and habitats, encompasses all living things and places (CSIRO 2002). First Nations Reconciliation Action Plans (RAPs) have defined areas which extend to coastal waters. However, Sea Country may include areas that extend beyond formally defined RAPs to include the sea and submerged lands extending to the continental shelf	Gunaikurnai people have occupied and managed coastal areas for thousands of years, including lands that area now submerged. Sea Country encompasses marine food resources, places to live and hunt, and practice cultural traditions	The Bunurong RAP group includes Mornington Peninsula, Western Port and the eastern most part of South Gippsland. There are a total of 677 registered shell midden sites found within 200 m of the shorelines which shows the long-lived relationship Bunurong people have had with the Bunurong coastlines (Biosis 2023).
Cultural obligations to care for Country and Sacred Areas	First Nations people are culturally obligated to care for and protect Country for present and future generations. Roles of caring for Country varies depending on First Nations groups and regions (Gunaikurnai Land and Waters Aboriginal Corporation, 2015)	The Gunaikurnai maintain customary rights and responsibility to care for sacred places and Country which provides in turn cares for Gunaikurnai people. Over 10,000 years ago the land between Tasmania and Victoria was connected by a land bridge. Marine Parks and reserves around Wilsons Promontory were terrestrial habitats and inhabited by First Nations ancestors. Wilsons Promontory has	The Bunurong people maintain connection to Country to preserve and protect the sacred lands and waterways of Bunurong Ancestors, places, traditional cultural, practices and stories (Bunurong Land Council Aboriginal Corporation, 2024)

		habitat that supports a diversity of marine flora and fauna, including culturally significant migratory shorebirds and fur seals.	
Knowledge Systems	First Nations knowledge is passed down from Ancestors to future generations. Knowledge systems are an intrinsic value of First Nations people and an important aspect of maintaining living culture. (Gunaikurnai Land and Waters Aboriginal Corporation, 2015)	Gunaikurnai people maintain customs and traditions which are passed through generations through song, dance, story, dreaming, and being on Country. Wilsons Promontory is a culturally significant site and valued for sharing intergenerational knowledge between Gunaikurnai people.	There is a large amount of registered shell midden sites within Bunurong Country which suggests knowledge systems of marine resources and an understanding of marine resources was used as practiced techniques by the Bunurong people to accumulate the amount of listed shell midden sites on Bunurong Country.
Culturally significant species – food resources	Fish and seafood are valued sources of food and hold significance for First Nations People (Gunaikurnai Land and Waters Aboriginal Corporation, 2015; NOO, 2002b).	Eels, bream, flathead, and pawns were and remain important food supplies for Gunaikurnai people. These resources are sources from freshwater and marine resources in Sea Country. Fishing and collecting of natural resources is valued by the Gunaikurnai and is a popular activity in the Gippsland Lake Coastal Park, among other locations in the region.	Bunurong country contains many shell midden sites along the coastline which indicates that high use of water based resources in the area.
Culturally significant species – whales, dolphins, seals, seabirds and shorebirds	Many Sea Country marine species such as whales, dolphins, seals, and seabirds are culturally significant for First Nations people (NOO, 2002b).	Wilsons Promontory Marine Park is recognised by the Gunaikurnai for the significant habitat it provides for a high diversity of marine plants, shorebirds, and fur seals.	Bunurong people maintain a connection to Sea Country, and continue to manage areas that provide habitat for culturally significant species including Australian Fur Seals at Phillip Island (Bunurong Land Aboriginal Corporation, 2024b).

5. ENVIRONMENTAL IMPACT AND RISK ASSESSMENT

To meet the requirements of the OPGGS(E) Regulations 21(5) and 21(6)– Evaluation of environmental impacts and risks, and 21(7) – Environmental performance outcomes and standards, this section evaluates the impacts and risks associated with the activity in accordance with the impact and risk assessment method (Section 2). The impact and risk assessment is appropriate to the nature and scale of each impact and risk and details the control measures that are used to reduce the risks to ALARP and an acceptable level.

Environmental Performance Outcomes (EPO), Environmental Performance Standards (EPS), and Measurement Criteria (MC) have been developed, described, and summarised in Section 5.7.

5.1.Impact and Risk Scoping

The context of the impact and risk assessment has been set through the description of the activity (Section 3) and identification of potential environmental receptors within the Operational Area and EMBA (Section 4). By considering the interactions between environmental aspects and the activity (Table 5-1), Emperor Energy has identified all impacts and risks to receptors which could potentially occur from the activity.

Impacts and risks resulting from each of these identified interactions were discussed at the project Environmental Impact Identification (ENVID) workshop and analysed further outside of the workshop where necessary to reduce uncertainty. The outcomes of this process, including consequence and likelihood evaluation, control measures identified, risk ranking and ALARP and acceptability determination, are provided in the following sections. EPOs, EPSs and measurement criteria are summarised in Section 5.7.

Within this section, impacts are framed as either a “Lower Order Impact” or a “Higher Order Impact”. All impacts are evaluated at the lower level until one or more factors trigger the impact to be evaluated at a higher level. These factors are:

- Uncertainty in the impact or risk assessment which requires further analysis, for example where modelling is required to understand the nature and scale of an impact.
- ALARP decision context B and above (refer to Section 2.2.4).
- Residual Risk Severity Moderate and above (refer to Section 2.2.3).
- Stakeholder concerns.

Higher order impacts require a higher order of evaluation, as described in the NOPSEMA Environment Plan Decision Making Guideline (N-04750-GL1721 A524696 December 2022).

The differentiation between higher and lower order impacts and risks is colour coded for each aspect-activity interaction in Table 5-1. The assessments of impacts and risks are provided in the following sections:

- Section 5.2 - Lower Order Impacts and Risks.
- Sections 5.3 –- 5.6 - Higher order Impacts and Risks.

EPOs and EPSs relevant to impacts and risks for oil spill response strategies are detailed in Section 6.

Table 5-1: Activity-Aspect Interactions

ACTIVITY		ASPECT													
		PHYSICAL PRESENCE		PLANNED EMISSIONS			PLANNED DISCHARGES				UNPLANNED INTERACTIONS		ACCIDENTAL RELEASE		
		SEABED DISTURBANCE	INTERACTION WITH OTHER USERS	LIGHT EMISSIONS	ATMOSPHERIC EMISSIONS	UNDERWATER SOUND EMISSIONS	DRILL CUTTINGS AND FLUIDS	HYDRAULIC FLUIDS AND CHEMICALS	CEMENT	OPERATIONAL DISCHARGES	INTERACTION WITH MARINE FAUNA	INTRODUCTION OF IMS	HAZARDOUS AND NON-HAZARDOUS MATERIALS	VESSEL COLLISION	LOSS OF WELL CONTROL
Site Surveys	Geophysical survey		✓			✓									
	Geotechnical survey	✓	✓			✓									
Drilling Activities	Well design					✓	✓								✓
	Contingency drilling activities														✓
	BOP install and function test							✓							
	Cementing operations								✓						
	Formation evaluation														
	Well test			✓	✓										
	Well P&A	✓						✓	✓						✓
	ROV survey														
Support Activities	MODU positioning	✓	✓												
	MODU operations		✓	✓	✓	✓				✓		✓	✓	✓	
	Vessel operations		✓	✓	✓	✓				✓	✓	✓	✓	✓	
	ROV operations	✓						✓							
	Helicopter operations					✓									

(green)	Lower order impact and risk
(yellow)	Higher order impact and risk

5.2.Lower Order Impacts and Risks

The assessment of lower order impacts and risks is provided in:

- Table 5-2 Planned Aspects, including;
  - Physical presence – seabed disturbance
  - Physical presence – interaction with other users
  - Emissions – light
  - Emissions – atmospheric
  - Planned discharge – drill cuttings and fluids
  - Planned discharge – hydraulic fluids and chemicals
  - Planned discharge – cement
  - Planned discharge – operational discharges
- Table 5-3 Unplanned Aspects, including,
  - Physical presence – interaction with marine fauna
  - Physical presence – introduction of IMS
  - Accidental release – hazardous and non-hazardous materials
  - Accidental release – vessel collision

5.2.1. Impact and risk assessment – planned aspects

Table 5-2: Impact and risk assessment – planned aspects

ASPECT	ACTIVITY	IMPACT	IMPACT / CONSEQUENCE EVALUATION	SEVERITY LEVEL	DEMONSTRATION OF ALARP				DEMONSTRATION OF ACCEPTABILITY	
					ALARP DECISION CONTEXT	CONTROL MEASURES	ADDITIONAL CONTROL MEASURES CONSIDERED	ALARP OUTCOME	ACCEPTABILITY ASSESSMENT	ACCEPTABILITY OUTCOME
PHYSICAL PRESENCE										
Physical presence – seabed disturbance	Site surveys Drilling activities Support activities	Change in habitat	<u>Benthic habitats and communities</u> Geotechnical survey, MODU positioning and well P&A activities may result in seabed disturbance causing a loss or change to benthic habitats and communities from: • the physical footprint of the CPT, core or sediment samples. • placement of anchors (semi-sub MODU), or • placement of jack-up footings (3). • wellhead cutting and removal. Disturbance to the seabed from the cut and removal of the wellhead below the mudline will be limited to the area immediately around the well. The area impacted is anticipated to be within the high impact zone within a 75 m radius of the well which is also contributed by seabed discharges from tophole drilling (Jones et al. 2021). The use of a semi-sub MODU compared to the jack-up option will result in the greater seabed disturbance footprint. Therefore, as a conservative estimate of total area of seabed disturbance is 4,680 m^2 based on: • Geotechnical sampling - 310 m^2 (Table 3-3) • Semi-sub MODU positioning - 360 m^2 per anchor and chain, 12 anchors in total (Section 3.7.1) • Wellhead removal – 50m^2 (Section 3.6.7). Any potential seabed disturbance will be limited to the Operational Area. Benthic habitat in the Operational Area is expected to comprise of sandy substrate devoid of large epibiota except for introduced screw shells and sponges (CEE Consultants 2003). No threatened benthic communities, protected areas or KEFs with benthic habitats and communities were identified within the Operational Area (Section 4). Benthic communities in the Operational Area, are expected to be limited to infauna communities related to sandy substrates highly represented within the Twofold Shelf bioregion (IMCRA 1998). Seabed disturbance of up to 4,680 m^2 of sandy substrate within the Operational Area is expected to result in localised injury / mortality of introduced screw shells and sponges and infauna communities highly represented within the Twofold Shelf bioregion. Seabed disturbance is therefore considered a localised impact to non-threatened benthic fauna with no potential to impact MNES. Ingole et al. (2013) and Bluhm (2001) cited in NERA (2018) suggests impacts to soft sediment communities are expected to be short-term, with conditions present to support re colonisation and recovery. Indirect impacts associated with the resuspension of sediment associated with sampling, MODU positioning well P&A activities is predicted to be temporary and localised around the area of disturbance.	1	A	CM 5: Planned System Maintenance CM 11: AGR Chemical assessment procedure CM 13: Use of WBM during drilling CM 14: No overboard discharge of whole SBM. CM 15: Residual materials management CM 16: Solids control equipment CM 17: Solids control equipment operator - to ensure monitoring. CM 18: Cementing procedures CM 19: Site surveys CM 20: Mooring analysis CM 21: MODU move and positioning plan	None identified	ALARP	No stakeholder objections or claims raised	Acceptable

ASPECT	ACTIVITY	IMPACT	IMPACT / CONSEQUENCE EVALUATION	SEVERITY LEVEL	DEMONSTRATION OF ALARP				DEMONSTRATION OF ACCEPTABILITY	
					ALARP DECISION CONTEXT	CONTROL MEASURES	ADDITIONAL CONTROL MEASURES CONSIDERED	ALARP OUTCOME	ACCEPTABILITY ASSESSMENT	ACCEPTABILITY OUTCOME
			Impacts to non-threatened epibiota (introduced screw shells and sponges) and infauna communities highly represented within the bioregion will be localised, with no long-term consequences. The predicted severity level to benthic habitats and communities from a change in habitats resulting from seabed disturbance activities has been evaluated as Slight (1).			CM 22: OPGGS Act				
	Drilling activities	Change in sediment quality	<u>Sediment quality</u> The cutting process during well plug and abandonment produces metal shavings (swarf), some of which remain on the seabed. Sediment quality within the Operational Area is expected to be of high quality with low background concentrations of trace metals and organic chemicals. Change in sediment quality from swarf deposits at the seabed will be limited to the area immediately around the well. The area impacted is anticipated to be within the high impact zone within a 75 m radius of the well which is also contributed by seabed discharges from tophole drilling (Jones et al. 2021). Change in sediment quality of the sandy substrate within the Operational Area is considered a localised and short-term impact. The predicted severity level to sediment quality from a change in sediment quality resulting from seabed disturbance activities has been evaluated as Slight (1).	1	A	CM 5: Planned System Maintenance CM 11: AGR Chemical assessment procedure CM 13: Use of WBM during drilling CM 14: No overboard discharge of whole SBM. CM 15: Residual materials management CM 16: Solids control equipment CM 17: Solids control equipment operator - to ensure monitoring. CM 18: Cementing procedures	None identified	ALARP	No stakeholder objections or claims raised	Acceptable

ASPECT	ACTIVITY	IMPACT	IMPACT / CONSEQUENCE EVALUATION	SEVERITY LEVEL	DEMONSTRATION OF ALARP				DEMONSTRATION OF ACCEPTABILITY	
					ALARP DECISION CONTEXT	CONTROL MEASURES	ADDITIONAL CONTROL MEASURES CONSIDERED	ALARP OUTCOME	ACCEPTABILITY ASSESSMENT	ACCEPTABILITY OUTCOME
	Site surveys Drilling activities Support activities	Change to the functions, interests or activities of other users	Cultural heritage values and sensitivities Sea Country extends areas that include the sea and submerged lands that extend to the continental shelf. Seabed disturbance has the potential to change the cultural heritage value of submerged landscapes if that disturbance is widespread and within those landscapes that feature within cultural practices. No known underwater culturally significant sites, benthic communities, or protected areas were identified within the Operational Area. Given the Operational Area and associated seabed disturbance is located away from reported culturally significant values and sensitivities. Disturbance to cultural heritage from seabed disturbance is considered to be a localised impact within the Operational Area. Impacts are assessed as Slight (1).	1	A	CM 19: Site surveys CM 20: Mooring analysis CM 21: MODU move and positioning plan CM 23: Dropped objects recovery procedure CM 24: Ongoing Consultation	None identified	ALARP	No stakeholder objections or claims raised	Acceptable
Physical presence – interaction with other users	Support activities Site Surveys	Change to the functions, interests or activities of other users	Commercial fisheries Interaction with other users will be limited to within the Operational Area. As detailed in Section 4.7, the following fisheries may be active in the Operational Area. 1. SESSF – Gillnet Hook and Trap Sector (Shark Gillnet sub-sector: low-medium) 2. SESSF – Commonwealth Trawl Sector (Otter-board trawl: low-medium) 3. SESSF – Commonwealth Trawl Sector (Danish seine: high) 4. Ocean Scallop Fishery (Victorian: low) MODU positioning and operations - While in position a 500 m PSZ will be maintained around the MODU, as required under the OPGGS Act. Where a semi-sub MODU is used for drilling activities, a 2 km radius around the mooring arrangement will be required to manage any potential snag or entanglement risk trawl fisheries (Danish Seine, Trawl Sector and the Victorian Ocean Scallop Fishery). Fishing activities will be restricted within the 500 m PSZ surrounding the MODU, for the duration of the drilling activities. Site surveys - While undertaking the geophysical surveys the survey vessel will be able to manoeuvre to avoid any commercial fishing vessels. For the geotechnical survey, while sampling is occurring a commercial fishing vessel would need to manoeuvre around the vessel as per any other stationary or slow-moving vessel. It is expected site surveys will take approximately 9 day to complete, presenting a potential short-term impact to fisheries. No stakeholder objections or claims raised. The outcome of stakeholder consultation confirms the functions, interests and activities of commercial fisheries may be affected by the temporary presence of the MODU PSZ and a 2 km area where the anchors are laid; if an anchored MODU is used. Therefore, the predicted severity level to commercial fisheries from a change to the functions, interests or activities resulting from the physical presence has been evaluated as Minor (2).	2	A	CM 22: OPGGS Act CM 23: Dropped objects recovery procedure CM 24: Ongoing consultation CM 25: Pre-start notifications CM 26: MODU PSZ CM 27: Navigation aids CM 38: MO 30: Prevention of collisions	None identified	ALARP	No stakeholder objections or claims raised	Acceptable
			Marine and coastal industry	1	A	CM 24: Ongoing consultation	None identified	ALARP	No stakeholder objections or claims raised	Acceptable

ASPECT	ACTIVITY	IMPACT	IMPACT / CONSEQUENCE EVALUATION	SEVERITY LEVEL	DEMONSTRATION OF ALARP				DEMONSTRATION OF ACCEPTABILITY	
					ALARP DECISION CONTEXT	CONTROL MEASURES	ADDITIONAL CONTROL MEASURES CONSIDERED	ALARP OUTCOME	ACCEPTABILITY ASSESSMENT	ACCEPTABILITY OUTCOME
			During MODU positioning and MODU operations activities, a 500m PSZ will be in force around the MODU, preventing unauthorised access to other marine users. Marine and coastal industries will be required to avoid the temporary 500 m PSZ when the MODU is on location. Marine and coastal industries within the Operational Area is limited to shipping activity devoid of major shipping routes. While undertaking the geophysical surveys the survey vessel will be able to manoeuvre to avoid any vessels. For the geotechnical survey, when sampling is occurring a vessel would need to manoeuvre around the vessel as per any other stationary or slow-moving vessel. Interaction with other users will be limited to within the Operational Area. No stakeholder objections or claims raised. Therefore, the predicted severity level to the marine and coastal industry from a change to the functions, interests or activities resulting from the physical presence has been evaluated as Slight (1).			CM 25: Pre-start notifications CM 26: MODU PSZ CM 27: Navigation aids CM 38: MO 30: Prevention of collisions				
			Cultural Heritage values and sensitivities The Operational Area does not contain historic wrecks and does not overlap World Heritage Properties, Commonwealth Heritage Properties or National Heritage Properties or known First Nations culturally significant areas. No stakeholder objections or claims raised. The outcome of stakeholder consultation confirms the functions, interests and activities relating to heritage and cultural sites will not be affected by the temporary presence of a 500 m PSZ within the Operational Area. Therefore, the predicted severity level to cultural heritage values and sensitivities from a change to the functions, interests or activities from the physical presence has been evaluated as Slight (1).	1	A	CM 24: Ongoing consultation CM 25: Pre-start notifications CM 26: MODU PSZ.	None identified	ALARP	No stakeholder objections or claims raised	Acceptable
EMISSIONS – LIGHT										

Emissions – light	Drilling activities Support activities	Change in fauna behaviour	Seabirds and shorebirds Sources of light for the activity include navigation and safety lighting from the MODU and vessels (continuous for the duration of the activity) and flaring during well testing (<42 hours). Activity vessels and the MODU will have external lighting required to support safe navigation and night-time operations. This lighting is typical for offshore vessels used for fishing and shipping activities. The extent to which lighting may have an impact depends on the source of lighting and the height of the lighting source. Light from the MODU and vessels will result in sky glow visible to human eyes within 20 km of the light source (DCCEEW, 2023b). Receptors that have important habitat within 20km from the Operational Area were considered for the impact assessment for routine lighting. This 20 km threshold (routine lighting EMBA) provides a precautionary limit based on observed effects of sky glow on marine turtle hatchlings, demonstrated to occur at 15–18 km, and fledgling seabirds grounded in response to artificial light 15 km away (DCCEEW, 2023b). Line of sight flare modelling, commissioned for the Corowa Development, was considered suitable for the Judith-2 well test, based on the comparable height of flare tip from the MODU and the flare rate (MMscf). Based on this, a light EMBA of 36 km from the MODU (at the proposed well location) was used to identify species, which may be exposed to lighting. Light emissions can affect fauna in two main ways: Behaviour: where artificial lighting has the potential to create a constant light level of light at night that can override behaviours initiated by the day/night cycle. Orientation: Species such as birds and marine turtles may use light from natural sources (the moon) at night. Where an artificial light source is brighter than the natural light source, this may override natural cues leading to disorientation. Light emissions may result in a localised change to marine fauna's behaviour. Species with the greatest sensitivity to light are marine turtles, seabirds and migratory shorebirds. The National Light Pollution Guidelines for Wildlife (DCCEEW, 2023b) recommend a 20 km threshold as a precautionary limit based on observed effects of sky glow on marine turtle hatchlings demonstrated to occur at 15–18 km and fledgling seabirds grounded in response to artificial light 15 km away. The guidelines recommend undertaking a light impact assessment where important habitat for list species sensitive to light are located within 20 km of the light source. The guidelines detail that important habitats are those areas necessary for an ecologically significant proportion of a listed species to undertake important activities such as foraging, breeding, roosting or dispersal. Ten foraging seabird BIAs occur within the light EMBA (Section 4.5.1). The seabird BIAs are limited to procellariforms such as albatrosses, petrels and shearwaters. Procellariforms have a nocturnal component of their life history, therefore are at greater risk of negative impacts from light emissions (DCCEEW, 2023). Procellariforms are shown to be attracted to artificial lights on vessels and oil and gas facilities which makes them susceptible to attraction to MODU and vessel lighting. Light emissions will enhance the capability of nocturnal seabirds to forage at night (DCCEEW, 2023b). Vessel deck lights and spotlights have been recorded to attract numerous nocturnal birds at night, particularly on nights with little moon light or low visibility (Montevecchi 2006). MODU and vessel lighting is expected to increase prey availability and extend nocturnal bird foraging activities. Based on general observations by oil and gas operators, behavioural effects to transient foraging birds in the routine light EMBA is expected to be limited to behavioural impacts such as attraction, extended foraging activities and resting on the MODU and vessels.	1	A	**CM 1:** Light management procedure	**Accepted:** IFC EHS Guidelines - Offshore Oil and Gas Development (2015) for flaring activities [CM 4]	ALARP	No stakeholder objections or claims raised	Acceptable

The absence of critical habitat or sensitive aggregation sites for EPBC Act listed birds within the lighting EMBA, ensures no physical impacts or impacts at the species population level.

Bird specific recovery plans and conservation advice documents, including those for bird species with BIAs within the routine light EMBA, does not identify light pollution as a threat. The National Light Pollution Guidelines for Wildlife (DCCEEW, 2023b) provides guidance on potential mitigation measures for seabirds, which have been considered during the ALARP and Acceptability process.

No actions specific to impacts to birds from light emissions are identified within the National Light Pollution Guidelines for Wildlife (CoA, 2020a) or Wildlife Conservation Plan for Migratory Shorebirds (DoE 2015a). Bird specific recovery plans and conservation advice documents, including those for bird species with BIAs within the light EMBA, do not identify light pollution as a threat.

Artificial lighting from the activity is unlikely to attract and/or affect the behaviour of birds at a population level. Behavioural impacts are expected to affect a small number of birds foraging through the lighting EMBA.

Marine Reptiles

No BIAs or habitat critical to the survival of the species were identified for marine turtles in the routine light EMBA. Loggerhead, green, leatherback and hawksbill turtles may occur within the light EMBA. Leatherback and loggerhead turtles presence within the light EMBA includes breeding likely to occur.

The Recovery Plan for Marine Turtles in Australia identifies light pollution as a high-risk threat to marine turtles because artificial light can disrupt critical behaviours such as adult nesting and hatchling orientation, sea-finding and dispersal (CoA, 2017). Further, the Recovery Plan for Marine Turtles in Australia identifies oceanic currents and gyres as hatchling dispersal habitats (CoA, 2017a). Given, the absence of nesting beaches within the light EMBA, impacts to marine turtles from operational lighting or flaring are not considered likely. Any impacts would be temporary affecting a small number of marine turtles passing through the routine light EMBA.

Given this, light emissions from the MODU or support vessels are unlikely to result in a change in fauna behaviour of seabirds, shorebirds or marine turtles at a population level. Behavioural impacts are expected to be localised affecting a small number of transient marine turtles or birds foraging through the lighting EMBA, with no long-term consequences. Therefore, the predicted impacts to marine fauna resulting in a change in fauna behaviour from light emissions has been evaluated as Slight (1).

ASPECT	ACTIVITY	IMPACT	IMPACT / CONSEQUENCE EVALUATION	SEVERITY LEVEL	DEMONSTRATION OF ALARP				DEMONSTRATION OF ACCEPTABILITY	
					ALARP DECISION CONTEXT	CONTROL MEASURES	ADDITIONAL CONTROL MEASURES CONSIDERED	ALARP OUTCOME	ACCEPTABILITY ASSESSMENT	ACCEPTABILITY OUTCOME
	Support activities Drilling activities	Change in fauna behaviour	<u>Cultural Heritage values and sensitivities: Marine Fauna</u> First Nations cultural heritage values associated with Sea Country including ecosystems and species are considered based on their ecological values, food sources, and/or culturally significant totemic values. The First Nations people's values associated with marine ecosystems and species have the potential to be disrupted if there are impacts to ecosystem functioning and integrity or species population. The intrinsic link between First Nations people and culturally significant species are understood to be based on First Nations obligations to care for the species (Weir, 2012). The management of culturally significant species is considered to be applied to the species at a population level. As a result, impacts to culturally significant species at a population level has the potential to disrupt the intrinsic link of First Nations people ability to care for culturally significant species. Culturally significant species such as whales, pinnipeds, seabirds and shorebirds are found within the region. First Nations people have a cultural obligation to care for marine fauna that reside within and migrate through Sea Country and ensure their habitat is sustained. As discussed above, light emissions from project activities are unlikely to attract and/or affect the behaviour of marine fauna including birds and sea turtles at a population level. Behavioural impacts are expected to affect a small number of birds and turtles foraging through the routine light EMBA. Behavioural change to marine fauna will be localised, with no long-term consequences. Impacts to cultural heritage values and sensitivities are assessed as Slight (1).	1	A	CM 1: Light management procedure CM 6: EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans CM 7: Adaptive Marine Fauna Management Plan CM 8: MFO (at least one member of support vessel crew trained in MFO and mitigation measures)	None identified	ALARP	No stakeholder objections or claims raised	Acceptable
DISCHARGES										
Planned discharges – drill cuttings, and fluids	Drilling activities	Change in water quality	<u>Water quality</u> Drill cuttings and fluid discharges released during well design operations, such as drill cuttings and fluids will result in localised and temporary changes to the water quality causing a temporary increase in turbidity around the wellhead at the seabed or at the sea surface. A total of ~357 m^3 of drill cuttings and fluids (Table 3-4) will be discharged at the seabed and below water surface (from the MODU). No long-term or continuous discharge of drill cuttings and fluids is planned. Water quality within the Operational Area is expected to represent the high-water quality found in offshore Victorian waters. Planned discharges of drill cuttings and fluids at the seabed and below water surface will increase turbidity and may introduce chemical contaminants in the water column. Discharged drill cuttings and fluids are expected to contain crushed sedimentary rock particles and additives including lubricants, detergents, emulsifiers, defoamers, foaming agents, bactericides and corrosion inhibitors (Jones et al. 2021). Most additives discharged will contain pre-hydrated bentonite (a viscosifier), barite (a weighting agent), and potassium chloride (to inhibit clay hydration) (Jones et al. 2021). A study conducted in the North West Shelf modelled and surveyed the fate of drill cuttings and fluids for three wells with a total discharge volume of 1,543 m^3 (Jones et al. 2021). The study found sporadic and intermittent total suspended solids (TSS) concentrations up to 10 mg L^{-1} ~1000 m from the discharge point lasting over a period of minutes for each discharge event (Jones et al. 2021). In context, during cyclones and storms TSS concentrations of tens or hundreds of mg L^{-1}	1	A	CM 5: Planned System Maintenance CM 11: AGR Chemical assessment procedure CM 13: Use of WBM during drilling (partially accepted) CM 14: No overboard discharge of whole SBM. CM 15: Residual materials management	Not accepted: Riserless Mud Recovery (RMR) for treatment of cuttings onboard MODU prior to discharge *Benefit unequal to risk* Not accepted: Onshore treatment and disposal *Benefit unequal to risk*	ALARP	No stakeholder objections or claims raised	Acceptable

ASPECT	ACTIVITY	IMPACT	IMPACT / CONSEQUENCE EVALUATION	SEVERITY LEVEL	DEMONSTRATION OF ALARP: ALARP DECISION CONTEXT	CONTROL MEASURES	ADDITIONAL CONTROL MEASURES CONSIDERED	ALARP OUTCOME	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY ASSESSMENT	ACCEPTABILITY OUTCOME
			over a few hours are common in tropical shallow water reef environments (Abdul Wahab et al. 2017; Fisher et al. 2015 cited in Jones et al. 2021). The Upwelling East of Eden KEF, which intersects with the Operational Area, highlights the high-energy environment within the Operational Area from the presence of the dynamic eddies of the East Australian Current (CoA 2015). Change in water quality within the high-energy environment of the Operational Area will be localised, with no long-term consequences. Impacts to cultural heritage values and sensitivities are assessed as Slight (1).			CM 16: Solids control equipment CM 17: Solids control equipment operator - to ensure monitoring.	Not accepted: Exclusion of barite from drilling materials *Benefit unequal to risk*			
	Drilling activities	Change in sediment quality	<u>Sediment quality</u> Well design discharges released at the seabed, or those that settle on the surrounding seabed, have the potential to change sediment quality. A total of ~357 m^3 of drill cuttings and fluids will be discharged at the seabed (~200 m^3) and below water surface (~157 m^3). Given the water depths in the Operational Area and highly mixed environment, it is not considered likely discharges form the below water surface (MODU) are likely to cause any impact to water quality. Sediment quality within the Operational Area is expected to be of high quality with low background concentrations of trace metals and organic chemicals. The closest previously drilled well is the Judith-1 well (located 2km SE) which was drilled by Esso Australia Ltd. In 1990, and the Kipper well (located 6 km SE) which was drilled by Esso Australia Ltd. in 1986. Any changes to sediment quality from these previously drilled wells are not expected to remain, given the recovery rate of sediments to marine discharges. Seabed discharge (~200 m^3) of drill cuttings and fluids will reduce sediment quality within the footprint of the discharge. The well will be drilled exclusively with water-based drilling fluid, which comprises of chemicals that pose little or no risk to the environment (OSPAR Commission 2012). The primary constituents used in WBM are barite and bentonite, which lead to elevated levels of barium in drill cuttings. Dissolved barium and any heavy metal contaminants in the barite can gradually leach from an anoxic cuttings pile (Neff, 2005). Additional chemicals of environmental concern, due to their potential toxicity and persistence, that might be present in some drilling mud barites include cadmium (Cd), chromium (Cr), copper (Cu), mercury (Hg), lead (Pb), and zinc (Zn). These are primarily insoluble mineralized sulfide salts in the barite (Neff, 2008). Field studies of drill cuttings and fluids discharge (Sanzone et al. 2016), found elevated seabed barium concentrations within 10 – 150 m of the discharge point. A review of drilling waste discharges from oil and gas platforms found elevated seabed barium concentrations up to 1,000 and 3,000 m from the platforms (Ellis et al. 2012). Changes to sediment quality will pose little or no risk to the environment, with no long-term or residual impacts. Sediments in the Operational Area of sandy substrates are widely represented of those in the Twofold Shelf bioregion. Discharges of drill cuttings and fluids will be short-term, limited to the duration of the drilling activity and localised (within a radius of 3km). Therefore, impacts to sediment quality from drill cuttings and fluids are assessed as Slight (1).	1	A	CM 5: Planned System Maintenance CM 11: AGR Chemical assessment procedure CM 13: Use of WBM during drilling (partially accepted) CM 14: No overboard discharge of whole SBM. CM 16: Solids control equipment CM 17: Solids control equipment operator - to ensure monitoring.	Not accepted: Riserless Mud Recovery (RMR) for treatment of cuttings onboard MODU prior to discharge *Benefit unequal to risk* Not accepted: Exclusion of barite from drilling materials *Benefit unequal to risk*	ALARP	No stakeholder objections or claims raised	Acceptable

ASPECT	ACTIVITY	IMPACT	IMPACT / CONSEQUENCE EVALUATION	SEVERITY LEVEL	DEMONSTRATION OF ALARP				DEMONSTRATION OF ACCEPTABILITY	
					ALARP DECISION CONTEXT	CONTROL MEASURES	ADDITIONAL CONTROL MEASURES CONSIDERED	ALARP OUTCOME	ACCEPTABILITY ASSESSMENT	ACCEPTABILITY OUTCOME
	Drilling activities	Change in habitats	Benthic habitats and communities Discharges of drill cuttings and fluids can smother benthic epifauna and infauna communities leading to a change in habitat. Benthic habitat in the offshore Operational Area, is expected to comprise of sandy substrate devoid of large epifauna except for introduced screw shells and sponges (CEE Consultants 2003). Benthic communities in the offshore Operational Area, is expected to be limited to infauna communities related to sandy substrates highly represented within the Twofold Shelf bioregion (IMCRA 1998). Fauna surveys surrounding the drill centres of three wells in the North West Shelf found a high impact zone within a 75 m radius of the well contributed by seabed discharges from tophole drilling (Jones et al. 2021). The high impact zone was largely devoid of all epibenthic fauna and showed a clear loss of soft corals, sponges, and hydroids (Jones et al. 2021). A medium impact zone, within 200 m of the well, found sponges and soft corals covered by sediment (Jones et al. 2021). Sponges have cleaning mechanisms to remove sediments from their surfaces including mucus production, tissue sloughing, self-cleaning surfaces (Pineda et al. 2017). Dernie et al (2003) conducted a study that identified sand-dominated communities had the most rapid recovery rate following disturbance. A survey of the recovery of deep-water megabenthic assemblages found partial megabenthic recovery between 3- and 10-years post-drilling (Jones et al. 2012). Where SBM may be used in the drilling program, the discharges will be minimized through drilling fluid recycling via solids control and secondary processing equipment on the drilling facility. Remaining SBM discharge is limited to material adhering to cuttings surfaces. Neff (2010) indicates that SBM-coated cuttings clump and settle rapidly near the discharge point, limiting dispersion and increasing cuttings pile thickness. This suggests that SBM drilling reduces dispersion extent while increasing pile accumulation (Neff, 2010). Previous studies on NAF cuttings dispersion around Gippsland Basin platforms indicate that the seabed dispersion process in eastern Bass Strait aids in reducing smothering and accelerating recovery. A study at the Snapper platform (55m depth) (Coffey, 2010) found, five months post-drilling, that cuttings accumulation was localized within 100m of the platform. ROV inspections revealed recolonization by benthic infauna, with numerous burrows and bioturbation mounds observed in both natural sediments and cuttings. Therefore, the predicted impacts to benthic habitats and communities from drill cuttings and fluids resulting in a change to habitats has been evaluated as Slight (1).	1	A	CM 5: Planned System Maintenance CM 11: AGR Chemical assessment procedure CM 13: Use of WBM during drilling (partially accepted) CM 14: No overboard discharge of whole SBM. CM 15: Residual materials management CM 16: Solids control equipment CM 17: Solids control equipment operator - to ensure monitoring.	Not accepted: Riserless Mud Recovery (RMR) for treatment of cuttings onboard MODU prior to discharge *Benefit unequal to risk* Not accepted: Onshore treatment and disposal *Benefit unequal to risk* Not accepted: Exclusion of barite from drilling materials *Benefit unequal to risk*	ALARP	No stakeholder objections or claims raised	Acceptable

ASPECT	ACTIVITY	IMPACT	IMPACT / CONSEQUENCE EVALUATION	SEVERITY LEVEL	DEMONSTRATION OF ALARP				DEMONSTRATION OF ACCEPTABILITY	
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	Drilling activities	Injury / mortality to marine fauna	Once the riser and BOP is installed, ~157 m^3 of drill cuttings will be discharged below surface and drill fluids will be recirculated at the surface (Table 3-4). The volume of planned drilling discharges will be limited and discharged intermittently over short durations. The Operational Area overlaps the Upwelling East of Eden KEF, which highlights high primary productivity within the Operational Area with the presence of the phytoplankton blooms and zooplankton (CoA 2015). The Upwelling East of Eden KEF also highlights the high-energy environment within the Operational Area from the presence of the dynamic eddies of the East Australian Current (CoA 2015). The dynamic eddies of the East Australian Current cause episodic mixing and nutrient enrichment events which will, over time, aid in the dispersion of discharged drilling solids and fluids. Discharged drill cuttings and fluids will contain additives including lubricants, detergents, emulsifiers, defoamers, foaming agents, bactericides and corrosion inhibitors (Jones et al. 2021). Where the well will be drilled exclusively with water-based drilling fluid, comprising of chemicals that pose little or no risk (PLONOR) to the environment (OSPAR Commission 2012). Small trace amounts of bactericides discharged with the drill fluids may lead to toxicity effects to plankton leading to low levels of localised mortality. The selection of PLONOR classified WBM minimizes acute and chronic toxicity risks to fauna, including benthic organisms. Its low toxicity and bioaccumulation potential, limit discharge impacts to localized areas, preventing food web contamination (Neff, 2010). Where, SBM are used, the biological effects of SBM cuttings discharges are mainly restricted to the benthic environment. Effects of treated Group III (negligible aromatic content) SBM cuttings accumulation in sediments are usually minor and biological recovery is often underway within a year of completion of discharge (IOGP 2016). Barite, a key component in all drilling muds (WBM and SBM), stabilizes boreholes and controls pressure, leading to elevated barium levels in cuttings. Additionally, cuttings may contain other potentially toxic metals such as arsenic, chromium, cadmium, copper, iron, lead, mercury, nickel, and zinc, which are present in drilling muds (Breuer, Stevenson, Howe, Carroll, & Shimmield, 2004). Barite is the most abundant solid in cuttings and is highly insoluble in seawater. Modern WBMs and SBMs use barite from sources with significantly lower trace metal content than in the past, resulting in metal concentrations similar to fine-grained marine sediments. While barite does contain mercury, studies indicate it is present as sulphide minerals, not as a substitution within the barite crystal lattice (Trefry & Smith, 2003). Field monitoring studies in Bass Strait and globally have assessed drilling discharge impacts. In stable cuttings piles with minimal disturbance, the dissolved, bioavailable metal fraction remains low. Furthermore, the low solubility of NAF materials limits their uptake and bioaccumulation, as evidenced by the absence of these base fluids in tissues of marine organisms near NAF cuttings discharges (IOGP, 2016). Early life stages of fish and other plankton, including embryos and larvae, are most vulnerable to potential toxic exposure from drilling fluids and cuttings due to their limited mobility and susceptibility to the discharge plume at the outfall. However, rapid recovery is anticipated following cessation of activity, given that during the early life stages, these species have ahigh	1	A	CM 5: Planned System Maintenance CM 11: AGR Chemical assessment procedure CM 13: Use of WBM during drilling (partially accepted) CM 14: No overboard discharge of whole SBM. CM 15: Residual materials management CM 16: Solids control equipment CM 17: Solids control equipment operator - to ensure monitoring.	Not accepted: Riserless Mud Recovery (RMR) for treatment of cuttings onboard MODU prior to discharge *Benefit unequal to risk* Not accepted: Onshore treatment and disposal *Benefit unequal to risk* Not accepted: Exclusion of barite from drilling materials *Benefit unequal to risk*	ALARP	No stakeholder objections or claims raised	Acceptable

ASPECT	ACTIVITY	IMPACT	IMPACT / CONSEQUENCE EVALUATION	SEVERITY LEVEL	DEMONSTRATION OF ALARP: ALARP DECISION CONTEXT	CONTROL MEASURES	ADDITIONAL CONTROL MEASURES CONSIDERED	ALARP OUTCOME	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY ASSESSMENT	ACCEPTABILITY OUTCOME
			natural mortality and rapid replacement rates (UNEP, 1985). Consequently, exposure of planktonic communities is not expected to cause significant population-level impacts that would affect ecological diversity or productivity within Commonwealth marine areas. Therefore, any potential environmental impact associated with this activity is considered localized and limited. Pelagic species, due to their mobility, are expected to experience minimal chemical exposure for brief durations when swimming near the discharge plume. Therefore, transient species are not anticipated to exhibit acute or chronic effects. At the population level, the consequence injury / mortality in a negligible number of syngnathids (given the absence of critical habitats and BIAs in the Operational Area) is not expected to increase mortality above that of natural levels. Where feasible, the well will be drilled exclusively with water-based drilling fluid, which comprises of chemicals that pose little or no toxicity to marine organisms (OSPAR Commission 2012; Neff 2005). The high-energy environment within the Operational Area will result in rapid dispersion of discharged cuttings and fluids. Chemical levels in the water column will return to pre-disturbance levels once dispersion has occurred, with no long-term affects to localised water quality. Injury / mortality of marine fauna will be localised, with no long-term consequences. Impacts are assessed as Slight (1).							
Drilling activities	Change in sediment quality	Cultural heritage values and sensitivities Impacts to water quality from discharges has the potential to result in physical and tangible change to cultural heritage value of oceans waterways.	1	A	**CM 5:** Planned System Maintenance **CM 11:** AGR Chemical	**Not accepted:** Riserless Mud Recovery (RMR) for treatment of	ALARP	No stakeholder objections or claims raised	Acceptable

ASPECT	ACTIVITY	IMPACT	IMPACT / CONSEQUENCE EVALUATION	SEVERITY LEVEL	DEMONSTRATION OF ALARP: ALARP DECISION CONTEXT	DEMONSTRATION OF ALARP: CONTROL MEASURES	DEMONSTRATION OF ALARP: ADDITIONAL CONTROL MEASURES CONSIDERED	DEMONSTRATION OF ALARP: ALARP OUTCOME	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY ASSESSMENT	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY OUTCOME
		Change in water quality Change in habitats Injury/mortality to marine fauna	As summarised above, change in sediment quality, change in water quality, and change in habitats is expected to be localised to the Operational Area, with no long-term consequences. Impacts are assessed as Slight (1).			assessment procedure CM 13: Use of WBM during drilling (partially accepted) CM 14: No overboard discharge of whole SBM. CM 15: Residual materials management CM 16: Solids control equipment CM 17: Solids control equipment operator - to ensure monitoring.	cuttings onboard MODU prior to discharge *Benefit unequal to risk* Not accepted: Onshore treatment and disposal *Benefit unequal to risk* Not accepted: Exclusion of barite from drilling materials *Benefit unequal to risk*			
Planned discharge – hydraulic fluids and chemicals	Drilling activities Support activities	Change in water quality	<u>Water quality</u> Installation of a BOP is conducted following tophole drilling and provides a mean for sealing, controlling and monitoring the well during drilling operations. Subsea control fluids contained within the BOP system, will be discharged during function testing of the BOP on installation and pressure testing. Pressure tests of the installed BOP are undertaken every 21-days. Function tests of the installed BOP are undertaken every 7 days. Function and pressure test discharges up to ~2,200 L of diluted control fluid per test. The control fluid is a fully biodegradable water-soluble product and is diluted with potable water (1 to 3% concentration). The discharged diluted control fluid is expected to readily disperse, and the biodegradability of the control fluid ensures the natural degradation should it enter the aquatic environment. Once dispersion has occurred, pre-disturbance levels is expected to also return rapidly because of the high-energy environment within the Operational Area. Water-based control fluids are used widely in marine environments worldwide with no observed environmental effect. A change in water quality from BOP installation and testing and well P&A activities will result in a localised and short-term impact around the well location with no long-term consequences. Impacts are assessed as Slight (1).	1	A	CM 11: AGR Chemical assessment procedure CM 15: Residual materials management	None identified	ALARP	No stakeholder objections or claims raised	Acceptable
	Drilling activities	Injury / mortality	<u>Plankton</u> The BOP function and pressure test discharges up to ~2,200 L of diluted control fluid per test.	1	A	CM 11: AGR Chemical	None identified	ALARP	No stakeholder	Acceptable

ASPECT	ACTIVITY	IMPACT	IMPACT / CONSEQUENCE EVALUATION	SEVERITY LEVEL	DEMONSTRATION OF ALARP: ALARP DECISION CONTEXT	DEMONSTRATION OF ALARP: CONTROL MEASURES	DEMONSTRATION OF ALARP: ADDITIONAL CONTROL MEASURES CONSIDERED	DEMONSTRATION OF ALARP: ALARP OUTCOME	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY ASSESSMENT	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY OUTCOME
		to marine fauna	The Operational Area overlaps the Upwelling East of Eden KEF, which highlights high primary productivity within the Operational Area with the presence of the phytoplankton blooms and zooplankton (CoA 2015). Discharged diluted control fluid may lead to toxicity effects to plankton leading to injury / mortality. The high-energy environment within the Operational Area will ensure rapid dispersion of discharged diluted control fluid. Once dispersion has occurred, pre-disturbance levels is expected to also return rapidly. Injury / mortality of plankton will be localised, with no long-term consequences. Impacts are assessed as **Slight (1)**.			assessment procedure CM 15: Residual materials management			objections or claims raised	
Planned discharge – cement	Drilling activities	Change in water quality	<u>Water quality</u> Cementing fluids, including cementing mix water, may require discharge to the marine environment under various scenarios. During testing of the cementing unit and completions activities, a maximum of 54m^3 may be released. In the event of a cement spoil or issue with cementing operations an additional 22m^3 may be released. Toxicity impacts are not predicted as cement is considered to Pose Little or No Risk to the Environment (PLONOR) (Cefas, 2022). Modelling of larger cement discharges (approximately 78 m^3 over a one-hour period) was completed for another offshore drilling project (BP, 2013). Results of this modelling showed that within two hours TSS concentrations ranged between 5-50 mg/L within the extent of the plume (approximately 150 m horizontal and 10 m vertical); and by four hours post-discharge, that concentrations were <5 mg/L within the plume range. Given the maximum individual cementing discharge is anticipated to be, less than the volume modelled, it is expected that the concentration of total suspended solids would be lower. In context, during cyclones and storms TSS concentrations of tens or hundreds of mg/L over a few hours are common in tropical shallow water reef environments (Abdul Wahab et al. 2017; Fisher et al. 2015 cited in Jones et al. 2021). No long-term or continuous discharge of cement is planned. A change in water quality from cement discharges will result in a localised and short-term impact around the well location with no long-term consequences. Impacts are assessed as **Slight (1)**.	1	A	CM 11: AGR Chemical assessment procedure CM 15: Residual materials management CM 16: Solids control equipment CM 17: Solids control equipment operator - to ensure monitoring. CM 18: Cementing procedures	Not accepted: No overboard residual cement discharge. *Benefit unequal to risk*	ALARP	No stakeholder objections or claims raised	Acceptable
		Change in sediment quality	<u>Sediment quality</u> Cement volumes are such that for the 30"/36" casing and the 13-3/8" casing approximately 76 m^3 of cement will be discharged to seabed. Sediment quality within the Operational Area is expected to be of high quality with background concentrations of trace metals and organic chemicals. Toxicity impacts are not predicted as cement is considered to Pose Little or No Risk to the Environment (PLONOR) (Cefas 2022). Change in sediment quality from cement discharges at the seabed will be limited to the area immediately around the well. The area impacted is anticipated to be within the high impact zone within a 75 m radius of the well which is also contributed by seabed discharges from tophole drilling (Jones et al. 2021). A change in sediment quality from cement discharges will result in a localised and short-term impacts around the well location with no long-term consequences. Impacts are assessed as **Slight (1)**.	1	A	CM 11: AGR Chemical assessment procedure CM 15: Residual materials management CM 16: Solids control equipment CM 17: Solids control equipment	Not accepted: No overboard residual cement discharge. *Benefit unequal to risk*	ALARP	No stakeholder objections or claims raised	Acceptable

ASPECT	ACTIVITY	IMPACT	IMPACT / CONSEQUENCE EVALUATION	SEVERITY LEVEL	DEMONSTRATION OF ALARP: ALARP DECISION CONTEXT	DEMONSTRATION OF ALARP: CONTROL MEASURES	DEMONSTRATION OF ALARP: ADDITIONAL CONTROL MEASURES CONSIDERED	DEMONSTRATION OF ALARP: ALARP OUTCOME	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY ASSESSMENT	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY OUTCOME
						operator - to ensure monitoring. **CM 18:** Cementing procedures				
		Change in habitat	<u>Benthic habitats and communities</u> Cement volumes are such that for the 30”/36” casing and the 13-3/8” casing approximately 76 m^3 of cement will be discharged to seabed. The benthic habitat in the offshore Operational Area, is expected to comprise of sandy substrate devoid of large epifauna except for introduced screw shells and sponges (CEE Consultants 2003). Benthic communities in the offshore Operational Area, is expected to be limited to infauna communities related to sandy substrates highly represented within the Twofold Shelf bioregion (IMCRA 1998). Subsea discharge of cement is expected to smother benthic epifauna and infauna communities leading to a temporary change in habitat around the well location. A change in habitats from cement discharges will result in a localised and short-term impact around the well location with no long-term consequences. Impacts are assessed as Slight (1).	1	A	**CM 19:** AGR Chemical assessment procedure **CM 15:** Residual materials management **CM 16:** Solids control equipment **CM 17:** Solids control equipment operator - to ensure monitoring. **CM 18:** Cementing procedures	**Not accepted:** No overboard residual cement discharge. *Benefit unequal to risk*	ALARP	No stakeholder objections or claims raised	Acceptable
		Injury / mortality to marine fauna	<u>Fishes</u> Cement volumes are such that for the 30” /36” casing and the 13-3/8” casing approximately 76 m^3 of cement will be discharged to seabed. Impacts to mobile fauna such as pelagic fishes, sharks and rays are not expected given their ability to avoid effected areas (IOGP 2016). Impacts from cement discharges are expected to be limited to slow swimming Syngnathid species, of which are not found in the Operational Area. Injury / mortality of any Syngnathids will be limited to any fish in the immediate vicinity of the well, with no long-term consequences. Impacts are assessed as Slight (1).	1	A	**CM 11:** AGR Chemical assessment procedure **CM 15:** Residual materials management **CM 16:** Solids control equipment **CM 17:** Solids control equipment operator - to ensure monitoring.	**Not accepted:** No overboard residual cement discharge. *Benefit unequal to risk*	ALARP	No stakeholder objections or claims raised	Acceptable

ASPECT	ACTIVITY	IMPACT	IMPACT / CONSEQUENCE EVALUATION	SEVERITY LEVEL	DEMONSTRATION OF ALARP: ALARP DECISION CONTEXT	CONTROL MEASURES	ADDITIONAL CONTROL MEASURES CONSIDERED	ALARP OUTCOME	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY ASSESSMENT	ACCEPTABILITY OUTCOME
						CM 18: Cementing procedures				
	Drilling activities	Change in water quality Change in sediment quality Change in habitat Injury / mortality to marine fauna	<u>Cultural heritage values and sensitivities</u> Impacts to water quality from discharges has the potential to result in physical and tangible change to cultural heritage value of oceans waterways. As summarised above, change in sediment quality, change in water quality, change in habitats, and injury/mortality to marine fauna is expected to be localised to the Operational Area, with no long-term consequences. Impacts are assessed as Slight (1).	1	A	CM 11: AGR Chemical assessment procedure CM 15: Residual materials management CM 16: Solids control equipment CM 17: Solids control equipment operator - to ensure monitoring. CM 18: Cementing procedures	None identified	ALARP	No stakeholder objections or claims raised	Acceptable
Planned discharge – Operational Discharges	Support activities	Change in water quality	<u>Water quality</u> The rate of sewage, greywater and putrescible waste discharged from the MODU and support vessels is expected to be ~78 m^3 / day. A release rate of 150 m^3 / day of sewage, greywater, and putrescible waste in the offshore marine environment from a fixed facility is not expected to exceed a 500 m mixing zone boundary (NERA 2017). Potential change in water quality from intermittent discharge of sewage, greywater, and putrescible waste will be limited to open-offshore waters of the Operational Area over 60 days. Water quality within the Operational Area is expected to represent the high-water quality found in offshore Victorian waters. Discharge of sewage, greywater and putrescible waste is expected to rapidly disperse because of the high-energy environment within the Operational Area. Sewage discharge monitoring for another offshore project (Woodside Energy Ltd 2014), determined that intermittent sewage discharges of 10 m^3 were rapidly diluted within 50 m of the discharge point. Change in water quality within the high-energy environment of the Operational Area will be localised, with no long-term consequences. Impacts are assessed as Slight (1). Cooling water acts as a heat exchange medium to cool machinery engines on the MODU and support vessels. Seawater is drawn from the ocean and flows counter-current through closed-circuit heat exchangers, transferring heat from the engines and machinery to the seawater, which	1	A	CM 5: Planned System Maintenance CM 11: AGR Chemical assessment procedure CM 12: Marine assurance system - vessel contractor pre-qualification assessment	None identified	ALARP	No stakeholder objections or claims raised	Acceptable

ASPECT	ACTIVITY	IMPACT	IMPACT / CONSEQUENCE EVALUATION	SEVERITY LEVEL	DEMONSTRATION OF ALARP				DEMONSTRATION OF ACCEPTABILITY	
					ALARP DECISION CONTEXT	CONTROL MEASURES	ADDITIONAL CONTROL MEASURES CONSIDERED	ALARP OUTCOME	ACCEPTABILITY ASSESSMENT	ACCEPTABILITY OUTCOME
			is then discharged back into the ocean. Cooling water temperatures vary with the vessel engine's workload and activity, generally around 32°C. Discharges of cooling water to the marine environment will result in a short-term and localised elevation in surface waters at the discharge point. Concentrated brine is a waste stream created through the vessel desalination equipment for potable water generation. Brine generated from the water supply systems on-board vessels will be discharged to the ocean at a salinity of approximately 20-50% higher than surrounding seawater. The rate of cooling water and RO brine discharged from the MODU and support vessels is expected to be ~4,968 m^3 / day. The intermittent discharges are expected to be limited to the open-offshore waters of the Operational Area over 60 days. Discharged cooling water and RO brine is expected to rapidly disperse through the surface layer of water because of the high-energy environment within the Operational Area. Previous studies on wastewater discharges show no elevation in levels above background concentrations in proximity to the discharge point (Woodside 2008; 2014; Shell 2009). Discharges from cooling water and brine resulting in changes to the water quality of the Operational Area will be localised, with no long-term consequences. Impacts are assessed as Slight (1). Bilge water generated on the MODU and support vessels consists of deck drainage and water from machinery spaces directed to a bilge water tank. Contaminants can include chemical spills on deck. This bilge water is diverted to a holding tank for either onshore disposal at a licensed facility or discharge, ensuring an oil content of <15ppm in accordance with Marine Order 91. Deck drainage and bilge may contain trace amounts of chemicals and hydrocarbons. Intermittent discharges of deck drainage and bilge are expected to be limited to the open-offshore waters of the Operational Area over 60 days. Discharged deck drainage and bilge is expected to rapidly disperse through the surface layer of water because of the high-energy environment within the Operational Area. Previous studies on wastewater discharges show no elevation in levels above background concentrations in proximity to the discharge point (Woodside 2008; 2014; Shell 2009). Change in water quality within the high-energy environment of the Operational Area will be localised, with no long-term consequences. Impacts are assessed as Slight (1).							

Support activities	Injury / mortality to marine fauna	Plankton The rate of sewage, greywater and putrescible waste discharged from the MODU and support vessels is expected to be ~78 m^3 / day. The intermittent discharges are expected to be limited to the open-offshore waters of the Operational Area over 60 days. Discharge of sewage, greywater and putrescible waste is expected to rapidly disperse because of the high-energy environment within the Operational Area. Eutrophication occurs when the addition of nutrients, such as nitrates and phosphates from sewage, greywater, and putrescible waste, results in an increased growth of primary producers such as phytoplankton (NERA 2017). Any potential change in phytoplankton or zooplankton abundance and composition is expected to be localised, typically returning to background conditions within tens to a few hundred metres of the discharge location (Parnell 2003 cited in NERA 2017). Change in zooplankton abundance and composition within the high-energy environment of the Operational Area will be localised, with no long-term consequences. Impacts are assessed as Slight (1). The rate of cooling water and brine discharged from the MODU and support vessels is expected to be ~4,968 m^3 / day. The intermittent discharges are expected to be limited to the open-offshore waters of the Operational Area over 60 days. Discharged cooling water and brine is expected to rapidly disperse through the surface layer of water because of the high-energy environment within the Operational Area. Studies on the effects of changes in salinity and temperature on zooplankton observed copepods are more sensitive to lower salinities than higher and changes in temperature had weaker negative effects on survival when compared to changes in salinity (Karlsson et al. 2018; Hall & Lewandowska 2022). Plankton, including fish eggs and larvae, may be impacted by exposure to operational discharges. Due to their limited mobility, these species are more susceptible to such discharges and often lack the ability to move away from potential discharge plumes. Any potential change in phytoplankton or zooplankton abundance and composition is expected to be localised, typically returning to background conditions within tens to a few hundred metres of the discharge location (Parnell 2003 cited in NERA 2017). Injury / mortality to plankton within the Operational Area will be localised, with no long-term consequences. Impacts are assessed as Slight (1). Intermittent discharges of deck drainage and bilge are expected to be limited to the open-offshore waters of the Operational Area over 60 days. Deck drainage and bilge discharges may cause sub-lethal or lethal effects to zooplankton; however, these effects are expected to be limited to the proximity of the discharge point (Woodside 2008; 2014; Shell 2009). Any potential change in phytoplankton or zooplankton abundance and composition is expected to be localised, typically returning to background conditions within tens to a few hundred metres of the discharge location (Parnell 2003 cited in NERA 2017). Injury / mortality to plankton within the Operational Area will be localised, with no long-term consequences. Impacts are assessed as Slight (1).	1	A	CM 5: Planned System Maintenance CM 11: AGR Chemical assessment procedure CM 12: Marine assurance system - vessel contractor pre-qualification assessment	None identified	ALARP	No stakeholder objections or claims raised	Acceptable

ASPECT	ACTIVITY	IMPACT	IMPACT / CONSEQUENCE EVALUATION	SEVERITY LEVEL	DEMONSTRATION OF ALARP				DEMONSTRATION OF ACCEPTABILITY	
					ALARP DECISION CONTEXT	CONTROL MEASURES	ADDITIONAL CONTROL MEASURES CONSIDERED	ALARP OUTCOME	ACCEPTABILITY ASSESSMENT	ACCEPTABILITY OUTCOME
Emissions – atmospheric										
Emissions – atmospheric	Drilling activities Support activities	Change in air quality	Air quality Atmospheric emissions are generated from flaring activities (maximum 42-hour duration), use of combustion engines on the MODU and vessels (24 hours a day for up to 60 days), embodied carbon of materials used, helicopter operations, and waste generated. Atmospheric emissions from the activity includes non-greenhouse gases, such as NO_X and SO_X, and greenhouse gases (GHGs), such as CH_4, CO_2 and N_2O, which can lead to reduction in local air quality. Air quality within the Operational Area includes pre-existing combustion exhaust emissions from offshore marine users (commercial shipping and fishing vessels). GHG assessment was conducted to estimate the GHG emissions (scopes 1, 2 and 3) generated from the activity (APPENDIX E). Scope 1 are the direct emissions generated from the activity; scope 2 are the indirect emissions from the consumption of purchased electricity, steam, heat or cooling purchased outside the boundary of the activity (in this case, there is no scope 2 emissions given no purchased electricity/energy); and scope 3 are the indirect emissions, other than the scope 2 emissions, generated as a result of the activity. The total GHG emissions resulting from the activity are expected to be approximately 45 kt CO_2-e, consisting of 58% and 42% of scopes 1 and 3 emissions respectively. The total volume of GHG emissions for this activity is small (no more than ~0.011% of the Australian carbon budget in 2025). Modelling NO_2 emissions from MODU power generation was completed for another offshore project (BP 2013). Results of modelling highlighted impacts to air quality is limited to a localised airshed adjacent to the MODU (BP 2013). Atmospheric emissions from MODU and vessel operations and flaring will result in localised and temporary change in air quality immediately surrounding the discharge point within open-ocean offshore waters of the Operational Area during the activity. Impacts are assessed as Slight (1).	1	A	CM 2: Green flare boom CM 3: Reporting GHG emissions CM 5: Planned system maintenance	Accepted: IFC EHS Guidelines - Offshore Oil and Gas Development (2015) for flaring activities [CM 4]	ALARP	No stakeholder objections or claims raised	Acceptable

5.2.2. Impact and risk assessment – unplanned aspects

Table 5-3: Impact and risk assessment – unplanned aspects

ASPECT	ACTIVITY	IMPACT	AFFECTED RECEPTOR	IMPACT / CONSEQUENCE EVALUATION	RISK ASSESSMENT			DEMONSTRATION OF ALARP				DEMONSTRATION OF ACCEPTABILITY	
					SEVERITY LEVEL	LIKELIHOOD	RISK RATING	ALARP DECISION CONTEXT	CONTROL MEASURES	ADDITIONAL CONTROL MEASURES CONSIDERED	ALARP OUTCOME	ACCEPTABILITY ASSESSMENT	ACCEPTABILITY OUTCOME
UNPLANNED INTERACTIONS													
Physical presence – interaction with marine fauna	Support activities	Injury / mortality to marine fauna	Marine Fauna - Fishes	The physical presence of vessels in the Operational Area introduces the potential for vessel collision with marine fauna during the activity. Marine fauna that inhabits surface waters, are most at risk from vessel collision. The white shark has a distribution BIA within the Operational Area and may be considered susceptible to vessel strike due to their habit of swimming on or near the surface. The Recovery Plan for the white shark does not identify vessel collision as a threat (CoA, 2013). However, the presence of white sharks within the Operational Area is expected to be transitory individuals only. Studies have found that fauna mortality in the event of a vessel strike is directly linked to vessel speed (Jensen and Silber 2004; Laist et al. 2001) with severe injuries caused by vessels travelling faster than 14 knots. Vessels within the Operational Area will be either stationary or operating at slow speeds (<8 knots). Sharks are expected to exhibit avoidance behaviours prior to colliding with vessels. In the event of a vessel collision between a shark and vessel in the Operational Area, recoverable injury to sharks may occur. Death from vessel collision is not expected because vessel speeds within the Operational Area will be slow. If a shark to vessel collision resulted in the death of an EPBC Act listed shark species, it is not expected that a single individual would have a detrimental effect on the overall population, suggesting this event would result in a limited environmental impact. The severity level is assessed as Slight (1). The presence of EPBC Act listed sharks in the Operational Area is limited to transitory individuals, thereby reducing the potential for vessel collision with marine fauna during the activity. The likelihood is assessed as Rare (1). The risk rating for shark to vessel collision during the activity is ranked Low (1).	1	1	1	A	CM 6: EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans. CM 7: Adaptive Marine Fauna Management Plan CM 8: MFO (at least one member of support vessel crew trained in MFO and mitigation measures)	None identified	ALARP	No stakeholder objections or claims raised	Acceptable
	Support activities	Injury / mortality to marine fauna	Marine Fauna - Marine reptiles	The physical presence of vessels in the Operational Area introduces the potential for vessel collision with marine fauna during the activity. Marine fauna that inhabits surface waters, such as marine turtles surfacing to breathe, are most at risk from vessel collision. Vessel disturbance is recognised as a key threat to marine turtles in the Recovery Plan for Marine Turtles (CoA, 2017). Increased boat traffic results	1	1	1	A	CM 6: EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans.	None identified	ALARP	No stakeholder objections or claims raised	Acceptable

ASPECT	ACTIVITY	IMPACT	AFFECTED RECEPTOR	IMPACT / CONSEQUENCE EVALUATION	RISK ASSESSMENT: SEVERITY LEVEL	RISK ASSESSMENT: LIKELIHOOD	RISK ASSESSMENT: RISK RATING	DEMONSTRATION OF ALARP: ALARP DECISION CONTEXT	DEMONSTRATION OF ALARP: CONTROL MEASURES	DEMONSTRATION OF ALARP: ADDITIONAL CONTROL MEASURES CONSIDERED	DEMONSTRATION OF ALARP: ALARP OUTCOME	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY ASSESSMENT	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY OUTCOME
				in increased risk of serious injury and / or death to individual marine turtles (CoA, 2017). The Recovery Plan for Marine Turtles highlights boat strike as an issue in shallow coastal foraging habitats and internesting areas (CoA, 2017). The Operational Area does not overlap BIAs including known foraging and internesting areas for marine turtles and is in offshore open waters. The Operational Area contains pre-existing vessel traffic from offshore marine users (commercial shipping and fishing vessels). The physical presence of vessels in the Operational Area will not introduce a new threat to marine turtles in the area. Marine turtles are known to avoid vessels by rapidly diving; however, their ability to respond varies greatly depending on the speed of the vessel. Hazel (2009) reported that the number of turtles that fled vessels decreased significantly as vessel speed increased. Vessels within the Operational Area will be either stationary or operating at slow speeds (<8 knots), therefore marine reptiles are anticipated to avoid vessels within the Operational Area. Although the outcome can be fatal for individual turtles, boat strike (as a standalone threat) has not been shown to cause stock level declines (DoEE, 2017). The severity level is assessed as Slight (1). The presence of EPBC Act listed marine reptiles in the Operational Area is limited to transitory individuals, thereby reducing the potential for vessel collision with marine fauna during the activity. The likelihood is assessed as Rare (1). The risk rating for marine reptiles to vessel collision during the activity is ranked Low (1).					CM 7: Adaptive Marine Fauna Management Plan CM 8: MFO (at least one member of support vessel crew trained in MFO and mitigation measures)				
	Support activities	Injury / mortality to marine fauna	Marine Fauna - Marine mammals	The physical presence of vessels in the Operational Area introduces the potential for vessel collision with marine fauna during the activity. Marine fauna that inhabits surface waters, such as marine mammals surfacing to breathe, are most at risk from vessel collision. Vessel disturbance (strike / collision) is recognised as a key threat for marine mammals that may swim through the Operational Area, which intersects the foraging BIA for the pygmy blue whale. Marine mammals are inquisitive and are often attracted to offshore vessels. The reaction of whales to the approach of an offshore vessel is variable. Some species remain motionless when in the vicinity of a vessel while others are known to be curious and often approach ships that have stopped or are slow moving, although they generally do not approach, and sometimes avoid, faster moving ships (Richardson et al. 1995).	1	1	1	A	CM 6: EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans CM 7: Adaptive Marine Fauna Management Plan CM 8: MFO (at least one member of support vessel crew trained in MFO and	None identified	ALARP	No stakeholder objections or claims raised	Acceptable

ASPECT	ACTIVITY	IMPACT	AFFECTED RECEPTOR	IMPACT / CONSEQUENCE EVALUATION	RISK ASSESSMENT: SEVERITY LEVEL	RISK ASSESSMENT: LIKELIHOOD	RISK ASSESSMENT: RISK RATING	DEMONSTRATION OF ALARP: ALARP DECISION CONTEXT	DEMONSTRATION OF ALARP: CONTROL MEASURES	DEMONSTRATION OF ALARP: ADDITIONAL CONTROL MEASURES CONSIDERED	DEMONSTRATION OF ALARP: ALARP OUTCOME	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY ASSESSMENT	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY OUTCOME
				Studies have found that fauna mortality in the event of a vessel strike is directly linked to vessel speed (Jensen and Silber 2004; Laist et al. 2001). Vanderlaan and Taggart (2007) found lethal vessel collision injuries to marine mammals increases significantly with vessels travelling at 13-15 knots. Slower moving vessels provide greater opportunity for both fauna and vessel to avoid collision (Vanderlaan and Taggart 2007). Some marine mammal species, such as humpback whales, can detect and change course to avoid a vessel (WDCS 2006). Vessel collisions will impede the recovery of blue whale populations if enough individuals in the population lose reproductive fitness or are killed (DoE, 2015b). Vessels in the Operational Area will be either stationary or slow moving (<8 knots) during the activity; therefore, the risk of marine mammal mortality from collision and the event itself is classified as Rare. Although the outcome of a vessel collision can be fatal, vessel collisions (as a standalone threat) are not expected to impede the recovery of marine mammal populations given vessels in the Operational Area will be either stationary or slow moving, removing the potential for vessel collisions to result in lethal injury. The severity level of a marine mammal to vessel collision is assessed as Slight (1). The slow-moving vessels in the Operational Area will provide opportunity for both fauna and vessel to avoid collision. Marine mammals also can detect and change course to avoid vessel collisions. The likelihood of a vessel collision to a marine mammal is assessed as Rare (1). The risk rating for marine mammal to vessel collision during the activity is ranked Low (1).					mitigation measures)				
	Support activities	Injury / mortality to marine fauna	Cultural heritage values and sensitivities	The intrinsic link between First Nations people and culturally significant species are understood to be based on First Nations obligations to care for the species (Weir, 2012). The management of culturally significant species is considered to be applied to the species at a population level. As a result, impacts to culturally significant species at a population level has the potential to disrupt the intrinsic link of First Nations people ability to care for culturally significant species. As discussed above, although the outcome of a vessel collision can be fatal, vessel collisions (as a standalone threat) is not expected to impede the recovery of marine fauna populations given vessels in the Operational Area will be either stationary or slow moving, removing the potential for vessel collisions to result in lethal injury. The severity level of a marine fauna to vessel collision is assessed as Slight (1).	1	1	1	A	CM 6: EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans CM 7: Adaptive Marine Fauna Management Plan CM 8: MFO (at least one member of support vessel crew trained in MFO and	None identified	ALARP	No stakeholder objections or claims raised	Acceptable

ASPECT	ACTIVITY	IMPACT	AFFECTED RECEPTOR	IMPACT / CONSEQUENCE EVALUATION	RISK ASSESSMENT: SEVERITY LEVEL	RISK ASSESSMENT: LIKELIHOOD	RISK ASSESSMENT: RISK RATING	DEMONSTRATION OF ALARP: ALARP DECISION CONTEXT	DEMONSTRATION OF ALARP: CONTROL MEASURES	DEMONSTRATION OF ALARP: ADDITIONAL CONTROL MEASURES CONSIDERED	DEMONSTRATION OF ALARP: ALARP OUTCOME	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY ASSESSMENT	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY OUTCOME
				The slow-moving vessels in the Operational Area will provide opportunity for both fauna and vessel to avoid collision. The likelihood of a marine fauna to vessel collision is assessed as Rare (1). The risk rating for marine fauna to vessel collision during the activity is ranked Low (1).					mitigation measures)				
Unplanned introduction of IMS	Support activities	Change in ecosystem dynamics	Benthic habitats and communities	Ballast water discharges or biofouling from MODU and vessel operations within the Operational Area can lead to the introduction, translocation, and establishment of IMS and change ecosystem dynamics of benthic communities. Change in ecosystem dynamics from IMS is generally dependant on successful reproduction and establishment of IMS populations which leads to IMS colonisation within native ecosystems. Benthic habitat in the offshore Operational Area is expected to comprise of sandy substrate devoid of large epifauna except for introduced screw shells and sponges (CEE Consultants 2003). Benthic communities in the offshore Operational Area, is expected to be limited to infauna communities related to sandy substrates highly represented within the Twofold Shelf bioregion (IMCRA 1998). The Operational Area overlaps the Upwelling East of Eden KEF, which highlights the high-energy environment within the Operational Area from the presence of the dynamic eddies of the East Australian Current (CoA 2015). IMS colonisation requires a suitable habitat in which to establish itself such as rocky and hard substrates or subsea infrastructure, especially with pre-existing biofouling. Open waters environments, with high levels of dilutions and dispersal are less susceptible to colonisation of IMS (Paulay et al. 2002). Natural dispersal barriers such as water currents and upwellings, extensive tracts of deep water, soft sediment or severe wave exposure limit successful reproduction and establishment of founder IMS populations (Forrest et al. 2009). Benthic habitats and communities of the Operational Area may be temporarily exposed to IMS from an unplanned introduction. Colonisation, reproduction and spread of IMS is not expected given the absence of hard substrates and high-energy environment within the Operational Area. The potential change in ecosystem dynamics of non-threatened epibiota (introduced screw shells and sponges) and infauna communities highly represented within the bioregion will be localised, with no long-term consequences. The severity level of unplanned introduction of IMS is assessed as Slight (1).	1	1	1	A	CM 28: MO 98: Marine pollution – anti-fouling systems CM 29: Australian Ballast Water Management Requirements CM 30: National Biofouling Management Guidance for the Petroleum Production and Exploration Industry CM 31: Australian Biofouling Management Requirements (Proposed) CM 32: IMS Biofouling Risk Assessment Process	None identified	ALARP	No stakeholder objections or claims raised	Acceptable

ASPECT	ACTIVITY	IMPACT	AFFECTED RECEPTOR	IMPACT / CONSEQUENCE EVALUATION	RISK ASSESSMENT: SEVERITY LEVEL	RISK ASSESSMENT: LIKELIHOOD	RISK ASSESSMENT: RISK RATING	DEMONSTRATION OF ALARP: ALARP DECISION CONTEXT	DEMONSTRATION OF ALARP: CONTROL MEASURES	DEMONSTRATION OF ALARP: ADDITIONAL CONTROL MEASURES CONSIDERED	DEMONSTRATION OF ALARP: ALARP OUTCOME	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY ASSESSMENT	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY OUTCOME
				The benthic environment of the Operational Area contains natural dispersal barriers for IMS including soft sediments, upwellings and is considered a high-energy environment that is subject to frequent natural scouring events. The likelihood of unplanned introduction of IMS is assessed as Rare (1). The risk rating for unplanned introduction of IMS during the activity is ranked Low (1).									
	Support activities	Change in ecosystem dynamics	Cultural heritage values and sensitivities	Change to benthic habitats occurring at a widespread level, such as the introduction, establishment and spread of IMS, has the potential to change the cultural heritage values of benthic ecosystems in coastal environment that provide habitat for culturally significant species, and resources for First Nations people. As discussed above, the potential change in ecosystem dynamics of non-threatened epibiota (introduced screw shells and sponges) and infauna communities highly represented within the bioregion will be localised, with no long-term consequences. The severity level of unplanned introduction of IMS is assessed as Slight (1). The benthic environment of the Operational Area contains natural dispersal barriers for IMS including soft sediments, upwellings and is considered a high-energy environment that is subject to frequent natural scouring events. The likelihood of unplanned introduction of IMS is assessed as Rare (1). The risk rating for unplanned introduction of IMS during the activity is ranked Low (1).	1	1	1	A	CM 28: MO 98: Marine pollution – anti-fouling systems CM 29: Australian Ballast Water Management Requirements CM 30: National Biofouling Management Guidance for the Petroleum Production and Exploration Industry CM 31: Australian Biofouling Management Requirements (Proposed) CM 32: IMS Biofouling Risk Assessment Process	None identified	ALARP	No stakeholder objections or claims raised	Acceptable
ACCIDENTAL RELEASE													
Accidental release – hazardous materials	Support activities	Change in water quality	Water quality	Small quantities of hazardous materials (1 m³ of liquid chemicals and hydrocarbons) may be accidentally released to the open-offshore waters of the Operational Area. Hazardous liquids are expected to rapidly disperse through the surface layer of water because of the high-energy environment within the Operational Area. The Operational Area overlaps the Upwelling East of	1	1	1	A	CM 10: Marine Order 95 (Marine pollution prevention – garbage) 2013.	None identified	ALARP	No stakeholder objections or claims raised	Acceptable

ASPECT	ACTIVITY	IMPACT	AFFECTED RECEPTOR	IMPACT / CONSEQUENCE EVALUATION	RISK ASSESSMENT: SEVERITY LEVEL	RISK ASSESSMENT: LIKELIHOOD	RISK ASSESSMENT: RISK RATING	DEMONSTRATION OF ALARP: ALARP DECISION CONTEXT	DEMONSTRATION OF ALARP: CONTROL MEASURES	DEMONSTRATION OF ALARP: ADDITIONAL CONTROL MEASURES CONSIDERED	DEMONSTRATION OF ALARP: ALARP OUTCOME	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY ASSESSMENT	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY OUTCOME
				Eden KEF, which highlights the high-energy environment within the Operational Area from the presence of the dynamic eddies of the East Australian Current (CoA 2015). Previous studies on wastewater discharges, including hydrocarbons, show no elevation in levels above background concentrations in proximity to the discharge point (Woodside 2008; 2014; Shell 2009). Existing pressures on the localised marine environment such as fishing, and shipping activities pose similar risks that result in localised and temporary water quality impacts. Change in water quality within the high-energy environment of the Operational Area will be localised, with no long-term consequences. Impacts are assessed as Slight (1). Prevention controls are in place to prevent the risk of accidental release of hazardous materials. The likelihood of accidental release of hazardous materials is assessed as Rare (1). The risk rating for accidental release of hazardous materials during the activity is ranked Low (1).					CM 11: AGR Chemical assessment procedure CM 33: Bunkering procedures CM 34: Drain management CM 35: Spill containment				
	Support activities	Injury / mortality to marine fauna	Marine Fauna - Plankton	Small quantities of hazardous materials (1 m^3 of liquid chemicals and hydrocarbons) may be accidentally released to the open-offshore waters of the Operational Area. Hazardous liquids may cause sub-lethal or lethal effects to zooplankton; however, these effects are expected to be limited to the proximity of the discharge point (Woodside 2008; 2014; Shell 2009). Any potential change in phytoplankton or zooplankton abundance and composition is expected to be localised, typically returning to background conditions within tens to a few hundred metres of the discharge location (Parnell 2003 cited in NERA 2017). Injury / mortality to plankton within the Operational Area will be localised, with no long-term consequences. Impacts are assessed as Slight (1). Prevention controls are in place to prevent the risk of accidental release of hazardous materials. The likelihood of accidental release of hazardous materials is assessed as Rare (1). The risk rating for accidental release of hazardous materials during the activity is ranked Low (1).	1	1	1	A	CM 10: Marine Order 95 (Marine pollution prevention – garbage) 2013. CM 11: AGR Chemical assessment procedure CM 33: Bunkering procedures CM 34: Drain management	None identified	ALARP	No stakeholder objections or claims raised	Acceptable
	Support activities	Change in water quality	Cultural heritage values and sensitivities	Impacts to water quality from hydrocarbon exposure and discharges has the potential to result in physical/tangible change to cultural heritage value of oceans and waterways.	1	1	1	A	CM 10: Marine Order 95 (Marine pollution	None identified	ALARP	No stakeholder objections or claims raised	Acceptable

ASPECT	ACTIVITY	IMPACT	AFFECTED RECEPTOR	IMPACT / CONSEQUENCE EVALUATION	RISK ASSESSMENT: SEVERITY LEVEL	RISK ASSESSMENT: LIKELIHOOD	RISK ASSESSMENT: RISK RATING	ALARP DECISION CONTEXT	DEMONSTRATION OF ALARP: CONTROL MEASURES	DEMONSTRATION OF ALARP: ADDITIONAL CONTROL MEASURES CONSIDERED	DEMONSTRATION OF ALARP: ALARP OUTCOME	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY ASSESSMENT	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY OUTCOME
				As discussed above, change in water quality within the high-energy environment of the Operational Area will be localised, with no long-term consequences. Impacts are assessed as Slight (1). Prevention controls are in place to prevent the risk of accidental release of hazardous materials. The likelihood of accidental release of hazardous materials is assessed as Rare (1). The risk rating for accidental release of hazardous materials during the activity is ranked Low (1).					prevention – garbage) 2013. CM 11: AGR Chemical assessment procedure CM 33: Bunkering procedures CM 34: Drain management				
Accidental release – vessel collision	Support activities	Change in water quality	Water quality	A collision between two vessels in the Operational Area has the potential to rupture a fuel tank and discharge 280 m^3 Marine Diesel Oil (MDO) to surface waters. Modelling predicted the maximum distance of floating oil at the moderate threshold (10 g/m^2) to extend 19 km from the release location (RPS 2022). A high percentage (95%) is expected to evaporate when on the sea surface with only a small portion (5%) expected to persist and decay over time. The hydrocarbon EMBA for MDO is expected to be mostly limited to offshore open waters, with no floating oil exposure predicted for any receptor at any threshold, and only a small amount of shoreline accumulation in localised areas predicted above the moderate threshold (100 g/m^2) (RPS, 2022). MDO is a light-persistent oil (classified as a Group II oil) with low density, pour point and dynamic viscosity. These characteristics indicates that a surface release of MDO will spread quickly when spilled at sea and thin out to low thicknesses, increasing the rate of evaporation. The volatile non-persistent compounds of MDO (making up 95% of MDO) is expected to evaporate over 3-4 days depending on wind conditions. The residual persistent compounds of MDO (5% of MDO) will be subject to more gradual decay through biological and photochemical processes (RPS, 2022). Residual MDO four days after release is expected to disperse through the surface layer of water because of the high-energy environment within the Operational Area. The Operational Area overlaps the Upwelling East of Eden KEF, which highlights the high-energy environment within the Operational Area from the presence of the dynamic eddies of the East Australian Current (CoA, 2015). Dispersion of residual MDO increases exposure available to microorganisms to attach to the surface of residual MDO for	2	1	1	A	CM 24: Ongoing stakeholder consultation CM 25 : Pre-start notifications CM 26: MODU PSZ. CM 27: Navigation aids CM 36: SOPEP/ SMPEP CM 37: Marine Operations Procedure(s) - vessel entry into project area, speeds, separation distances CM 38: MO 30: Prevention of collisions CM 39: AIS transceiver CM 41: NOPSEMA accepted MODU Safety Case CM 44: NOPSEMA accepted Oil Pollution	None identified	ALARP	No stakeholder objections or claims raised	Acceptable

ASPECT	ACTIVITY	IMPACT	AFFECTED RECEPTOR	IMPACT / CONSEQUENCE EVALUATION	RISK ASSESSMENT: SEVERITY LEVEL	RISK ASSESSMENT: LIKELIHOOD	RISK ASSESSMENT: RISK RATING	ALARP DECISION CONTEXT	DEMONSTRATION OF ALARP: CONTROL MEASURES	DEMONSTRATION OF ALARP: ADDITIONAL CONTROL MEASURES CONSIDERED	DEMONSTRATION OF ALARP: ALARP OUTCOME	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY ASSESSMENT	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY OUTCOME
				biodegradation to take place (ITOPF 2022). These microorganisms are naturally present in marine environments, even before the occurrence of oil spills, and can break down hydrocarbons to water soluble compounds and eventually to carbon dioxide and water (ITOPF 2022; Bacosa et al. 2022). Change in water quality from the accidental release of 280 m^3 of MDO within the high-energy environment of the Operational Area will be localised, with no long-term consequences. Impacts are assessed as Minor (2). Prevention controls are in place to prevent the risk of accidental release from vessel collision. The likelihood of accidental release – vessel collision is assessed as Rare (1). The risk rating for accidental release – vessel collision during the activity is ranked Low (1).					Emergency Plan (OPEP)				
	Support activities	Injury / mortality to marine fauna	Marine Fauna - Plankton	A collision between two vessels in the Operational Area has the potential to rupture a fuel tank and discharge 280 m^3 Marine Diesel Oil (MDO) to surface waters. Modelling predicted the maximum distance of floating oil at the moderate threshold (10 g/m^2) to extend 19 km from the release location (RPS 2022). Therefore, any impacts to plankton are anticipated to be localised and not cause significant changes at a population level. Phytoplankton are typically not sensitive to oil, whereas zooplankton are (Hook et al. 2016). Water column organisms, such as zooplankton, may be impacted by oil and gas via exposure through ingestion, inhalation and dermal contact (NRDA 2012), which can cause immediate mortality or declines in reproduction (Hook et al. 2016). Lethal and sublethal effects on zooplankton include narcosis, alterations in feeding, development, and reproduction (Almeda et al. 2014). Plankton populations have evolved to respond to environmental perturbations by copious production within short generation times (ITOPF 2011). They are known to have naturally high mortality rates (primarily through predation), however once water quality returns to ambient, plankton populations will return to previous conditions within weeks or months due to recruitment of plankton from surrounding waters. Injury / mortality to plankton within the Operational Area will be localised, with no long-term consequences. Impacts are assessed as Minor (2). Prevention controls are in place to prevent the risk of accidental release from vessel collision. The likelihood of accidental release – vessel collision is assessed as Rare (1).	2	1	1	A	CM 24: Ongoing stakeholder consultation CM 25: Pre-start notifications CM 27: Navigation aids CM 36: SOPEP/ SMPEP CM 37: Marine Operations Procedure(s) - vessel entry into project area, speeds, separation distances CM 38: MO 30: Prevention of collisions CM 39: AIS transceiver CM 41: NOPSEMA accepted MODU Safety Case	None identified	ALARP	No stakeholder objections or claims raised	Acceptable

ASPECT	ACTIVITY	IMPACT	AFFECTED RECEPTOR	IMPACT / CONSEQUENCE EVALUATION	RISK ASSESSMENT: SEVERITY LEVEL	RISK ASSESSMENT: LIKELIHOOD	RISK ASSESSMENT: RISK RATING	ALARP DECISION CONTEXT	DEMONSTRATION OF ALARP: CONTROL MEASURES	DEMONSTRATION OF ALARP: ADDITIONAL CONTROL MEASURES CONSIDERED	DEMONSTRATION OF ALARP: ALARP OUTCOME	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY ASSESSMENT	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY OUTCOME
				The risk rating for accidental release – vessel collision resulting in injury / mortality to plankton during the activity is ranked Low (1).					CM 44: NOPSEMA accepted Oil Pollution Emergency Plan (OPEP)				
	Support activities	Injury / mortality to marine fauna	Marine Fauna - Birds	A collision between two vessels in the Operational Area has the potential to rupture a fuel tank and discharge 280 m^3 Marine Diesel Oil (MDO) to surface waters. Modelling predicted the maximum distance of floating oil at the moderate threshold (10 g/m^2) to extend 19 km from the release location (RPS 2022). A high percentage (95%) is expected to evaporate when on the sea surface with only a small portion (5%) expected to persist and decay over time. The maximum length of shoreline accumulation above the moderate threshold (100 g/m^2) is only predicted to be 1 km during winter conditions. The maximum volume of hydrocarbons ashore is predicted as 9.1 m^3 during winter conditions (RPS, 2022). The hydrocarbon EMBA for MDO is expected to be mostly limited to offshore open waters, with no floating oil exposure predicted for any receptor at any threshold, and only a small amount of shoreline accumulation in localised areas predicted above the moderate threshold (100 g/m^2) (RPS, 2022). Twenty three foraging seabird BIAs occur within the hydrocarbon EMBA (moderate exposure) for MDO. The seabird BIAs are limited to procellariforms such as albatrosses, petrels and shearwaters. Procellariforms have the potential to directly contact surface hydrocarbons given shearwaters rest on the sea surface and albatrosses and petrels feed by plunge-diving. Foraging seabirds may continue to forage within slicks. Direct contact with surface hydrocarbons during foraging will lead to damage to external tissues including skin and eyes, as well as internal tissue irritation in their lungs and stomachs (ITOPF 2011). Oiling of seabird feathers affects their ability to thermoregulate resulting in hypothermia. A bird suffering from cold, exhaustion (resulting from fouling of plumage) may dehydrate, drown or starve (ITOPF 2011, CoA, 2022, AMSA 2013). The absence of critical habitat or sensitive aggregation sites for EPBC Act listed birds within the hydrocarbon EMBA (moderate exposure) for MDO ensures no impacts at the species population level. Seabirds with foraging BIAs in the hydrocarbon EMBA (moderate exposure) for MDO are highly pelagic species and unlikely to impact the species at a population level.	3	1	1	A	CM 24: Ongoing stakeholder consultation CM 25 : Pre-start notifications CM 27: Navigation aids CM 36: SOPEP/ SMPEP CM 37: Marine Operations Procedure(s) - vessel entry into project area, speeds, separation distances CM 38: MO 30: Prevention of collisions CM 39: AIS transceiver CM 41: NOPSEMA accepted MODU Safety Case CM 44: NOPSEMA accepted Oil Pollution Emergency Plan (OPEP)	None identified	ALARP	No stakeholder objections or claims raised	Acceptable

ASPECT	ACTIVITY	IMPACT	AFFECTED RECEPTOR	IMPACT / CONSEQUENCE EVALUATION	RISK ASSESSMENT: SEVERITY LEVEL	RISK ASSESSMENT: LIKELIHOOD	RISK ASSESSMENT: RISK RATING	DEMONSTRATION OF ALARP: ALARP DECISION CONTEXT	DEMONSTRATION OF ALARP: CONTROL MEASURES	DEMONSTRATION OF ALARP: ADDITIONAL CONTROL MEASURES CONSIDERED	DEMONSTRATION OF ALARP: ALARP OUTCOME	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY ASSESSMENT	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY OUTCOME
				Impacts to birds from surface hydrocarbon exposure because of a vessel collision is expected to be localised and temporary based on weathering properties of MDO. Due to the presence of a foraging BIA for EPBC Act listed bird species (Section 4.5.1), it is possible that a small number of bird mortalities may occur in the event they are present during the spill event and subsequent weathering of the MDO release, however no long term- or population level effects are expected to occur. Impacts are assessed as Severe (3). Prevention controls are in place to prevent the risk of accidental release from vessel collision. The likelihood of accidental release – vessel collision is assessed as Rare (1). The risk rating for accidental release – vessel collision resulting in injury / mortality to fishes during the activity is ranked Low (1).									
	Support activities	Injury / mortality to marine fauna	Marine Fauna - Fishes	A collision between two vessels in the Operational Area has the potential to rupture a fuel tank and discharge 280 m^3 Marine Diesel Oil (MDO) to surface waters. Modelling predicted the maximum distance of floating oil at the moderate threshold (10 g/m^2) to extend 19 km from the release location (RPS 2022). A high percentage (95%) is expected to evaporate when on the sea surface with only a small portion (5%) expected to persist and decay over time. The maximum length of shoreline accumulation above the moderate threshold (100 g/m^2) is only predicted to be 1 km during winter conditions. The maximum volume of hydrocarbons ashore is predicted as 9.1 m^3 during winter conditions (RPS 2022). The hydrocarbon EMBA for MDO is expected to be mostly limited to offshore open waters, with no floating oil exposure predicted for any receptor at any threshold, and only a small amount of shoreline accumulation in localised areas predicted above the moderate threshold (100 g/m^2) (RPS 2022). BIAs for the white shark and grey nurse shark occur within the hydrocarbon EMBA (moderate exposure) for MDO. Habitat degradation (pollution) is listed as a threat in the recovery plans for the for the white shark (CoA 2013) and grey nurse shark (CoA, 2014). The hydrocarbon EMBA (moderate exposure) for MDO does not contain critical habitats or feeding aggregation areas for white and grey nurse sharks. The presence of white and grey nurse sharks within the EMBA is therefore expected to be limited to transitory individuals that will not be subject to long-term hydrocarbon exposure. In the event of an accidental release of MDO from a vessel collision, fishes in the hydrocarbon EMBA (moderate exposure) for MDO are susceptible	2	1	1	A	CM 24: Ongoing stakeholder consultation CM 25 : Pre-start notifications CM 27: Navigation aids CM 36: SOPEP/ SMPEP CM 37: Marine Operations Procedure(s) - vessel entry into project area, speeds, separation distances CM 38: MO 30: Prevention of collisions CM 39: AIS transceiver CM 41: NOPSEMA accepted MODU Safety Case CM 44: NOPSEMA accepted Oil	None identified	ALARP	No stakeholder objections or claims raised	Acceptable

ASPECT	ACTIVITY	IMPACT	AFFECTED RECEPTOR	IMPACT / CONSEQUENCE EVALUATION	RISK ASSESSMENT: SEVERITY LEVEL	RISK ASSESSMENT: LIKELIHOOD	RISK ASSESSMENT: RISK RATING	DEMONSTRATION OF ALARP: ALARP DECISION CONTEXT	DEMONSTRATION OF ALARP: CONTROL MEASURES	DEMONSTRATION OF ALARP: ADDITIONAL CONTROL MEASURES CONSIDERED	DEMONSTRATION OF ALARP: ALARP OUTCOME	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY ASSESSMENT	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY OUTCOME
				to injury / mortality from exposure to hydrocarbons. The absence of habitat features or conditions for site-attached fishes in the hydrocarbon EMBA (moderate exposure) for MDO limits potential risk to fishes from MDO exposure to transient individuals. Transient fish species are highly mobile and as such are not likely to suffer extended exposure to hydrocarbons (ITOPF 2011). A study by Claireaux et al. (2017) revealed seabass detect and avoid in-water dissolved hydrocarbons at concentrations of 3 to 15 ppb. Based on this study, it is expected that pelagic fishes can detect and avoid in-water hydrocarbons at concentrations below levels that would lead to chronic effects. Impacts to fishes from in-water hydrocarbon exposure because of a vessel collision is expected to be localised and temporary based on weathering properties of MDO. No long-term effects are expected however exposure to a small number of EPBC Act listed fishes are expected because of the presence of distribution BIAs. Impacts are assessed as Minor (2). Prevention controls are in place to prevent the risk of accidental release from vessel collision. The likelihood of accidental release – vessel collision is assessed as Rare (1). The risk rating for accidental release – vessel collision resulting in injury / mortality to fishes during the activity is ranked Low (1).					Pollution Emergency Plan (OPEP)				
	Support activities	Injury / mortality to marine fauna	Marine Fauna - Marine reptiles	A collision between two vessels in the Operational Area has the potential to rupture a fuel tank and discharge 280 m^3 Marine Diesel Oil (MDO) to surface waters. Modelling predicted the maximum distance of floating oil at the moderate threshold (10 g/m^2) to extend 19 km from the release location (RPS 2022). A high percentage (95%) is expected to evaporate when on the sea surface with only a small portion (5%) expected to persist and decay over time. The maximum length of shoreline accumulation above the moderate threshold (100 g/m^2) is only predicted to be 1 km during winter conditions. The maximum volume of hydrocarbons ashore is predicted as 9.1 m^3 during winter conditions (RPS 2022). The hydrocarbon EMBA for MDO is expected to be mostly limited to offshore open waters, with limited shoreline accumulation (<1 km maximum length of shoreline at East Gippsland) predicted for localised areas above the moderate threshold (100 g/m^2) (RPS 2022). No BIAs, nesting, internesting areas or habitat critical to the survival of the species were identified for marine turtles in the hydrocarbon EMBA (moderate exposure) for MDO. Loggerhead, green, leatherback and hawksbill turtles may occur within the hydrocarbon EMBA (moderate	3	1	1	A	CM 24: Ongoing stakeholder consultation CM 25 : Pre-start notifications CM 27: Navigation aids CM 36: SOPEP/ SMPEP CM 37: Marine Operations Procedure(s) - vessel entry into project area, speeds, separation distances	None identified	ALARP	No stakeholder objections or claims raised	Acceptable

ASPECT	ACTIVITY	IMPACT	AFFECTED RECEPTOR	IMPACT / CONSEQUENCE EVALUATION	RISK ASSESSMENT: SEVERITY LEVEL	RISK ASSESSMENT: LIKELIHOOD	RISK ASSESSMENT: RISK RATING	DEMONSTRATION OF ALARP: ALARP DECISION CONTEXT	DEMONSTRATION OF ALARP: CONTROL MEASURES	DEMONSTRATION OF ALARP: ADDITIONAL CONTROL MEASURES CONSIDERED	DEMONSTRATION OF ALARP: ALARP OUTCOME	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY ASSESSMENT	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY OUTCOME
				exposure) for MDO. Only a small proportion of any marine reptile population is expected to be exposed to this EMBA. Light oils, such as unweathered MDO, expose marine reptiles to volatile PAHs which may result in breathing, sight, or gastro-intestinal injuries (CoA 2017a). These injuries to marine reptiles can result in decreased health, starvation, increased stranding and decreased breeding condition (CoA 2017a). Sudden high toxic contaminant load during pre-dive inhalations have caused instantaneous death to marine turtles (Shigenaka, 2021 cited in Yaghmour et al. 2022). Impacts to marine reptiles from surface hydrocarbon exposure because of a vessel collision is expected to be localised and temporary based on weathering properties of MDO. No long-term effects are expected however impacts leading to death to individual EPBC Act listed marine reptiles may occur. Impacts are assessed as Severe (3). Prevention controls are in place to prevent the risk of accidental release from vessel collision. The likelihood of accidental release – vessel collision is assessed as Rare (1). The risk rating for accidental release – vessel collision resulting in injury / mortality to marine reptiles during the activity is ranked Low (1).					CM 38: MO 30: Prevention of collisions CM 39: AIS transceiver CM 41: NOPSEMA accepted MODU Safety Case CM 44: NOPSEMA accepted Oil Pollution Emergency Plan (OPEP)				
	Support activities	Injury / mortality to marine fauna	Marine Fauna - Marine mammals	A collision between two vessels in the Operational Area has the potential to rupture a fuel tank and discharge 280 m^3 Marine Diesel Oil (MDO) to surface waters. Modelling predicted the maximum distance of floating oil at the moderate threshold (10 g/m^2) to extend 19 km from the release location (RPS 2022). A high percentage (95%) is expected to evaporate when on the sea surface with only a small portion (5%) expected to persist and decay over time. The maximum length of shoreline accumulation above the moderate threshold (100 g/m^2) is only predicted to be 1 km during winter conditions. The maximum volume of hydrocarbons ashore is predicted as 9.1 m^3 during winter conditions (RPS 2022). The hydrocarbon EMBA for MDO is expected to be mostly limited to offshore open waters, with limited shoreline accumulation (<1 km maximum length of shoreline at East Gippsland) predicted for localised areas above the moderate threshold (100 g/m^2) (RPS 2022). The migration and reproduction BIAs for the southern right whale, foraging and distribution BIAs for the pygmy blue whale, migratory and foraging BIA for the humpback whale, and breeding BIA for the Indo Pacific spotted bottlenose dolphin occur within the hydrocarbon EMBA (moderate exposure) for MDO.	3	1	1	A	CM 24: Ongoing stakeholder consultation CM 25 : Pre-start notifications CM 27: Navigation aids CM 36: SOPEP/ SMPEP CM 37: Marine Operations Procedure(s) - vessel entry into project area, speeds, separation distances CM 38: MO 30: Prevention of collisions	None identified	ALARP	No stakeholder objections or claims raised	Acceptable

ASPECT	ACTIVITY	IMPACT	AFFECTED RECEPTOR	IMPACT / CONSEQUENCE EVALUATION	RISK ASSESSMENT SEVERITY LEVEL	LIKELIHOOD	RISK RATING	ALARP DECISION CONTEXT	DEMONSTRATION OF ALARP CONTROL MEASURES	ADDITIONAL CONTROL MEASURES CONSIDERED	ALARP OUTCOME	DEMONSTRATION OF ACCEPTABILITY ACCEPTABILITY ASSESSMENT	ACCEPTABILITY OUTCOME
				MDO is considered a light hydrocarbon that rapidly evaporates (RPS 2022). In the event of an accidental release of MDO, marine mammals are more likely to be exposed to volatile hydrocarbon fumes from ingestion or inhalation. Physical oiling of marine mammals from MDO is unlikely. The absence of hairs and the frequent sloughing of skin cells provide little opportunity for oil to adhere to cetacean bodies (Helm et al. 2015). Cetaceans do not drink large volumes of sea water and would not ingest much oil, their foraging strategies likely do not include scavenging on oil-killed prey, and the toxic volatile components of oil can dissipate quickly so exposure to toxins through inhalation may be minimal. (Helm et al. 2015). In the event a marine mammal surfaces in fresh MDO surface slick, effects of hydrocarbon inhalation or ingestion may lead to hypothermia, organ dysfunction, congested lungs, damaged airways, emphysema, gastrointestinal ulceration and haemorrhaging, eye and skin lesions, and decreased body mass due to restricted diet (AMSA 2022). The potential for population impacts to marine mammals following an MDO release would need to coincide with a migration event to result in exposure of many individuals. Southern right whales and pygmy blue whales are pelagic (move freely in the oceans) and because of their migratory patterns may only be occasionally affected by surface hydrocarbons (AMSA 2022). Given the mobility and wide geographical distribution of marine mammals, only transient marine mammal individuals would be expected to surface in an area exposed to surface hydrocarbons, resulting in short-term and localised consequences, with no long-term population viability effects (Helm et al. 2015). Impacts to marine mammals from surface hydrocarbon exposure because of a vessel collision is expected to be localised and temporary based on weathering properties of MDO. No long-term effects are expected however impacts leading to injury to a small number of EPBC Act listed marine mammals may be expected due to the presence of BIAs (Section 4.5.3). Impacts are assessed as Severe (3). Prevention controls are in place to prevent the risk of accidental release from vessel collision. The likelihood of accidental release – vessel collision is assessed as Rare (1). The risk rating for accidental release – vessel collision resulting in injury / mortality to marine mammals during the activity is ranked Low (1).					CM 39: AIS transceiver CM 41: NOPSEMA accepted MODU Safety Case CM 44: NOPSEMA accepted Oil Pollution Emergency Plan (OPEP) CM 45: Operational & Scientific Monitoring Bridging Implementation Plan (OSM-BIP)				
	Support activities	Change to the functions, interests or	Commercial fisheries and aquaculture	A collision between two vessels in the Operational Area has the potential to rupture a fuel tank and discharge 280 m^3 Marine Diesel Oil (MDO) to surface waters.	2	1	1	A	CM 24: Ongoing stakeholder consultation	None identified	ALARP	No stakeholder objections or claims raised	Acceptable

ASPECT	ACTIVITY	IMPACT	AFFECTED RECEPTOR	IMPACT / CONSEQUENCE EVALUATION	RISK ASSESSMENT: SEVERITY LEVEL	RISK ASSESSMENT: LIKELIHOOD	RISK ASSESSMENT: RISK RATING	DEMONSTRATION OF ALARP: ALARP DECISION CONTEXT	DEMONSTRATION OF ALARP: CONTROL MEASURES	DEMONSTRATION OF ALARP: ADDITIONAL CONTROL MEASURES CONSIDERED	DEMONSTRATION OF ALARP: ALARP OUTCOME	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY ASSESSMENT	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY OUTCOME
		activities of other users		Modelling predicted the maximum distance of floating oil at the moderate threshold (10 g/m^2) to extend 19 km from the release location (RPS 2022). A high percentage (95%) is expected to evaporate when on the sea surface with only a small portion (5%) expected to persist and decay over time. The maximum length of shoreline accumulation above the moderate threshold (100 g/m^2) is only predicted to be 1 km during winter conditions. The maximum volume of hydrocarbons ashore is predicted as 9.1 m^3 during winter conditions (RPS 2022). The hydrocarbon EMBA for MDO is expected to be mostly limited to offshore open waters, with limited shoreline accumulation (<1 km maximum length of shoreline at East Gippsland) predicted for localised areas above the moderate threshold (100 g/m^2) (RPS 2022). Eight Commonwealth-managed fisheries have management areas that occur within the hydrocarbon EMBA (low exposure) for MDO. Commercial fishing has the potential to be impacted through exclusion zones associated with the hydrocarbon release, the release response and subsequent reduction in fishing effort. Exclusion zones may impede access to commercial fishing areas, for a short period of time. The precautionary exclusion from fishing grounds can be expected until water quality monitoring verifies the absence of residual hydrocarbons, as such providing confidence to consumers in fisheries tainting. Fishing areas may be closed for fishing for a short duration because of the risks of the catch being tainted by hydrocarbons. Concentrations of petroleum contaminants in fish and crustacean and mollusc tissues pose adverse human health effects, and until these products cleared by the health authorities, they could be restricted for sale and human consumption. Studies of laboratory trials or of fish collected after release events (including the Hebei Spirit, Macondo, Sea Empress, Montara spills) find evidence of elimination of PAHs in fish tissues returning to reference levels within two months of exposure (Challenger and Mauseth 2011; Davis et al. 2002; Gagnon & Rawson 2011; Gohlke et al. 2011; Jung 2011; Law 1997; Rawson et al. 2011). Change to the functions, interests or activities of commercial fisheries will be localised, with no long-term consequences. Impacts are assessed as Minor (2). Prevention controls are in place to prevent the risk of accidental release from vessel collision. The likelihood of accidental release – vessel collision is assessed as Rare (1).					CM 25 : Pre-start notifications CM 27: Navigation aids CM 36: SOPEP/ SMPEP CM 37: Marine Operations Procedure(s) - vessel entry into project area, speeds, separation distances CM 38: MO 30: Prevention of collisions CM 39: AIS transceiver CM 41: NOPSEMA accepted MODU Safety Case CM 44: NOPSEMA accepted Oil Pollution Emergency Plan (OPEP) CM 45: Operational & Scientific Monitoring Bridging Implementation Plan (OSM-BIP)				

ASPECT	ACTIVITY	IMPACT	AFFECTED RECEPTOR	IMPACT / CONSEQUENCE EVALUATION	RISK ASSESSMENT: SEVERITY LEVEL	RISK ASSESSMENT: LIKELIHOOD	RISK ASSESSMENT: RISK RATING	DEMONSTRATION OF ALARP: ALARP DECISION CONTEXT	DEMONSTRATION OF ALARP: CONTROL MEASURES	DEMONSTRATION OF ALARP: ADDITIONAL CONTROL MEASURES CONSIDERED	DEMONSTRATION OF ALARP: ALARP OUTCOME	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY ASSESSMENT	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY OUTCOME
				The risk rating for accidental release – vessel collision resulting in change to the functions, interests or activities of commercial fisheries during the activity is ranked Low (1).									
	Support activities	Change to the functions, interests or activities of other users	Marine and coastal industry Tourism and recreation	A collision between two vessels in the Operational Area has the potential to rupture a fuel tank and discharge 280 m^3 Marine Diesel Oil (MDO) to surface waters. Modelling predicted the maximum distance of floating oil at the low threshold (1 g/m^2) to extend 168 km from the release location due to a small, isolated patch which had resurfaced near the NSW boarder during a simulation under summer conditions. Under winter conditions the maximum distance of floating oil at the low threshold (1 g/m^2) is predicted to extend only 28 km from the release location (RPS 2022). The hydrocarbon EMBA for MDO is expected to be mostly limited to offshore open waters, with limited shoreline accumulation (<1 km maximum length of shoreline at East Gippsland) predicted for localised areas above the moderate threshold (100 g/m^2) (RPS 2022). Other marine users are expected to include commercial shipping, defence activities and recreational users. Following a hydrocarbon release other marine users are expected to be impacted largely by implementation of exclusion zones. Exclusion zones may impede access to areas, for a short period of time. Marine users in the area may be impacted by oiled/contamination of equipment and assets. Notably, commercial traffic may require water intake for system cooling and heating. In the event of a spill, it is anticipated that any oceanwater intakes will be closed off to prevent contamination and equipment damage. As there is limited shoreline contact (<1 km maximum length of shoreline at East Gippsland) most recreational fishing and other coastal recreation activities will be unaffected by an MDO release. Given the offshore location and volatility of MDO these any impacts would be largely perception issues associated with visible hydrocarbons. Following Macondo well blowout in the Gulf of Mexico in 2010, recreational fishing harvests in 2011, 2012 and 2013 were recorded to exceed landings from 2007-09, prior to the blowout (BP 2014), suggesting recovery of fish stocks and confidence that public perception in fish quality. Change to the functions, interests or activities of other users will be localised, with no long-term consequences. Impacts are assessed as Minor (2). Prevention controls are in place to prevent the risk of accidental release from vessel collision. The likelihood of accidental release – vessel collision is assessed as Rare (1).	2	1	1	A	CM 24: Ongoing stakeholder consultation CM 25 : Pre-start notifications CM 27: Navigation aids CM 36: SOPEP/ SMPEP CM 37: Marine Operations Procedure(s) - vessel entry into project area, speeds, separation distances CM 38: MO 30: Prevention of collisions CM 39: AIS transceiver CM 41: NOPSEMA accepted MODU Safety Case CM 44: NOPSEMA accepted Oil Pollution Emergency Plan (OPEP) CM 45: Operational & Scientific Monitoring Bridging Implementation Plan (OSM-BIP)	None identified	ALARP	No stakeholder objections or claims raised	Acceptable

ASPECT	ACTIVITY	IMPACT	AFFECTED RECEPTOR	IMPACT / CONSEQUENCE EVALUATION	RISK ASSESSMENT: SEVERITY LEVEL	RISK ASSESSMENT: LIKELIHOOD	RISK ASSESSMENT: RISK RATING	DEMONSTRATION OF ALARP: ALARP DECISION CONTEXT	DEMONSTRATION OF ALARP: CONTROL MEASURES	DEMONSTRATION OF ALARP: ADDITIONAL CONTROL MEASURES CONSIDERED	DEMONSTRATION OF ALARP: ALARP OUTCOME	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY ASSESSMENT	DEMONSTRATION OF ACCEPTABILITY: ACCEPTABILITY OUTCOME
				The risk rating for accidental release – vessel collision resulting in change to the functions, interests or activities of other users during the activity is ranked Low (1).									
	Support activities	Change in water quality	Cultural heritage values and sensitivities	Impacts to water quality from hydrocarbon exposure has the potential to result in physical/tangible change to cultural heritage value of oceans and waterways. The intrinsic link between First Nations people and culturally significant species are understood to be based on First Nations obligations to care for the species (Weir, 2012). The management of culturally significant species is considered to be applied to the species at a population level. As a result, impacts to culturally significant species at a population level has the potential to disrupt the intrinsic link of First Nations people ability to care for culturally significant species. As discussed above, impacts to species from surface hydrocarbon exposure because of a vessel collision is expected to be localised and temporary based on weathering properties of MDO. No long-term effects are expected however impacts leading to the death of individual EPBC Act listed species may occur. Impacts to species is assessed as Minor (2) and Severe (3). Prevention controls are in place to prevent the risk of accidental release from vessel collision. The likelihood of accidental release – vessel collision is assessed as Rare (1). The risk rating for accidental release – vessel collision resulting in injury / mortality to fishes during the activity is ranked Low (1).	3	1	1	A	CM 24: Ongoing stakeholder consultation CM 25 : Pre-start notifications CM 27: Navigation aids CM 36: SOPEP/ SMPEP CM 37: Marine Operations Procedure(s) - vessel entry into project area, speeds, separation distances CM 38: MO 30: Prevention of collisions CM 39: AIS transceiver CM 41: NOPSEMA accepted MODU Safety Case CM 44: NOPSEMA accepted Oil Pollution Emergency Plan (OPEP) CM 45: Operational & Scientific Monitoring Bridging Implementation Plan (OSM-BIP)	None identified	ALARP	No stakeholder objections or claims raised	Acceptable

5.3. Higher Order Impacts and Risks

The ENVID identified the need for either modelling outcomes or an in-depth literature review to support the evaluation and assessment of potential impacts to receptors. In these cases, a detailed higher order impacts and risks evaluation has been provided for:

- Impulsive underwater sound emissions (Section 5.4)
- Continuous underwater sound emissions (Section 5.5)
- Accidental release – loss of well control (Section 5.6).

5.4. Impulsive Underwater Sound Emissions

5.4.1. Aspect Source

The activity will generate impulsive underwater sound emissions from:

- Geophysical surveys (up to 4 days):
  - MBES
  - SSS
  - SBP
  - 2D seismic survey (2D survey)
- Vertical seismic profiling (VSP) (up to 4 hours)

See Table 3-3 and Section 3.6.5 for further details on each of these activities.

5.4.1.1. Noise Modelling

To determine the spatial extent for impact evaluation, Emperor Energy commissioned JASCO to undertake a modelling study of underwater sound levels associated with activities identified to produce impulsive sound emissions (Lui et al. 2025; APPENDIX F).

Based on a review of the geophysical and VSP equipment to be used (Section 3.5.1 and 3.6.5), it was identified that the 2D geophysical survey and VSP techniques were most relevant to the assessment of potential impacts to receptors, due to the greater range in operating frequencies and higher source sound levels (Lui et al. 2025). Impulsive sound emissions produced from the other geophysical survey activities are expected to have sound contours within those produced for 2D survey and VSP techniques, and therefore have not been evaluated further. JASCO's Airgun Array Source Model (AASM) was used to predict the sound source levels for the VSP and 2D survey activities, with the sound source modelled over the AASM's full frequency range, up to 25 kHz (Lui et al. 2025).:

- Modelling of the VSP sound source (Lui et al. 2025) predicts the peak source pressure level of 241 dB re 1 µPa m.
- Modelling of the 2D survey sound source (Lui et al. 2025) predicts the peak source pressure level of 230 dB re 1 µPa m.

The selected equipment and associated sound source levels used in the modelling are representative for those that will be used in the activity. The equipment specifications are expected to be analogous to those considered by Lui et al. (2025) whose modelling accounted for a range of sound source types.

Table 5-4 details the impulsive sound emission scenarios modelled for this activity.

Table 5-4: Description of scenarios, site location and water depth for impulsive noise modelling scenarios (Lui et al. 2025)

SCENARIO	DESCRIPTION	SOUND SOURCES	LATITUDE (°S)	LONGITUDE (°E)	DEPTH (M)
1	VSP operations – with a total of 5, 10, 25, 50, 100, 150, 200, 250, and 300 impulses were considered independently to inform the assessment of different operational configurations.	VSP - with a source volume of 600 in^3 over a 24-hour period.	38°08'30.87''	148°32'21.8''	66.7
2	Geophysical Survey - 2D Shallow Seismic Survey with a total of 495 discharges impulses.	Single 160 in^3 seismic source over a 24-hour period.	38°08'30.87''	148°32'21.8''	66.7

5.4.1.2. Thresholds and Results

To assess whether an impact may occur modelled received sound levels were compared to receptor noise effect criteria associated with behavioural changes, Temporary Threshold Shifts (TTS), Permanent Threshold Shifts (PTS), mortality or potential mortal injury for sound sensitive receptors (Table 5-5). These criteria are based on published scientific research and papers as detailed in and within the relevant receptor section. In the absence of noise criteria specific to 2D survey and VSP techniques, criteria applied for seismic surveys have been used.

Table 5-5: Impulsive PTS, TTS and Behaviour sound effect criteria used and the maximum distance to noise effect criteria for 2D survey and VSP (Lui et al. 2025)

RECEPTOR	NOISE EFFECT CRITERIA	MAXIMUM RMAX DISTANCE (KM)		REFERENCE
		2D SURVEY	VSP	
Invertebrates: effect at the seafloor	209 dB PK-PK 210 dB PK-PK 212 dB PK-PK	- - -	0.64 0.51 0.01	Day et al. 2016
Invertebrates: no effect at the seafloor	202 dB PK-PK	0.03	0.18	Payne et al. 2007
Fishes: (no swim bladder): mortality/potential mortal injury	>213 dB PK or >219 dB SEL_{24h}	- -	0.02 -	Popper et al. 2014
Fishes: (no swim bladder): recoverable injury	>213 dB PK or >216 dB SEL_{24h}	- -	0.02 -	Popper et al. 2014
Fishes – including fish eggs, and larvae: (swim bladder not involved in hearing): mortality/ potential mortal injury	>207 dB PK or >210 dB SEL_{24h}	- -	0.41 0.02	Popper et al. 2014
Fishes– including fish eggs, and larvae: (swim bladder not involved in hearing): recoverable injury	>207 dB PK or >203 dB SEL_{24h}	- -	0.41 0.06	Popper et al. 2014
Fishes: (swim bladder involved in hearing): mortality/ potential mortal injury	>207 dB PK or >207 dB SEL_{24h}	- -	0.41 0.03	
Fishes: (swim bladder involved in hearing): recoverable injury	>207 dB PK or >203 dB SEL_{24h}	- -	0.41 0.06	Popper et al. 2014

RECEPTOR	NOISE EFFECT CRITERIA	MAXIMUM RMAX DISTANCE (KM)		REFERENCE
		2D SURVEY	VSP	
Fishes: (swim bladder or no swim bladder): TTS	>186 dB SEL_{24h}	0.10	1.07	Popper et al. 2014
Turtle: behavioural response	166 dB SPL	0.70	1.74	McCauley et al. 2000
Turtle: behavioural disturbance	175 dB SPL	0.17	0.54	McCauley et al. 2000
Turtle: PTS	>232 dB PK or 204 dB SEL_{24h}	- -	- 0.05	Finneran et al. 2017
Turtle: TTS	>226 dB PK or 189 dB SEL_{24h}	- -	- 0.53	Finneran et al. 2017
Marine mammals: behavioural	160 dB SPL	1.48	2.82	NOAA 2024
Low-frequency cetaceans: PTS (humpback and pygmy blue whales)	222 dB PK 183 dB SEL_{24h}	- 0.02	- 0.85	NMFS 2024
Low-frequency cetaceans: TTS (humpback and pygmy blue whales)	216 dB PK 168 dB SEL_{24h}	- 2.00	- 4.82	NMFS 2024
High-frequency cetaceans: PTS (dolphins, beaked whales, sperm whales)	230 dB PK 193 dB SEL_{24h}	- -	- -	NMFS 2024
High-frequency cetaceans: TTS (dolphins, beaked whales, sperm whales)	224 dB PK 178 dB SEL_{24h}	- -	- 0.03	NMFS 2024
Very High-frequency cetaceans: PTS (pygmy and dwarf sperm whales)	202 dB PK 159 dB SEL_{24h}	0.03 -	0.07 -	NMFS 2024

RECEPTOR	NOISE EFFECT CRITERIA	MAXIMUM RMAX DISTANCE (KM)		REFERENCE
		2D SURVEY	VSP	
Very High-frequency cetaceans: TTS (pygmy and dwarf sperm whales)	196 dB PK 144 dB SEL_{24h}	0.05 -	0.28 0.16	NMFS 2024
Otariid pinnipeds: PTS (seals)	230 dB PK 185 dB SEL_{24h}	- -	- -	NMFS 2024
Otariid pinnipeds: TTS (seal)	224 dB PK 170 dB SEL_{24h}	- -	- 0.05	NMFS 2024

Peak sound pressure level: dB re 1 µPa; SEL24h dB re 1µPa2·s.

5.4.2. Impact Evaluation

Potential impacts of impulsive underwater sound emissions to receptors are:

- Behavioural changes to marine fauna
- Auditory Impairment to marine fauna, including:
  - Recoverable injury
  - Mortality / potential mortal injury
  - Temporary threshold shift (TTS)
  - Permanent threshold shift (PTS).

Underwater impulsive sound emissions may impact the following biological receptors:

- Marine invertebrates
- Fishes
- Marine reptiles
- Marine mammals.

5.4.2.1. Marine Invertebrates

Comprehensive reviews of seismic noise impacts to invertebrates have been undertaken by Carroll et al. (2017) and Edmonds et al. (2016). Literature reviews suggests particle motion, rather than sound pressure, is a more important factor for crustacean and bivalve hearing. There are currently no defined noise effect criteria for invertebrates and hence the results from the Day et al. (2016) study on acoustic impacts from seismic exposure on southern rock lobsters (*Jasus edwardsii*) are typically used. 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 peak-peak pressure: 209–212 dB re 1 µPa.

Payne et al (2007) found no effects to the American lobster (*Homarus americanus*) in righting time or haemolymph biochemistry but a possible reduction in calcium after exposure to received noise levels of 202 dB re 1 µPa (PK-PK). Thus, the Payne et al (2007) level is applied as a no effect criteria.

Noise modelling (Lui et al. 2025: APPENDIX F : Table 5-5) predicted invertebrate noise criteria for effect or no effect at the seafloor to be reached. Review of the maximum distances to noise effect criteria for invertebrates identified underwater sound generated from VSP reaches these criteria at a greater range in comparison to 2D survey maximum distances. The maximum distances to invertebrate noise criteria for impulsive underwater sound emissions expected for the activities are:

- Invertebrate effect at the seafloor criteria were reached within 64 m of the VSP sound source. These effect criteria were not reached for the 2D survey.
- Invertebrate no effect at the seafloor criterion was reached with 180 m of the VSP sound source and 30 m of the 2D survey sound source.

As such, both effect and no effect criteria for invertebrates may occur, however, the effect will be limited to within the operational area, in proximity to the sound source.

McCauley et al. (2000) assessed the effects of air gun noise on caged squid (*Sepioteuthis australis*). No sub-lethal injury or mortality because of exposures in this study was observed. Several squid showed alarm responses to the start-up of an airgun by firing their ink sacs and/or jetting away from the source, but this was not observed for similar or greater levels if the signal was ramped up. General habituation was observed with a decrease in alarm responses with subsequent exposures. During the trial the squid showed avoidance to the airgun by keeping close to the water surface at the end of the cage furthest from the airgun (within the sound shadow). As such, avoidance of invertebrates may occur during VSP and the 2D seismic surveys, however, the maximum area affected is anticipated to be limited to <180 m, and therefore impacts are not expected to be significant.

Based on noise modelling, only sublethal effects to invertebrates are expected within 180 m of an impulsive sound source during the activity. Invertebrates within this range may include commercially valued invertebrate species such as squid, octopus, rock lobster and giant crab species. Impacts to commercially valued marine invertebrates are expected to be limited to behavioural effects such as altered swimming patterns. Impact severity level was assessed as Slight (1).

5.4.2.2. Fishes

Noise effect criteria for fishes are based on the presence of a swim bladder. Typically, site-attached and demersal fish have a swim bladder, whereas pelagic fish do not. As noise effect criteria for sharks does not currently exist, they are assessed as fishes without swim bladders. Qualitative and quantitative noise effect criteria used in this assessment for fishes are from the American National Standards Institute (ANSI) accredited report of sound exposure guidelines for fishes and sea turtles (Popper et al. 2014).

Behavioural Effects

There is limited research on how free-ranging fish react to seismic sound sources (Carroll et al. 2017). One study by Wardle et al. (2001) found that free-ranging marine fish inhabiting an inshore reef exposed to seismic source sounds (195-218 dB re 1 µPa) exhibited a startle response but did not avoid the area. Behavioural response studies on caged fish exposed to seismic sound sources observed startle and alarm responses (Carroll et al. 2017; Fewtrell and McCauley 2012).

Popper et al. (2014) suggests fishes are highly likely to exhibit a behavioural response to impulsive sound within hundreds of metres from the sound source. As a result, behavioural responses (startle and avoidance) to fishes are expected to be limited to within the Operational Area during VSP operations or geophysical surveys.

The Operational Area does not overlap areas where site-attached EPBC Act listed fish species are likely to be present or contains habitats that encourage aggregations of these fishes (Sections 4.4.1 and 4.5.2). Potential behavioural response effects to fishes are expected to be limited to transiting fish individuals, including the following EPBC Act listed threatened species with the potential to be present in the Operational Area:

- Blue Warehou (CD)
- Eastern Gemfish (CD)
- Harrison's Dogfish (CD)
- Little Gulper Shark (CD)
- Orange Roughy (CD)
- School Shark (eastern) (CD)

- Whale Shark (V)
- White Shark (V)

Given the intermittent and short-duration of geophysical surveys and VSP operations, the limited spatial area (within hundreds of metres from the impulsive sound source) where behavioural responses (startle and avoidance) to fishes are expected, and the absence of habitats encouraging aggregations or site-attached fishes, potential behavioural effects to fishes is unlikely to result in population level effects. Impact severity level was assessed as Slight (1).

Injury and Mortality

Popper et al. (2014) defined quantitative effect criteria for three types of immediate effects to fishes from impulsive sound exposure:

- Mortality, including injury leading to death.
- Recoverable injury, including injuries unlikely to result in mortality, such as hair cell damage and minor haematoma.
- TTS.

Table 5-5 details the noise effect criteria from Popper et al. (2014) and the distances at which modelling estimated they could be reached for fishes with and without a swim bladder. In summary:

- Mortality/potential mortal injury noise effect criteria is predicted within a maximum distance of 410 m for fish with a swim bladder, and 20 m for fish without a swim bladder from the VSP sound source. These noise effect criteria were not reached for the 2D survey.
- Recoverable injury noise effect criteria is predicted within a maximum distance of 410 m for fish with a swim bladder, and 20 m for fish without a swim bladder from the VSP sound source. These noise effect criteria were not reached for the 2D survey.
- TTS noise effect criterion for fish with or without a swim bladder was predicted within at a maximum distance of 1.07 km from the VSP sound source and 0.10 km from the 2D survey sound source.

As such, the potential for auditory injury to fish will be limited to within the operational area, in proximity to the sound source. Studies to date have not shown mortality in relation to potential impact to fish from impulsive noise, though prolonged or extreme exposure to high-intensity, low-frequency sound, may lead to physical damage such as threshold shifts in hearing or barotraumatic ruptures (Carroll et al. 2017). Based on timeframes of geophysical surveys (4 days) and VSP (4 hours) for the activity, impulsive underwater sound generated during the activities is not expected result in prolonged exposure to fish.

The Operational Area does not overlap any areas where site-attached EPBC Act listed fish species are likely to be present or contains habitats that encourage aggregations of these fish (Sections 4.4.1 and 4.5.2). Potential impacts to fish are expected to be limited to transiting fish individuals, including the following EPBC Act listed threatened species with the potential to be present in the Operational Area as listed in Table 4-4.

Given the intermittent and short-duration of geophysical surveys and VSP operations, the limited spatial area (approximately 1 km of an impulsive sound source) of exposure to impulsive sound above fish noise effect criteria, and the absence of habitats encouraging aggregations or site-attached fish, potential impacts to fish is unlikely to result in population level effects. Impact severity level was assessed as Slight (1).

5.4.2.3. Marine Turtles

Behavioural Effects

McCauley et al. (2000) noise effect criteria for behavioural response to turtles from impulsive sound was used in this assessment. Table 5-5 details the noise effect criteria from MacCauley et al. (2000) and the distances at which modelling estimated they could be reached. For VSP and the 2D survey the behavioural response noise effect criteria were predicted at maximum distances of 1.74 km and 700 m from the impulsive sound sources, respectively. As a result, behavioural responses to marine turtles are expected to be limited to within the Operational Area during VSP operations or geophysical surveys.

Three marine turtle species may occur within the Operational Area. No BIAs or habitat critical to the survival of the species occur within the Operational Area (see Section 4.5.4). The potential for behavioural response effects on marine turtles from impulsive sound generated during the activity is expected to be limited to transiting individuals.

Given the intermittent and short-duration of geophysical surveys and VSP operations, the limited spatial area (within 1.74 km from the impulsive sound source) where behavioural response to marine turtles are expected, and the absence of BIAs or habitat critical to the survival of the species within the Operational Area, potential behavioural effects to marine turtles is unlikely to result in population level effects. Impact severity level was assessed as Slight (1).

Injury (TTS and PTS)

Finneran et al. (2017) noise effect criteria for injury to turtles from impulsive sound exposure was used in this assessment. Table 5-5 details the noise effect criteria from Finneran et al. (2017) and the distances at which modelling estimated they could be reached. In summary:

- The noise effect criteria for injury to turtles were not reached for the geophysical survey.
- The noise effect criteria for injury to turtles for VSP is predicted at a maximum distance of 530 m (TTS) for the sound exposure level (SEL) while the noise effect criteria based on the for the peak sound pressure level (PK) is not reached.

The Finneran et al. (2017) noise effect criteria for injury to turtles from impulsive sound exposure is a SEL_{24h} cumulative metric that requires a turtle to be consistently exposed at this noise effect criteria for a 24-hour period for injury to occur. For injury to occur, marine turtles require to remain within 530 m of the MODU during VSP operation for at least a 24-hour period. Given that marine turtles (if present) are expected to be transiting through the Operational Area and the duration of VSP operations is limited to up to 4 hours, the risk of injury to marine turtles is not credible.

5.4.2.4. Marine Mammals

Behavioural Effects

The United States National Marine Fisheries Service (NOAA 2024) acoustic threshold for behavioural effects in marine mammals was used in this assessment. The acoustic threshold for behavioural effects in marine mammals is predicted at a maximum of 2.82 km for the VSP operations, and 1.48 km for the 2D seismic survey (Table 5-5). As a result, behavioural effects to marine mammals are expected to be limited to within the Operational Area during VSP operations or geophysical surveys.

- The following marine mammal species listed as threatened or migratory under the EPBC Act have the potential to be present in the Operational Area: Blue whale, southern right whale (endangered, migratory)

- Fin whale, sei whale (vulnerable, migratory)
- Antarctic minke whale, Bryde's whale, dugong, dusky dolphin, humpback whale, killer whale, pygmy right whale, sperm whale (migratory).

The Operational Area also overlaps 'possible foraging area' BIA for the pygmy blue whale, and the migration BIA for the southern right whale. Other marine mammals that may undertake biologically important behaviours (foraging, feeding or related behaviour likely in the likely to occur) in the Operational Area include the fin whale, pygmy right whale, and the sei whale.

Given the intermittent and short-duration of geophysical surveys and VSP operations, and the limited spatial area (within 2.82 km from the impulsive sound source) where behavioural response to marine mammals may occur, the risk of behavioural effects to marine mammals is unlikely to result in population level effects. The impact severity levels for potential behavioural effects to marine mammals was assessed as Minor (2) based on:

- Localised and temporary impacts to migrating southern right whales, possibly foraging blue whales and marine mammals that may undertake biologically important behaviours (blue whale, fin whale, pygmy right whale, and the sei whale) in the Operational Area.
- Implementing the control measures detailed in Section 5.4.3, adapted using maximum distances to marine mammal behavioural effects threshold, can reduce the risk of displacement of possibly foraging blue whales during VSP operations and the 2D survey. Distances to the marine mammal behavioural effects threshold (2.82 km for the VSP operations, and 1.48 km for the 2D seismic survey (Table 5-5)) have been used to define operating distances, observation distances and pre-activity/activity survey zones for the control measures detailed in Section 5.4.3. The control measures detailed in Section 5.4.3 ensures the activity is in accordance with the Guidance on Key Terms within the Conservation Management Plan for the Blue Whale (DAWE 2021a) that details mitigation measures must be implemented to reduce the risk of displacement occurring during the activity where modelling indicates that behavioural disturbance within a Foraging Area may occur.
- The fin and sei whale's conservation advice (TSSC 2015b; TSSC 2015c) has a consequence rating for anthropogenic noise and acoustic disturbance as minor with the extent over which the threat may operate as moderate-large.
- The Recovery Plan for the Southern Right Whale (DCCEEW, 2024c) identifies acute industrial noise, of which geophysical surveys and VSP would be classed, as a threat that is classified as a minor consequence which is defined as individuals are affected but no affect at a population level. Distances to the marine mammal behavioural effects threshold (2.82 km for the VSP operations, and 1.48 km for the 2D seismic survey (Table 5-5)) have been used to define operating distances, observation distances and pre-activity/activity survey zones for the control measures detailed in Section 5.4.3. Therefore, these control measures can be implemented to reduce the risk of behavioural disturbance to migrating southern right whales.

Injury (TTS and PTS)

The US National Marine Fisheries Service (NMFS 2024) reviewed available literature to determine exposure criterion for the onset of temporary hearing TTS and PTS for marine mammals based on their frequency hearing range. NMFS (2024) details that after sound exposure ceases or between successive sound exposures, the potential for recovery from hearing loss exists, with PTS resulting in incomplete recovery and TTS resulting in complete recovery.

National Marine Fisheries Service (NMFS 2024) has provided updated thresholds for the onset of PTS and TTS. These criteria as details in Table 5-5 are based on dual acoustic injury criteria for impulsive sounds that included peak pressure level thresholds and SEL_{24h} thresholds, where the subscripted 24h refers to the accumulation period for calculating SEL. The peak sound pressure level (PK) criterion is not frequency weighted whereas the SEL_{24h} is frequency weighted according to the marine mammal species hearing group. The following sections provide an evaluation on potential injury based on each marine mammal species hearing group.

LOW-FREQUENCY CETACEANS

Table 5-5 details the low-frequency cetacean noise effect criteria for PTS and TTS and the distances at which modelling estimated these criteria are reached. In summary:

- VSP operations: PTS and TTS SEL_{24h} thresholds were predicted at maximum distances of 850 m and 4.82 km from the sound source, respectively.
- 2D survey: PTS and TTS SEL_{24h} thresholds were predicted at maximum distances of 20 m and 2 km from the sound source, respectively.
- PTS and TTS PK noise effect criteria for both VSP operations and the 2D survey were not reached.

Modelling results have predicted only the impulsive sound TTS and PTES SEL_{24h} thresholds for low-frequency cetaceans to be reached. TTS and PTS SEL_{24h} thresholds is a cumulative metric that requires a receptor to be consistently exposed at this noise effect criteria for a 24-hour period for injury to occur. As a result, the potential of injury (TTS and PTS) to low-frequency cetaceans during the activity requires a low-frequency cetacean to be consistently exposed to VSP operations or the 2D survey for a 24-hour period for injury to occur. VSP operations is limited to up to 4 hours, therefore the risk of injury to low-frequency cetaceans during VSP operations is not credible and not considered further. For the 2D survey, low-frequency cetaceans require to remain within 2 km of the moving survey vessel for at least a 24-hour period for injury to occur. As a result, the only event where potential risk of injury to low-frequency cetaceans can occur is during the 2D survey.

The following low-frequency cetaceans listed as threatened or migratory under the EPBC Act have the potential to be present in within 2 km of the moving survey vessel in the Operational Area:

- Blue whale, southern right whale (endangered, migratory)
- Fin whale, sei whale (vulnerable, migratory)
- Antarctic minke whale, Bryde's whale, humpback whale, pygmy right whale (migratory).

The Operational Area also overlaps ‘possible foraging area’ BIA for the pygmy blue whale, and the migration BIA for the southern right whale. Other marine mammals that may undertake biologically important behaviours (foraging, feeding or related behaviour likely in the likely to occur) in the Operational Area include the fin whale, pygmy right whale, and the sei whale.

The Operational Area does not contain habitats that encourages high-site fidelity for low-frequency cetaceans given the area does not overlap reproduction, known foraging area, foraging annual high use area BIAs for low-frequency cetaceans. Low-frequency cetaceans in the Operational Area are not expected to remain for extended periods and are expected to transit through. Given the intermittent and short-duration of the 2D survey, the limited spatial area (within 2 km from the moving survey vessel) where injury may occur, and that low-frequency cetaceans in the Operational Area are expected to transit through and not remain in the area for extended periods, potential injury to low-frequency cetaceans during the 2D survey is not considered credible and not considered further.

HIGH AND VERY HIGH-FREQUENCY CETACEANS

Table 5-5 details the high and very high-frequency cetacean noise effect criteria for PTS and TTS and the distances at which modelling estimated these criteria are reached. In summary:

- High-frequency cetaceans: TTS SEL_{24h} threshold for VSP operations was the only impulsive noise effect criteria reached, which was predicted within a maximum distance of 30 m from the sound source.
- Very high-frequency cetaceans: TTS SEL_{24h} threshold for VSP operations was the only SEL_{24h} threshold reached, which was predicted within a maximum distance of 190 m from the sound source. The TTS and PTS PK noise effect criteria for VSP operations were predicted at maximum distances of 280 m and 70 m from the sound source, respectively. The TTS and PTS PK noise effect criteria for the 2D survey were predicted at maximum distances of 50 m and 30 m from the sound source, respectively.

The maximum distances to high and very high-frequency cetacean noise effect criteria for PTS and TTS are within the Operational Area. As a result, the following high and very high-frequency cetacean species listed as migratory under the EPBC Act have the potential to be present in the Operational Area:

- Dusky dolphin, killer whale, sperm whale (migratory).

These high and very high-frequency cetaceans may occur in the Operational Area, but no BIAs of biologically important behaviours were identified. High and very high-frequency cetaceans (if present) are expected to be transiting through the Operational Area.

It is considered highly unlikely that high and very high-frequency cetaceans would experience the onset of TTS and PTS from impulsive sound, given the intermittent and short-duration of geophysical surveys and VSP operations, the limited spatial area (within 280 m from the impulsive sound source) where injury may occur, and the absence of BIAs in the Operational Area. If impulsive sound exposure was to occur, impacts would be limited to individuals and therefore unlikely to result in population level effects. The impact severity levels for potential injury (PTS and TTS) to high and very high-frequency cetaceans was assessed as Slight (1).

PINNIPEDS

Table 5-5 details the otariid pinnipeds noise effect criteria for PTS and TTS and the distances at which modelling estimated these criteria are reached. For otariid pinnipeds, the only PTS and TTS noise effect criteria reached was TTS SEL_{24h} threshold during VSP operations, which was predicted at a maximum of 50 m from the sound source.

The long-nosed fur-seal and the Australian fur-seal may occur in the Operational Area but no BIAs or haul out areas were identified. Modelling results have predicted only the impulsive sound TTS SEL_{24h} thresholds for otariid pinnipeds to be reached during VSP operations. SEL_{24h} thresholds is a cumulative metric that requires a receptor to be consistently exposed at this noise effect criteria for a 24-hour period for injury to occur. As a result, the potential of injury (TTS S) to otariid pinnipeds during the activity requires an otariid pinnipeds to be consistently exposed to VSP operations for a 24-hour period for injury to occur. VSP operations is limited to up to 4 hours, therefore the risk of injury to otariid pinnipeds during VSP operations is not credible and not considered further.

5.4.2.5. First Nations Cultural Heritage Values and Sensitivities

The intrinsic link between First Nations people and culturally significant species are understood to be based on First Nations obligations to care for the species (Weir, 2012). The management of culturally significant species is considered to be applied to the species at a population level. As a result, impacts to culturally significant species at a population level has the potential to disrupt the intrinsic link of First Nations people ability to care for culturally significant species.

FISHES

Culturally significant food sources such as fish are located within and migrate through the south-east marine region. Fish were one of the main food resources in coastal areas and cultural heritage listed fish traps can still be found in this region. Many coastal First Nations groups, including the Gunaikurnai and Bunurong people used coastal areas for marine resources and continue to engage in cultural and spiritual significant coastal practices which include subsistence fishing and collecting of other coastal resources in this area (Gunaikurnai Land and Waters Aboriginal Corporation, 2015; Biosis, 2024; NOO, 2002b).

Potential Disruption to Cultural Heritage Values and Sensitivities

Fish are an important resource for First Nations people identified during a review of relevant First Nations group Country Plans and NOO (2002b). First Nations people have a responsibility to care for fish and their habitats to ensure resources can be continued for future generations (NOO, 2002b). Disruptions to species and habitats have the potential to affect the success of populations, which can affect the cultural practices associated with coastal resource fishing and collection.

As discussed in Section 5.4.2.2, potential impacts are assessed as Slight (1) for fish which is unlikely to have a significant impact on individuals at a population level and are not expected to impact the value of culturally significant species. As such, the intrinsic link between environmental receptors and First Nations people's cultural heritage values and sensitivities is expected to be maintained.

CETACEANS

First Nations people around Australia have long had a strong connection to whales and dolphins, which has significance as totemic ancestors to some groups. Cetaceans in Sea Country hold deep cultural significance to First Nations groups of the South-East marine region and feature in Dreaming stories, ceremony, song and dance traditions (NOO, 2002b).

Cetaceans are culturally significant species for the First Nations peoples as identified during a review of relevant First Nations group Country Plans and NOO (2002b). First Nations people have a cultural responsibility to ensure cetaceans that reside within and migrate through Sea Country are cared for and healthy and their habitat is sustained. Whales feature in Dreaming stories, ceremony, song and dance of some First Nations groups along the coasts of Australia. The protection of whale species is paramount to First Nations groups of the South-East marine regions spiritual, physical wellbeing and it is the responsibility of First Nations people to care for Sea Country and protect the species for present and future generations. Whales are also a food resource, and First Nations people still collect parts of beached whales, as has been done for thousands of years (NOO, 2002b).

As discussed in Section 5.4.2.4, EPBC threatened and migratory cetaceans may be present within ensonification area.

Potential Disruption to Cultural Heritage Values and Sensitivities

First Nations people may have kinship and/or a responsibility to care for culturally significant species and their habitats. Impacts to species at a population level may inhibit First Nations people's ability to perform cultural obligations to care for culturally significant species and their habitats. If responsibilities have not been met it could result in a sense of powerlessness to members of First Nation groups responsible for the protection and care of these species (Holcombe, 2022).

As discussed in Section 5.4.2.4, impacts for high and very high frequency whales is assessed as Slight (1) for which is unlikely to have a significant impact on individuals at a population level. Potential impacts to low frequency whales is not considered credible and are not expected to impact the value of culturally significant species. As such, the intrinsic link between environmental receptors and First Nations people's cultural heritage values and sensitivities is expected to be maintained.

PINNIPEDS

Pinnipeds such as seals and sealions are culturally significant species for the First Nations peoples as identified during a review of relevant First Nations group Country Plans and NOO (2002b). The First Nations people of the south-east marine region have a profound relationship with Sea Country and seals feature in cultural practices and Dreaming stories and have been hunted as a valuable food resource. Seals feature in song and dance of the First Nations people and are also a food resource (NOO, 2002b).

Seals and sealions are culturally significant species and of value to First Nations peoples of the south-east marine region. Two species of pinniped may occur within the Operational Area: the New Zealand fur-seal and the Australian fur-seal. No BIAs or habitat critical to the survival of the species were identified for pinnipeds (Section 4.5.3).

Potential Disruption to Cultural Heritage Values and Sensitivities

First Nations people may have kinship and/or a responsibility to care for culturally significant species and their habitats. Impacts to species at a population level may inhibit First Nations people's ability to perform cultural obligations to care for culturally significant species and their habitats. If responsibilities have not been met it could result in a sense of powerlessness to members of First Nation groups responsible for the protection and care of these species (Holcombe, 2022).

As discussed in Section 5.4.2.4, potential impacts pinnipeds is not considered credible and are not expected to impact the value of culturally significant species. As such, the intrinsic link between environmental receptors and First Nations people's cultural heritage values and sensitivities is expected to be maintained.

It is to be noted that through a review of Country Plans, publicly available information, and consultation that turtles have not been identified as a culturally significant species for the First Nations people of this region.

5.4.3. Control Measures ALARP and Acceptability Assessment

Review of the risk evaluation for impulsive underwater sound emissions found the worst-case impact severity level for all receptors is Minor (2). This impact severity level is considered tolerable/acceptable, and ALARP is demonstrated as follows.

5.4.3.1. ALARP Decision Context: Type B

Impacts from impulsive underwater noise emissions are relatively well understood, supported by the existing and growing body of scientific literature and in situ observations. However, inherent variability in individual animal responses introduces a degree of uncertainty when predicting specific reactions. Noise modelling was conducted for the Judith-2 activities to reduce uncertainty.

Activities are well practised, and there are no conflicts with company values, no partner interests and no significant media interests.

An ALARP determination of Type B has been applied to the blue and Southern right whales due to a residual, albeit Minor (2), risk of behavioural disturbance within a BIA. Recognising this residual risk, and consistent with a precautionary approach, the CMP for blue whales and the National Recovery Plan for Southern right whales recommend additional mitigation measures and adaptive management strategies for specific activities and times of year. In response, further risk management controls have been evaluated and several have been adopted. These adopted controls ensure the project's environmental performance objectives are achieved and are aligned with the objectives and relevant actions outlined in the respective species recovery plans. Consequently, an ALARP Decision context Type B has been selected for this aspect.

5.4.3.2. Controls and Acceptability Assessment

ALARP Decision context Type B assigned for impulsive underwater noise highlights additional controls may be required to ensure impacts can be managed to an acceptable level.

Table 5-6 lists and justifies adopted controls and provides evidence against additional controls assessed to ensure impacts associated with impulsive underwater noise is acceptable.

Table 5-6: Controls and Acceptability Assessment

ADOPTED CONTROLS	SOURCE OF GOOD PRACTICE CONTROL MEASURES
CM 9: AGR Whale Observation Management Procedure (VSP and Seismic survey)	The AGR Whale Observation Management Procedure details the controls to prevent possible displacement impacts to foraging pygmy blue whale and migrating southern right whales that maybe present in the Operational Area. The procedure assumes that once an activity is underway foraging/migrating whales that enter the pre-activity survey zone are not displaced as foraging/migrating behaviour has not been disrupted as the whale has commenced or continued foraging/migrating and thus aligns with the Conservation Management Plan for the Blue Whale (CoA 2015a), National Recovery Plan for the Southern Right Whale (DCCEEW 2024) and DAWE (2021) definitions. Prior to an activity commencing, a pre-activity survey will be undertaken of the activity survey zone for: • VSP – 3 km (based on modelled 2.82 km behavioural effect distance) • Geophysical survey – 1.5 km (based on modelled 1.48 km behavioural effect distance) The activity survey zones are based on the distance to the behaviour effect criteria, as detailed in Table 5-5, and have been rounded up to take into account accuracy of estimation of distance at sea. A conservative approach will be adopted whereby it is assumed that all whales present in the activity survey zones are conducting biologically important behaviours (e.g. foraging blue whales, migrating southern right whales). Surveys will be undertaken for 30 min prior to the activity commencing. If a whale is sighted within the pre-activity survey zone the activity will not commence until: • No whales are observed for 30 min within the pre-activity survey zone; or • Whales are observed leaving the pre-activity survey zone. • MFO observations are possible up to 7 km from a vessel bridge height of ~20 m. The period of 30 min is deemed as sufficient time to observe deep diving whales such as blue whales and southern right whales based on blue whale foraging behaviour and dive duration and southern right whale migration behaviours (Section 4.5.3.1). Once the activity has commenced observations will be undertaken within the activity survey zone distances detailed above.

ADOPTED CONTROLS	SOURCE OF GOOD PRACTICE CONTROL MEASURES
	If a whale is sighted within the activity survey zone the following will occur: If the vessel can do so it will move away from the whale and maintain a minimum separation distance equal to the activity survey zone. If the vessel cannot move away from the whale, the vessel will reduce thrusters if safe to do so. The activity will cease as soon as it is safe, and the vessel will move out of the activity survey zone. The activity can recommence once: • No whales are observed for 30 min within the activity survey zone; or • Whales are observed leaving the activity survey zone. Activities can commence at night or in low visibility conditions (i.e., when observations cannot be undertaken) if no more than three whales have been seen in the activity survey zone in the preceding daylight hours and there was a two-hour period of no sightings in the activity survey zone. The no more than three whales criterion is acceptable for blue whales because it indicates the krill stock at the location has been diminished. More than three whales within the previous daylight hours may indicate a large krill supply and more whales could be expected. The daylight hours is justified because it is the longest possible continuous observation period (i.e., one full day of observations). Three southern right whales would be an indication that there is an increased likelihood of a southern right whale within the activity survey zone during the period that observations cannot be undertaken. The following tasks will be undertaken to determine the presence of whales within the Operational Area: • One week prior to an activity being undertaken a review of whale data to determine if blue and/or southern right whales have been observed in the Operational Area. • When undertaking geophysical survey or VSP, presence of whales observed will be communicated via radio.
CM 8: Marine Fauna Observer	At least one trained MFO on active duty during daylight hours during activities.

ADDITIONAL CONTROLS	COST/BENEFIT ANALYSIS	CONTROL IMPLEMENTED?
Seasonal timing	The Operational Area overlaps pygmy blue whale distribution and foraging BIA, where possible foraging may occur, and southern right whale migration BIA. Pygmy blue whales are potentially within Operational Area from November through to June. Southern right whales may travel through the Operational Area to and from coastal aggregation and migration areas during May-June and September-November. MMO data from January 2021 to April 2022 for a drilling program in the Otway Development Area identified four southern right whales from June to August (Beach 2022). It is safe to assume there is no period	No

ADDITIONAL CONTROLS	COST/BENEFIT ANALYSIS	CONTROL IMPLEMENTED?
	when there is not a whale undertaking a biologically important behaviour within the Operational Area. Implementation of CM 9: AGR Whale Observation Management Procedure will prevent possible displacement impacts to foraging pygmy blue whales and behavioural effects to migrating southern right whales that maybe present in the activity survey zones which are based on modelled maximum distances to behavioural effects for low-frequency cetaceans. the implementation of seasonal timing controls does not afford any further benefit given there is no period when there is not a whale undertaking a biologically important behaviour within the Operational Area.	
Implementation of the EPBC Act Policy 2.1 Shutdown Zones for Geophysical Survey and VSP operations	EPBC Act Policy 2.1 was developed for seismic surveys with the aim of the policy to provide: practical standards to minimise the risk of acoustic injury to whales in the vicinity of seismic survey operations. a framework that minimises the risk of biological consequences from acoustic disturbance from seismic survey sources to whales in biologically important habitat areas or during critical behaviours. provide guidance to both proponents of seismic surveys and operators conducting seismic surveys about their legal responsibilities under the EPBC Act. The impulsive underwater sound emissions impact assessment found the potential for injury to low-frequency cetaceans as not credible. However, there is potential for behavioural effects to possible foraging blue whales and migrating southern right whales. Implementation of CM 9: AGR Whale Observation Management Procedure will prevent possible displacement impacts to foraging pygmy blue whales and behavioural effects to migrating southern right whales that maybe present in the activity survey zones which are based on modelled maximum distances to behavioural effects for low-frequency cetaceans. CM 8 assumes that once an activity is underway foraging blue whales or migrating southern right whales that enter the pre-activity survey zone are not displaced as the foraging/migrating behaviours have not been disrupted as the whale has commenced or continued foraging/migrating and thus aligns with the Conservation Management Plan for the Blue Whale (CoA 2015a), DAWE (2021) definitions and the National Recovery Plan for the Southern Right Whale (DCCEEW 2024). As such, based on the assumption that once an activity is underway foraging/migrating whales that enter the pre-activity survey zone are not displaced and that injury to low-frequency cetaceans is not considered	No

ADDITIONAL CONTROLS	COST/BENEFIT ANALYSIS	CONTROL IMPLEMENTED?
	credible, the implementation of shut-down zones does not afford any further benefit.	
Implementation of the EPBC Act Policy 2.1 Soft start for Geophysical Survey	Soft starts are applied to seismic surveys to slowly ramp up the seismic source allowing fauna to move away from the source. Implementation of CM 9: AGR Whale Observation Management Procedure will prevent possible displacement impacts to possible foraging pygmy blue whales that maybe present in the Operational Area by conducting a pre-activity survey to ensure foraging blue whales are not within the behavioural effect range prior to starting VSP operations or the 2D survey. Given CM 8 prevents the potential for foraging blue whales within the zone of potential behavioural effects to be displaced, the implementation of soft starts does not afford any further benefit. .	No
Passive acoustic monitoring (PAM)	PAM is most useful in the detection of odontocetes such as sperm whales, dolphins and porpoise known to emit regular distinctive clicks and high frequency calls during long dives. PAM has limited utility in detecting lower frequency calls of baleen whales (such as blue whales, southern right whales) especially when in the presence of constant background low frequency sound such as that generated by the vessel towing the PAM system. Given the very low utility and associated unreliability of using PAM to inform mitigation decision making, any additional cost is considered disproportionate to the benefit gained.	No
Marine mammal observer	Cost disproportionate to increase in environmental benefit and given that an MFO (trained crew member) will be observing for marine fauna during VSP operations and the 2D survey.	No
Dedicated monitoring vessel	An additional dedicated vessel is not required as monitoring activities can be effectively conducted from the survey vessel and the MODU. Cost is disproportionate to marginal environmental benefit.	No
Aerial surveillance	Aerial surveillance from aircraft or drones is not required as monitoring activities can be effectively conducted from the survey vessel and the MODU. MFO observations are possible up to 7 km from a vessel bridge height of ~20 m. Activity survey zones are within 3 km. Cost is disproportionate to marginal environmental benefit.	No

ACCEPTABILITY CRITERIA	DETERMINATION
To meet the principles of ESD	Impulsive underwater sound emissions were assessed as having a Minor (2) impact severity level which is not considered as having the potential to result in serious or irreversible environmental damage. Consequently, no further evaluation against the principles of ESD is required. Further, quantitative modelling has been undertaken to remove some of the scientific uncertainty associated with this aspect. As such, the activity is consistent with the principles of ESD.
Internal context	The proposed management of the impact is aligned with the Emperor Energy Health, Safety, and Environment Policy (APPENDIX A). Activities will be undertaken in accordance with the Implementation Strategy (Section 8).
External context	There have been no stakeholder objections or claims regarding impulsive underwater sound emissions.
Other requirements	Impulsive underwater sound emissions will be managed in accordance with legislative requirements. Impulsive underwater sound emissions will: • not impact on the recovery of marine turtles as per the Recovery Plan for Marine Turtles in Australia (CoA, 2017a). • be managed such that any blue whale continues to utilise the area without injury and is not displaced from a foraging area (CoA 2015a; DAWE 2021a). • not impact the recovery of the blue whale as per the Conservation Management Plan for the Blue Whale (CoA 2015a). • not impact the recovery of the southern right whale as per the Recovery Plan for the Southern Right Whale (DCCEEW 2024c). • not impact the recovery of the white shark as per the Recovery Plan for the White Shark (DSEWPaC 2013). • Actions from the Conservation Management Plan for the Blue Whale (CoA 2015a; DAWE 2021a) applicable to the activity in relation to assessing and addressing anthropogenic noise have been addressed as per: – assessing the effect of anthropogenic noise on blue whale behaviour. Section 5.4.2.4 assesses the effects of anthropogenic noise from the activity on blue whale behaviour. – 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. Section 5.4.2.4 demonstrates that the activity can be conducted in a manner that is consistent with the conservation

ACCEPTABILITY CRITERIA	DETERMINATION
	management plan and will not result in injury or displacement of pygmy blue whales from a foraging BIA.
Monitoring and review	Cetacean sightings will be recorded using the DCCEEW sighting sheets as detailed in Section 8.7.2.
Acceptability outcome	Acceptable

5.5. Continuous Underwater Sound Emissions

Continuous underwater sound generated by the activity will impact ambient sound levels in the Twofold Shelf bioregion.

Heavy vessel traffic, including tanker, cargo, support, and passenger vessels, pass through the Twofold Shelf bioregion based on the location of major ports. The south-eastern coast is one of Australia's busiest in terms of shipping activity and volumes. There is no main commercial shipping routes within the Operational Area, however there is high vessel activity along the NSW coastline (see Section 4.7.3.1). Heavy traffic along the main shipping fairways provides a significant and continuous contribution to the ambient sound levels in the Operational Area.

Oil and gas activities, and strong weather conditions (cyclonic events) in the south-eastern coast of Australia temporarily contribute to the ambient sound levels in the Operational Area. The temporary generation of underwater sound from the activity will introduce and replicate existing oil and gas activities' contributions to ambient sound levels.

5.5.1. Aspect Source

The activity will generate continuous underwater sound emissions for the duration of the activity ~60 days (see Section 3.3) from:

- Drilling operations
- Vessel and MODU operations
- ROV operations (i.e. well cutting)
- Helicopter operations.

Continuous underwater sound can be propagated by drill-rock interface during drilling operations, ROV operations, helicopters during take-off and landing from the MODU, and vessel operations including propeller cavitation, thrusters, hydrodynamic flow around the hull, and operation of machinery and equipment (Salgado Kent et al. 2016).

Comparison of these continuous underwater sound sources found those from thrusters used for vessel dynamic positioning have the greatest contribution to continuous underwater sound (Erbe et al. 2013).

For continuous underwater sound, this assessment focuses on underwater sound generated from vessel and MODU dynamic positioning operations.

5.5.1.1. Noise Modelling

To determine the spatial extent for impact evaluation, Emperor Energy commissioned JASCO to undertake a modelling study of underwater sound levels associated with activities identified to produce continuous sound emissions (e.g. drilling and support activities) (Lui et al. 2025; APPENDIX F).

The selected vessels and associated sound source levels are considered to be representative for those that will be used in the activity. The vessels for the activities will be selected as part of a tender process as planning progresses. Vessel specifications are expected to be analogous to those considered by Lui et al. (2025) whose modelling accounted for a range of AHTS and OSV vessels. Table 5-7 provides a summary of the sound sources used within the noise modelling of the continuous sound source identified for the activity (Lui et al. 2025; APPENDIX F).

Table 5-7: Technical information of the source levels for the continuous sound sources (Lui et al. 2025)

SOUND SOURCE	DESCRIPTION	SOUND LEVEL	BROADBAND
Offshore Support Vessel (OSV)	Stationary under DP	181.2 dB re 1 µPa^{2}m^2	10 Hz to 25 kHz
	Slow transit	175.1 dB re 1 µPa^{2}m^2	
MODU	Drilling	175.5 dB re 1 µPa^{2}m^2	10 Hz to 31 kHz
Anchor Handler Tug Supply (AHTS) Vessel	Stationary under DP	194.1 dB re 1 µPa^{2}m^2	10 Hz to 25 kHz
	Slow transit	173.1 dB re 1 µPa^{2}m^2	
ROV	Wellhead cutting	161.4 dB re 1 µPa^{2}m^2	2.5 kHz to 20 kHz

Table 5-8 details the continuous sound emission scenarios modelled for this activity.

Table 5-8: Description of scenarios, site location and water depth for continuous noise modelling scenarios (Lui et al. 2025)

SCENARIO	DESCRIPTION	SOUND SOURCES	LATITUDE (°S)	LONGITUDE (°E)	DEPTH (M)
1	Pre-lay Activities and MODU Positioning	2 x AHTS (in transit) + 1 x AHTS (under DP)	38°08'32.31"	148°30'59.26"	66.7
			38°08'28.92"	148°33'43.70"	
			38°08'47.61"	148°32'22.46"	
2	Drilling operations with an anchored MODU	MODU drilling	38°08'30.87"	148°32'21.8"	66.7

3	Drilling operations with an anchored MODU and a vessel on standby.	MODU drilling + 1 x OSV (slow transit)	38°08'30.87"	148°32'21.8"	66.7
			38°08'29.7131"	148°33'46.8094"	72.8
4	Drilling operations with an anchored MODU and a vessel undertaking resupply operations.	MODU drilling + 1 x OSV (under DP for 8 hours)	38°08'30.87"	148°32'21.8"	66.7
			38°08'30.7983"	148°32'24.6740"	66.9
5	Well plug, abandonment and removal (i.e. wellhead cutting)	1 x ROV (cutting operations)	38°08'29.7131"	148°33'46.8094"	72.8
			38°08'30.87"	148°32'21.8"	66.7

5.5.1.2. Thresholds and Results

To assess whether an impact may occur modelled received sound levels were compared to receptor noise effect criteria (Table 5-9). These criteria are based on published scientific research and papers as detailed in and within the relevant receptor section.

Table 5-9: Continuous PTS, TTS and Behaviour sound effect criteria used and the applicable results for representative single pulse sites and for accumulated SEL scenarios (Lui et al. 2025)

HEARING GROUP	NOISE EFFECT CRITERIA	MAXIMUM RMAX DISTANCE (KM)					REFERENCE
		SCENARIO 1	SCENARIO 2	SCENARIO 3	SCENARIO 4	SCENARIO 5	
Fishes: (swim bladder): recoverable injury	>170 dB SPL for 48 h	-	-	-	-	-	Popper et al. 2014
Fishes: (swim bladder): TTS	>158 dB SPL for 12 h	0.08	-	-	-	-	Popper et al. 2014
Turtle: PTS	220 dB re 1 µPa²·s	-	-	-	-	-	Finneran et al. 2017
Turtle: TTS	200 dB re 1 µPa²·s	0.22	-	-	-	-	Finneran et al. 2017
Marine mammals: behavioural	120 dB SPL	23.7	2.24	3.31	5.22	3.06	NOAA 2024
Low-frequency cetaceans: PTS (humpback and pygmy blue whales)	197 dB SEL24h	0.44	0.03	0.03	0.09	-	NMFS 2024
Low-frequency cetaceans: TTS (humpback and pygmy blue whales)	177 dB SEL_{24h}	8.20	0.53	0.63	1.07	0.05	NMFS 2024
High-frequency cetaceans: PTS	201 dB SEL_{24h}	0.04	-	-	-	-	NMFS 2024

(dolphins, beaked whales, sperm whales)							
High-frequency cetaceans: TTS (dolphins, beaked whales, sperm whales)	181 dB SEL_{24h}	0.92	0.08	0.08	0.16	0.03	NMFS 2024
Very High-frequency cetaceans: PTS (pygmy and dwarf sperm whales)	181 dB SEL_{24h}	0.06	0.06	0.01	0.13	0.03	NMFS 2024
Very High-frequency cetaceans: TTS (pygmy and dwarf sperm whales)	161 dB SEL_{24h}	0.98	0.99	0.99	1.06	0.31	NMFS 2018
Otariid seals: PTS	219 dB SEL_{24h}	0.03	-	-	-	-	NMFS 2018
Otariid seals: TTS	199 dB SEL_{24h}	0.86	0.08	0.08	0.16	0.04	NMFS 2018

5.5.2. Impact Evaluation

Generation of underwater sound emissions during the activity introduces the following potential impacts to environmental receptors:

Potential impacts of impulsive underwater sound emissions to receptors are:

- Behavioural changes to marine fauna
- Auditory Impairment to marine fauna including:
  - Recoverable injury
  - Temporary threshold shift (TTS)
  - Permanent threshold shift (PTS).

Underwater continuous sound emissions may impact the following biological receptors:

- Fishes
- Marine reptiles
- Marine mammals.

5.5.2.1. Fishes

Popper et al. (2014) details that there is no direct evidence of mortality or potential mortal injury to fishes from ship sound emissions. Popper et al., (2014) details that risks of mortality and potential mortal injury, and recoverable injury impacts to fishes with no swim bladder (sharks) or where the swim bladder is not involved in hearing is low and that TTS in hearing may be a moderate risk near (tens of metres) the vessel. For fishes with a swim bladder involved in hearing risks of mortality and potential mortal injury impacts is low. However, some evidence suggests that fishes sensitive to acoustic pressure show a recoverable loss in hearing sensitivity, or injury when exposed to high levels of sound and Popper et al. (2014) details SPL criteria for fishes with a swim bladder involved in hearing.

Table 5-9 details the criteria and modelled distances to them (Lui et al. 2025: APPENDIX F). The modelled distances for the continuous underwater sound emissions expected for the activities predicted:

- 48 hr recoverable injury criteria to not be reached by any scenario.
- 12 hr TTS criteria to be reached within 80 m (Scenario 1 only).

As there are no habitats likely to support site-attached fish in the Operational Area it is also unlikely that fish species would be present for a period of 12 hours within this restricted distance (80 m) to experience an onset of TTS. Thus, TTS impacts are not predicted.

Behavioural impacts, such as avoidance / moving away from the vessel, are more likely. Currently, quantitative threshold criteria for behavioural responses of fishes from continuous sound do not exist (Popper et al. 2014). Fishes are highly likely to exhibit behavioural disturbances within tens of metres from continuous sound sources (Popper et al. 2014). Behavioural disturbances to fishes from underwater sound are therefore localised and limited to within the Operational Area.

Fishes in the Operational Area are likely to exhibit avoidance responses from continuous sounds generated and radiated by the activity (Carroll et al. 2017). Fishes that do not avoid underwater sound radiated by the activity are likely to exhibit changes to schooling patterns and distribution from continuous sound (McPherson et al. 2016).

There are no habitats or features within the Operational Area that would restrict fish and sharks from moving away from the vessel.

The Operational Area is within a distribution BIA for the white shark though no habitat critical to the survival of the species or behaviours were identified. The Recovery Plan for the White Shark (*Carcharodon carcharias*) (CoA, 2013) does not identify sound as a threat.

The extent of the area of impact is predicted to be within the Operational Area for the duration of vessel and MODU operations. The severity of impact to fishes is assessed as **Slight (1)** based on:

- The Recovery Plan for the White Shark (*Carcharodon carcharias*) (CoA, 2013) does not identify sound impacts as a threat.
- Avoidance behaviour may occur within the Operational Area, however, no habitats likely to support site-attached fish have been identified within the Operational Area.
- Temporary avoidance behaviour may occur within the Operational Area; however, recovery would occur once the activity has finished. Based on the small area of impact, and that displaced fish would still be able to be caught outside of the Operational Area, impacts to commercial fishing are not predicted.

5.5.2.2. Marine Turtles

Popper et al. (2014) details that there is no direct evidence of mortality or potential mortal injury to sea turtles from ship sound emissions. Popper et al. (2014) found that there was insufficient data available to propose a quantitative exposure guideline or criteria for marine turtles for continuous sound such as those generated by vessels and instead suggested general distances to assess potential impacts. Using semi-quantitative analysis, Popper et al. (2014) suggests that there is a low risk to marine turtles from shipping and continuous sound except for TTS near (10s of metres) to the sound source, and masking at near, intermediate (hundreds of metres) and far (thousands of metres) distances and behaviour at near and intermediate distances from the sound source. Based on this information avoidance behaviour may occur within the Operational Area.

Finneran et al. (2017) presented revised thresholds for turtle PTS and TTS for continuous sound. Table 5-9 details the criteria and modelled distances to them (Lui et al. 2025; APPENDIX F). The modelled distances for the continuous underwater sound emissions expected for the activities predicted:

- 24 hr PTS criteria to not be reached by any scenario
- 24 hr TTS criteria to be reached within 220 m for Scenario 1 only.

The onset of TTS may occur during Scenario 1: pre-lay activities and anchor setup of the MODU (Scenario 1), these activities are expected to be undertaken within the Operational Area and take a maximum of 24 hours to complete. Three marine turtle species may occur within the Operational Area though no BIAs or habitat critical to the survival of the species were identified. Given the absence of BIAs and habitat critical to the survival of the species within the Operational Area it is unlikely that marine turtles would be present in the Operational Area for a 24-hour period within 220 m of pre-lay activities to experience an onset of TTS. Thus, TTS impacts are not predicted.

Marine turtles in the Operational Area are likely to exhibit avoidance responses from continuous sounds generated and radiated by the activity (Hazel et al. 2007, Nelms et al. 2016). Hazel et al. (2007) observed marine turtles to flee an approaching vessel travelling at speeds representative of those proposed in the Operational Area.

The Recovery Plan for Marine Turtles in Australia (CoA 2017a) identifies noise interference as a threat to turtles. It details that exposure to chronic (continuous) loud noise in the marine environment may lead to avoidance of important habitat. Given the Operational Area does not overlap important habitat for marine turtles, continuous sound generated during pre-lay activities is not considered a threat.

The extent of the area of impact is predicted to be within the Operational Area. The severity of impact to marine turtles is assessed as Slight (1) based on:

- The Recovery Plan for Marine Turtles in Australia (CoA 2017a) details that exposure to chronic (continuous) loud noise in the marine environment may lead to avoidance of important habitat, however, no habitats important to marine turtles are located within the Operational Area.
- Thresholds for turtle TTS over 24 hrs were predicted to occur with a maximum distance of 220 m within the Operational Area where no marine turtle important habits are located. Thresholds for the onset of PTS in turtles were not reached.
- Avoidance behaviour may occur within the Operational Area where no marine turtle important habits are located.
- Low numbers of marine turtles are predicted in the Operational Area and therefore impacts would be limited to a small number of individuals.

5.5.2.3. Marine Mammals

BEHAVIOURAL EFFECTS

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. The NMFS (NOAA 2024) criterion of 120 dB re 1 µPa for non-impulsive sound sources such as vessels is used as the marine mammal behavioural criteria for this assessment as it represents a conservative criterion as Southall et al. (2019) reviewed extensive literature and studies in relation to marine mammal behavioural response to impulsive (seismic, pile driving) and non-impulsive (drilling, vessels) and found that most marine mammals exhibited varying responses between 140 and 180 dB re 1 µPa.

The NMFS (NOAA 2024) marine mammal behaviour criterion of 120 dB re 1 µPa was predicted to be reached within 23.7 km of a continuous sound source in the Operational Area. As a result, behavioural effects to marine mammals are expected to extend up to 23.7 km from the boundary of the Operational Area (sound EMBA) during vessel operations.

The following marine mammal species listed as threatened or migratory under the EPBC Act have the potential to be present in the sound EMBA:

- Blue whale, southern right whale (endangered, migratory)
- Fin whale, sei whale (vulnerable, migratory)
- Antarctic minke whale, Bryde's whale, dugong, dusky dolphin, humpback whale, killer whale, pygmy right whale, sperm whale (migratory).

The sound EMBA also overlaps ‘possible foraging area’ BIA for the pygmy blue whale, and the migration BIA for the southern right whale. Other marine mammals that may undertake biologically important behaviours (foraging, feeding or related behaviour likely in the likely to occur) in the sound EMBA include the fin whale, pygmy right whale, and the sei whale.

Given the intermittent and short-duration of vessel operations, the risk of behavioural effects to marine mammals is unlikely to result in population level effects. The impact severity levels for potential behavioural effects to marine mammals was assessed as Minor (2) based on:

- Temporary impacts to migrating southern right whales, possibly foraging blue whales and marine mammals that may undertake biologically important behaviours (blue whale, fin whale, pygmy right whale, and the sei whale) in the sound EMBA.
- Implementing the control measures detailed in Section 5.5.3, adapted using the maximum distance to marine mammal behavioural effects threshold, can reduce the risk of displacement of possibly foraging blue whales during vessel operations. The distances to the marine mammal behavioural effects threshold (23.7 km) has been used to define operating distances, observation distances and pre-activity/activity survey zones for the control measures detailed in Section 5.5.3. The control measures detailed in Section 5.5.3 ensures the activity is in accordance with the Guidance on Key Terms within the Conservation Management Plan for the Blue Whale (DAWE 2021a) that details mitigation measures must be implemented to reduce the risk of displacement occurring during the activity where modelling indicates that behavioural disturbance within a Foraging Area may occur.
- The fin and sei whale's conservation advice (TSSC 2015b; TSSC 2015c) has a consequence rating for anthropogenic noise and acoustic disturbance as minor with the extent over which the threat may operate as moderate-large.
- The National Recovery Plan for the Southern Right Whale (DCCEEW 2024) identifies shipping and industrial noise as a threat that is classed as a minor consequence which is defined as individuals are affected but no affect at a population level.

INJURY (TTS AND PTS)

National Marine Fisheries Service (NMFS 2024) has provided updated thresholds for the onset of PTS and TTS. These criteria as detailed in Table 5-9 are based SEL_{24h} thresholds, where the subscripted 24h refers to the accumulation period for calculating SEL. SEL_{24h} thresholds are frequency weighted according to the marine mammal species hearing group. The following sections provide an evaluation on potential injury based on each marine mammal species hearing group.

LOW-FREQUENCY CETACEANS

Modelled distances to low-frequency (LF) cetacean PTS and TTS threshold criteria for continuous underwater sound predicted:

- 24 hr PTS criteria to be reached within 440 m (Scenario 1)
- 24 hr TTS criteria to be reached within 8.20 km (Scenario 1).

TTS and PTS SEL_{24h} thresholds is a cumulative metric that requires a receptor to be consistently exposed at this noise effect criteria for a 24-hour period for injury to occur. As a result, the potential of injury (TTS and PTS) to low-frequency cetaceans during the activity requires a low-frequency cetacean to be consistently exposed to vessel/MODU/drilling operations for a 24-hour period for injury to occur. Low-frequency cetaceans require to remain within 8.20 km of a vessel/MODU for at least a 24-hour period for injury to occur.

To identify low-frequency cetaceans that could be injured as a result of continuous underwater noise generated in the Operational Area, a search was conducted for EPBC Act listed species within an 8.20 km buffer of the Operational Area. The following low-frequency cetaceans were found:

- Blue whale, southern right whale (endangered, migratory)

- Fin whale, sei whale (vulnerable, migratory)
- Antarctic minke whale, Bryde's whale, humpback whale, pygmy right whale (migratory).

The area within an 8.20 km buffer of the Operational Area also overlaps 'possible foraging area' BIA for the pygmy blue whale, and the migration BIA for the southern right whale. Other marine mammals that may undertake biologically important behaviours (foraging, feeding or related behaviour likely in the likely to occur) in this area include the fin whale, pygmy right whale, and the sei whale.

The area within an 8.20 km buffer of the Operational Area does not contain habitats that encourages high-site fidelity for low-frequency cetaceans given the area does not overlap reproduction, known foraging area, foraging annual high use area BIAs for low-frequency cetaceans. Low-frequency cetaceans in this area are not expected to remain for extended periods and are expected to transit through. Given the intermittent and short-duration of continuous underwater sound emissions (Section 5.5.1), the limited spatial area (within 8.20 km from the vessel/MODU) where injury may occur, and that low-frequency cetaceans in an 8.20 km buffer of the Operational Area are expected to transit through and not remain in the area for extended periods, potential injury to low-frequency cetaceans from continuous underwater sound is not considered credible and not considered further.

HIGH AND VERY HIGH-FREQUENCY CETACEANS

Table 5-9 details the high and very high-frequency cetacean noise effect criteria for PTS and TTS and the maximum distances at which modelling estimated these criteria are reached. In summary:

- High-frequency cetaceans: PTS and TTS SEL_{24h} thresholds were predicted within maximum distances of 40 m and 920 m from the sound source, respectively.
- Very high-frequency cetaceans: PTS and TTS SEL_{24h} thresholds were predicted within maximum distances of 130 m and 1.06 km from the sound source, respectively.

The potential of injury (TTS and PTS) to high and very high-frequency cetaceans during the activity requires a high or very high-frequency cetacean to be consistently exposed to vessel/MODU/drilling operations for a 24-hour period for injury to occur. Conservatively, high and very high-frequency cetaceans require to remain within 1.06 km of a vessel/MODU for at least a 24-hour period for injury to occur.

To identify high and very high-frequency cetaceans that could be injured as a result of continuous underwater noise generated in the Operational Area, a search was conducted for EPBC Act listed species within a 1.06 km buffer of the Operational Area. The following high and very high-frequency cetaceans were found:

- Dusky dolphin, killer whale, sperm whale (migratory).

These high and very high-frequency cetaceans may occur within a 1.06 km buffer of the Operational Area, but no BIAs of biologically important behaviours were identified. High and very high-frequency cetaceans (if present) are expected to be transiting through this area.

The area within a 1.06 km buffer of the Operational Area does not contain habitats that encourages high-site fidelity for high and very high-frequency cetaceans given the area does not overlap BIAs for high and very high-frequency cetaceans. High and very high-frequency cetaceans in this area are not expected to remain for extended periods and are expected to transit through. Given the intermittent and short-duration of continuous underwater sound emissions (Section 5.5.1), the limited spatial area (within 1.06 km from the vessel/MODU) where injury may occur, and that high and very high-frequency cetaceans in a 1.06 km buffer of the Operational Area are expected to transit through and not remain in the area for extended periods, potential injury to high and very high-frequency cetaceans from continuous underwater sound is not considered credible and not considered further.

PINNIPEDS

Table 5-9 details the otariid pinnipeds noise effect criteria for PTS and TTS and the distances at which modelling estimated these criteria are reached. For otariid pinnipeds, the maximum distances to PTS and TTS noise effect criteria was predicted within 30 m and 860 m from the sound source, respectively.

The long-nosed fur-seal and the Australian fur-seal may occur in the Operational Area and surrounds but no BIAs or haul out areas were identified. SEL_{24h} thresholds is a cumulative metric that requires a receptor to be consistently exposed at this noise effect criteria for a 24-hour period for injury to occur. As a result, the potential of injury (PTS and TTS) to otariid pinnipeds during the activity requires an otariid pinniped to be consistently exposed to continuous underwater noise for a 24-hour period for injury to occur.

The Operational Area and surrounds does not contain habitats that encourages high-site fidelity for otariid pinnipeds given the area does not overlap BIAs or haul out areas for otariid pinnipeds. Otariid pinnipeds in this area are not expected to remain for extended periods and are expected to transit through. Given the intermittent and short-duration of continuous underwater sound emissions (Section 5.5.1), the limited spatial area (within 860 m from the vessel/MODU) where injury may occur, and that otariid pinnipeds in a 860 m buffer of the Operational Area are expected to transit through and not remain in the area for extended periods, potential injury to otariid pinnipeds from continuous underwater sound is not considered credible and not considered further.

5.5.2.4. First Nations Cultural Heritage Values and Sensitivities

The intrinsic link between First Nations people and culturally significant species are understood to be based on First Nations obligations to care for the species (Weir, 2012). The management of culturally significant species is considered to be applied to the species at a population level. As a result, impacts to culturally significant species at a population level has the potential to disrupt the intrinsic link of First Nations people ability to care for culturally significant species.

FISHES

Culturally significant food sources such as fish are located within and migrate through the south-east marine region. Fish were one of the main food resources in coastal areas and cultural heritage listed fish traps can still be found in this region. Many coastal First Nations groups, including the Gunaikurnai and Bunurong people used coastal areas for marine resources and continue to engage in cultural and spiritual significant coastal practices which include subsistence fishing and collecting of other coastal resources in this area (Gunaikurnai Land and Waters Aboriginal Corporation, 2015; Biosis, 2024; NOO, 2002b).

<u>Potential Disruption to Cultural Heritage Values and Sensitivities</u>

Fish are an important resource for First Nations people identified during a review of relevant First Nations group Country Plans and NOO (2002b). First Nations people have a responsibility to care for fish and their habitats to ensure resources can be continued for future generations (NOO, 2002b). Disruptions to species and habitats have the potential to affect the success of populations, which can affect the cultural practices associated with coastal resource fishing and collection.

As discussed in Section 5.5.2.1, potential impacts are assessed as Slight (1) for fish which is unlikely to have a significant impact on individuals at a population level and are not expected to impact the value of culturally significant species. As such, the intrinsic link between environmental receptors and First Nations people’s cultural heritage values and sensitivities is expected to be maintained.

CETACEANS

First Nations people around Australia have long had a strong connection to whales and dolphins, which has significance as totemic ancestors to some groups. Cetaceans in Sea Country hold deep cultural significance to First Nations groups of the South-East marine region and feature in Dreaming stories, ceremony, song and dance traditions (NOO, 2002b).

Cetaceans are culturally significant species for the First Nations peoples as identified during a review of relevant First Nations group Country Plans and NOO (2002b). First Nations people have a cultural responsibility to ensure cetaceans that reside within and migrate through Sea Country are cared for and healthy and their habitat is sustained. Whales feature in Dreaming stories, ceremony, song and dance of some First Nations groups along the coasts of Australia. The protection of whale species is paramount to First Nations groups of the South-East marine regions spiritual, physical wellbeing and it is the responsibility of First Nations people to care for Sea Country and protect the species for present and future generations. Whales are also a food resource, and First Nations people still collect parts of beached whales, as has been done for thousands of years (NOO, 2002b).

As discussed in Section 5.5.2.3, EPBC threatened and migratory cetaceans may be present within the ensonification area.

Potential Disruption to Cultural Heritage Values and Sensitivities

First Nations people may have kinship and/or a responsibility to care for culturally significant species and their habitats. Impacts to species at a population level may inhibit First Nations people's ability to perform cultural obligations to care for culturally significant species and their habitats. If responsibilities have not been met it could result in a sense of powerlessness to members of First Nation groups responsible for the protection and care of these species (Holcombe, 2022).

As discussed in Section 5.4.2.4, impacts for whales is assessed as Minor (2) which is unlikely to have a significant impact on individuals at a population level. As such, the intrinsic link between environmental receptors and First Nations people's cultural heritage values and sensitivities is expected to be maintained.

It is to be noted that through a review of Country Plans, publicly available information, and consultation, that turtles have not been identified as a culturally significant species for the First Nations people of this region.

5.5.3. Control measures ALARP and acceptability assessment

Review of the risk evaluation for underwater sound emissions found the worst-case residual risk for all receptors is Minor (2). This impact severity level is considered tolerable/acceptable, and ALARP is demonstrated as follows.

5.5.3.1. ALARP Decision Context: Type B

Impacts from continuous underwater noise emissions are relatively well understood, supported by the existing and growing body of scientific literature and in situ observations. However, inherent variability in individual animal responses introduces a degree of uncertainty when predicting specific reactions. Noise modelling was conducted for the Judith-2 activities to reduce uncertainty.

Activities are well practised, and there are no conflicts with company values, no partner interests and no significant media interests.

An ALARP determination of Type B has been applied to the blue and Southern right whales due to a residual, albeit Minor (2), risk of behavioural disturbance within a BIA. Recognising this residual risk, and consistent with a precautionary approach, the CMP for blue whales and the National Recovery Plan for Southern right whales recommend additional mitigation measures and adaptive management strategies for specific activities and times of year. In response, further risk management controls have been evaluated and several have been adopted. These adopted controls ensure the project's environmental performance objectives are achieved and are aligned with the objectives and relevant actions outlined in the respective species recovery plans.

Consequently, an ALARP Decision context Type B has been selected for this aspect.

5.5.3.2. Controls and Acceptability Assessment

ALARP Decision context Type B assigned for continuous underwater noise highlights additional controls may be required to ensure impacts can be managed to an acceptable level.

Table 5-10 lists and justifies adopted controls and provides evidence against additional controls assessed to ensure impacts associated with continuous underwater noise is acceptable.

Table 5-10: Controls and Acceptability Assessment

ADOPTED CONTROLS	SOURCE OF GOOD PRACTICE CONTROL MEASURES
CM 6: EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans	EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans describes strategies to ensure whales and dolphins are not harmed during offshore interactions with vessels and helicopters. Vessels will adhere to EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans in relation to distances to cetaceans. These regulations stipulate a safe operating distance of 300 m. Helicopters will adhere to EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans in relation to distances to cetaceans.
CM 7: AGR Whale Observation Management Procedure (vessel and drilling operations)	The AGR Whale Observation Management Procedure (vessel and drilling operations) details the controls to prevent possible displacement impacts to foraging pygmy blue whale and migrating southern right whales that maybe present in the Operational Area and surrounds. The procedure assumes that once an activity is underway foraging/migrating whales that enter the pre-activity survey zone are not displaced as foraging/migrating behaviour has not been disrupted as the whale has commenced or continued foraging/migrating and thus aligns with the Conservation Management Plan for the Blue Whale (CoA 2015a), National Recovery Plan for the Southern Right Whale (DCCEEW 2024) and DAWE (2021) definitions. Prior to an activity commencing, a pre-activity survey will be undertaken of the activity survey zone for: • Pre-lay Activities and MODU Positioning: 24 km • Drilling operations with an anchored MODU: 2.5 km • Drilling operations with an anchored MODU and a vessel on standby: 3.5 km • Drilling operations with an anchored MODU and a vessel undertaking resupply operations: 5.5 km Well plug, abandonment and removal (i.e. wellhead cutting): 3.1 km

ADOPTED CONTROLS	SOURCE OF GOOD PRACTICE CONTROL MEASURES
	MFO observations are possible up to 7 km from a vessel bridge height of ~20 m. For pre-lay activities, MFO observations during a dedicated monitoring vessel may be required to visually survey out to 24 km from the pre-lay vessel. The activity survey zones are based on the distance to the behaviour effect criteria, as detailed in Table 5-9, and have been rounded up to take into account accuracy of estimation of distance at sea. A conservative approach will be adopted whereby it is assumed that all whales present in the activity survey zones are conducting biologically important behaviours (e.g. foraging blue whales, migrating southern right whales). Surveys will be undertaken for 30 min prior to the activity commencing. If a whale is sighted within the pre-activity survey zone the activity will not commence until: • No whales are observed for 30 min within the pre-activity survey zone; or • Whales are observed leaving the pre-activity survey zone. The period of 30 min is deemed as sufficient time to observe deep diving whales such as blue whales and southern right whales based on blue whale foraging behaviour and dive duration and southern right whale migration behaviours (Section 4.5.3.1). Once the activity has commenced observations will be undertaken within the activity survey zone distances detailed above. If a whale is sighted within the activity survey zone the following will occur: • If the vessel can do so it will move away from the whale and maintain a minimum separation distance equal to the activity survey zone. • If the vessel cannot move away from the whale, the vessel will reduce thrusters if safe to do so. The activity will cease as soon as it is safe, and the vessel will move out of the activity survey zone. The activity can recommence once: • No whales are observed for 30 min within the activity survey zone; or • Whales are observed leaving the activity survey zone. Activities can commence at night or in low visibility conditions (i.e., when observations cannot be undertaken) if no more than three whales have been seen in the activity survey zone in the preceding daylight hours and there was a two-hour period of no sightings in the activity survey zone. The no more than three whales criterion is acceptable for blue whales because it indicates the krill stock at the location has been diminished. More than three whales within the previous daylight hours may indicate a large krill supply and more whales could be expected. The daylight hours is justified because it is the longest possible continuous observation period (i.e., one full day of observations). Three southern right whales would be an indication that there is an increased likelihood of a southern right whale within the activity survey zone during the period that observations cannot be undertaken. The following tasks will be undertaken to determine the presence of whales within the Operational Area:

ADOPTED CONTROLS	SOURCE OF GOOD PRACTICE CONTROL MEASURES
	• One week prior to an activity being undertaken a review of whale data to determine if blue and/or southern right whales have been observed in the Operational Area. • When undertaking the activity, presence of whales observed will be communicated via radio.
CM 8: Marine Fauna Observer	At least one trained MFO on active duty during daylight hours during activities.
CM 5: Planned System Maintenance	Power generation and propulsion systems on the vessels will be operated in accordance with manufacturer's instructions and ongoing maintenance to ensure efficient operation.

ADDITIONAL CONTROLS	COST/BENEFIT ANALYSIS	CONTROL IMPLEMENTED?
Seasonal timing	Pygmy blue whales may possibly forage within the sound EMBA from November through to June. Southern right whales may travel through the sound EMBA to and from coastal aggregation and migration areas during May-June and September-November. MMO data from January 2021 to April 2022 for a drilling program in the Otway Development Area identified four southern right whales from June to August (Beach 2022). It is safe to assume there is no period when there is not a whale undertaking a biologically important behaviour within the sound EMBA. The implementation of additional controls above the legislative requirements of the EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans will be implemented to manage potential impacts to whales undertaking biologically important behaviour.	No
Anchoring of the vessels	This control is not feasible for the support vessels based on: Vessel standby activities require the vessel to be able to react immediately in the event of an issue on the platform.	No
Passive acoustic monitoring (PAM)	PAM is most useful in the detection of odontocetes such as sperm whales, dolphins and porpoise known to emit regular distinctive clicks and high frequency calls during long dives. PAM has limited utility in detecting lower frequency calls of baleen whales (such as blue whales, southern right whales) especially when in the presence of constant background low frequency sound such as that generated by the vessel towing the PAM system. Given the very low utility and associated unreliability of using PAM to inform mitigation decision making, any additional cost is considered disproportionate to the benefit gained.	No

ADDITIONAL CONTROLS	COST/BENEFIT ANALYSIS	CONTROL IMPLEMENTED?
Dedicated monitoring vessel	An additional dedicated vessel may be required to conduct visual surveys up to 24 km from the pre-lay vessel during pre-lay activities and MODU positioning. MFO observations from the pre-lay vessel or MODU is expected to be limited to 7 km from a vessel bridge height of ~20 m and not capable to visually monitor the 24 km activity survey zone for pre-lay activities and MODU positioning. The use of a dedicated monitoring vessel visually surveying the 24 km activity survey zone will enable the practical implementation of CM 7: AGR Whale Observation Management Procedure (vessel and drilling operations).	Yes
Aerial surveillance	Aerial surveillance from aircraft or drones is not required as monitoring activities can be effectively conducted from the geophysical vessel or support vessel. Cost is disproportionate to marginal environmental benefit.	No

ACCEPTABILITY CRITERIA	DETERMINATION
To meet the principles of ESD	Continuous underwater sound emissions were assessed as having a Minor (2) impact severity level which is not considered as having the potential to result in serious or irreversible environmental damage. Consequently, no further evaluation against the principles of ESD is required. Further, quantitative modelling has been undertaken to remove some of the scientific uncertainty associated with this aspect. As such, the activity is consistent with the principles of ESD.
Internal context	The proposed management of the impact is aligned with the Emperor Energy Environment Policy (APPENDIX A). Activities will be undertaken in accordance with the Implementation Strategy (Section 8).
External context	There have been no stakeholder objections or claims regarding continuous underwater sound emissions.
Other requirements	Continuous underwater sound emissions will be managed in accordance with legislative requirements. Continuous underwater sound emissions will: • not impact on the recovery of marine turtles as per the Recovery Plan for Marine Turtles in Australia (CoA, 2017a). • be managed such that any blue whale continues to utilise the area without injury and is not displaced from a foraging area (CoA 2015a; DAWE 2021a).

ACCEPTABILITY CRITERIA	DETERMINATION
	• not impact the recovery of the blue whale as per the Conservation Management Plan for the Blue Whale (CoA 2015a). • not impact the recovery of the southern right whale as per the Recovery Plan for the Southern Right Whale (DCCEEW 2024c). • not impact the recovery of the white shark as per the Recovery Plan for the White Shark (DSEWPaC 2013). • Actions from the Conservation Management Plan for the Blue Whale (CoA 2015a; DAWE 2021a) applicable to the activity in relation to assessing and addressing anthropogenic noise have been addressed as per: – assessing the effect of anthropogenic noise on blue whale behaviour. Section 5.5.2.3 assesses the effects of anthropogenic noise from the activity on blue whale behaviour. – 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. Section 5.5.2.3 demonstrates that the activity can be conducted in a manner that is consistent with the conservation management plan and will not result in injury or displacement of pygmy blue whales from a foraging BIA.
Monitoring and review	Cetacean sightings will be recorded using the DCCEEW sighting sheets as detailed in Section 8.7.2.
Acceptability outcome	Acceptable

5.6. Accidental Release – Loss of Well Control

Exploration well drilling introduces the risk of a loss of a well control (LOWC) event. LOWC refers to the uncontrolled flow of formation fluids due to the failure of surface equipment or procedures (Holand 2017). Loss of Well Control (LOWC) can occur due to several factors, often related to equipment failure, procedural errors, or unexpected formation pressures. This section deals with the higher order (most severe) spill scenarios. The Worst-Case Discharge for the Judith-2 well has been modelling and evaluated below.

5.6.1. Aspect Source

The activity may result in the accidental release of formation fluid through a LOWC event during drilling activities (Section 3.6).

5.6.1.1. Hydrocarbon Spill Modelling

Hydrocarbon spill modelling was undertaken by RPS (2022) for the following worst-case scenario:

- An uncontrolled subsea loss of well control (LOWC) releasing a total of 347,584 bbl (or 55,256 m^3) of condensate depleting over 77 days (average daily rate of 4,514 bbl/day or 717 m^3 /day).

The spill modelling was performed using an advanced three-dimensional trajectory and fates model, Spill Impact Mapping Analysis Program (SIMAP). The SIMAP model calculates the transport, spreading, entrainment and evaporation of spilled hydrocarbons over time, based on the prevailing wind and current conditions, and the physical and chemical properties.

The SIMAP model can track hydrocarbons to levels lower than biologically significant or visible to the naked eye. Therefore, reporting thresholds have been specified (based on the scientific literature) to account for "exposure" on the sea surface and "contact" to shorelines at meaningful levels.

5.6.1.2. Thresholds

Based on available information, concentration thresholds for use in the impact assessment have been defined for the different exposure types (surface, in-water, shoreline) (Table 5-11). These impact thresholds and exposure pathways are then applied at a receptor level for use in the consequence evaluations.

These thresholds align with the NOPSEMA environmental bulletin 'Oil Spill modelling' (NOPSEMA 2019).

The hydrocarbon exposure thresholds detailed in Table 5-11 are considered appropriate to:

- Predict potential hydrocarbon contact at conservative (low exposure) concentrations and inform the description of the environment (Section 4), inform the EPBC Protected Matters Search APPENDIX B) and identify the Australian Marine Park (AMP), Marine National Park (MNP), Marine Park (MP), and Ramsar wetlands that may require monitoring in the event of a worst-case discharge based upon conservative (low exposure) in-water thresholds.
- Inform the oil spill impact and risk evaluation.
- Inform oil spill response planning based upon potentially actionable concentrations of hydrocarbons and potential monitoring requirements (see Section 6.1.1).

Table 5-11: Hydrocarbon exposure thresholds

EXPOSURE TYPE	EXPOSURE THRESHOLD		
	LOW	MODERATE	HIGH
Floating (surface)	1 g/m²	10 g/m²	50 g/m²
Shoreline (accumulated)	10 g/m²	100 g/m²	1,000 g/m²
Dissolved	10 pb	50 ppb	400 ppb
Entrained	10 ppb	-	100 ppb

5.6.1.3. Spill Modelling Results

Table 5-12 provides a summary of the results from the stochastic modelling report for the worst-case credible LOWC (RPS, 2022; APPENDIX C). The EMBA displayed in Figure 4-1 to identify the environment that may be affected has been based on the low exposure threshold for surface, shoreline, and in-water (dissolved and entrained). The risk evaluation (Section 5.6.2) is based on the exposure thresholds relevant to each receptor as defined in each evaluation subsection.

Table 5-12: Summary of the spill modelling results for the worst-case credible LOWC (RPS, 2022)

EXPOSURE VALUES	SUMMARY OF WORST-CASE PREDICTED EXPOSURE
Surface Exposure	
Low (1g/m²)	The maximum distance for floating hydrocarbon exposure from the source was predicted to be 202.2km. The minimum time to floating hydrocarbon exposure at any given receptor(s) was 140 hours (5.83 days) for Victorian State Waters, East Gippsland Lowlands nearshore waters, and Point Hicks MP. The probability of intersect with Victorian State Waters is 23% and the East Gippsland Lowlands at 18%.
Moderate (10g/m²)	The maximum distance for floating hydrocarbon exposure from the source was predicted to be 18.3 km. No exposure was predicted to any receptor(s) at this threshold.
High (50g/m²)	The maximum distance for floating hydrocarbon exposure from the source was predicted to be 0.4 km. No exposure was predicted to any receptor(s) at this threshold.
Shoreline Exposure	
Low (10g/m²)	The highest probability of accumulation at this threshold on any shoreline was 98%, with the absolute minimum time for shoreline accumulation predicted in 70 hours (2.92 days), and the maximum length of shoreline accumulation predicted to be 79 km, all during winter conditions. East Gippsland had the highest probability for shoreline accumulation at 89% with shoreline accumulation occurring within 70 hours (3 days).

	The peak volume of oil ashore was forecast for East Gippsland at 28 m^3. East Gippsland recorded the maximum length of shoreline accumulation at this threshold of 68.3 km during winter conditions.
Moderate (100g/m^2)	East Gippsland had the highest probability for shoreline accumulation at this threshold at 18% with shoreline accumulation occurring within 150 hours (6.25 days). The peak volume of oil ashore was forecast for East Gippsland at 28 m^3, with a maximum length of shoreline accumulation at this threshold of 3.6 km predicted during winter conditions. The peak volume of oil ashore was forecast for East Gippsland at 28 m^3. East Gippsland recorded the maximum length of shoreline accumulation at this threshold of 3.6 km during both summer and winter conditions.
High (500g/m^2)	No exposure at this threshold was predicted.
In-Water Exposure - Dissolved	
Low (10ppb)	Cape Howe MNP and Victorian State Waters recorded the highest dissolved concentrations both at 394 ppb during winter conditions. The maximum distance for at this exposure from the source was predicted to be 1,039.1 km from the release location. The highest probability of exposure was predicted for Cape Howe MNP, New Zealand Star Bank, and both News South Wales and Victorian State waters at 100 % during winter conditions. The minimum time to dissolved hydrocarbon exposure was ~29 hours (1.21 days) at New Zealand Star Bank during winter conditions.
Moderate (50ppb)	The maximum distance for this exposure from the source was predicted to be 898.8 km from the release location. The highest probability of exposure was predicted for New Zealand Star Bank at 76 % during winter conditions. The minimum time to dissolved hydrocarbon exposure was ~31 hours (1.29 days) at New Zealand Star Bank during winter conditions.
High (400ppb)	The maximum distance for dissolved hydrocarbons at this exposure from the source was predicted to be 898.8 km. There was no exposure predicted for any receptor at concentrations above 400 ppb.
In-Water Exposure - Entrained	
Low (10ppb)	The highest concentration of entrained hydrocarbons was predicted at the Big Horseshoe Canyon KEF as 518 ppb. The maximum distance for this exposure from the source was predicted to be 917.2 km from the release location. The highest probability of entrained exposure was predicted for New Zealand Star Bank, Point Hicks MNP and Victorian and New South Wales State Waters at 100% at this threshold.

	The minimum time to entrained hydrocarbon exposure was ~19 hours (0.79 days) at New Zealand Star Bank during winter conditions.
High (100ppb)	The maximum distance for entrained hydrocarbons at this exposure from the source was predicted to be 578.3 km from the release location. The highest probability of exposure was predicted for New Zealand Star Bank and Victoria State Waters at 78% during summer conditions. The minimum time to entrained hydrocarbon exposure was ~34 hours (1.42 days) at Big Horseshoe Canyon KEF during winter conditions.

5.6.2. Risk Evaluation

The presence hydrocarbons in the environment introduces the following risks to environmental receptors:

- change in water quality
- injury / mortality to fauna
- change in fauna behaviour
- change in ecosystem dynamics
- changes to the functions, interests or activities of other users

To assess whether an impact may occur, modelled LOWC hydrocarbon extent predictions were compared to hydrocarbon exposure threshold levels for surface, shoreline and in-water hydrocarbons (Table 5-11).

5.6.2.1. Surface Hydrocarbons

Based on the hydrocarbon exposure modelling predictions (RPS, 2022) as summarised in Section 5.6.1.3, surface water hydrocarbons may impact:

- Seabirds and Shorebirds
- Marine reptiles
- Pinnipeds
- Cetaceans (whales and dolphins)
- Recreation and tourism (recreational fisheries)
- Industry (shipping)
- Industry (oil and gas)
- First Nations Cultural Heritage Values and Sensitivities

Table 5-13: Risk evaluation to ecological receptors within the EMBA – sea surface

RECEPTOR GROUP	RECEPTOR TYPE	IMPACTS	EXPOSURE EVALUATION	RISK EVALUATION
Marine Fauna	Seabirds	Change in fauna behaviour Injury/mortality to fauna	Several listed Threatened, Migratory and/or listed marine species have the potential to be rafting, resting, diving and feeding within 19 km of the release location predicted to be exposed to moderate levels of surface hydrocarbons. Foraging BIAs for several albatross is present in the area affected by the moderate threshold (Section 4.5.1). Foraging, breeding and migration BIAs are identified within the area for several petrel and tern species. Several shearwater species and the Black-Faced Cormorant were also identified to have foraging and breeding BIAs present in the area affected by the moderate threshold Section 4.5.1). Foraging and breeding BIAs for Little Penguins are within the EMBA (Section 4.5.1).	Seabirds within the hydrocarbon EMBA (moderate exposure) have the potential to directly contact surface hydrocarbons given shearwaters rest on the sea surface and albatrosses and petrels feed by plunge-diving. Foraging seabirds may continue to forage within slicks. Direct contact with surface hydrocarbons during foraging will lead to damage to external tissues including skin and eyes, as well as internal tissue irritation in their lungs and stomachs (ITOPF 2011). Acute or chronic toxicity impacts (death or long-term poor health) to birds making contact close to the spill source at the time of the spill (i.e. areas of concentrations >10 g/m^2 out to <19 km from the release location) are possible but unlikely for a condensate spill because of the limited period of exposure above 10 g/m^2 (as volatile surface hydrocarbons (83%) are expected to evaporate over 3-4 days.). Oiling of seabird feathers affects their ability to thermoregulate resulting in hypothermia. A bird suffering from cold, exhaustion (resulting from fouling of plumage) may dehydrate, drown or starve (ITOPF 2011a, CoA, 2022, AMSA 2013). However, the absence of critical habitat or sensitive aggregation sites for EPBC Act listed birds within the hydrocarbon EMBA (moderate exposure) for LOWC reduces the potential for impact to these species to negligible at the population level. Seabirds with foraging BIAs in the hydrocarbon EMBA (moderate exposure) for LOWC are highly pelagic species. Therefore, potential impact would likely be limited to individuals, however, impacts to aggregations may occur. The consequence of a LOWC event to seabirds is assessed as Major (4). No long-term effects are expected however impacts leading to death to a small

RECEPTOR GROUP	RECEPTOR TYPE	IMPACTS	EXPOSURE EVALUATION	RISK EVALUATION
				number of EPBC Act listed birds may be likely to occur due to their presence within the foraging BIAs. Prevention controls are in place to prevent the risk of a LOWC event. The likelihood of a LOWC event leading to injury / mortality to birds is assessed as **Rare (1).** The risk rating for injury / mortality to birds from an accidental release – LOWC during the activity is ranked **Medium (4)**.
	Marine reptiles (including marine turtles)	Change in fauna behaviour Injury/mortality to fauna	There may be marine turtles in the area predicted to be exposed to surface hydrocarbons. However, no BIAs or habitat critical to the survival of the species have been identified within this area. No other marine reptile was identified within the EMBA.	Marine turtles are vulnerable to the effects of oil at all life stages. Marine turtles can be exposed to surface oil externally (i.e. swimming through oil slicks) or internally (i.e. swallowing the oil). Ingested oil can harm internal organs and digestive function. Oil on their bodies can cause skin irritation and affect breathing. No habitat critical to the survival of the species have been identified in the area, and no BIA has been designated in the region of the LOWC EMBA. The number of marine turtles that may be exposed to condensate is expected to be low due to their limited and transient presence in the area. Surface oiling area is expected to reduce quickly, with the majority (85%) of the hydrocarbon volume predicted to have evaporated within a few days of release (3-4 days). Therefore, potential impact would be limited to individuals, with population impacts not anticipated. Marine pollution is listed as a threat to marine turtles within the Recovery Plan for Marine Turtles in Australia 2017-2027 (CoA 2017a), particularly in relation to shoreline oiling of nesting beaches. There are no nesting beaches within the EMBA, and the activity will be conducted in a manner which is not inconsistent with the relevant management actions. The potential consequence to marine turtles from a LOWC event is assessed as **Minor (2)** based on the potential for localised and short-term impacts to

RECEPTOR GROUP	RECEPTOR TYPE	IMPACTS	EXPOSURE EVALUATION	RISK EVALUATION
				species of recognized conservation value but not affecting local ecosystem functioning. Prevention controls are in place to prevent the risk of a LOWC event. The likelihood of a LOWC event leading to injury / mortality to marine reptiles is assessed as **Rare (1)**. The risk rating for injury / mortality to marine reptiles from an accidental release – LOWC during the activity is ranked **Low (2)**.
	Pinnipeds (seals and sea-lions)	Change in fauna behaviour Injury/mortality to fauna	There are two species of pinnipeds Australian Fur-seal and the Long-nosed Fur-seal that may occur in the area predicted to affected by surface hydrocarbons (see Table 4-6).	Exposure to surface oil can result in skin and eye irritations and disruptions to thermal regulation. Oiling of pinnipeds can lead to hypothermia if the fur is affected, or poisoning if oil is ingested, resulting in reduced foraging and reproductive fitness or death (DSEWPaC 2013b). Fur seals are particularly vulnerable to hypothermia from oiling of their fur (however the characteristics of condensate mean this is not likely), as well as irritation to lungs if breathing in fumes (e.g. if feeding occurs in the area). No habitat critical to the survival of the species have been identified in the area, and no BIA has been designated in the region of the LOWC EMBA. The number of pinnipeds that may be exposed to condensate is expected to be low due to their limited and transient presence in the area. Surface oiling area is expected to reduce quickly with 85% of the condensate predicted to evaporate within a few days of the release (3-4 days). Therefore, potential impact would be limited to individuals, with population impacts not anticipated. Given that fur seals are vulnerable to hypothermia from oiling and poisoning from ingestion, the potential consequence to pinnipeds from a LOWC event is assessed as **Severe (3)** based on the potential for localised and short-term impacts to species of recognized conservation value but not affecting local ecosystem functioning.

RECEPTOR GROUP	RECEPTOR TYPE	IMPACTS	EXPOSURE EVALUATION	RISK EVALUATION
				Prevention controls are in place to prevent the risk of a LOWC event. The likelihood of a LOWC event leading to injury / mortality to pinnipeds is assessed as Rare (1). The risk rating for injury / mortality to pinnipeds from an accidental release – LOWC during the activity is ranked Low (3).
	Cetaceans	Change in fauna behaviour Injury/mortality to fauna	Several Threatened, Migratory and/or Listed Marine cetacean species have the potential to be migrating, resting or foraging within an area predicted to be exposed to surface hydrocarbons. The following BIAs have been designated and overlap within the area exposed to surface hydrocarbons: • Pygmy Blue Whale foraging and distribution BIAs • Southern Right Whale breeding and migration BIAs.	Physical contact by individual whales of condensate is unlikely to lead to any long-term impacts. Given the mobility of whales, only a small proportion of the population would surface in the affected areas, resulting in short-term and localised consequences, with no long-term population viability effects. Geraci (1988) found little evidence of cetacean mortality from hydrocarbon spills; however, some behaviour disturbance (including avoidance of the area) may occur. While this reduces the potential for physiological impacts from contact with hydrocarbons, active avoidance of an area may disrupt behaviours such as migration, or displace individuals from important habitat, such as foraging, resting or breeding. If whales are foraging at the time of the spill, a greater number of individuals may be present in the plume, however due to the rapid weathering of condensate and the short duration of the surface exposures at higher concentrations, this is not considered likely. While avoidance of an area with a barely visible sheen (i.e. 0.1 g/m^2) is considered unlikely, it is acknowledged that this may occur within the aggregation areas. However, given that the area in which it is identified that the species will aggregate, as delineated by the BIA, is a small percentage of the total BIA area and that surface condensate is expected to rapidly weather, the risk of displacement to whales is considered low. The potential consequence is assessed as Major (4) based on the potential for localised short-term impacts to species/habitats of recognised conservation value, but not affecting local ecosystem functioning.

RECEPTOR GROUP	RECEPTOR TYPE	IMPACTS	EXPOSURE EVALUATION	RISK EVALUATION
				Prevention controls are in place to prevent the risk of a LOWC event. The likelihood of a LOWC event leading to injury / mortality to marine mammals is assessed as **Rare (1)**. The risk rating for injury / mortality to marine mammals from an accidental release – LOWC during the activity is ranked **Medium (4)**.
Human systems	Recreation and tourism	Changes to the functions, interests or activities of other users and aesthetic values	Marine pollution can result in impacts to marine-based tourism from reduced visual aesthetic. Condensate is known to rapidly spread and thin out on release and consequently, a large area may be exposed to surface hydrocarbon.	Low exposure thresholds (1 g/m^2) are predicted up to 176.1 km ENE (summer) or 202.2 km NE (winter) of the release location. Receptors where low threshold surface oil is predicted include East Gippsland, Gabo Island, Cape Howe and Point Hicks. Visible surface hydrocarbons (i.e. rainbow sheen) have the potential to reduce the visual amenity of the area for tourism and discourage recreational activities. However, the relatively short duration, and distance from shore means there may be short-term and localised consequences, which are ranked as **Minor (2)** as they could be expected to result in localised short-term impacts. Prevention controls are in place to prevent the risk of a LOWC event. The likelihood of a LOWC event impacting recreation and tourism is assessed as **Rare (1)**. The risk a change to the functions, interests of activities of other users or aesthetic values affecting recreation and tourism from an accidental release – LOWC during the activity is ranked **Low (2)**. Refer also to: • Marine Mammals (Pinnipeds, Cetaceans); and • State Marine Protected Areas.
	Coastal settlements	Changes to the functions, interests or	Marine pollution can result in impacts to coastal settlements from reduced visual aesthetic.	Low exposure thresholds (1 g/m^2) are predicted up to 176.1 km ENE (summer) or 202.2 km NE (winter) of the release location. Receptors where low

RECEPTOR GROUP	RECEPTOR TYPE	IMPACTS	EXPOSURE EVALUATION	RISK EVALUATION
		activities of other users and aesthetic values	Condensate is known to rapidly spread and thin out on release and consequently, a large area may be exposed to surface hydrocarbon.	threshold surface oil is predicted include East Gippsland, Gabo Island, Cape Howe and Point Hicks. Visible surface hydrocarbons (i.e. rainbow sheen) have the potential to reduce the visual amenity of the area. However, the relatively short duration, and distance from shore means there may be short-term and localised consequences, which are ranked as Minor (2) as they could be expected to result in localised short-term impacts. Prevention controls are in place to prevent the risk of a LOWC event. The likelihood of a LOWC event impacting recreation and tourism is assessed as Rare (1). The risk a change to the functions, interests of activities of other users or aesthetic values affecting coastal settlements from an accidental release – LOWC during the activity is ranked Low (2).
	Marine and Coastal Industry (shipping)	Changes to the functions, interests or activities of other users	Shipping occurs within the area predicted to be exposed to surface hydrocarbons.	Vessels may be present in the area exposed to sea surface oil, however, due to the short duration of surface exposure (85% evaporated within a few days) impacts would be localised and short term, consequently, the potential consequence is considered to be Slight (1). Prevention controls are in place to prevent the risk of a LOWC event. The likelihood of a LOWC event impacting industry (shipping) is assessed as Rare (1). The risk rating for changes to the functions, interests or activities of other users to industry (shipping) from an accidental release – LOWC during the activity is ranked Low (1).
	Marine and Coastal Industry (oil and gas)	Changes to the functions, interests or activities of other users	Oil and gas platforms are located within the area predicted to be exposed to surface hydrocarbons.	Oil and gas infrastructure is present in the area exposed to surface hydrocarbons, mostly concentrated to the south west (i.e. Esso operated assets). However, due to the short duration of surface exposure (85% evaporated within a few days) impacts would be localised and short term, consequently, the potential consequence is considered to be Slight (1).

RECEPTOR GROUP	RECEPTOR TYPE	IMPACTS	EXPOSURE EVALUATION	RISK EVALUATION
				Prevention controls are in place to prevent the risk of a LOWC event. The likelihood of a LOWC event impacting industry (oil and gas) is assessed as Rare (1). The risk rating for changes to the functions, interests or activities of other users from an accidental release – LOWC during the activity is ranked Low (1).
	First Nations	Changes to the functions, interests or activities of other users and aesthetic values	First Nations people are intrinsically linked to Sea Country which encompasses lands, waterways, seas, cultural practices and values to which they are connected (AIATSIS 2022). Country is a cultural landscape which includes both tangible values (i.e. cultural heritage sites) and intangible values (i.e. creation stories and cultural practices). First Nations cultural concepts are directly connected with Country. Country describes all aspects of place, environment, spirituality, law and identity. Values of Country differ between First Nations groups, and not all First Nations groups and communities in Australia hold the same belief systems or spirituality. Connection to Sea Country is accompanied by a complexity of cultural rights and	Visible surface hydrocarbons have the potential to reduce the visual amenity of known culturally significant values identified within the marine environment, subsequently potentially impacting the value of the site to First Nations people. An unplanned hydrocarbon spill will impact the waters within Sea Country for a period while the spill disperses and weathers and has the potential to disrupt cultural values of Sea Country. The likelihood of a hydrocarbon spill occurring is assessed as highly unlikely and the actual area that may be affected from any single spill event would be considerably smaller than represented by the EMBA. The potential consequence is assessed as Major (4) based on the potential for localised short-term impacts to species/habitats of recognised cultural value, but not affecting local ecosystem functioning or a disruption to cultural heritage values and sensitivities. Refer also to: • Seabirds and Shorebirds • Marine Mammals Prevention controls are in place to prevent the risk of a LOWC event. The likelihood of a LOWC event leading to a disruption to cultural heritage value and sensitivities is assessed as Rare (1). The risk rating for disruption to cultural heritage value and sensitivities from an accidental release – LOWC during the activity is ranked Medium (4). As

RECEPTOR GROUP	RECEPTOR TYPE	IMPACTS	EXPOSURE EVALUATION	RISK EVALUATION
			responsibilities. Coastal areas traditionally were amongst the most densely populated areas due to the abundance of resources available. Formal recognition of Sea Country rights is significantly slower compared to land rights. This could be for a range of reasons including conflicting perspectives and opinions on traditional custodianship of land and how far it extends (Smyth and Isherwood 2016). Hydrocarbon exposure may have the potential to impact the aesthetic and cultural values of Sea Country by the presence of physical hydrocarbons or the presence of oil spill responders.	such, the intrinsic link between environmental receptors and First Nations people's cultural heritage values and sensitivities is expected to be maintained.

5.6.2.2. Shoreline Hydrocarbons

Based on the hydrocarbon exposure modelling predictions (RPS, 2022) as summarised in Section 5.6.1.3, shoreline hydrocarbons may impact:

- Seabirds and shorebirds
- Marine Invertebrates
- Saltmarsh
- Wetlands and Coastal settlements
- Recreation and Tourism
- Heritage
- First Nations Cultural Heritage Values and Sensitivities

Table 5-14: Risk evaluation to ecological receptors within the EMBA – shoreline

RECEPTOR GROUP	RECEPTOR TYPE	IMPACTS	EXPOSURE EVALUATION	RISK EVALUATION
Marine Fauna	Seabirds and shorebirds	Change in fauna behaviour Injury/mortality to fauna	Listed marine, threatened and/or migratory bird species have the potential to be breeding, foraging, feeding, roosting or resting within the area potentially exposed to hydrocarbons ashore. These faunae can be present in wide range of habitats including sandy beaches and rocky shores (refer also to the exposure evaluation for these habitats). There are several seabird foraging, breeding and aggregation BIAs throughout the area, however these species are pelagic, oceanic foragers, not shoreline foragers. There are no Shorebird BIAs that overlap the LOWC EMBA, as there is no critical habitat identified crucial to the survival of these species. However, the Curlew Sandpiper, Eastern Curlew and the Great Knot are all EPBC Listed Critically Endangered species which may be found within the EMBA. Given hydrocarbons may wash ashore prior to weathering, there is the potential for both physical oiling and toxicity (e.g. surface contact or ingestion; particularly for shorebirds utilizing the intertidal area). Noting that these	Shoreline species may suffer both direct oiling and potential displacement from foraging and/or nesting sites. Acute or chronic toxicity impacts (death or long-term poor health) to small numbers of birds are possible, however this is not considered significant at a population level. Direct oiling of nesting sites is considered unlikely as hydrocarbons would typically accrue within the upper swash zone, and nests would occur above this level on a beach. However, oiled fauna may track oil into their nests, which may then have subsequent impacts on any eggs present. This would be more of a risk for fauna, such as the Little Penguin, that must traverse the intertidal area to reach nesting sites. There are no known breeding locations for penguins along the mainland coast at risk of shoreline oil accumulation. In addition, given the volatility of the exposed oil, any impact to nests is expected to occur to individuals and not considered to pose a long-term risk at population level. Other species including the Curlew Sandpiper, Eastern Curlew and the Great Knot, may be present on shorelines within the EMBA, however there are no known BIA's or critical habitat for these species, within the EMBA. Therefore, the potential consequence to seabirds and shorebirds from shoreline hydrocarbon exposure event are considered to be Minor (2), as they could be expected to result in localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning. Prevention controls are in place to prevent the risk of a LOWC event. The likelihood of a LOWC event impacting shorebirds and seabirds is assessed as Rare (1).

RECEPTOR GROUP	RECEPTOR TYPE	IMPACTS	EXPOSURE EVALUATION	RISK EVALUATION
			events will be temporary, so length of exposure is limited.	The risk rating for injury / mortality to shorebirds and seabirds from an accidental release – LOWC during the activity is ranked Low (1).
	Marine Invertebrates	Change in fauna behaviour Injury/mortality to fauna	Invertebrates that live in intertidal zones include crustaceans, molluscs and infauna, and can be present in wide range of habitats including sandy beaches and rocky shores (refer also to the exposure evaluation for these habitats). Exposure to hydrocarbons for invertebrates is typically via direct contact and smothering but can also occur via ingestion.	The impact of oil on any marine organism depends on the toxicity, viscosity and amount of oil, on the sensitivity of the organism and the length of time it is in contact with the oil. Acute or chronic exposure, through surface contact, and/or ingestion can result in toxicological impacts, reproductive impacts, smothering and potentially cause death. However, the presence of an exoskeleton (e.g. crustaceans) will reduce the impact of hydrocarbon absorption through the surface membrane. Other invertebrates with no exoskeleton and larval forms may be more sensitive to impacts from hydrocarbons. If invertebrates are contaminated by hydrocarbons, tissue taint can remain for several months, but can eventually be lost. As condensate is expected to rapidly spread out, a large portion of the coast with the potential to be exposure to hydrocarbons comprises habitats that are suitable for intertidal invertebrates could be exposed, with the potential consequences assessed as Severe (3) based on the potential for localised medium-term impacts to species or habitats of recognised conservation value or to local ecosystem function. Prevention controls are in place to prevent the risk of a LOWC event. The likelihood of a LOWC event impacting marine invertebrates is assessed as Rare (1). The risk rating for injury / mortality to marine invertebrates from an accidental release – LOWC during the activity is ranked Low (3).

RECEPTOR GROUP	RECEPTOR TYPE	IMPACTS	EXPOSURE EVALUATION	RISK EVALUATION
Natural systems	Saltmarsh	Changes in ecosystem dynamics	Communities of saltmarsh are within the area potentially exposed to hydrocarbons ashore; and is present within some estuaries and inlet/riverine systems. Some of the saltmarsh habitat along this coast will be representative of the Subtropical and Temperate Saltmarsh TEC. Oil can enter saltmarsh systems during the tidal cycles if the estuary/inlet is open to the ocean. Similar to mangroves, this can lead to a patchy distribution of the oil and its effects, because different places within the inlets are at different tidal heights. Oil (in liquid form) will readily adhere to the marshes, coating the stems from tidal height to sediment surface. Heavy oil coating will be restricted to the outer fringe of thick vegetation, although lighter oils can penetrate deeper, to the limit of tidal influence.	Saltmarsh is considered to have a high sensitivity to hydrocarbon exposure. Saltmarsh vegetation offers a large surface area for oil absorption and tends to trap oil. Evidence from case histories and experiments shows that the damage resulting from oiling, and recovery times of oiled marsh vegetation, are very variable. In areas of light to moderate oiling where oil is mainly on perennial vegetation with little penetration of sediment, the shoots of the plants may be killed but recovery can take place from the underground systems. Good recovery commonly occurs within one to two years (IPIECA 1994). Thus, the potential consequence to saltmarshes from exposure are assessed as Severe (3). Prevention controls are in place to prevent the risk of a LOWC event. The likelihood of a LOWC event impacting saltmarshes is assessed as Rare (1). The risk rating for a change in ecosystem dynamics to salt marshes from an accidental release – LOWC during the activity is ranked Low (3).
	Wetlands	Changes in ecosystem dynamics	Five Wetlands of International Importance (RAMSAR) are present within the potential monitoring area. One further RAMSAR site is located within 15 km of the EMBA. Three wetland communities with TEC status are present within the potential monitoring area; Assemblages of species associated with open-coast salt-wedge estuaries of western and central Victoria ecological community, Coastal swamp sclerophyll forest of NSW and	The impacts of hydrocarbons on wetlands are generally similar to those described for saltmarshes. The degree of impact of oil on wetland vegetation are variable and complex, and can be both acute and chronic, ranging from short-term disruption of plant functioning to mortality. Spills reaching wetlands during the growing season will have a more severe impact than if oil reaches wetlands during the times when many plant species are dormant. Wetland habitat can be of particular importance for some species of birds and invertebrates. As such, in addition to direct impacts on plants, oil that reaches wetlands also affects these fauna

RECEPTOR GROUP	RECEPTOR TYPE	IMPACTS	EXPOSURE EVALUATION	RISK EVALUATION
			south east QLD, River-flat eucalypt forest on coastal floodplains of southern NSW and east Vic.	utilising wetlands during their life cycle, especially benthic organisms that reside in the sediments and are a foundation of the food chain. Thus, the potential consequence to wetlands from exposure are assessed as **Severe (3)** based on the potential for localised medium-term impacts to species or habitats of recognized conservation value or to local ecosystem function. Refer also to: • Marine Invertebrates. • Seabirds and Shorebirds. Prevention controls are in place to prevent the risk of a LOWC event. The likelihood of a LOWC event impacting wetlands is assessed as **Rare (1)**. The risk rating for a change in ecosystem dynamics to wetlands from an accidental release – LOWC during the activity is ranked **Low (3)**.
Human systems	Coastal Settlements	Changes to the functions, interests or activities of other users and aesthetic values	Coastal settlements are within the area potentially exposed to hydrocarbons ashore; however, the stretch of coast expected to be exposed is not densely populated. Noting that these events will be temporary, so duration of exposure is also limited. Most of the hydrocarbons will be concentrated along the high tide mark while the lower/upper parts are often untouched (IPIECA 1995) and expected to be visible.	Visible hydrocarbons have the potential to reduce the visual amenity of the area for coastal settlements. Given its rapid weathering and potential for tidal flushing and rapid degradation, the potential consequence to coastal settlements is assessed as **Minor (2)** based on the potential for localised short-term impacts. Prevention controls are in place to prevent the risk of a LOWC event. The likelihood of a LOWC event impacting coastal settlements is assessed as **Rare (1)**. The risk rating for a change to the functions, interests or activities of other users and aesthetic values of coastal settlements from an accidental release – LOWC during the activity is ranked **Low (2)**.

RECEPTOR GROUP	RECEPTOR TYPE	IMPACTS	EXPOSURE EVALUATION	RISK EVALUATION
	Recreation and Tourism	Changes to the functions, interests or activities of other users and aesthetic values	Recreational and tourism activities occur within the area potentially exposed hydrocarbons ashore; however, the stretch of coast expected to be exposed, as such the volume of recreation/tourism is not as high as other places.	Visible hydrocarbons stranded on a shoreline have the potential to temporarily reduce the visual amenity of the area for tourism and discourage recreational activities. The potential consequence to recreation and tourism is assessed as Minor (2) based on the potential for localised short-term impacts. Prevention controls are in place to prevent the risk of a LOWC event. The likelihood of a LOWC event impacting recreation and tourism is assessed as Rare (1). The risk rating for a change to the functions, interests or activities of other users and aesthetic values of recreation and tourism from an accidental release – LOWC during the activity is ranked Low (2).
	Heritage	Changes to the functions, interests or activities of other users and aesthetic values	Specific locations of spiritual and ceremonial places of significance, or cultural artefacts, are often unknown, but are expected to be present along the mainland coast. Therefore, there is the potential that some of these sites may be within the area potentially exposed to hydrocarbons ashore. Five national heritage places with coastal features are present within the potential monitoring EMBA; Royal National Park and Garawarra State conservation Area, Kamay Botany Bay, Kurnell Peninsula Headland, Bondi Beach and Surf Pavilion, North Head Sydney. Noting that these events will be temporary, so duration of exposure is also limited. Most of	Hydrocarbons stranded on a shoreline have the potential to temporarily reduce the Heritage value of the area. However, it is expected that these sites would be above the high tide mark. Thus, the potential consequence to heritage is assessed as Minor (2) as they could be expected to result in localised short-term impacts. Prevention controls are in place to prevent the risk of a LOWC event. The likelihood of a LOWC event impacting heritage sites is assessed as Rare (1). The risk rating for a change to the functions, interests or activities of other users and aesthetic values of heritage sites from an accidental release – LOWC during the activity is ranked Low (2).

RECEPTOR GROUP	RECEPTOR TYPE	IMPACTS	EXPOSURE EVALUATION	RISK EVALUATION
			the oil will be concentrated along the high tide mark while the lower/upper parts are often untouched (IPIECA 1995) and expected to be visible.	
	First Nations	Changes to the functions, interests or activities of other users and aesthetic values	First Nations people are intrinsically linked to Sea Country which encompasses lands, waterways, seas, cultural practices and values to which they are connected (AIATSIS 2022). Country is a cultural landscape which includes both tangible values (i.e. cultural heritage sites) and intangible values (i.e. creation stories and cultural practices). First Nations cultural concepts are directly connected with Country. Country describes all aspects of place, environment, spirituality, law and identity. Values of Country differ between First Nations groups, and not all First Nations groups and communities in Australia hold the same belief systems or spirituality. Connection to Sea Country is accompanied by a complexity of cultural rights and responsibilities. Coastal areas traditionally were amongst the most densely populated areas due to the abundance of resources available. Formal recognition of Sea Country rights is significantly slower compared to land rights. This could be for a range of reasons including conflicting perspectives and opinions on	Visible hydrocarbons along a shoreline have the potential to reduce the visual amenity of known heritage sites along the coastline, subsequently potentially impacting the value of the site to First Nations people. An unplanned hydrocarbon spill will impact the waters within Sea Country for a period while the spill disperses and weathers and has the potential to disrupt cultural values of Sea Country. The likelihood of a hydrocarbon spill occurring is assessed as highly unlikely and the actual area that may be affected from any single spill event would be considerably smaller than represented by the EMBA. As condensate is expected to rapidly spread out, a large portion of the coast with the potential to be exposure to hydrocarbons comprises habitats that are suitable for habitats and species could be exposed, with the potential consequences assessed as Severe (3) based on the potential for localised medium-term impacts to species or habitats of recognised cultural heritage value or to local ecosystem function. Refer also to: • Coastal Habitats • State Marine Parks Prevention controls are in place to prevent the risk of a LOWC event. The likelihood of a LOWC event leading to a disruption to cultural heritage value and sensitivities is assessed as Rare (1).

RECEPTOR GROUP	RECEPTOR TYPE	IMPACTS	EXPOSURE EVALUATION	RISK EVALUATION
			traditional custodianship of land and how far it extends (Smyth and Isherwood 2016). Hydrocarbon exposure may have the potential to impact the aesthetic and cultural values of Sea Country by the presence of physical hydrocarbons or the presence of oil spill responders.	The risk rating for a disruption to cultural heritage values and sensitivities from an accidental release – LOWC during the activity is ranked Low (3). As such, the intrinsic link between environmental receptors and First Nations people's cultural heritage values and sensitivities is expected to be maintained.

5.6.2.3. In-water Hydrocarbons

Based on the hydrocarbon exposure modelling predictions (RPS, 2022) as summarised in Section 5.6.1.3, in-water hydrocarbons may impact:

- Benthic habitat (e.g. macroalgae, soft coral, and seagrass)
- Plankton
- Marine invertebrates
- Fishes
- Marine reptiles
- Pinnipeds
- Cetaceans (whales and dolphins)
- Commercial and recreational fisheries
- Recreation and tourism
- State and Marine Protected Areas (MPAs)
- Australian Marine Parks (AMPs)
- Key Ecological Features (KEFs)
- Wetlands

Table 5-15: Risk evaluation to ecological receptors within the EMBA – in-water

RECEPTOR GROUP	RECEPTOR TYPE	IMPACTS	EXPOSURE EVALUATION	RISK EVALUATION
Habitat	Benthic habitats (e.g. macroalgae, soft coral, seagrass)	Change in habitat	Benthic habitats may be present within the area predicted to be exposed above thresholds. Note that the greater wave action and water column mixing within the nearshore environment will also result in rapid weathering of the condensate residue	Exposure of entrained hydrocarbons to shallow subtidal corals has the potential to result in lethal or sublethal toxic effects, resulting in acute impacts or death at moderate to high exposure thresholds (Shigenaka 2001). Contact with corals may lead to reduced growth rates, tissue decomposition, and poor resistance and mortality of sections of reef (NOAA 2010). Reported toxic responses to oils have included a variety of physiological changes to enzyme systems, photosynthesis, respiration, and nucleic acid synthesis (Lewis & Pryor 2013). A review of field studies conducted after spill events by Connell et al. (1981) indicated a high degree of variability in the level of impact, but in all instances, the macroalgae appeared to be able to recover rapidly from even very heavy oiling. There is the potential that exposure could result in sub-lethal impacts, more so than lethal impacts, possibly because much of seagrasses' biomass is underground in their rhizomes (Zieman et al. 1984). However, given the restricted range of exposure (shallow nearshore and intertidal waters only) and the predicted lower concentrations of hydrocarbons that could reach these waters, any impact to benthic habitat is not expected to result in long-term or irreversible damage. Thus, the potential consequence to benthic habitats is assessed as Minor (2) based on the potential for localised short-term impacts to species/habitats of recognised conservation value, but not affecting local ecosystem functioning. Prevention controls are in place to prevent the risk of a LOWC event. The likelihood of a LOWC event impacting benthic habitats is assessed as Rare (1). The risk rating for a Change in habitat of benthic habitats from an accidental release – LOWC during the activity is ranked Low (2).

RECEPTOR GROUP	RECEPTOR TYPE	IMPACTS	EXPOSURE EVALUATION	RISK EVALUATION
Marine Fauna	Plankton	Change in fauna behaviour Injury/mortality to fauna	Plankton are likely to be exposed to entrained hydrocarbon. Exposure is predicted in the 0-10 m water depth, which is also where plankton are generally more abundant. Entrained condensate is not shown to intersect the upwelling east of Eden KEF. Therefore, any impact is expected to be extremely localised and temporary.	Phytoplankton are typically not sensitive to oil, whereas zooplankton are (Hook et al. 2016). Water column organisms, such as zooplankton, may be impacted by exposure to hydrocarbons through ingestion, inhalation, and dermal contact (NRDA 2012), which can cause immediate mortality or declines in reproduction (Hook et al. 2016). Lethal and sublethal effects on zooplankton include narcosis, alterations in feeding, development, and reproduction (Almeda et al. 2014). Plankton populations have evolved to respond to environmental perturbations by copious production within short generation times (ITOPF 2011). They are known to have naturally high mortality rates (primarily through predation), however once water quality returns to ambient, plankton populations will return to previous conditions within weeks or months due to recruitment of plankton from surrounding waters. Consequences are assessed as Minor (2) based on the potential for short-term and localised impacts, but not affecting local ecosystem functioning. Prevention controls are in place to prevent the risk of a LOWC event. The likelihood of a LOWC event leading to injury / mortality to plankton is assessed as Rare (1). The risk rating for injury / mortality to plankton from an accidental release – LOWC during the activity is ranked Low (2).
	Marine Invertebrates	Change in fauna behaviour Injury/mortality to fauna	The modelling indicates that entrained condensate may be present at 0-10 m water depth. Impact by direct contact of benthic species with hydrocarbon in the deeper areas of the release area is not expected given the surface nature of the spill and the water depths throughout much of the	Acute or chronic exposure through contact and/or ingestion can result in toxicological risks. However, the presence of an exoskeleton (e.g. crustaceans) reduces the impact of hydrocarbon absorption through the surface membrane. Invertebrates with no exoskeleton and larval forms may be more prone to impacts. Localised impacts to larval stages may occur which could impact on population recruitment that year. Tainting of recreation or commercial species is considered unlikely to occur, however if it did it is expected to be localised and low level with recovery expected.

RECEPTOR GROUP	RECEPTOR TYPE	IMPACTS	EXPOSURE EVALUATION	RISK EVALUATION
			EMBA. Species closer to shore may be affected although these effects will be localised, low level and temporary. Filter-feeding benthic invertebrates such as sponges, bryozoans, abalone and hydroids may be exposed to sub-lethal impacts, however, population level impacts are considered unlikely. Tissue taint may occur and remain for several months in some species (e.g. lobster, abalone) however, this will be localised and low level with recovery expected. In-water invertebrates of value have been identified to include squid, crustaceans (rock lobster, crabs) and molluscs (scallops, abalone). Several commercial fisheries for marine invertebrates are within the area predicted to be exposed above the impact threshold: Commonwealth fisheries Bass Strait Scallop Central Zone Scallop Fishery State fisheries Victorian Abalone Fishery	Thus, the potential consequence to invertebrates including commercially fished invertebrates is assessed as Minor (2) based on the potential for short-term and localised impacts, but not affecting local ecosystem functioning. Prevention controls are in place to prevent the risk of a LOWC event. The likelihood of a LOWC event leading to injury / mortality to marine invertebrates is assessed as Rare (1). The risk rating for injury / mortality to marine invertebrates from an accidental release – LOWC during the activity is ranked Low (2).

RECEPTOR GROUP	RECEPTOR TYPE	IMPACTS	EXPOSURE EVALUATION	RISK EVALUATION
			Victorian Ocean Scallop Fishery Victorian Rock Lobster Fishery Victorian Sea Urchin Fishery Tasmanian Giant Crab Fishery Tasmanian Rock Lobster Fishery NSW Abalone Fishery NSW Lobster Fishery NSW Sea Urchin and Turban Shell Fishery	
	Fishes (including sharks and rays)	Change in fauna behaviour Injury/mortality to fauna	Entrained hydrocarbon droplets can physically affect fish exposed for an extended duration (weeks to months). Effects will be greatest in the upper 10 m of the water column and areas close to the spill source where hydrocarbon concentrations are likely to be highest. Several fish communities in these areas are demersal and therefore more prevalent towards the seabed, which modelling does not predict is exposed >10m water depth. Therefore, any impacts are expected to be highly localised. There is a known distribution and breeding (nursery area) BIA for the great white shark in the area predicted to be over the impact	Pelagic free-swimming fish and sharks are unlikely to suffer long-term damage from oil spill exposure because dissolved/entrained hydrocarbons in water are not expected to be sufficient to cause harm (ITOPF, 2011). Subsurface hydrocarbons could potentially result in acute exposure to marine biota such as juvenile fish, larvae, and planktonic organisms, although impacts are not expected cause population-level impacts. Impacts on fish eggs and larvae entrained in the upper water column are not expected to be significant given the temporary period of water quality impairment, and the limited areal extent of the spill. As egg/larvae dispersal is widely distributed in the upper layers of the water column it is expected that current induced drift will rapidly replace any oil affected populations. The Recovery Plan for the white shark identifies habitat degradation (pollution) as a threat (CoA, 2013). The hydrocarbon EMBA (moderate exposure) for LOWC does not contain critical habitats or feeding aggregation areas for white and whale sharks. The presence of white and whale sharks within the EMBA is therefore expected to be limited to transitory individuals that will not be subject to long-term hydrocarbon exposure. In the event of a LOWC event, fishes in the hydrocarbon EMBA (moderate exposure) for LOWC are susceptible to injury / mortality from exposure to

RECEPTOR GROUP	RECEPTOR TYPE	IMPACTS	EXPOSURE EVALUATION	RISK EVALUATION
			threshold, however, it is not expected that this species spends a large amount of time close to the surface where thresholds are predicted to be exceeded.	hydrocarbons. The absence of habitat features or conditions for site-attached fishes in the hydrocarbon EMBA (moderate exposure) for LOWC limits potential risk to fishes from dry gas exposure to transient individuals. Transient fish species are highly mobile and as such are not likely to suffer extended exposure to hydrocarbons (ITOPF 2011). A study by Claireaux et al. (2017) revealed seabass detect and avoid in-water dissolved hydrocarbons at concentrations of 3 to 15 ppb. Based on this study, it is expected that pelagic fishes can detect and avoid in-water hydrocarbons at concentrations below levels that would lead to chronic effects. Thus, the potential consequence to fish and sharks including commercially fished species is assessed as **Major (4)** based on the potential for localised short-term impacts to species/habitats of recognised conservation value, but not affecting local ecosystem functioning. Prevention controls are in place to prevent the risk of a LOWC event. The likelihood of a LOWC event leading to injury / mortality to fishes is assessed as **Rare (1)**. The risk rating for injury / mortality to fishes from an accidental release – LOWC during the activity is ranked **Medium (4)**.
	Marine Reptiles (including marine turtles)	Change in fauna behaviour Injury/mortality to fauna	No BIAs, nesting, internesting areas or habitat critical to the survival of the species were identified for marine turtles in the hydrocarbon EMBA (moderate exposure) for LOWC. Loggerhead, green, leatherback and hawksbill turtles may occur within the hydrocarbon EMBA (moderate exposure) for LOWC. Only a small proportion of any marine reptile population is	Light oils, such as unweathered condensate, expose marine reptiles to volatile PAHs which may result in breathing, sight, or gastro-intestinal injuries (CoA 2017a). These injuries to marine reptiles can result in decreased health, starvation, increased stranding, and decreased breeding condition (CoA 2017a). Sudden high toxic contaminant load during pre-dive inhalations have caused instantaneous death to marine turtles (Shigenaka, 2021 cited in Yaghmour et al. 2022). Impacts to marine reptiles from LOWC surface hydrocarbon exposure is expected to be widespread and temporary based on weathering properties of dry gas. No long-term effects are expected however impacts leading to death to individual EPBC Act listed marine reptiles may occur. Therefore, impacts are assessed as **Major (4)**.

RECEPTOR GROUP	RECEPTOR TYPE	IMPACTS	EXPOSURE EVALUATION	RISK EVALUATION
			expected to be exposed to this EMBA.	Prevention controls are in place to prevent the risk of a LOWC event. The likelihood of a LOWC event leading to injury / mortality to marine reptiles is assessed as **Rare (1)**. The risk rating for injury / mortality to marine reptiles from an accidental release – LOWC during the activity is ranked **Medium (4)**.
	Pinnipeds (seals and sea-lions)	Change in fauna behaviour Injury/mortality to fauna	There are two species of pinnipeds Australian Fur-seal and the Long-nosed Fur-seal that may occur in the area predicted to be exposed to entrained hydrocarbons above thresholds. (Section 4.5).	Exposure to low/moderate effects level hydrocarbons in the water column or consumption of prey affected by the oil may cause sub-lethal impacts to pinnipeds, however given the temporary and localised nature of the spill, their widespread nature, the low-level exposure zones and rapid loss of the volatile components of condensate in choppy and windy seas (such as that of the EMBA), the potential consequence is assessed as **Severe (3)** based on the potential for localised short-term impacts to species/habitats of recognised conservation value, but not affecting local ecosystem functioning. Prevention controls are in place to prevent the risk of a LOWC event. The likelihood of a LOWC event leading to injury / mortality to pinnipeds is assessed as **Rare (1)**. The risk rating for injury / mortality to pinnipeds from an accidental release – LOWC during the activity is ranked **Low (3)**.
	Cetaceans	Change in fauna behaviour Injury/mortality to fauna	Several threatened, migratory and/or listed marine cetacean species have the potential to be migrating, resting or foraging within an area predicted to be exposed to in-water hydrocarbons. The following BIAs are within the area predicted to be exposed to entrained hydrocarbons above thresholds.:	In a LOWC event, marine mammals are more likely to be exposed to volatile hydrocarbon fumes from ingestion or inhalation. Physical oiling of marine mammals from condensate is unlikely. The absence of hairs and the frequent sloughing of skin cells provide little opportunity for hydrocarbons to adhere to cetacean bodies (Helm et al. 2015). Cetaceans do not drink large volumes of sea water and would not ingest much hydrocarbons, their foraging strategies likely do not include scavenging on oil-killed prey, and the toxic volatile components of condensate can dissipate quickly so exposure to toxins through inhalation may be minimal. (Helm et al. 2015).

RECEPTOR GROUP	RECEPTOR TYPE	IMPACTS	EXPOSURE EVALUATION	RISK EVALUATION
			• Pygmy Blue Whale foraging and distribution BIAs • Southern Right Whale migration and breeding BIA • Humpback Whale foraging and migration BIAs • Indo-Pacific Spotted Bottlenose Dolphin breeding BIA	In the event a marine mammal surfaces in fresh condensate surface slick, effects of hydrocarbon inhalation or ingestion may lead to hypothermia, organ dysfunction, congested lungs, damaged airways, emphysema, gastrointestinal ulceration and haemorrhaging, eye and skin lesions, and decreased body mass due to restricted diet (AMSA 2022), Such impacts are associated with 'fresh' hydrocarbon; the risk of impact declines rapidly as the condensate weathers. The potential for population impacts to marine mammals following a LOWC event would need to coincide with a migration event to result in exposure of many individuals. Southern right whales and pygmy blue whales are pelagic (move freely in the oceans) and because of their migratory patterns may only be occasionally affected by surface hydrocarbons (AMSA 2022). Given the mobility and wide geographical distribution of marine mammals, only transient marine mammal individuals would be expected to surface in an area exposed to surface hydrocarbons, resulting in short-term consequences, with no long-term population viability effects (Helm et al. 2015). A proportion of the migrating population of whales could be affected for a single migration event, thus potential consequence is assessed as Major (4) based on the potential for localised short-term impacts to species/habitats of recognised conservation value, but not affecting local ecosystem functioning. Prevention controls are in place to prevent the risk of a LOWC event. The likelihood of a LOWC event leading to injury / mortality to marine mammals is assessed as Rare (1). The risk rating for injury / mortality to marine mammals from an accidental release – LOWC during the activity is ranked Medium (4).
Natural systems	KEFS	Changes in ecosystem dynamics	Big Horseshoe Canyon, Canyons on the eastern continental slope, Seamounts South and east of Tasmania, Shelf rocky Reefs,	Based on the worse case potential consequence to key receptors within these KEFs, the potential consequence is assessed to be Major (4).

RECEPTOR GROUP	RECEPTOR TYPE	IMPACTS	EXPOSURE EVALUATION	RISK EVALUATION
			Tasman Front and eddy field, and Tasmania seamount Chain are predicted to be exposed to entrained hydrocarbons above thresholds. Values associated with these include: • High productivity and aggregation of marine life due to their ability to influence currents, creating localised upwelling and turbulent mixing • Hard substrates provide attachment points for sessile invertebrates in an otherwise relatively featureless environment • Support a diverse range of benthic, demersal and pelagic species as well as a high degree of endemism	Prevention controls are in place to prevent the risk of a LOWC event. The likelihood of a LOWC event leading to injury / mortality to the values of the impacted KEF is assessed as Rare (1). The risk rating for a change in ecosystem dynamics to KEFs from an accidental release – LOWC during the activity is ranked Medium (4). Refer also to: • Coral • Macroalgae • Seagrass • Plankton • Invertebrates • Seabirds • Fish and Sharks • Marine mammals (Pinnipeds, Cetaceans).
	State Marine Protected Areas	Changes in ecosystem dynamics	Marine protected areas predicted to be exposed to entrained hydrocarbons above thresholds: Commonwealth	Based on the worse case potential consequence to key receptors the consequence to protected marine areas is assessed Major (4). Prevention controls are in place to prevent the risk of a LOWC event. The likelihood of a LOWC event leading to injury / mortality to the values of the impacted State marine protected area is assessed as Rare (1).

RECEPTOR GROUP	RECEPTOR TYPE	IMPACTS	EXPOSURE EVALUATION	RISK EVALUATION
			Australian Marine Parks: Beagle and East Gippsland <u>State</u> Marine National Parks: Point Hicks Marine Parks: Batemans, Jervis Bay Marine Sanctuary: Beware Reef Conservation values for these areas include high marine fauna and flora diversity, including fish and invertebrate assemblages and benthic coverage (sponges, soft corals, macroalgae).	The risk rating for a change in ecosystem dynamics to the State marine protected area from an accidental release – LOWC during the activity is ranked **Medium (4)**. Refer to: • Invertebrates. • Macroalgae. • Pinnipeds.
Human systems	Commercial fishing	Changes to the functions, interests or activities of other users and aesthetic values	In-water exposure to entrained condensate may result in a reduction in commercially targeted marine species, resulting in impacts to commercial fishing and aquaculture. Actual or potential contamination of seafood can affect commercial and recreational fishing and can impact seafood markets long after any actual risk to seafood from a spill has subsided (NOAA 2002) which can have economic impacts to the industry. Several commercial and state fisheries operate in the EMBA and	Commercial fishing has the potential to be impacted through exclusion zones associated with the hydrocarbon release, the release response and subsequent reduction in fishing effort. Exclusion zones may impede access to commercial fishing areas, for a short period of time. The precautionary exclusion from fishing grounds can be expected until water quality monitoring verifies the absence of residual hydrocarbons, as such providing confidence to consumers in fisheries tainting. Fishing areas may be closed for fishing for as short period (days) because of the risks of the catch being tainted by hydrocarbons. Any exclusion zone established would be limited to the immediate vicinity of the release point, and due to the rapid weathering of condensate would only be in place 1-3 days after release, therefore physical displacement to vessels is unlikely to be a significant impact. Concentrations of petroleum contaminants in fish and crustacean and mollusc tissues pose adverse human health effects, and until these products cleared by the health authorities, they could be restricted for sale and human

RECEPTOR GROUP	RECEPTOR TYPE	IMPACTS	EXPOSURE EVALUATION	RISK EVALUATION
			overlap the spatial extent of the water column hydrocarbon predictions.	consumption. Any acute impacts are expected to be limited to small numbers of juvenile fish, larvae, and planktonic organisms, which are not expected to affect population viability or recruitment. Impacts from entrained exposure are unlikely to manifest at a fish population viability level. Studies of laboratory trials or of fish collected after release events (including the Hebei Spirit, Macondo, Sea Empress, Montara spills) find evidence of elimination of PAHs in fish tissues returning to reference levels within two months of exposure (Challenger and Mauseth 2011; Davis et al. 2002; Gagnon & Rawson 2011; Gohlke et al. 2011; Jung 2011; Law 1997; Rawson et al. 2011). Actual or potential contamination of seafood can affect commercial and recreational fishing and can impact seafood markets long after any actual risk to seafood from a spill has subsided (NOAA, 2002) which can have economic impacts to the industry. Thus, the potential consequence to commercial and recreational fisheries is assessed as Major (4) based on changes to the functions, interests or activities of commercial fisheries will be widespread, with no long-term consequences. Prevention controls are in place to prevent the risk of a LOWC event. The likelihood of a LOWC event leading to change to the functions, interests, or activities to commercial fisheries is assessed as Rare (1). The risk rating for change to the functions, interests, or activities to commercial fisheries from an accidental release – LOWC during the activity is ranked Medium (4). Refer also to: • Fish and Sharks • Invertebrates.

RECEPTOR GROUP	RECEPTOR TYPE	IMPACTS	EXPOSURE EVALUATION	RISK EVALUATION
	Recreation and tourism	Changes to the functions, interests or activities of other users and aesthetic values	In-water exposure to entrained condensate may result in a negative impact to recreation and tourism activities.	Any impact to receptors that provide nature-based tourism features (e.g. whales) may cause a subsequent negative impact to recreation and tourism activities. However, the relatively short duration, and distance from shore means there may be short-term and localised consequences, which are ranked as **Minor (2).** Prevention controls are in place to prevent the risk of a LOWC event. The likelihood of a LOWC event leading to change to the functions, interests, or activities to recreation and tourism is assessed as **Rare (1)**. The risk rating for change to the functions, interests, or activities to recreation and tourism from an accidental release – LOWC during the activity is ranked **Medium (4)**. Refer also to: • Fish and Sharks • Cetaceans • Invertebrates • Recreational Fishing
	First Nations	Changes to the functions, interests or activities of other users and aesthetic values	First Nations people are intrinsically linked to Sea Country which encompasses lands, waterways, seas, cultural practices and values to which they are connected (AIATSIS 2022). Country is a cultural landscape which includes both tangible values (i.e. cultural heritage sites) and intangible values (i.e. creation stories and cultural practices). First Nations cultural concepts are	First Nations people connection to Sea Country could potentially be impacted by exposure to hydrocarbons. See Section 4.7.6.5 for further details of the values. In-water exposure at relevant thresholds may impact culturally important significant coastal habitats such as mangroves, and species to First Nations peoples, such as cetaceans, marine reptiles, and fish which may impact the cultural value of the species and cultural obligation to care for Country. The 10ppb low entrained exposure threshold (used to define the extent of the EMBA) represents the very lowest concentration and corresponds generally with the lowest trigger levels for chronic exposure for entrained hydrocarbons in water quality guidelines, no ecological impacts are

RECEPTOR GROUP	RECEPTOR TYPE	IMPACTS	EXPOSURE EVALUATION	RISK EVALUATION
			directly connected with Country. Country describes all aspects of place, environment, spirituality, law and identity. Values of Country differ between First Nations groups, and not all First Nations groups and communities in Australia hold the same belief systems or spirituality. Connection to Sea Country is accompanied by a complexity of cultural rights and responsibilities. Coastal areas traditionally were amongst the most densely populated areas due to the abundance of resources available. Formal recognition of Sea Country rights is significantly slower compared to land rights. This could be for a range of reasons including conflicting perspectives and opinions on traditional custodianship of land and how far it extends (Smyth and Isherwood 2016). An unplanned hydrocarbon spill will impact the waters within Sea Country for a period while the spill disperses and weathers and has the potential to disrupt cultural values of Sea Country. The	anticipated at this threshold. It is considered highly unlikely that there will be long-term impacts to First Nations activities from contact at the low entrained threshold. Furthermore, the spill scenario is expected to be localised and short-term, with the condensate rapidly weathering within the first few days. As evaluated above, impacts and risks to First Nations values are not expected to result in widespread long-term impacts to Sea Country, ecosystem functions and integrity, or culturally significant species populations. Based on the worse case potential consequence to key environmental receptors and therefore lead to a disruption in cultural heritage values and sensitivities, the consequence to protected marine areas is assessed Major (4). Refer also to: • Benthic habitats and Communities • Marine Invertebrates • Mangroves • Cetaceans • Marine Reptiles • Seabirds and Shorebirds • State Marine Parks • Commonwealth Marine Parks Prevention controls are in place to prevent the risk of a LOWC event. The likelihood of a LOWC event leading to a disruption in cultural heritage values and sensitivities is assessed as Rare (1). The risk rating for a change in ecosystem dynamics leading to a disruption in cultural values and sensitivities from an accidental release – LOWC during the activity is ranked Medium (4). As such, the intrinsic link between

RECEPTOR GROUP	RECEPTOR TYPE	IMPACTS	EXPOSURE EVALUATION	RISK EVALUATION
			likelihood of a hydrocarbon spill occurring is assessed as highly unlikely and the actual area that may be affected from any single spill event would be considerably smaller than represented by the EMBA. Hydrocarbon exposure may have the potential to impact the aesthetic and cultural values of Sea Country by the presence of physical hydrocarbons or the presence of oil spill responders.	environmental receptors and First Nations people's cultural heritage values and sensitivities is expected to be maintained.

5.6.3. Control measures ALARP and acceptability assessment

Review of the risk evaluation for a LOWC event found the worst-case residual risk for all environmental receptors is Medium (4). This risk is considered tolerable/acceptable, and ALARP is demonstrated as follows.

5.6.3.1. ALARP Decision Context: Type B

Drilling activities have been undertaken in the Gippsland Basin hydrocarbon province with no LOWC incident recorded to date. Drilling activities are highly regulated with associated control measures, well understood, and are implemented across the offshore industry.

There were no objections from stakeholders regarding the risk of a LOWC event from this activity.

However, a LOWC incident would likely attract public and media interest. Although modelling has been undertaken to inform the assessment, there is a large degree of uncertainty regarding the risks from a LOWC incident. Consequently, Emperor Energy believes that ALARP Decision Context B should be applied.

5.6.3.2. Adopted Control Measures

Table 5-16 lists the adopted preventative and response controls to be used during the activity to prevent and respond to a LOWC event.

Table 5-16: Adopted Preventative and Response Controls

ADOPTED CONTROLS	SOURCE OF GOOD PRACTICE CONTROL MEASURES
PREVENTATIVE	
CM 24: Ongoing consultation	Under the *Navigation Act 2012*, the Australian Hydrographic Office (AHO) are responsible for maintaining and disseminating hydrographic and other nautical information and nautical publications such as Notices to Mariners. Engagement with AMSA requested the Australian Hydrographic Office be contacted through datacentre@hydro.gov.au no less than four working weeks before operations commence for the promulgation of related notices to mariners.
CM 40: NOPSEMA accepted WOMP	Under Part 5 of the Offshore Petroleum and Greenhouse Gas Storage (Resource Management and Administration) Regulations 2011, NOPSEMA is required to accept a WOMP to enable well activities to be undertaken. The WOMP details well barriers and the integrity testing that will be in place for the program. Emperor Energy's NOPSEMA-accepted WOMP describes the minimum requirements for well barriers during drilling activities.
CM 41: NOPSEMA accepted MODU Safety Case	Under the Offshore Petroleum and Greenhouse Gas Storage (Safety) Regulations 2009 (OPGGS(S)) set out the requirements for the contents of safety cases. The MODU requires and Australian Safety Case detailing the control in place to prevent a major accident event. The MODU Safety Case: • identifies the hazards and risks • describes how the risks are controlled • describes the safety management system in place to ensure the controls are effectively and consistently applied.

ADOPTED CONTROLS	SOURCE OF GOOD PRACTICE CONTROL MEASURES
	Emperor Energy will only contract a MODU with a NOPSEMA accepted safety case in place.
CM 38: MO 30: Prevention of collisions	AMSA MO 30 [Prevention of collisions] requires that onboard navigation, radar equipment, and lighting meets the International Rules for Preventing Collisions at Sea (COLREGs) and industry standards.
CM 42: Preventative Maintenance System – BOP testing	BOP routinely function and pressure tested in accordance with manufacturer's specifications and in alignment with Drilling Contractors preventative maintenance System.
RESPONSIVE	
CM 43: Source Control Contingency Plan (SCCP)	A SCCP shall be developed consistent with International Oil and Gas Producers (IOGP) Report 594 - Subsea Well Source Control Emergency Response Planning Guide for Subsea Wells (January 2019). Specifically detailing: • the structure and function of the Wells Source Control IMT (SC IMT) • a timeline for the effective implementation of source control key events / actions • a well-specific worst-case discharge (WCD analysis) • casing design • structural integrity analysis • gas plume study.
	A relief well plan shall be developed in line with OGUK guidance to ensure that Emperor Energy has considered the response requirements to: • reduce the time required to initiate relief well drilling operations in the event of a LOWC • allow the relief well to be completed in the shortest time practicable. The relief well plan includes a detailed schedule with estimated times to: • source, mobilise and position a rig • drill and intercept the well • complete the well kill successfully.
CM 44: NOPSEMA accepted Oil Pollution Emergency Plan (OPEP)	Under the OPGGS(E) Regulations, NOPSEMA require that the petroleum activity have an accepted OPEP in place before the activity commences. In the event of a LOWC, the OPEP will be implemented.
CM 45: NOPSEMA accepted OSM-BIP	Under the OPGGS(E) Regulations, NOPSEMA require that the Implementation Strategy of the Environment Plan provides for monitoring of an oil pollution emergency.

5.6.3.3. Additional Controls Assessed

Table 5-17 identifies additional control measures that are not disproportionate to the benefit gained, to demonstrate the levels are reduced to ALARP.

Table 5-17: Additional Control Measures Considered

CONTROL	COST / BENEFIT ANALYSIS	CONTROL IMPLEMENTED
Undertake activity at a different time of year to reduce potential exposure of receptors to hydrocarbons	Pygmy blue whales are potentially in the foraging BIA within Operational Area waters from November through to June. Southern right whales may travel through the Operational Area to and from coastal aggregation and migration areas during May-June and September-November. It is safe to assume there is no period when there is not a whale undertaking a biologically important behaviour within the Operational Area. The implementation of additional controls above the legislative requirements of the EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans will be implemented to manage potential impacts to whales undertaking biologically important behaviour.	No
CM 26: A 500 m Petroleum Safety Zone (PSZ) will be established at the MODU/well location.	The drilling activity will be short in duration. The temporary exclusion of vessels from a 500 m radius of the MODU would not cause significant impact on socio-economic receptors, such as fisheries and shipping. By restricting the potential interactions between vessels and the MODU, the overall benefit in spill prevention is considered reasonable.	Yes
Source control support through the APPEA MOU arrangement	Emperor Energy is a signatory to APPEA mutual aid MOU that provides access to emergency equipment including rig in a LOWC event. In addition to this, Emperor Energy maintains a list of rigs available in the area that would be suitable to drill a relief well in the case of an emergency. The overall benefit in LOWC response is considered reasonable.	Yes

5.6.3.4. Acceptability Assessment

Table 5-18 details the acceptability assessment against the criteria listed in Section 2.2.5.

Table 5-18: Acceptability Assessment

CRITERIA	DETERMINATION
To meet the principles of ESD	Based upon the risk assessment completed for this activity, potential risks from a LOWC event were assessed to have a residual risk ranking of Medium (4). This residual risk ranking is considered tolerable and has been demonstrated ALARP.

CRITERIA	DETERMINATION
	Further, quantitative modelling has been undertaken to remove some of the scientific uncertainty associated with this aspect. As such, the activity is consistent with the principles of ESD.
Internal context	The proposed management of the impact is aligned with the Emperor Energy Health, Safety and Environment Policy (APPENDIX A). Activities will be undertaken in accordance with the Implementation Strategy (Section 8).
External context	No objections or claims have been raised during stakeholder consultation regarding the potential for a LOWC event.
Other requirements	A LOWC event is to be managed in consideration with: • MO 91: Marine Pollution Prevention – Oil • OPGGS(E) Regulations. The management of a LOWC event was not deemed to be inconsistent with the plans, conservation advice or recovery plans listed in Table 1-2.
Monitoring and review	Impacts as a result of a hydrocarbon spill will be monitored and reported in accordance with the OSM-BIP Reviewing requirements are outlined in Section 8.10 of the Implementation Strategy. The environment impacts and risks associated with this aspect are sufficiently monitored and reviewed to inform this risk assessment.
Acceptability outcome	Acceptable

5.7.Environmental Performance Outcomes, Performance Standards and Measurement Criteria

Table 5-19 EPO, EPS and MC

ENVIRONMENTAL PERFORMANCE OUTCOME	CONTROL MEASURE	ENVIRONMENTAL PERFORMANCE STANDARD	MEASUREMENT CRITERIA
EPO1: No death or injury to fauna, including listed threatened or migratory species, from the activity. EPO2: Noise emissions in BIAs will be managed such that any whale, including blue whales, continues to utilise the area without injury, and is not displaced from a foraging area. EPO3: Biologically important behaviours within a BIA or outside a BIA can continue while the activity is being undertaken. EPO4: No substantial reduction of air quality within local airshed caused by atmospheric emissions produced during the activity.	CM 1: Light management procedure	A Light Management procedure will be developed and implemented as per the National Light Pollution Guidelines for Wildlife (DCCEEW, 2023b), and relevant species management plans.	Records demonstrate that a light management procedure developed and implemented.
	CM 2: Green flare boom	A 'Green Burning' system and air compressors will be used to atomise the hydrocarbon and yield smoke free combustion and reduce atmospheric emissions.	MODU inspection.
	CM 3: Reporting GHG emissions	Emperor Energy Organisational Emissions associated with the Activity are reported annually.	NGER reports.
	CM 4: IFC EHS Guidelines - Offshore Oil and Gas Development (2015) for flaring activities	Emperor Energy will verify that the contractor will comply with IFC EHS guidelines with respect to maximising flaring efficiency, specifically: • maintenance program to ensure maximum flare efficiency • use of a reliable pilot ignition system • minimum volume of hydrocarbons required for well testing to the flared and durations reduced to the extent practical.	Well clean-up, well testing records and safety checklist.
	CM 5: Planned System Maintenance	Power generation and propulsion systems on the vessels and MODU will be operated in accordance with manufacturer's instructions and ongoing maintenance to ensure efficient operation.	PMS records.
		Equipment used to treat planned discharges shall be maintained in accordance with manufacturer's specification as detailed within the preventative maintenance system.	
	CM 6: EPBC Regulations 2000 – Part 8 Division 8.1 interacting with cetaceans	Vessel operators shall adhere to the distances and vessel management practices of EPBC Regulations (Part 8) and report vessel interactions with cetaceans specifically: Vessels will not travel greater than 6 knots within 300m of a cetacean or turtle (caution zone) and not approach closer than 100m from a whale. Vessels will not approach closer than 50m for a dolphin or turtle and/or 100 m for a whale (with the exception of animals bow riding). If the cetacean or turtle shows signs of being disturbed, project vessels will immediately withdraw from the caution zone at a constant speed of <6 knots, without changing direction or moving into the path of the animal. Vessels operators shall report vessel interactions with non-foraging whales. Helicopters will not fly lower than 1650 ft when within 500 m horizontal distance of a cetacean except when landing or taking off and will not approach a cetacean from head on.	Records demonstrate no breaches with EPBC Regulations 2000 – Part 8 Division 8.1 Interacting with cetaceans.
	CM 7: AGR Whale Observation Management Procedure (vessel and drilling operations)	Pre-start actions, start criteria, and noise control actions as detailed in the Adaptive Marine Fauna Management Plan (vessel and drilling operations) will be implemented. Details of controls include: Prior to an activity commencing, a pre-activity survey will be undertaken of the activity survey zone for: • Pre-lay Activities and MODU Positioning: 24 km	Records including daily and MFO reports demonstrate that AGR Whale Observation Management Procedure (vessel and drilling operations) was implemented.

ENVIRONMENTAL PERFORMANCE OUTCOME	CONTROL MEASURE	ENVIRONMENTAL PERFORMANCE STANDARD	MEASUREMENT CRITERIA
		• Drilling operations with an anchored MODU: 2.5 km • Drilling operations with an anchored MODU and a vessel on standby: 3.5 km • Drilling operations with an anchored MODU and a vessel undertaking resupply operations: 5.5 km • Well plug, abandonment and removal (i.e. wellhead cutting): 3.1 km Surveys will be undertaken for 30 min prior to the activity commencing. If a whale is sighted within the pre-activity survey zone the activity will not commence until: • No whales are observed for 30 min within the pre-activity survey zone; or • Whales are observed leaving the pre-activity survey zone. • Surveys will be undertaken for 30 min prior to the activity commencing. If a whale is sighted within the pre-activity survey zone the activity will not commence until: • No whales are observed for 30 min within the pre-activity survey zone; or • Whales are observed leaving the pre-activity survey zone. • If a whale is sighted within the activity survey zone the following will occur: If the vessel can do so it will move away from the whale and maintain a minimum separation distance equal to the activity survey zone. If the vessel cannot move away from the whale, the vessel will reduce thrusters if safe to do so. The activity will cease as soon as it is safe, and the vessel will move out of the activity survey zone. The activity can recommence once: • No whales are observed for 30 min within the activity survey zone; or • Whales are observed leaving the activity survey zone. The following tasks will be undertaken to determine the presence of whales within the Operational Area: • One week prior to an activity being undertaken a review of whale data to determine if blue and/or southern right whales have been observed in the Operational Area. • When undertaking the activity, presence of whales observed will be communicated via radio.	
	CM 8: MFO (at least one member of support vessel crew trained in MFO and mitigation measures)	At least one trained MFO on active duty during daylight hours during activities.	MFO CV MFO reports. Daily reports.

ENVIRONMENTAL PERFORMANCE OUTCOME	CONTROL MEASURE	ENVIRONMENTAL PERFORMANCE STANDARD	MEASUREMENT CRITERIA
	CM 9: AGR Whale Observation Management Procedure (VSP and Seismic survey)	The AGR Whale Observation Management Procedure (VSP and Seismic survey) details the controls to prevent possible displacement impacts to foraging pygmy blue whale and migrating southern right whales that maybe present in the Operational Area. Details of controls include: Prior to an activity commencing, a pre-activity survey will be undertaken of the activity survey zone for: • VSP – 3 km (based on modelled 2.82 km behavioural effect distance) • Geophysical survey – 1.5 km (based on modelled 1.48 km behavioural effect distance) Surveys will be undertaken for 30 min prior to the activity commencing. If a whale is sighted within the pre-activity survey zone the activity will not commence until: • No whales are observed for 30 min within the pre-activity survey zone; or • Whales are observed leaving the pre-activity survey zone. • If a whale is sighted within the activity survey zone the following will occur: • If the vessel can do so it will move away from the whale and maintain a minimum separation distance equal to the activity survey zone. If the vessel cannot move away from the whale, the vessel will reduce thrusters if safe to do so. The activity will cease as soon as it is safe, and the vessel will move out of the activity survey zone. The activity can recommence once: • No whales are observed for 30 min within the activity survey zone; or • Whales are observed leaving the activity survey zone. The following tasks will be undertaken to determine the presence of whales within the Operational Area: • One week prior to an activity being undertaken a review of whale data to determine if blue and/or southern right whales have been observed in the Operational Area. • When undertaking geophysical survey or VSP, presence of whales observed will be communicated via radio.	Records including daily and MFO reports demonstrate that AGR Whale Observation Management Procedure (VSP and Seismic survey) was implemented.
EPO5: No impact to water quality or sediment quality at a distance >500 m from the well from planned marine discharges. EPO6: Seabed and associated biota disturbance will be less than 0.8 km^2 and within the Operational Area.	CM 10: Marine Order 95 (Marine pollution prevention – garbage) 2013.	Waste management procedure, requiring: • vessels to implement a Garbage Management Plan that complies with Annex V of MARPOL • waste hierarchy is applied to project wastes • waste with potential to be windblown shall be stored in covered containers • waste lost overboard is recorded and recovered if possible waste transfers are recorded.	HSE inspection records Garbage record book
	CM 11: AGR Chemical assessment procedure	Chemicals that will be or have the potential to be discharged to the marine environment will meet the chemical acceptance criteria as the AGR Chemical Assessment Process. Chemicals used as a component of a planned drilling discharge will meet the drilling chemical acceptance criteria as per the AGR Chemical Assessment Process, including: • components of water-based drilling fluid (WBDF); • components of synthetic-based drill fluid (SBDF); • stock barite;	Chemical assessment process demonstrates the chemical selection, assessment and approval process for selected chemicals is followed.

ENVIRONMENTAL PERFORMANCE OUTCOME	CONTROL MEASURE	ENVIRONMENTAL PERFORMANCE STANDARD	MEASUREMENT CRITERIA
		• cementing products; and • hydraulic control fluids.	
	CM 12: Marine assurance system - vessel contractor pre-qualification assessment	Oil contaminated water shall be treated via a MARPOL (or equivalent) approved oily water separator and only discharge if oil content less than 15 ppm.	Vessel inspection records demonstrate vessels are compliant with standard maritime safety procedures and MARPOL certification.
		Sewage discharged at sea shall be treated via a MARPOL (or equivalent) approved sewage treatment system.	
		Food waste only discharged when macerated to ≤25 mm and at distance greater than 3 nm from land.	
	CM 13: Use of WBM during drilling (as a priority) CM 14: No overboard discharge of whole SBM. CM 15: Residual materials management	No whole SBM shall be discharged overboard.	Daily drill reports
		Remaining synthetic-based drill fluid shall be contained on board the MODU for use when drilling future wells.	
		When unable to be reconditioned offshore, whole synthetic-based drill fluid shall be transported to shore for reconditioning.	
		Discharge tank wash shall not exceed 2% base fluid content.	
	CM 16: Solids control equipment CM 17: Solids control equipment operator - to ensure monitoring.	SCE shall be used to recondition and recycle SBDF and reduce the residual fluid on cuttings (ROC)% to ≤8% ROC (dry weight) per well section prior to overboard discharge.	Retort test results
		ROC shall be monitored every 300 m whilst drilling with SBDF or twice daily (whichever comes first).	
	CM 18: Cementing procedures	Detailed cementing procedures shall be developed including provision to mix only enough cement to complete the cementing operation with allowance for loss to formation and the monitoring and reconciliation of used quantities of cement against planned quantities for each cementing operation.	Documented cementing procedure Monitoring and reconciliation records
		At the end of the drilling activity, excess dry bulk cement shall be used for subsequent drilling activities or returned to shore.	Backloading records to demonstrate appropriate management of excess dry bulk cements.
	CM 19: Site surveys	Site survey undertaken prior to finalising MODU position and location of mooring equipment, and prior to installing or removing wellhead.	Survey records
	CM 20 Mooring analysis	A mooring analysis shall be undertaken prior to anchoring.	Documented mooring analysis
		Mooring tension monitoring shall be undertaken while the MODU is anchored on location.	Control room logbook
	CM 21: MODU move and positioning plan	All mooring equipment shall to be within 2 km Operational Area of the well. Mooring equipment will not be deployed outside the area that has been surveyed as part of the site survey.	Documented mooring analysis Control room logbook

ENVIRONMENTAL PERFORMANCE OUTCOME	CONTROL MEASURE	ENVIRONMENTAL PERFORMANCE STANDARD	MEASUREMENT CRITERIA
	CM 22: OPGGS Act	Upon well abandonment, all subsea equipment shall be removed from sea floor, with wellheads cut below mudline and retrieved to surface.	Documented mooring plan
		Retrieval of all mooring equipment from the sea floor within 3 months following the drilling campaign	Drilling Report
	CM 23: Dropped objects recovery procedure	Any dropped object will be recovered following the dropped objects and recovery procedure.	Records show that dropped objects and recovery procedures were implemented.
	CM 24: Ongoing consultation	Notifications for any on-water activities and ongoing consultations shall be undertaken as per Section 7 (Stakeholder Consultation)	Notification records. Communication records.
EPO 7: Undertake the activity in a manner that will not interfere with other marine users to a greater extent than is necessary for the exercise of right conferred by the titles granted.	CM 24: Ongoing consultation CM 25: Pre-start notifications	Notifications for any on-water activities and ongoing consultations shall be undertaken as per Section 7 (Stakeholder Consultation)	Notification records. Communication records.
		AUSCOAST warning issued by AMSA for anchors equipped with a surface buoy.	AUSCOAST warning
	CM 26: A 500 m Petroleum Safety Zone (PSZ) will be established at the MODU/well location.	A 500 m PSZ zone shall be established around the MODU during the drilling activity.	PSZ gazettal Records of adverse interactions in 500m PSZ with other marine users are recorded. Control room records
		Access into the 500 m PSZ, including approach directions and speed, shall be managed via the MODU.	
		At least one project support vessel shall be stationed near the MODU at all times to guard the MODU from errant vessels.	
	CM 27: Navigation aids	Anchors equipped with a surface buoy with a navigation light.	Prelay Anchor Field Report
	CM 23: Dropped objects recovery procedure	Any dropped object will be recovered following the dropped objects and recovery procedure.	Records show that dropped objects and recovery procedures were implemented.
EPO 8: No introduction of a known or potential invasive marine species	CM 28: Marine Order 98: Marine pollution – anti-fouling systems	Support vessels shall have a current anti-fouling certificate.	Vessel inspection records demonstrate vessels are compliant with marine orders and have vessel anti-fouling certificate.
	CM 29: Australian Ballast Water Management Requirements	Support vessels shall have a valid Ballast Water Management Plan and ballast water management certificate.	Ballast water records. Vessel Ballast Water Management Plan. Vessel inspection records demonstrate vessels are compliant with marine orders and have vessel anti-fouling certificate.
		Prior to mobilisation to the first drilling location for the program, Operator shall validate that the MODU complies with the Australian Ballast water Requirements (Rev 7), specifically, ensuring the MODU has:	Ballast water records. Vessel Ballast Water Management Plan.

ENVIRONMENTAL PERFORMANCE OUTCOME	CONTROL MEASURE	ENVIRONMENTAL PERFORMANCE STANDARD	MEASUREMENT CRITERIA
		• a valid Ballast Water Management Plan; • a ballast water management certificate: and • a ballast water record system with a minimum of 2 years records retained on board.	Vessel inspection records demonstrate vessels are compliant with marine orders and have vessel anti-fouling certificate.
		Operator shall validate MODU ballast water has been exchanged outside 12 nm from the nearest land and in water depths greater than 50 m prior to undertaking drilling activities.	Ballast water records
	CM 30: National Biofouling Management Guidance for the Petroleum Production and Exploration Industry	Rental anchors and/or mooring equipment shall be cleaned prior to deployment to field.	In-water equipment checklist.
		Support vessels shall have a low-risk rating based on (or equivalent to) the WA Department of Fisheries Biofouling Risk Assessment Tool (in lieu of a Commonwealth or VIC specific tool).	Documented biofouling risk assessment indicating 'low-risk' rating.
	CM 31: Australian Biofouling Management Requirements (Proposed)	Prior to arrival at the drilling location, Operator shall validate that the MODU has a biofouling management plan and record book consistent with IMO Biofouling Guidelines.	Biofouling Management Plan Biofouling Record Book
	CM 32: IMS Biofouling Risk Assessment Process	Before entering the Operational Area, all vessels and relevant immersible equipment are determined to be low risk of introducing IMS of concern and maintain this low risk status to mobilisation.	Biofouling Management Plan Records of IMS Biofouling Risk Assessment Process is maintained for all vessels and relevant immersible equipment, as required by the management plan.
EPO 9: No unplanned discharge of waste to the marine environment.	**CM 10:** Marine Order 95 (Marine pollution prevention – garbage) 2013.	Waste management procedure, requiring: • vessels to implement a Garbage Management Plan that complies with Annex V of MARPOL • waste hierarchy is applied to project wastes • waste with potential to be windblown shall be stored in covered containers • waste lost overboard is recorded and recovered if possible • waste transfers are recorded. Waste with potential to be windblown shall be stored in covered containers.	HSE inspection records Garbage record book Incident report
	CM 23: Dropped objects recovery procedure	Any dropped object will be recovered following the dropped objects and recovery procedure.	Records show that dropped objects and recovery procedures were implemented.
EPO 10: No spills of chemicals or hydrocarbons to the marine environment.	**CM 33:** Bunkering procedures	Chemical and hydrocarbon bunkering shall be undertaken in accordance with Drilling Contractor bunkering procedures.	JHA records Bunkering records demonstrate bunkering/refuelling undertaken in accordance with drilling contractor bunkering procedures.
	CM 34: Drain management	All overboard discharge points from mud pits, and areas containing potentially hazardous substances locked closed and only open under permit.	Permits issued.
	CM 35: Spill containment	Materials and equipment that have the potential to spill onto the deck or marine environment shall be stored within a contained area.	MODU/vessel inspection.
	CM 24: Ongoing consultation **CM 25:** Pre-start notifications	Notifications for any on-water activities and ongoing consultations shall be undertaken as per Section 7 (Stakeholder Consultation)	Notification records. Communication records.

ENVIRONMENTAL PERFORMANCE OUTCOME	CONTROL MEASURE	ENVIRONMENTAL PERFORMANCE STANDARD	MEASUREMENT CRITERIA
	CM 36: SOPEP/ SMPEP	MODU and support vessels shall have a SMPEP (or equivalent appropriate to class) which is: • implemented in the event of a spill to deck or marine environment. • tested as per the MODU/vessel test schedule. • spill response kits shall be available and routinely checked to ensure adequate stock is maintained.	MODU/vessel SMPEP MODU/vessel inspection MODU/vessel exercise schedule Inspection records confirm presence of spill kits.
	CM 37: Marine Operations Procedure(s) - vessel entry into project area, speeds, separation distances. **CM 38:** MO 30: Prevention of collisions.	Support vessels shall meet the safety measures and emergency procedures of the AMSA MO 21.	Vessel inspection.
		Support vessels shall meet the navigation equipment, watchkeeping and radar requirements of the AMSA MO 30.	Vessel inspection.
		Support vessels will meet survey, maintenance and certification of regulated Australian vessels as per AMSA MO 31.	Vessel certification.
	CM 39: AIS transceiver	The MODU and support vessels shall be fitted with an automatic identification system (AIS) transceiver enabling the MODU/vessel to receive the data broadcasted by surrounding vessels, such as Maritime Mobile Service Identity (MMSI) number, IMO number, VHF call sign, speed, heading and course over ground. AIS shall be monitored 24 hours per day.	MODU/vessel inspection
	CM 26: A 500 m Petroleum Safety Zone (PSZ) will be established at the MODU/well location.	A 500 m PSZ zone shall be established around the MODU during the drilling activity.	PSZ gazettal Records of adverse interactions in 500m PSZ with other marine users are recorded. Control room records
		Access into the 500 m PSZ, including approach directions and speed, shall be managed via the MODU.	
		At least one project support vessel shall be stationed near the MODU at all times to guard the MODU from errant vessels.	
	CM 40: NOPSEMA accepted WOMP	Well integrity shall be maintained in accordance with the NOPSEMA accepted WOMP.	NOPSEMA accepted WOMP in place prior to the commencement of the drilling activity.
	CM 41: NOPSEMA accepted MODU Safety Case	Operator shall validate that a NOPSEMA accepted MODU Safety Case is implemented, and safety notification and reporting in places undertaken for MODU operations, in accordance with the Regulations (as applicable).	NOPSEMA accepted MODU Safety Case in place prior to the commencement of the drilling activity.
	CM 42: Preventative Maintenance System – BOP testing	The BOP shall be routinely function and pressure tested in accordance with manufacturer's specifications and in alignment with Drilling Contractors preventative maintenance system.	BOP maintenance records
EPO 11: Undertake oil spill response in a manner that will not result in additional impacts to marine environment, coastal habitat and oiled wildlife.	**CM 43:** Source Control Contingency Plan (SCCP)	A relief well plan shall be developed in line with OGUK guidance to ensure that Emperor Energy has considered the response requirements to: reduce the time required to initiate relief well drilling operations in the event of a LOWC allow the relief well to be completed in the shortest time practicable. The relief well plan includes a detailed schedule with estimated times to: • source, mobilise and position a rig • drill and intercept the well	Documented SCCP in place and consistent with IOGP Report 594 prior to drilling.

ENVIRONMENTAL PERFORMANCE OUTCOME	CONTROL MEASURE	ENVIRONMENTAL PERFORMANCE STANDARD	MEASUREMENT CRITERIA
		• complete the well kill successfully.	
		The SCCP shall be consistent with the International Oil and Gas Producers (IOGP) Report 594 - Subsea Well Source Control Emergency Response Planning Guide for Subsea Wells (2019), Specifically detailing: • the structure and function of the Wells Source Control IMT (SC IMT) • a timeline for the effective implementation of source control key events / actions • a well-specific worst-case discharge (WCD analysis) • casing design • structural integrity analysis • gas plume study.	Documented well-specific relief well plan developed in line with OGUK guidance prior to drilling.
	CM 44: NOPSEMA accepted Oil Pollution Emergency Plan (OPEP)	Emergency spill response capability shall be maintained in accordance with the OPEP	Outcomes of internal audits and tests demonstrate preparedness.
		Implement spill response in accordance with relevant EPOs and EPSs in the NOPSEMA accepted OPEP.	EMT log
	CM 45: Operational & Scientific Monitoring Bridging Implementation Plan (OSM-BIP)	Operational and scientific monitoring capability shall be maintained in accordance with the OSM-BIP: • a month prior to the commencement of drilling a review of the contracted OSM-BIP provider/s capability will be undertaken by the Operator to ensure that the OSM-BIP requirements can be met by the contracted OSM-BIP provider/s. • during drilling the contracted OSM-BIP provider/s will provide a monthly report to show that capability as detailed in the OSM-BIP is maintained. • the contracted OSM-BIP provider/s capability to meet the requirements detailed in the OSM-BIP will be tested prior to commencing drilling.	Outcomes of internal audits and tests demonstrate preparedness.

6. HYDROCARBON POLLUTION EMERGENCY RESPONSE

The credible worst-case hydrocarbon release scenarios have been identified as:

- Loss of well control (LOWC) resulting in an uninterrupted flow of condensate for 77 days at continuous release of 717 m^3/day. Total release of 55,256 m^3 over a duration of 77 days.
- Vessel fuel tank rupture resulting in the total loss of containment of MDO from a fuel tank (280 m^3).

6.1. Preliminary Net Environmental Benefit Analysis (NEBA) of Response Strategy Options

A Net Environmental Benefit Analysis (NEBA) process is a useful tool to identify the most applicable and suitable response strategies to reduce the environmental impacts to as low as reasonably practicable (ALARP) in the event of a hydrocarbon release incident. The priority for any response strategy is to mitigate damage to the environment, however, it is important to note that some response strategies do have the potential to cause further damage to the environment from unsuitable selection, incorrect execution, and poor planning. Prior to initiating any response strategy, the potential outcome of each response option needs to be evaluated.

The NEBA process allows several factors to be evaluated for each available response strategy, including: the environmental benefits, the potential impacts and/or risks, operational/functional constraints, and the response applicability related to the specific hydrocarbon type involved in the incident.

The focus of the NEBA is to compare the environmental consequences that would occur if no action is taken against those if each available response strategy was implemented. This process allows the strategies that result in a beneficial outcome to the environment to be identified. The output of the NEBA process allows all viable and appropriate response strategies to be identified for each identified credible spill scenario, which is used to identify:

1. Primary response strategies - used and applied as soon as possible in the event of a hydrocarbon release;
2. Secondary response strategies - only applied as needed when practical;
3. Not applicable response strategies - strategy not applicable for specific hydrocarbon type; and
4. Rejected response strategies - are options that will not be used due to the lack of net environmental benefit

This section provides the preliminary strategic NEBA constructed for each available strategy and their applicability to the credible and worst-case hydrocarbon release scenarios identified for the activity (Table 6-1). In the event of a hydrocarbon release during the activity the Drilling Incident Management Team (DIMT) will review the response options identified by the NEBA prior to implementation, as a part of the Incident Action Plan (IAP) process, to ensure they remain valid and effective strategies.

Table 6-1: Preliminary strategic NEBA

RESPONSE STRATEGY	ENVIRONMENTAL BENEFIT(S)	POTENTIAL ENVIRONMENTAL IMPACTS / RISKS	FUNCTIONAL/OPERATIONAL CONSTRAINTS	CONDENSATE			MDO		
				RESPONSE APPLICABILITY BASED ON HYDROCARBON TYPE PRESENT YES / NO / PARTIAL	PRIMARY / SECONDARY / NA / REJECT	JUSTIFICATION	RESPONSE APPLICABILITY BASED ON HYDROCARBON TYPE PRESENT YES / NO / PARTIAL	PRIMARY / SECONDARY / NA / REJECT	JUSTIFICATION
Source Control (ROV Emergency BOP Intervention)	Restricting or halting the flow of hydrocarbons from the well reducing the total volume of hydrocarbons released into the environment, reducing the overall potential impact to the environment.	Risks / impacts from operation of MODU and vessels (e.g., seabed disturbance, liquid waste, air emissions from fuel usage, noise disturbance, marine fauna interaction, interference with other users, vessel collisions, etc.).	Effective only if BOP barriers are not fully compromised. ROV on MODU may be inoperable, may require additional ROV support from another vessel, increasing mobilization time for ROV intervention. Availability of ROV capabilities on support vessels.	Yes	Primary	Will be implemented in order to attempt to regain control of well through operation of the BOP. Can only be used if well is being drilled using a semi-submersible MODU.	No	NA	MDO spills only occur from vessels and therefore ROV intervention is not applicable to controlling this source
Source Control (Capping Stack)		Risks / impacts from operation of heavy lift vessels (e.g., liquid waste, air emissions from fuel usage, noise, marine fauna interaction, interference with other users, collisions, etc.). Seabed disturbance from positioning of capping stack.	The effectiveness of capping a condensate well with a high gas component in shallow water depth is unknown and will largely be dependent on the event and operational conditions at the time. The feasibility will depend on whether it was safe to deploy within the metocean conditions and gas plume environment at the time of the response. Furthermore, for successful deployment adequate water depth is required. The shallow water depths (70 m) combined with harsh metocean conditions may make it operationally unsuitable.	Yes	Secondary	Will be implemented as a secondary response option should the parameters of the event and the operational conditions at the time deemed to be appropriate, through consultation with capability provider. Can only be used if well is being drilled using a semi-submersible MODU.	No	NA	MDO spills only occur from vessels and therefore capping stacks are not applicable to controlling the source
Source Control (Relief Well)		Risks / impacts from operation of MODU and vessels (e.g., seabed disturbance, liquid waste, air emissions from fuel usage, noise, marine fauna interaction, interference with other users, collisions, etc.). Discharge of chemicals/cement to the environment.	Timeframe to mobilise a relief rig to Victoria; dependent on the national/international availability of a suitable relief rig. Available rigs will be monitored on a monthly basis to ensure mobilisation of relief rigs remains feasible within the assumed timeframes. Health and safety of relief rig and personnel.	Yes	Primary	The drilling of a relief well is a primary response strategy and the only permanent solution for a LOWC event.	No	NA	MDO spills only occur from vessels and therefore relief wells are not applicable to controlling the source

RESPONSE STRATEGY	ENVIRONMENTAL BENEFIT(S)	POTENTIAL ENVIRONMENTAL IMPACTS / RISKS	FUNCTIONAL/OPERATIONAL CONSTRAINTS	CONDENSATE			MDO		
				RESPONSE APPLICABILITY BASED ON HYDROCARBON TYPE PRESENT YES / NO / PARTIAL	PRIMARY / SECONDARY / NA / REJECT	JUSTIFICATION	RESPONSE APPLICABILITY BASED ON HYDROCARBON TYPE PRESENT YES / NO / PARTIAL	PRIMARY / SECONDARY / NA / REJECT	JUSTIFICATION
Source Control (Subsea dispersant application)		Risks/impacts from applying dispersant into the marine environment. Risks / impacts from operation of vessels (e.g., seabed disturbance, liquid waste, air emissions from fuel usage, noise, marine fauna interaction, interference with other users, collisions, etc.).	Subsea dispersant injection (SSDI) may reduce volatile organic compounds (VOCs) at sea surface within the response area, therefore creating a safer work environment for responders. In the event that a capping stack is required, subsea dispersant may be effective in creating a safe environment.	Yes	Secondary	Considered a potentially feasible and effective response strategy in the event of capping stack operations are required. Application of subsea dispersant will only be considered if the operational NEBA indicates that there will be a net benefit to the environment. Can only be used if well is being drilled using a semi-submersible MODU.	No	NA	MDO spills on occur on the surface and therefore subsea dispersant application is not a suitable response strategy.
Source Control (Subsea First Response Toolkit)		Risks / impacts from operation of MODU and vessels (e.g., seabed disturbance, liquid waste, air emissions from fuel usage, noise disturbance, marine fauna interaction, interference with other users, vessel collisions, etc.).	Timeframe to access SFRT (i.e. from contract with AMOSC/Oceaneering, stockpile located in W.A)	Yes	Secondary	May support decision making for source control strategy, and allow for debris clearance if required, i.e. assistance during the deployment of a capping stack (if response option is deemed appropriate). Can only be used if well is being drilled using a semi-submersible MODU.	No	NA	MDO spills only occur from vessels and therefore SFRT are not applicable to controlling the source
Source Control (Shipboard Oil Pollution Emergency Plan)	The SOPEP contains details on applicable strategies (i.e., fuel transfer procedures) to reduce or minimise the volume of hydrocarbons released in the event of that a vessel storage tank is ruptured.	Outdated or irrelevant contents of plan through irregular updates. Non-applicable or superseded information could lead to delayed or ineffective response preventing an intervention in fuel loss (e.g., air emissions, noise, fuel use, waste generation etc.).	Availability and validity of plan to ensure strategies included are still relevant and easily applied. Presence of trained individuals familiar with the document and its location.	No	NA	This is not a requirement for a LOWC scenario. This is an International Convention for the Prevention of Pollution from Ships (MARPOL) requirement for applicable vessels.	Yes	Primary	Primary response strategy for all spills in accordance with vessel SMPEP/SOPEP. AMSA is the Control Agency in the event of a stricken vessel in Commonwealth waters and will have access to NatPlan resources.

RESPONSE STRATEGY	ENVIRONMENTAL BENEFIT(S)	POTENTIAL ENVIRONMENTAL IMPACTS / RISKS	FUNCTIONAL/OPERATIONAL CONSTRAINTS	CONDENSATE			MDO		
				RESPONSE APPLICABILITY BASED ON HYDROCARBON TYPE PRESENT YES / NO / PARTIAL	PRIMARY / SECONDARY / NA / REJECT	JUSTIFICATION	RESPONSE APPLICABILITY BASED ON HYDROCARBON TYPE PRESENT YES / NO / PARTIAL	PRIMARY / SECONDARY / NA / REJECT	JUSTIFICATION
In-situ Burning	To remove hydrocarbons from the marine environment.	High risks and safety concerns associated with the combustion of hydrocarbons. Risks/ impacts from operations of vessels and aircraft (e.g., liquid waste, air emissions from fuel usage, noise, marine fauna interaction, interference with other users, vessel collisions, etc.).	Health and safety requirements. Logistics to coordinate response. Fire resistant boom not available within Australia, coordination of equipment and trained personnel from outside of Australia would be required. High costs associated. Specific hydrocarbon thickness required for response to be feasible. Thin hydrocarbons not ideal. Calm metocean conditions required. Approvals required for response.	Partial	Reject	Potentially feasible, response strategy has not been executed in Australia before. Strategy rejected due to the fate and behaviour (high volatility and spreading) of the condensate gas.	Partial	Reject	Potentially feasible, response strategy has not been executed in Australia before. Strategy rejected due to the fate and behaviour (high volatility and spreading) of the condensate gas.
Monitoring and Evaluation	To maintain situational awareness, and ongoing monitoring and evaluation of the response. Required for real-time decision making during a spill event. Identifies emerging risks to sensitive receptors; information for response planning and assessment of effectiveness of response actions.	Risks/ impacts from operations of monitoring vessels and aircraft (e.g., liquid waste, air emissions from fuel usage, noise, marine fauna interaction, interference with other users, vessel collisions, etc.).	Visual observation activities at night or during poor weather restricted. Stringent safety management requirements for aerial and marine operations employed. Coordination of multiple vessels within limited area.	Yes	Primary	This primary response strategy is critical for gaining and maintaining situational awareness to inform the response and remediation operations. Specifics will be dependent on the nature and extent of the spill.	Yes	Primary	This primary response strategy is critical for gaining and maintaining situational awareness to inform the response and remediation operations. Specifics will be dependent on the nature and extent of the spill.
Natural Dispersion	Allowing natural processes to break down the hydrocarbons present within the marine environment.	No risks/impacts identified.	No functional/operational constraints identified.	Yes	Primary	Strategy is effective due to the characteristics of the condensate gas, and the metocean characteristics of the activity location.	Yes	Primary	Strategy is effective due to the characteristics of the condensate gas, and the metocean characteristics of the activity location.
Dispersant Application (surface – vessel and aerial)	Breakdown surface spills into small droplets within the water column. Allows for increased biodegradation, reducing the potential threat to marine fauna.	Risks/impacts from applying dispersant into the marine environment. Risks / impacts from operation of vessels and/or aircraft (e.g., seabed disturbance, liquid waste, air emissions from fuel	Not recommended for Group I oils such as condensate gas due to the very low viscosity and high volatility – generally no environmental benefit gained by the application on Group I oils. Dispersant considered "conditional" for Group II oil.	No	Reject	Strategy not effective due to the characteristics and properties of the condensate gas.	Partial	Reject	Strategy partially effective due to the characteristics and properties of MDO. Although dispersant is considered "conditional" for Group II oil, the size of the potential spill volume and the natural

RESPONSE STRATEGY	ENVIRONMENTAL BENEFIT(S)	POTENTIAL ENVIRONMENTAL IMPACTS / RISKS	FUNCTIONAL/OPERATIONAL CONSTRAINTS	CONDENSATE			MDO		
				RESPONSE APPLICABILITY BASED ON HYDROCARBON TYPE PRESENT YES / NO / PARTIAL	PRIMARY / SECONDARY / NA / REJECT	JUSTIFICATION	RESPONSE APPLICABILITY BASED ON HYDROCARBON TYPE PRESENT YES / NO / PARTIAL	PRIMARY / SECONDARY / NA / REJECT	JUSTIFICATION
		usage, noise, marine fauna interaction, interference with other users, collisions, etc.).	The ITOPF Technical Information Paper 4 – Dispersant Application1 states that light products (including gas condensate) generally do not form emulsions but rather a thin layer or sheen that evaporate and dissipate quickly. It is considered good practice that dispersants are not applied, rather other response options are used to recover the minimal remaining product in the environment. For vessel application - having vessels travel through gas condensate is not advisable and poses a hazard to responders due to the volatility of the gas condensate when released.						tendency of spreading into very thin films is evidence that dispersant will be an ineffective response. The dispersant droplets will penetrate through the thin oil layer and cause 'herding' of the oil.
Containment and Recovery	Contains the spill as close as possible to the spill source. Recovery enables the spread of surface hydrocarbons to be reduced, thereby reducing the risk of impact to sensitive receptors. Removal of hydrocarbons from the marine environment.	Risks/ impacts from operation of vessel-based containment and recovery activities (e.g., liquid waste, air emissions from fuel usage, noise, marine fauna interaction, interference with other users, collisions, etc.). Equipment and labour intensive. Waste disposal of recovered condensate. Cleaning and disposal of contamination from booms and response vessels.	This strategy requires relatively calm conditions with currents speeds <0.5 m/s (<~1 knot). Requires slick concentrations >10 g/m2.	No	Reject	Rejected given the evaporative and dispersive nature of the hydrocarbon. Weather conditions unlikely to permit efficient offshore containment using booms, weirs and skimmers. Surface concentrations >10 g/m2 remain offshore. Zero probability of floating oil > 10 g/m2 in MNP, State Waters or Nearshore Waters.	No	Reject	Weather conditions unlikely to permit efficient offshore containment using booms, weirs and skimmers. Surface concentrations >10 g/m2 remain offshore. Zero probability of floating oil > 10 g/m2 in MNP, State Waters or Nearshore Waters.
Shoreline Protection and Deflection	If modelling predicts impacts to sensitive receptors, then near-shoreline deployment of booming equipment can be undertaken to protect target receptors and to	Risks/ impacts from operation of vessel-based protection and deflection activities (e.g., liquid waste, air emissions from fuel usage, noise, marine fauna interaction,	Wind and surface currents are key constraint in the deployment and operations of booms in nearshore coastal environments. Considerable resources and logistics support needed (i.e., equipment and labour intensive).	Yes	Primary	Considered a primary response option as modelling predicts shoreline impact. Application, location, and tactics required will depend on the nature and scale of the	Yes	Primary	Considered a primary response option as modelling predicts shoreline impact. Application, location, and tactics required will depend on the nature

RESPONSE STRATEGY	ENVIRONMENTAL BENEFIT(S)	POTENTIAL ENVIRONMENTAL IMPACTS / RISKS	FUNCTIONAL/OPERATIONAL CONSTRAINTS	CONDENSATE			MDO		
				RESPONSE APPLICABILITY BASED ON HYDROCARBON TYPE PRESENT YES / NO / PARTIAL	PRIMARY / SECONDARY / NA / REJECT	JUSTIFICATION	RESPONSE APPLICABILITY BASED ON HYDROCARBON TYPE PRESENT YES / NO / PARTIAL	PRIMARY / SECONDARY / NA / REJECT	JUSTIFICATION
	deflect to lower priority areas.	interference with other users, collisions, etc.). Habitat disturbance from securing booms on shallow nearshore benthic environments. Generation of waste from booms and disposal of recovered condensate and water. Potential impacts to intertidal areas if deflected to low sensitivity shorelines.	Site constraints such as breaking waves, etc.			incident at the time of the response.			and scale of the incident at the time of the response.
Shoreline Clean-Up	Hydrocarbon removal from shorelines to minimise impacts to marine fauna and flora that may use shorelines: Reduced visual impact. Reduces risk of marine fauna contact and smothering effects. Reduce risk of re-entrainment of hydrocarbons from shoreline back into marine environment.	Potential shoreline disturbance to sensitive habitats (e.g., turtle nesting beaches) from clean-up operations (trampling by response personnel and equipment). Waste from removal of contaminated sediment from beaches and impacts to associated flora and fauna during removal activities. Temporary storage of waste has the potential to cause contamination to areas not originally contacted by the spill. Presence of response personnel, equipment and facilities will increase the risk of hydrocarbon cross contamination from an impacted site to a non-impacted site.	Labour intensive, significant logistical planning, including waste management considerations required. Personnel management and coordination to reduce environmental and safety risks/impacts. Applicability is influenced by shoreline characteristics (substrate type, beach type, exposure to wave action, biological, social, heritage or economic resources, amount of hydrocarbon present and access to site). In the event of shoreline impact, appropriate shoreline clean-up tactics could be implemented to reduce the impact to the shoreline habitats and species. Actionable amount of shoreline accumulation > 100g/m2?	Yes	Primary	Potentially feasible. The maximum length of actionable shoreline oil is approximately 7 km with initial shoreline contact predicted to occur within 3.5 days of the release, with a maximum loading of 28.1 m^2. The nature of the gas condensate means that it is difficult to collect and clean from shorelines, therefore the tactics effectiveness is unknown. Note: specific techniques to be decided following the completion of an operational NEBA in consultation with relevant stakeholders and under the direction of the relevant Control Agency.	Partial	Secondary	Shoreline clean-up not considered feasible. Modelling does not predict shoreline impact at the actionable threshold (>100g/m^2), therefore, hydrocarbons not able to be removed. However, if monitoring indicates that shoreline impact will occur at the time of the response, Shoreline Clean-up Assessment Technique (SCAT), will still be required, and continued monitoring to ensure the threshold does not reach >100 g/m^2.

RESPONSE STRATEGY	ENVIRONMENTAL BENEFIT(S)	POTENTIAL ENVIRONMENTAL IMPACTS / RISKS	FUNCTIONAL/OPERATIONAL CONSTRAINTS	CONDENSATE			MDO		
				RESPONSE APPLICABILITY BASED ON HYDROCARBON TYPE PRESENT YES / NO / PARTIAL	PRIMARY / SECONDARY / NA / REJECT	JUSTIFICATION	RESPONSE APPLICABILITY BASED ON HYDROCARBON TYPE PRESENT YES / NO / PARTIAL	PRIMARY / SECONDARY / NA / REJECT	JUSTIFICATION
Oiled Wildlife Response (OWR)	Prevent impact to wildlife (e.g., onshore exclusion barriers, hazing, pre-emptive capture). Reduce impact to wildlife (e.g., collection and rehabilitation to treat oiled fauna and return to similar suitable habitat or to the cleaned habitat).	Risks/ impacts from operation of vessel-based oiled wildlife response activities (e.g., liquid waste, air emissions from fuel usage, noise, marine fauna interaction, interference with other users, collisions, etc.). Hazing could disrupt wildlife (e.g., separating parents/offspring pairs, deterrence to nesting grounds etc.). Potential risk of fauna injury and inappropriate field collection/ handling during pre-emptive capture and post-oiled collection. Rehabilitation activities could result in inadequate/ inappropriate animal husbandry leading to stress/ injury/ death. Inappropriate fauna relocation points leading to disorientation/ stress.	Labour intensive and significant logistics considerations. Wind is a key constraint, calm seas and ideal conditions are considered necessary for capture operations. Weather constraints for use of aerial observation/ tracking fauna. Navigation of multiple vessels within a small area. Availability of suitable space/ location in township for staging area and rehabilitation and fauna treatment areas. Utilisation of local skilled fauna handlers and veterinarians for treatment of oiled wildlife. Availability of an additional vessel for wildlife transport to rehabilitation centre	Yes	Primary	This response will be implemented as a primary response option as wildlife reconnaissance will be implemented as soon as practicable. The specifics tactics will be determined based on the nature and scale of the spill.	Yes	Primary	This response will be implemented as a primary response option as wildlife reconnaissance will be implemented as soon as practicable. The specifics tactics will be determined based on the nature and scale of the spill.
Waste Management	Appropriate management of hydrocarbon-contaminated waste to reduce the potential for further contamination of the environment if not disposed of correctly.	Temporary storage and/or the inadequate disposal of waste has the potential to cause contamination to areas not originally contacted by the spill (secondary contamination). Risks / impacts from transport of wastes via vessels and/or land	Appropriate waste receptacles required for potentially large volumes of contaminated waste. Agreement in place with third-party waste contractor. Third-party contractor will develop a waste management plan and remain responsible for all waste removal activities.	Yes	Primary	Standard industry requirement. Any hydrocarbon contaminated wastes generated during a spill will be managed appropriately.	Yes	Primary	Standard industry requirement. Any hydrocarbon contaminated wastes generated during a spill will be managed appropriately.

RESPONSE STRATEGY	ENVIRONMENTAL BENEFIT(S)	POTENTIAL ENVIRONMENTAL IMPACTS / RISKS	FUNCTIONAL/OPERATIONAL CONSTRAINTS	CONDENSATE			MDO		
				RESPONSE APPLICABILITY BASED ON HYDROCARBON TYPE PRESENT YES / NO / PARTIAL	PRIMARY / SECONDARY / NA / REJECT	JUSTIFICATION	RESPONSE APPLICABILITY BASED ON HYDROCARBON TYPE PRESENT YES / NO / PARTIAL	PRIMARY / SECONDARY / NA / REJECT	JUSTIFICATION
		vehicle (air emissions from fuel usage, noise, fauna interaction, interference with other users, collisions, etc.).							
Operational and Scientific Monitoring Bridging Implementation Plan (OSM-BIP)	By determining the potential ongoing environmental impact attributable to the spill or response activities, OSM-BIP ensures remediation activities are appropriate and well informed.	Risks/ impacts from operations of OSM-BIP include vessels and aircraft (e.g. liquid waste, solid waste from sampling, air emissions from fuel usage, noise, marine fauna interaction, interference with other users, collisions, etc.).	Access to water / sediment sampling locations due to weather, currents and spill constraints Visual observation activities at night or during poor weather restricted. Stringent safety management requirements for aerial and marine operations employed. Coordination of multiple vessels within limited area. Third-party contractor will develop an Operational and Scientific Monitoring Bridging Implementation Plan (OSM-BIP) and remain responsible for maintaining capability, equipment and resourcing and implementing the monitoring plans after activation from the Control Agency in the event of a spill event. Exchange of information will take place between the OSM-BIP contractor and the relevant control agency.	Yes	Primary	Standard industry requirement. This primary response to be implemented once initiation criteria have been triggered.	Yes	Primary	Standard industry requirement. This secondary response to be implemented once initiation criteria have been triggered.

6.1.1. Spill Response Strategies

Based on the preliminary NEBA detailed in Table 6-1, the following response options have been identified as appropriate for the credible worst-case hydrocarbon release scenarios for the activity. Further information, including capability and resources to facilitate the response options, are included in the OPEP.

6.1.1.1. Source Control

For a vessel collision, the source control tactics include:

- Vessel source control

Source control tactics for a LOWC scenario for consideration in this plan include:

- ROV Emergency BOP Intervention
- Capping stack
- Relief Well
- Subsea dispersant application

Vessel Source Control

Vessel source control actions are those in accordance with the vessel's SOPEP and dependent on the scenario type. It may include transfer of the fuel from the damage tank and repairing the damage tank.

ROV Emergency BOP Intervention

Emergency BOP activation involves delivering hydraulic fluid to the BOP stack using an ROV to mitigate any problems that may have arisen with the BOP control system in a loss of well control event.

Capping Stack

Well capping and containment involves the deployment of specialist capping stack equipment, which uses hydraulic pressure to seal off the damaged BOP and stop the flow of hydrocarbons. An intervention riser system may also be used to capture and transport hydrocarbons for safe storage and processing via a supporting vessel. As part of its' well management operating procedures, Emperor Energy will put in place a service agreement with a capping stack provider during a hydrocarbon spill event if it is deemed to be effective as containment equipment.

Currently, Emperor Energy are considering both a jack-up rig and semi-submersible option for drilling Judith-2. Capping stacks are not suitable for wells drilled from a jack-up rig since there is not a wellhead on the seabed. In the event that a semi-submersible MODU was used to drill Judith-2, Emperor Energy would have access to capping stacks from Wild Well Control's Singapore, Houston and UK stockpiles.

For a worst-case scenario where the capping stack and deployment vessel are both coming from Singapore there are two options

- Assemble and test capping stack in Singapore and then mobilize to location on the deployment vessel. It is estimated the transit time to location is 16 days.
- Air freight the capping stack to Australia while the vessel sails to Melbourne to pick up the stack. This could save 5 days as the capping stack can be tested while the vessel is in transit.

A detailed logistics plan will be developed if the event that a semi-submersible MODU is chosen.

Table 6-2: Debris Clearance Plan

DEBRIS CLEARANCE ITEM	MAXIMUM DURATION (DAYS)	COMMENTS
Mobilise crews and equipment to Port	0-1	Based on previous simulations. Concurrently source capping stack construction vessel with Australia safety case. Commence safety case revision.
Continue to source and mobilise vessel to Singapore	0-7	Typical response time based on market knowledge of suitable in South-East Asia. A suitable vessel register will be updated on monthly basis prior to spud.
Loadout debris clearance equipment on construction vessel	7-8	
Transit capping stack directly to well location	8-24	Estimated transit time from Port to location.
Deployment of debris clearing equipment	24	
Total	24	

Table 6-3: Capping Stack Deployment Plan

DEPLOYMENT ITEM	MAXIMUM DURATION (DAYS)	COMMENTS
Mobilise crews and equipment to Port	0-3.5	Based on previous simulations. Concurrently source capping stack construction vessel with Australian safety case. Commence safety case revision.
Stack up and test capping stack	3.5-7.5	Most recent exercise reduced this time to 2.8 days.
Continue to source and mobilise vessel to Singapore	0-7.5	Typical response time based on market knowledge of suitable vessels in SE Asia. A suitable vessel register will be updated on a monthly basis prior to spud.
Loadout caping stack to construction vessel	7.5-9.5	Conservative estimate with 1 day achievable
Transit capping stack directly to well location	9.5-25.5	Estimated transit time from Port to location

Awaiting safety case revision	0-16	
Deployment of capping stack	25.5-30	Assumes vertical access is possible. Additional time to allow for adverse weather.
Total	30	

At the same time as the above, the safety case revision for capping stack deployment for the construction vessel will be progressed. An indicative timeline for safety case revision approval is shown below in Table 6-4.

Table 6-4: Safety Case Revision Timeline

	DURATION (DAYS)	COMMENTS
Identify vessel	1	-
Safety case revision kick-off	1	Commence safety case revision plan. Engage with NOPSEMA to prioritise
Develop safety case revision	7	Perform HAZID. Complete safety case revision.
Submit safety case revision	0	NOPSEMA review safety case revision.
Safety case review process	7	Ongoing dialogue with NOPSEMA to optimise RFFWI response
Safety case accepted	0	
Total	16	

Relief Well

The drilling of a relief well provides an opportunity to permanently suspend the well. A relief well is drilled to intersect the compromised well bore above the blowout location. Weighted drill fluid is pumped down the relief well at high rates to kill the existing well. This requires the mobilisation of another suitable MODU to the existing well location.

Relief Well Design:

Two relief well designs were developed for Judith-2, one based on a blowout from the 12-1/4" (Figure 6-1) and one based on 8-1/2" (Figure 6-2). The conceptual well trajectories are shown below, based on a 600m offset for Judith-2.

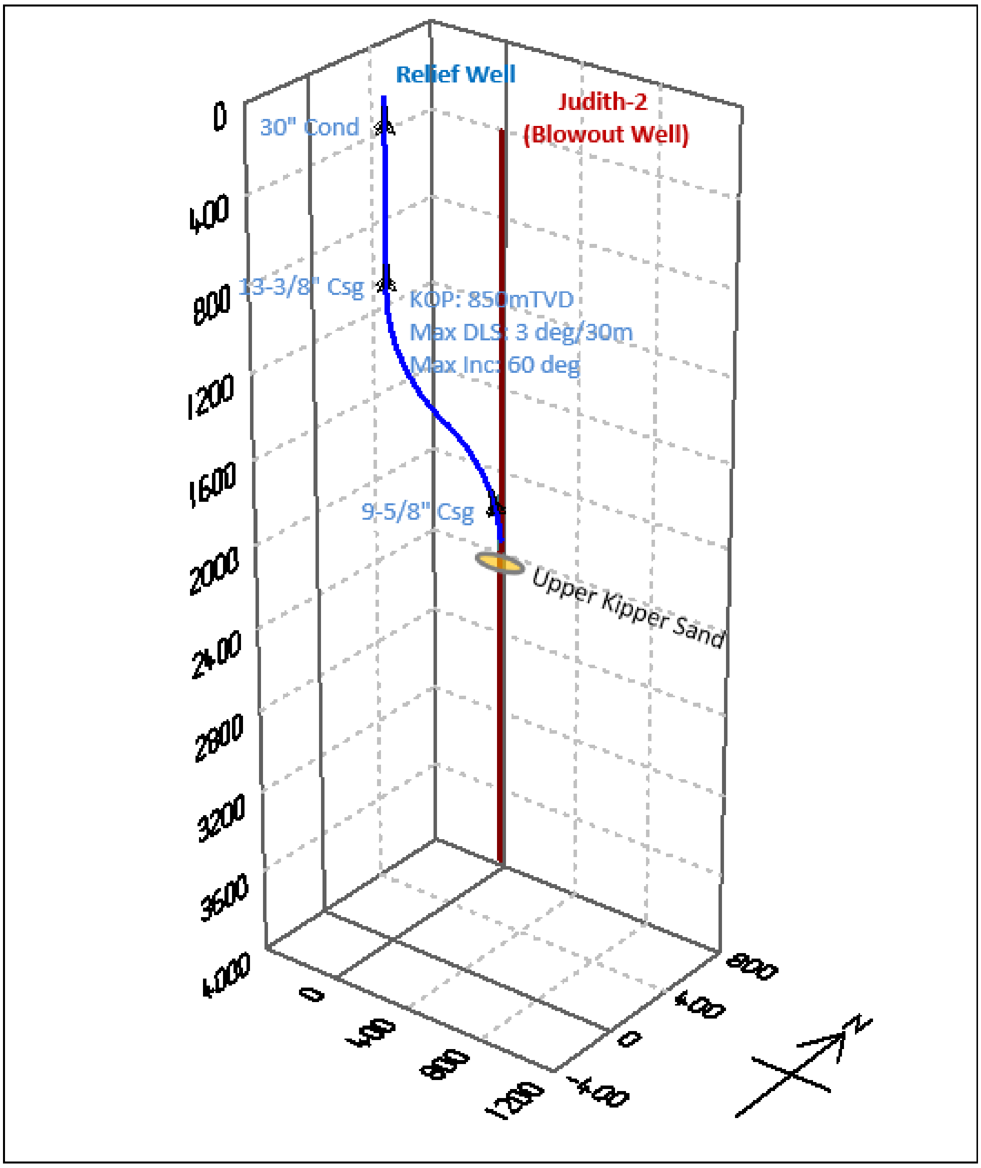

Figure 6-1: Relief Well for Blowout in 12-1/4" section

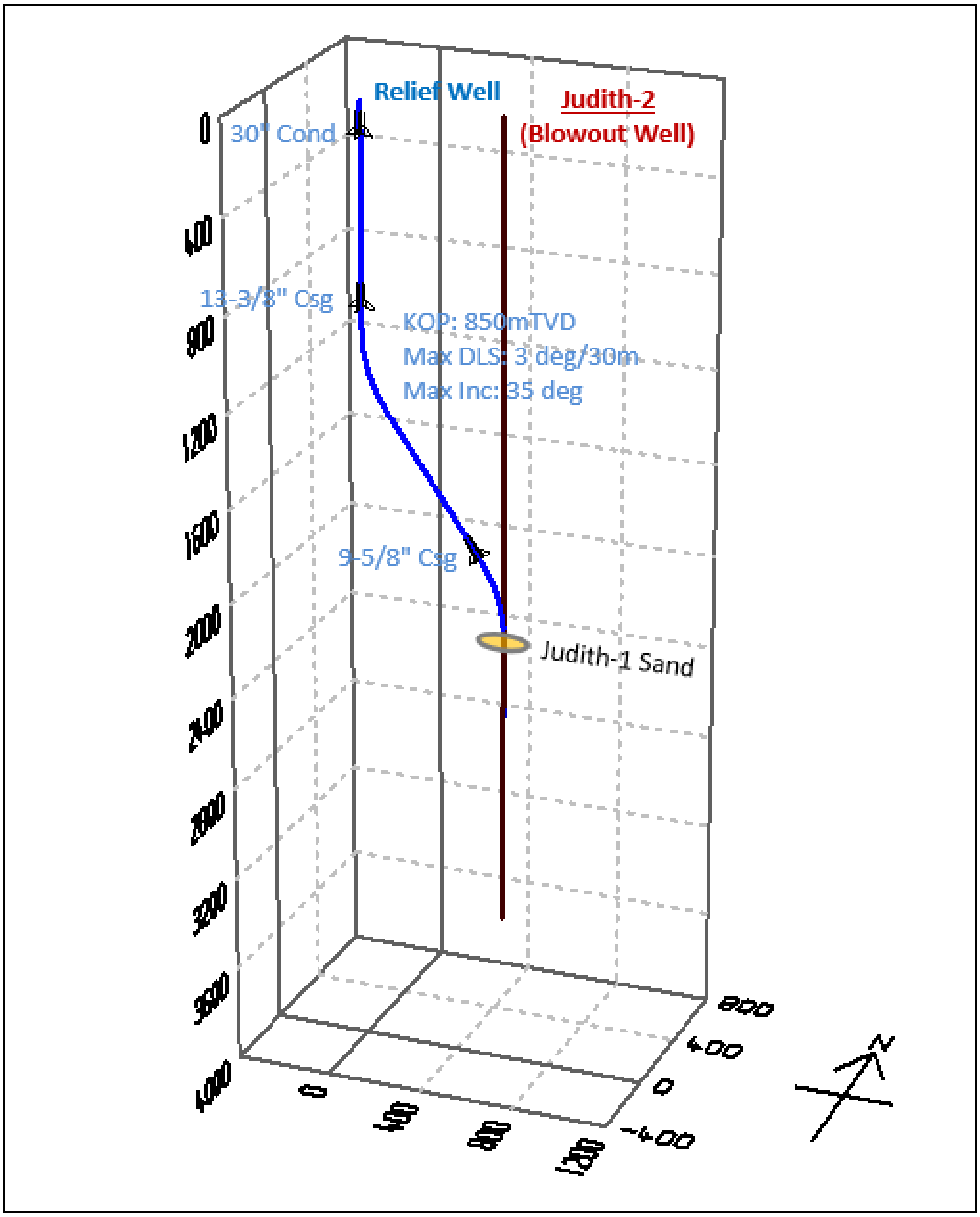

Figure 6-2: Relief Well for Blowout in 8-1/2 section"

Worst Case Discharge:

On behalf of Emperor and AGR, Schlumberger (SLB) were contracted to assess the worst-case discharge potential of both the 12-1/4" and 8-1/2" hole sections for Judith-2.

The Inflow Performance Relationship (IPR) curves for all 10 reservoirs were modelled individually, using reservoir information based on offset well data from nearby wells in the field.

The Day 1 blowout rates were modelled for both cases based on the combined flow of all 3 & 7 reservoirs, considering a blowout to surface with no drill pipe or other restrictions in the well. The day 1 worst case discharge rates for the 12-1/4" section was modelled at 274.3 MMscf/day of gas and 5,870.9 stb/day condensate for a CGR of 21.4 stb/MMscf. With 268 MMscf/day of the flow coming from the Upper Kipper Sand alone. The day 1 worst case discharge rates for the 8-1/2" section was modelled at 80.56 MMscf/day of gas and 805.6 stb/day condensate for a CGR of 10 stb/MMscf. Majority of the flow came from Judith 2, 3 and 4 sands.

The P50 GIIP modelled by Emperor, was used in the pressure depletion calculations. With the Day 77, pressures reached in each case by modelling all reservoirs combined flow with a regressive daily pressure decline. The result arrives at a table of reservoir pressures and associated gas flow rate for each reservoir. The advantage of this method is, that the interaction of all reservoirs flowing simultaneously is captured in the simulation.

The modelled Day 77 pressures are then input into the Drillbench model and used to simulate the blowout equivalent to the 77 days blowout time. The depleted flow after 77 days for the 12-1/4" section is 147.4 MMscf/day gas and 3,153.6 stb/day condensate. The depleted flow for the 8-1/2" section is 77.9 MMscf/day gas and 778.8 stb/day condensate.

After 77 days the total worst-case discharge result are outlined in Table 6-5 and Table 6-6.

Table 6-5: Worst-case discharge rates for Judith-2

DISCHARGE	12-1/4"	8-1/2"
Total Condensate (stb) (77days)	34,584	58,483
Total Gas (bscf) (77 days)	16.3	6.1

Table 6-6: Worst-case depletion rates for each Judith-2 reservoir

	TOTAL	UPPER KIPPER SAND	LOWER GOLDEN BEACH	BASAL GOLDEN BEACH
Pressure – Day 1 (psia)	-	3,201	3,209	3,470
Pressure – Day 77 (psia)	-	2,064	3,204	3,415
Pressure Depletion (psi)	-	1,136.7	5.2	55.1
Pressure Depletion (%)	-	35.51%	0.16%	1.59%
Gas Rate – Day 1 (MMscf/day)	274.3	268.0	0.3	6.0
Gas Rate – Day 77 (MMscf/day)	147.4	140.4	0.3	6.6
Condensate – Day 1 (stb/day)	5,870.9	5,735.1	6.5	129.4
Condensate – Day 77 (stb/day)	3,153.6	3,004.6	7.4	141.6

Drilling Timing:

Once the rig is on location is it estimate that it would take approximately 36.4 days to drill, intercept and kill the well. A breakdown of this timeline is shown in Table 6-7.

Table 6-7: Indicative timing for Relief Well Drilling

RELIEF WELL DRILLING	DAYS (CUMULATIVE)	DAYS (INTERVAL)
Position rig on location and prepare for spud	4.24	4.24
Drill 36" x 26"-hole section	4.70	0.49
Run & cement 30" x 20" conductor	5.88	1.24
Drill 17-1/2" hole section to casing depth	7.77	1.98
Run & cement 13-3/8" casing	8.94	1.25
Install wellhead and nipple up BOP	10.73	1.82
Drill 12-1/4" hole section to casing depth	16.30	5.78
Run & cement 9-5/8" casing, test BOPs	18.64	2.43
Drill out 9.5/8" shoe	19.43	0.81
Allowance for ranging, intercept and well kill	36.43	17.00
Total	36.43	

MODU Mobilisation:

Once it is identified that a relief well rig is required, the rig operators identified prior to spud would be approached, in accordance with the APPEA MoU, to secure their well and release the rig for relief well drilling.

From this point onwards, a number of parallel activities would be kicked off, including gaining a safety case, mobilising relief well equipment and mobilising the rig to location. Worst case, it is assumed the rig would come from the Northwest Shelf, Western Australia.

The discharge modelling assumed in the hydrocarbon spill modelling report (RPS, 2022) assumed a conservative 77 days, which is greater than the estimate shown in Table 6-8.

Table 6-8: Indicative total relief well drilling timeframes

MODU MOBILISATION	COMMENT	DAY
Identify suitable MODU	Suitable MODU's are identified 2 months prior to spud and updated monthly. Members of APPEA MOU.	0-1
Source Control Response (SCR) Plan developed	Meet NOPSEMA to discuss imminent source control response and its urgency	1-2

Source Control Response submitted	Source control response plan submitted to NOPSEMA	2-16
Source Control Response Review process	Ongoing dialogue with NOPSEMA to optimise RFFWI response.	16-23
Source Control Response Accepted		24
MODU mobilised	Well secured. HLV mobilised. Transit to Gippsland. Spud equipment loaded to MODU. Specialised equipment mobilised.	10-30
MODU drills relief well	Well killed.	30-66.4
Total		66.4

Subsea Dispersant Application

Subsea dispersant involves application of dispersant at the well site via a work-class ROV with a specialist dispersant application wand. The application of subsea dispersant aims to accelerate the biodegradation process by breaking the condensate into tiny, neutrally buoyant droplets within the water column. The application would also potentially lower the VOCs at the surface, allowing for a safer working environment for responders who are undertaking capping stack operations.

6.1.1.2. Monitoring, Evaluation and Surveillance

Monitoring, Evaluation, and Surveillance (MES) is conducted to assist in identifying resources that are at risk of exposure, directing response efforts, and evaluating the effectiveness of response techniques. MES activities are conducted throughout the incident response. The MES tactics that may be used to evaluate the parameters and potential trajectory of the spill may include:

- Initial hydrocarbon characterisation – using vessels and sampling equipment to obtain samples of the released hydrocarbon for laboratory analysis of its physical and chemical properties at the time of release.
- Hydrocarbon fate and weathering modelling – computer modelling, and computational techniques estimate the weathering of a hydrocarbon type.
- Oil Spill Trajectory Modelling (OSTM) – computer models, and computational techniques estimate the speed and direction of movement, weathering, and dispersal patterns.
- Visual Surveillance (aerial/vessel) – observers on aircrafts or vessels use standard references to characterise surface oil type, movement and behaviour.
- Satellite Imagery Observation – a method that uses remote sensing technologies to identify and track surface oil. Can be accessed through the relevant contractor company.
- Tracking buoys – are heavy duty floating devices designed for deployment from MODUs, support vessels and helicopters to accurately track a surface hydrocarbon spill. Tracking buoys contain a global satellite tracking system and are used to track the leading edge or centre of a spill and provide an spill response team with information to plan the incident response.

6.1.1.3. Shoreline Protection and Deflection

Protection and deflection tactics are utilised to divert hydrocarbons away from sensitive shoreline receptors prior to spill contact. They are typically used to protect smaller, high priority sections of shoreline. Spill modelling indicates that if a worst-case spill were to occur as a result of the Judith-2 exploration drilling activity, shoreline contact would occur and therefore the protection and deflection of shorelines is likely to be required.

Techniques vary depending on the location and type of sensitivity being protected. The requirement for response personnel to access the shoreline (i.e. via foot, vehicle, vessel) to be protected, and the implementation of an anchoring system for the nearshore booms (i.e. on the shoreline and / or in the nearshore environment) will cause a potential impact to the environment.

6.1.1.4. Shoreline Clean-up

Shoreline operations will be under the direction of the relevant Control Agency. The Control Agency is determined based on the source of the spill and whether the spill takes place in Commonwealth or State waters. Control Agencies for the spill scenarios considered for the activities within this EP are outlined in Section 3 of the OPEP.

Shoreline Clean-up Assessment involves the deployment of personnel to relevant shorelines to identify response priorities, access points, and techniques required. Shoreline clean-up techniques consists of different manual and mechanical recovery techniques to remove oil and contaminated debris from the shoreline to reduce environmental impact from hydrocarbons. Resourcing and equipment details are provided in the OPEP.

The shoreline techniques which may be required to complete a shoreline clean-up response include:

- Natural recovery – no intervention i.e. allowing shoreline to clean itself (surf washing).
- Manual collection of oil and debris – use of personnel (e.g. shovels, rakes).
- Mechanical collection of oil and debris – use of machinery.
- Flushing– use of high-pressure (on artificial substrate only) and low-pressure water flushing techniques to wash stranded or buried oil from shorelines.
- Recovery – use of specialist equipment (e.g. skimmers, pumps, vacuums) to recovery floating oil.
- Vegetation clearing – removal contaminated vegetation.
- Cleaning agents – application of chemicals to remove oil (often only applicable for artificial substrates).

6.1.1.5. Oiled Wildlife Response (OWR)

Any release of oil into the marine environment has the potential to impact wildlife. The level of oiled wildlife response (OWR) will be determined by data collected via initial Monitor and Evaluate response. The OWR within State waters will be conducted in accordance with the relevant State Control Agency and relevant state specific oiled wildlife response plans.

OWR can typically be separated into three stages, these include:

1) Wildlife Reconnaissance - situational awareness / visual observations of species present and identification of species that may potentially be impacted by vessel, aircraft, vehicle, AUV, or foot.
2) Preventative Actions – deterrence strategies (i.e. hazing), displacement strategies (i.e. fencing), and pre-emptive capture (translocation of wildlife prior to oiling)

3) Wildlife Rescue – capture, triage, cleaning, rehabilitation and release.

6.1.1.6. Waste Management

Hydrocarbon spills to the marine environment can generate significant amounts of waste that need to be collected, stored, and disposed of appropriately, in accordance with MARPOL 73/78 Annex V – Garbage, relevant Commonwealth and State/Territory laws and regulations.

Due to the high volatility nature of both hydrocarbon types (MDO and condensate), and their subsequent susceptibility to weathering processes (i.e. evaporation), combined with the low predicted shoreline impact from the modelling, significant volumes of waste are not anticipated from an accidental release during the activity. Furthermore, containment and recovery has not been identified as a primary or secondary strategy for either the condensate or MDO scenario meaning the waste storage capacity required is likely to be very small.

Despite small waste volumes being predicted, the waste management arrangements will need to be reviewed to adapt to the response and ensure a continuous response can be maintained. Any resulting waste is likely to be transported by vessel from the spill response location to Newcastle. From there the waste will be transported to a licensed waste disposal facility by a dedicated waste contractor via controlled-waste-licensed vehicles in accordance with the relevant State regulations.

6.1.1.7. Operational and Scientific Monitoring Bridging Implementation Plan (OSM-BIP)

An Operational and Scientific Monitoring Bridging Implementation Plan (OSM-BIP) will be conducted on behalf of Emperor Energy by a contracted monitoring service provider and will occur in the event of a Tier 2 or 3 hydrocarbon release scenario. The OSM-BIP addresses the requirements of Regulation 22 (8) – 22(16) of the Offshore Petroleum and Greenhouse Gas (Environment) Regulations 2023.

The main aim of a OSM-BIP is to allow any environmental impacts resulting from hydrocarbon discharge to be monitored and to provide information on the remediation activities that may be occurring during and/or after the response. The OSM-BIP is activated upon an initiation criterion being triggered. The OSM-BIP will compose of two types of monitoring which often occur in parallel depending on the initiation trigger for each:

- Operational monitoring - which will be implemented during the first strike response phase and continued throughout the response, will often be used to provide guidance to the IMT during the hydrocarbon response.
- Scientific monitoring - which is to be implemented during the recovery phase of the response and will often occur from a long time after the initial hydrocarbon discharge response has been terminated. Used to inform requirements and/or success of remediation efforts.

The OSM-BIP is a strategic document and key component of the environmental management framework of this activity.

6.2. Spill Response Options Environmental Impact Assessment

The impacts and risks associated with vessel, aerial and MODU operations, undertaken to support oil spill response and source control activities, have been assessed in detail in previous EP sections. The risk evaluation for this section has focused on the potential consequences from activities that are specific to oil spill response activities, which has not already been covered by previous sections. These include risks from:

- Shoreline Response:

  - Protection and Deflection
  - Shoreline Clean-up
- Oiled Wildlife Response (OWR)

These emergency response activities may introduce the following risks to environmental receptors:

- damage and/or loss of shoreline habitats
- injury / mortality to fauna
- change in fauna behaviour
- change in ecosystem dynamics

6.2.1. Risk Evaluation

6.2.1.1. Source Control

The application of subsea dispersant into the marine environment has the potential to result in a reduction in the water quality and impact sensitive marine fauna species within the area of application due the potential toxicity effects of the chemical dispersant. In general, the sensitivity of species to chemical dispersants depends on the species type and life-stage, the dispersant type, volume, and exposure duration.

Subsea dispersant injection (SSDI) may reduce volatile organic compounds (VOCs) at sea surface within the response area, therefore creating a safer work environment for responders. Therefore, the application of subsea dispersant will be considered if a capping stack is required, to lower the VOCs to create a safe environment for responders. The application aims to accelerate the biodegradation process by breaking the condensate into tiny, neutrally buoyant droplets within the water column.

The use of chemical dispersants can effectively reduce the severity of hydrocarbon impact to some species by dispersing oil into the water column. This reducing the amount of oil that can become stranded on shorelines and/or smother sensitive marine species the surface or shoreline. However, species present within the water column such as whales, dugongs, dolphins and sharks, and sensitive habitats such as corals, and associated processes (i.e., spawning), could be negatively affected by the increased concentration of dispersed oil and associated chemicals in the water column.

Potential impacts from the use of chemical dispersants include:

- increased toxicity to marine habitats and fauna due, to the addition of dispersant chemicals to the marine environment
- increased toxicity to marine habitats and fauna due to dispersed oil in the water column in the form of entrained oil and dissolved oil.

To prevent these impacts, only trained responders will undertake subsea dispersant application. This will eliminate any impacts from untrained personnel. The application will be implemented in accordance with the SCERP. Monitoring of the subsea application will be conducted to ensure the response is effective and the dispersant will only be applied within a 'dispersant application zone' which excludes:

- waters shallower than 20 m
- 4 km from Coastal Waters maritime boundary
- 10 km from Australian Marine Parks (excluding multiple use zones)
- 10 km from State Marine Protected Areas

- 10 km from World National and Commonwealth Heritage List areas
- 10 km from sensitive receptors (e.g., shoals or reefs).

6.2.1.2. Shoreline Response

Potential impacts from a shoreline response (shoreline assessment, protection and deflection, and shoreline clean-up) will vary depending on the method used, the location, and the type of shoreline being affected. Particular values and sensitivities in the area that may be affected by the spill include nearshore and estuarine habitats (such as seagrass) and shoreline habitats (sandy beach habitats).

The response may result in the potential damage and/or loss of shoreline habitats, disturbance or injury / mortality of fauna, or the alteration of fauna habitats. For example, vessels may be required to deploy booms within shallow nearshore environments, increasing the risk of sedimentation and smothering of habitats and communities. The use of anchors for shoreline booms may damage the nearshore or estuarine habitat (i.e. seagrass), affecting the fauna which utilise it.

Loss of vegetation may occur where equipment cannot be mobilise using existing tracks or where protection booms may be placed. Based upon the nature of the spill events associated with this EP, and the limited area of shoreline that would likely be exposed to hydrocarbons above impact / response thresholds, any impacts are likely to be highly localised the response infrastructure. These impacts would likely result in localised medium-term impacts to species or habitats with recover over months to a year.

6.2.1.3. Oiled Wildlife Response (OWR)

In the event that a OWR response is required, risks to fauna would predominantly be associated with the use of untrained resources to capture and handle the fauna potentially resulting in distress, injury or death.

To prevent these impacts, only DEECA (or other relevant state agencies) trained oiled wildlife responders will approach and handle fauna. This will eliminate any handling impacts to fauna from untrained personnel and reduce the potential for distress, injury or death of a species.

Hazing and exclusion of wildlife from known congregation, resting, feeding, breeding or nesting areas may have a short- or long-term impact on the survival of that group if cannot access preferred resources. These effects may be experienced by target and non-target species. For example, shoreline booming, or ditches dug to contain oil may prevent penguins from reaching their burrows after they've excited the water and low helicopter passes flown regularly over a beach to deter coastal birds from feeding in an oil-affected area may also deter penguins from leaving their burrows to feed at sea, which may impact on their health.

The consequence of spill response activities (subsea dispersant, shoreline response and oiled wildlife response) is assessed as Minor (2), with a likelihood assessed as Rare (1), with an overall risk ranking of Low (2), based on:

- Prevention controls are in place to prevent the risk of a LOWC event (see Section 5.6) and will subsequently reduce the risk of spill response activities being required.
- Subsea dispersant will only be implemented in the event that a 1) a semi-submersible MODU is used for drilling, 2) a capping stack is required for source control, and 3) following the NEBA determination that a net positive outcome will occur. The strategy will be conducted using trained specialists, under the direction of the relevant Control Agency following the relevant Source Control Emergency Response Plan (SCERP).
- The hydrocarbon modelling report predicts that characteristics of MDO and gas condensate (light, low viscosity, and volatile) will result in a relatively large portion undergoing natural dispersion from

weathering (i.e. evaporation), with only a comparatively small amount expected to persist within the environment, and reach shorelines, therefore reducing the amount of potential intervention required by the shoreline response.

- Sensitive receptors will be identified by the operational NEBA, ensuring mitigation measures are in place prior to the shoreline response activities are implemented.
- OWR will only be implemented where the operational NEBA determines a net positive outcome, and will be conducted using trained specialists, under the direction of the relevant Control Agency following the relevant State oiled wildlife plan.
- Shoreline response activities will be carried out in accordance with a NOPSEMA approved OPEP, under the guidance of the National Plan (AMSA 2020), using only trained responders to ensure they are compliant with industry best practice and Australian legislation and requirements.
- Impacts from shoreline response techniques are anticipated to only result in localised, medium-term impacts to species or habitats.

6.2.2. Control measures ALARP and acceptability assessment

6.2.2.1. ALARP Decision Content: Type B

Impacts from spill response activities are relatively well understood though there is the potential for uncertainty in relation to the impact severity level.

Activities are well practised, and there are no conflicts with company values, no partner interests and no significant media interests.

Consequently, an ALARP Decision context Type B has been selected for this aspect.

6.2.2.2. Adopted Control Measures

Table 6-9 lists the adopted controls to be used during the activity to reduce impacts from spill response activities.

Table 6-9: Adopted Preventative and Response Controls

ADOPTED CONTROLS	SOURCE OF GOOD PRACTICE CONTROL MEASURES
PREVENTATIVE	
Maintain subsea dispersant application capability	Emperor Energy will maintain the required level of response capability to implement subsea dispersant application, in the event that a submersible drilling rig is used for the activity, to commensurate with the spill events detailed in this EP.
Dispersant selection process	Subsea dispersants used would be selected from the AMSA OSCA Register.
Maintain shoreline response capability	Emperor Energy will maintain the required level of response capability to implement shoreline response strategies (i.e. assessment, protection, deflection, clean-up etc.) commensurate with the spill events detailed in this EP.

ADOPTED CONTROLS	SOURCE OF GOOD PRACTICE CONTROL MEASURES
Maintain Oiled Wildlife Response capability	Emperor Energy will maintain the required level of response capability to implement an OWR strategy commensurate with the spill events detailed in this EP.
Develop TRPs for priority protection sites	Identify priority protection sites and apply tactical response planning measures
Ongoing consultation	Consultation in the event of a spill will ensure that relevant government agencies support the protect and deflect strategy thus minimising potential impacts and risks to sensitivities.
RESPONSIVE	
Dispersant application zone	Application of chemical subsea dispersant to only occur within a designated 'dispersant application zone'
Deployment of equipment and implementation of strategies will only be undertaken by trained incident response personnel.	The implementation of the spill response activities, including source control, will only be undertake by trained responders and as per the direction of the relevant Control Agency in the event that the NEBA shows a positive outcome.
OSM-BIP (Monitor response effectiveness)	Monitoring the response effectiveness will ensure response is terminated where the response is no longer effective or where a net environmental benefit is no longer present.
Use of Existing Tracks and Pathways	Utilising existing tracks and paths where possible will ensure the disturbance footprint associated with the implementation of this response technique is reduced to ALARP.
Trained fauna handlers will handle wildlife (unless otherwise directed by the relevant State Control Agency)	Wildlife is only approached or handled by State agency trained oiled wildlife responders unless formal direction is received from the Government IMT. Emperor Energy response personnel are advised of wildlife interaction restrictions through site safety inductions.

6.2.2.3. Additional Controls Assessed

Table 6-10 identifies additional control measures that are not disproportionate to the benefit gained, to demonstrate the levels are reduced to ALARP.

Table 6-10: Additional Control Measures Considered

CONTROL	COST / BENEFIT ANALYSIS	CONTROL IMPLEMENTED
Implement optimum protect and deflect	Any equipment mobilised to site would need to be purchased by Emperor Energy. Most equipment	No

CONTROL	COST / BENEFIT ANALYSIS	CONTROL IMPLEMENTED
sooner by storing equipment at strategic locations	proposed to be used (available via the various agreements) can only be mobilised in an emergency as it needs to be stored and available in strategic locations nationwide for the whole industry. Purchasing such equipment would result in significant costs that are considered grossly disproportionate to the level of risk reduction achieved. The environmental benefits associated with this option are negligible; existing logistics pathways have demonstrated that this equipment can be mobilised to potentially impacted shorelines before shoreline contact occurs.	
Training and competencies	State agencies lead the oiled wildlife response, providing trained personnel, technical expertise and instruction to Cooper Energy for support as required. Training additional personnel before an event occurs is not expected to provide any benefit; responders will be given direction from the appropriate agency during an OWR. This option has therefore not been implemented. Personnel handling oiled wildlife are trained as fauna handlers or are guided by OWR-trained personnel. During an oil spill there is the potential for fauna to come into contact with floating or stranded oil. If this occurs, State response agencies would lead oiled wildlife response, with Emperor Energy providing labour and resources as requested by the controlling agency.	No

6.2.2.4. Acceptability Assessment

Table 6-11 details the acceptability assessment against the criteria listed in Section 2.2.5.

Table 6-11: Acceptability Assessment

CRITERIA	DETERMINATION
To meet the principles of ESD	Based upon the risk assessment completed for this activity, potential risks from a LOWC event were assessed to have a residual risk ranking of Medium (4). This residual risk ranking is considered tolerable and has been demonstrated ALARP. Further, quantitative modelling has been undertaken to remove some of the scientific uncertainty associated with this aspect. As such, the activity is consistent with the principles of ESD.
Internal context	The proposed management of the impact is aligned with the Emperor Energy Health, Safety, and Environment Policy (APPENDIX A).

CRITERIA	DETERMINATION
	Activities will be undertaken in accordance with the Implementation Strategy (Section 8).
External context	No objections or claims have been raised during stakeholder consultation regarding the potential for a LOWC event.
Other requirements	A LOWC event is to be managed in consideration with: MO 91: Marine Pollution Prevention – Oil OPGGS(E) Regulations. The management of a LOWC event was not deemed to be inconsistent with the plans, conservation advice or recovery plans listed in Table 1-2.
Monitoring and review	Impacts as a result of a hydrocarbon spill will be monitored and reported in accordance with the OSM-BIP Reviewing requirements are outlined in Section 8.10 of the Implementation Strategy. The environment impacts and risks associated with this aspect are sufficiently monitored and reviewed to inform this risk assessment.
Acceptability outcome	Acceptable

7. CONSULTATION

7.1. Introduction

Emperor Energy is committed to early and open engagement with individuals or groups who may be affected by our activities or who have an interest in, or influence on, what we do.

In support of this EP, Emperor Energy has sought to:

- Identify relevant persons as defined in regulation 25(1) of the OPGGS(E) Regulations
- Provide each relevant person sufficient information to allow the relevant person to make an informed assessment of the possible consequences of the activity on their functions, interests or activities as per regulation 25(2) of the OPGGS(E) Regulations
- Allow each relevant person a reasonable period for consultation as per regulation 25(3) of the OPGGS(E) Regulations
- Advise each relevant person that they may request that particular information provided not be published, and take reasonable steps to ensure information subject to such a request not be published as per regulation 25(4) of the OPGGS(E) Regulations
- Capture in its report on consultation, as per regulation 24(b) of the OPGGS(E) Regulations, the following:
  - A summary of each response made by a relevant person; and
  - an assessment of the merits of any objection or claim about the adverse impact of each activity to which the environment plan relates; and
  - a statement of the titleholder's response, or proposed response, if any, to each objection or claim; and
  - a copy of the full text of any response by a relevant person.
- Engage relevant persons in a way that is appropriate to their interests and information needs.
- Provide feedback to relevant persons on any objections or claims they may have raised, and any measures adopted in response to consultation with that relevant person.
- Ensure appropriate ongoing consultation with relevant Commonwealth and state authorities and other relevant interested persons or organisations as per regulation 22(15) of the OPGGS(E) Regulations as part of the implementation strategy. This is described in Section 7.2.

7.1.1. Relevant person Identification

Emperor Energy developed a Socio-Economic EMBA to allow for identification of a "Universe of relevant persons" whilst also applying a general assessment to intersection of project aspects with the values and sensitivities of each identified group of relevant persons. This mapping is shown in Table 7-3.

The Socio-economic EMBA is a geospatial representation of the areas represented by the hydrocarbon thresholds defined by NOPSEMA. This would reflect a worst-case scenario through a Loss of Well Control unplanned event.

By overlaying the "universe of relevant persons" with the geospatial Socio-economic EMBA, it is possible to broaden the pool of potentially relevant persons to those with direct exposure at an appropriate level that impacts their values and sensitivities justifying their relevance. The thresholds for the socio-economic EMBA are listed in Table 7-1.

After identifying categories of groups that may be affected by the proposed activities, individual relevant persons from each group were identified by reviewing:

- Existing accepted Environmental Plans in the Gippsland Basin area. This was a primary source for Emperor Energy as it is a more recent operator in the region without a significant existing stakeholder database.
- Commonwealth and State fisheries jurisdictions and fishing effort in the region.
- NOPSEMA Guideline (N-04750-GL1887 A705589): Consultation with Australian Government agencies with responsibilities in the Commonwealth Marine Area.
- Online search results.

Emperor Energy has followed the requirements of Regulation 25 of the Environment Regulations to identify relevant persons, these being:

- Each Commonwealth or State agency or authority to which the activities to be carried out under the environment plan may be relevant;
- The Department of the responsible State Minister
- A person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the EP
- Any other person or organisation that the Emperor Energy considers relevant

Commonwealth and State Government agencies relevant to this EP have been identified based on their responsibility for managing or protecting the marine environment, including those with responsibilities for environmental and fisheries management, oil pollution preparedness and response, defence and communications, biosecurity, maritime/navigational safety, marine parks and Native Title.

Commonwealth and State managed fisheries relevant to this EP have been identified based on fishery zone overlap with titles, the Judith-2 well location and consideration of Commonwealth and State fishing effort data. Relevant persons for this EP are outlined in Table 7-2.

The effort in broadening the consultation beyond that historically required is a result of the “instructive reasons given by the Full Federal Court of Australia, in its appeal decision Santos NA Barossa Pty Ltd v Tipakalippa [2022] FCAFC 193 (appeal decision) on 2 December 2022, which from this date, represents the law regarding requirements for consultation in accordance with the Environment Regulations.”(Guideline – Consultation in the course of preparing an environment plan”.

Emperor’s approach to consultation was to not look to unnecessarily restrict any person claiming to be a relevant person from being treated as such.

Table 7-1: Hydrocarbon exposure thresholds for Socio-economic EMBA

THRESHOLD EXPOSURE VALUE	DESCRIPTION	LOCATION OF HYDROCARBON
1 g/m^2	Low	Floating (Surface)
10 g/m^2	Low	Shoreline
50 ppb	Moderate	Dissolved
100 ppb	High	Entrained

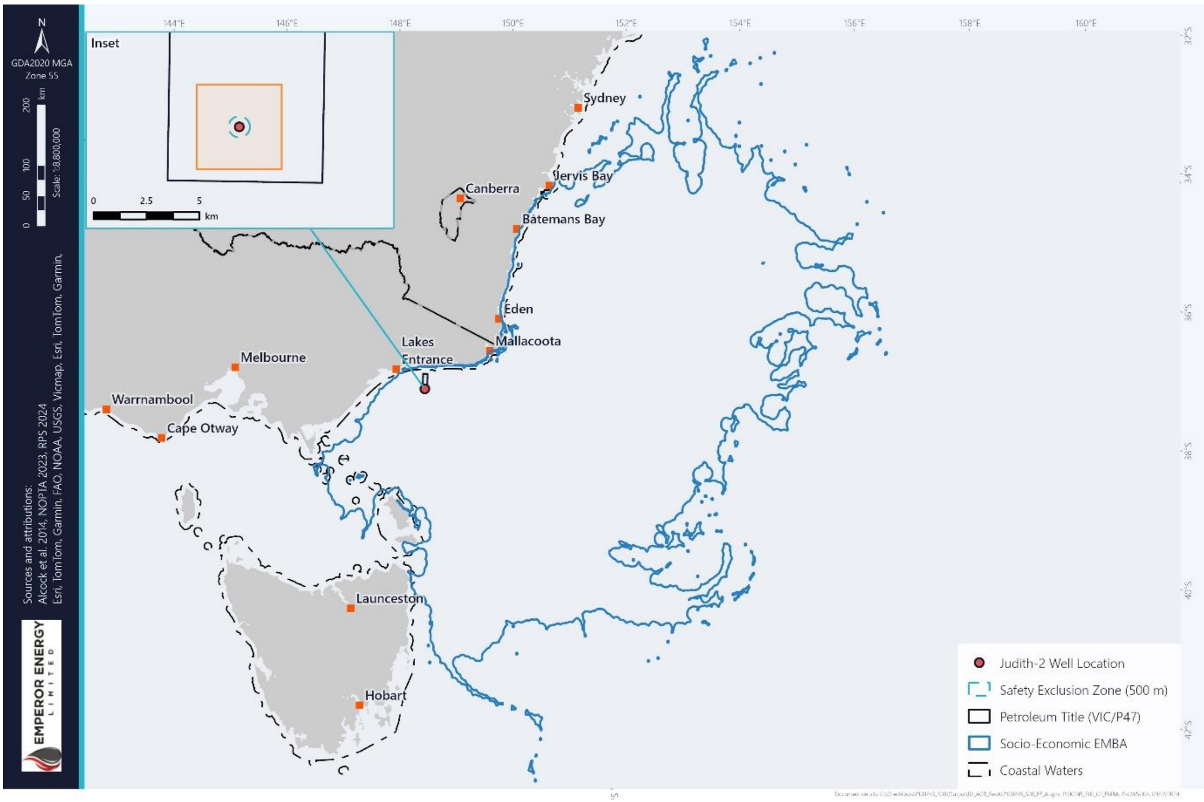

Figure 7-1 Judith-2 Well Socio-Economic EMBA

7.1.1. Extended enquiry

Efforts to identify relevant persons were not restricted to the Socio-economic EMBA, as interests within the EMBA may be held by persons or organisations residing outside the EMBA. Extended enquiry was made to search within and beyond the EMBA through media advertising extending from Sydney to Melbourne and northern Tasmania. Advertising comprised regional media across the south coast of NSW, Gippsland and northern Tasmania, further broadened through metro-based state-wide press in Melbourne and Sydney. In addition, the Koori Mail (indigenous press) was used to provide nation-wide coverage.

To further support broad capture, identified relevant persons were asked to share knowledge of any other persons whose interests, functions or activities might be impacted by the planned activities under this EP. In addition, advertisements were run twice with the latest campaign in December 2024 using the following papers, providing coverage from south Gippsland to south of Sydney, and across NSW, Victoria and norther Tasmania via major metropolitan press, and Australian wide in the Koori Mail.

Regional press

- Bairnsdale Advertiser
- The Bridge – Yarram District
- Foster Mirror
- Lakes Post
- Orbost Snowy River Mail
- Sale Gippsland Times
- Eden Magnet
- Bega District News
- Eurobodalla Independent
- Illawarra Mercury
- Moruya Examiner
- Narooma News
- Nowra News
- South Coast Register

Metro-based

- Herald Sun (state-wide)
- Daily Telegraph (state-wide)
- The Examiner – Launceston (northern Tasmania region)

National

- Koori Mail

Overall interest and response levels were relatively low, most likely due to familiarity with oil and gas operations over the last 50 years in the offshore Gippsland region. Only two persons self-identified as a result of advertising, and a number were recommended via other relevant persons.

7.1.2. Provision of sufficient time

Emperor Energy provides stakeholders a minimum of 30 days to review and respond to advice about proposed activities where stakeholders are potentially affected. Emperor Energy believes this time to be appropriate for the Judith-2 exploration well given the nature and potential impacts of the activity.

The consultation period for this Environment Plan (EP) meets or exceeds the standard timeframes set out in other applicable legislative frameworks:

- Regulation 30 of the Environment Regulations requires a minimum public consultation period of 30 days.
- The Department of Mines and Petroleum's *Guidelines for Consultation with Indigenous People by Mineral Explorers* recommends engaging with traditional owners for 21 to 30 days.
- Although no longer in effect, the *Aboriginal Cultural Heritage Act 2021 – Consultation Guidelines* (Government of Western Australia, 2023) previously indicated that a consultation period of up to 12 weeks may be appropriate to allow enough time for identifying and contacting First Nations stakeholders and receiving their feedback—unless an alternative timeframe is agreed upon through a co-designed approach.

However, once two-way dialogue has been initiated, Emperor Energy provides significant flexibility on timing based on complexity of issues raised and nature and resourcing of the relevant person. For example, should a First Nations organisation request time to organise a meeting with members, reasonable additional periods would be accommodated.

In practice, all relevant persons have been provided at least 3 months, and the majority in excess of 11 months, exceeding the above benchmarks.

No relevant person has requested additional time.

Table 7-2 Relevant persons identified for the activities

RELEVANT PERSON	FUNCTIONS, INTERESTS OR ACTIVITIES	RELEVANCE
Department or agency of the Commonwealth to which the activities to be carried out under the EP may be relevant 25(1)(a)		
Australian Fisheries Management Authority (AFMA)	Australian Government agency responsible for the management and sustainable use of fisheries resources.	Activity is within a number of Commonwealth fishery areas or will impact or potentially impact a Commonwealth fishery area or resource. Via previous consultation with AFMA by our environmental consultants, AFMA has recommended that engagement with CFA as the peak fishing industry body for commonwealth and that ABARES reports should be reviewed for fishery status. CFA is included in this table as a relevant person. Recent publications were used to determine which Commonwealth fisheries have fishing effort within the activity area (ABARES 2021) (AFMA 2022).
Australian Hydrological Office (AHO)	Australian Government agency responsible for providing hydrographic services, enabling safe navigation, maritime trade and supporting protection of the marine environment.	Via previous consultation by our environmental consultants, AHO has requested to provide information at least three weeks prior to commencement of any oil and gas activity to allow for publication of notices to mariners.
Australian Maritime Safety Authority (AMSA)	Australia's national agency responsible for maritime safety, protection of the marine environment, and maritime aviation search and rescue	Via previous consultation by our environmental consultants, AMSA has provided shipping activities within the area of the activity. Requested AMSA Joint Rescue Coordination Centre (JRCC) contacted 24-48 hours before activity commences* to promulgate AUSCOAST warning and AHO contacted 4 weeks prior to activities for notice to mariners. *AMSA JRCC will also be notified if the vessel moves out of the area that the broadcast is issued for.
Commonwealth Department of Climate	DCCEEW administers the Underwater Cultural Heritage Act 2018 (UCH Act). DCCEEW regulates activities in relation to protected	DCCEEW is a relevant agency for consultation where an activity has the potential to directly or indirectly adversely impact protected UCH whether located or unlocated;

RELEVANT PERSON	FUNCTIONS, INTERESTS OR ACTIVITIES	RELEVANCE
Change, Energy, the Environment and Water- Underwater Cultural Heritage	underwater cultural heritage (UCH) within Australian waters including the Commonwealth marine area.	
Department of Agriculture, Fisheries and Forestry (DAFF) – Biosecurity (marine pests)	Australian Government department responsible for Australia's primary industries.	Responsible for managing biosecurity of incoming goods and conveyances (including biosecurity) in Australia. Responsible for implementation of marine pest and biosecurity within Australian waters (12nm), including conveyances into Australian waters
Forestry (DAFF) – Biosecurity (vessel, aircraft and personnel)	Australian Government department responsible for Australia's primary industries	Potential for introduction of IMS
Department of Agriculture, Fisheries and Forestry (DAFF) – Fisheries	Australian Government department responsible for Australia's primary industries	Activities are within a Commonwealth fishery area or will impact or potentially impact a Commonwealth fishery area or resource.
Department of Defence (DoD)	Australian Government department responsible for Australian Defence Force	Potential for training areas or UXO to overlap activities

RELEVANT PERSON	FUNCTIONS, INTERESTS OR ACTIVITIES	RELEVANCE
Parks Australia – Director of National Parks	Australian Government department that supports the management of Australian Marine Parks.	The Director of National Parks is a relevant person for consultation where: the activity or part of the activity is within the boundaries of a proclaimed Australian Marine Park activities proposed to occur outside a reserve may impact on the values within an Australian Marine Park an environmental incident occurs in Commonwealth waters surrounding an Australian Marine Park and may impact on the values within the park.
Each Department or agency of a State or the Northern Territory to which the activities to be carried out under the EP may be relevant 25(1)(a)		
Department of Primary Industries and Regional Development NSW	Regional development body promoting business and development	Emergency response activities within the Socio-economic EMBA may affect activities
Transport for NSW (Formerly RMS)	Responsible for marine pollution response arrangements in NSW jurisdiction. Transport NSW coordinate advice with other state agencies involved in marine pollution response including NSW Environment Protection Authority (EPA) and port authorities	In the event of a marine pollution incident, activities associated with spill response may be required to enter NSW waters. Supports and reviews development of OPEP
Victorian Department of Premier and Cabinet – First	FPSR is a group within Victorian DPC responsible for work in areas of cultural rights, First Nations cultural heritage, self-determination and treaty.	Activities may be relevant to DPC FPSR due to potential risk to submerged cultural heritage within submerged cultural landscapes.

RELEVANT PERSON	FUNCTIONS, INTERESTS OR ACTIVITIES	RELEVANCE
Peoples State Relations		
Victorian Department of Transport and Planning (DTP)	Responsible for marine pollution response arrangements in Victorian jurisdiction. DoT coordinates advice with other state agencies involved in marine pollution response including DELWP and port authorities	Considered a stakeholder due to possibility of spill in State waters. Supports and reviews development of OPEP
Victorian Fishery Authority	Independent statutory authority that manages Victoria's fisheries.	Activities are within a Victorian fishery area or will impact or potentially impact a Victorian fishery area or resource.
Victoria – Heritage Victoria	Heritage Victoria regulates and enforces the Victorian Heritage Act 2017, and also acts as the Commonwealth delegate for heritage matters in Commonwealth waters offshore Victoria	Activities are in Commonwealth waters offshore Victoria
Victoria Parks	Responsible for State marine protected areas within Victorian jurisdiction, and oiled wildlife response.	Engagement is undertaken through Department of Transport and Planning (DTP) – Victoria with respect to OPEP.
Tasmania Department of Premier and Cabinet – Aboriginal Partnerships	Supports interests of First Nations peoples in their area	Interests may overlap Socio-economic EMBA
Tasmania Department of Primary Industries, Parks, Water	Responsible for preparedness and responding to oil and chemical spills in Tasmanian waters. Spill Response 'Control Agency' for any spill that enters (or threatens to enter Tasmanian coastal waters). Tasmania EPA coordinate advice with other state agencies involved	In the event of a marine pollution incident, activities associated with spill response may be required to enter Tasmanian waters. Supports and reviews development of OPEP

RELEVANT PERSON	FUNCTIONS, INTERESTS OR ACTIVITIES	RELEVANCE
and Environment (DPIPWE) – EPA	in marine pollution response including DPIPWE Fisheries branch and wildlife and conservation branch.	
The Department of the responsible State Minister 25(1)(b)		
Victorian Department of Energy, Environment and Climate Action (DEECA) (ERR)	Victorian department that forms part of the Joint Authority responsible for offshore petroleum in Commonwealth waters	DEECA is part of the offshore Joint Authority that is responsible for key petroleum title decisions in Commonwealth waters. Also plays active role in emergency response in case of state waters impact, particularly in relation to Oiled Wildlife Response and state marine parks
A person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the environment plan, or the revision of the environment plan 25(1)(d)		
Commercial Fishers		
Abalone Council Australia Ltd	Peak body representing Australian Wildcatch Abalone Industry	Activity overlaps management areas in Victoria, Tasmania, and NSW. Active fishing effort is only recorded in Tasmania and Tasmania.
Abalone Victoria Central Zone (Vic)	Peak body representing interests of Abalone Central Zone entitlement holders	Activity is within the fishery management area but there is no fishing effort.

RELEVANT PERSON	FUNCTIONS, INTERESTS OR ACTIVITIES	RELEVANCE
Australian Southern Bluefin Tuna Industry Association (Port Lincoln)	Peak body representing statutory fishing right owners, holders, fish processors and sellers, and associate members of the Southern Bluefin Tuna Fishery	Activity is within the fishery management area but there is no fishing effort.
Commonwealth Fisheries Association	Peak body representing the collective rights, responsibilities and interests of commercial fishing industries in Commonwealth Waters.	Activities overlap with Commonwealth fisheries.
Lakes Entrance Fishermen's Co-operative Limited – through South East Trawl Fishing Industry Association (SETFIA)	Voice of the Australian fishing industry situated in the South East trawl area of Australia.	Activities overlap with State fisheries who maybe members of the co-operative. Area of concern is restricting access to fishing areas. Engagement will be through SETFIA.
San Remo Fisherman's Co-operative	Industry body and fishing services provider. Represents views and interests of its members.	Activity overlaps with State fisheries who may be members of the cooperative. Engagement is via SIV.
Seafood Industry Tasmania (previously Tasmanian Seafood	Peak body representing the collective rights, responsibilities and interests of commercial fishing industries in Tasmanian state managed fisheries.	Active fishing occurs within EMBA.

RELEVANT PERSON	FUNCTIONS, INTERESTS OR ACTIVITIES	RELEVANCE
Industry Council)		
Seafood Industry Victoria (SIV)	Peak industry body representing the interests of fishers operating in Victoria's state fisheries. SIV is the primary contact for State fishers.	From previous EPs, SIV has expressed interest in seismic, displacement and PSZs. Activities overlap with numerous State fisheries.
Scallop Fishermans Association Inc. (Vic)	Peak body representing Victoria scallop fisheries	Activity overlaps management area. Active fishing occurs within EMBA.
Scallop Fishermans Association of Tasmania (Tas)	Peak body representing Tasmania scallop fisheries	Activity overlaps management area. Active fishing occurs within EMBA.
South-east Fishing Trawl Industry Association - SETFIA	Industry association representing quota owners, fishermen and sellers in the southeast trawl fishery	Activities overlap with State fisheries which SETFIA represent (Southern Shark Industry Alliance, Eastern Rock Lobster and Small Pelagic Fishery Industry Association). Emperor Energy will have ongoing engagement with SETFIA with SETFIA providing a notification to fishers when activities being undertaken.
Southern Rock Lobster Ltd	National peak body representing the Australian Southern Rock Lobster Industry.	Activities overlap management area with fishing effort recorded in Victoria, Tasmania, and NSW.
Southern Shark Industry Alliance (SSIA) – consultation through SETFIA	Industry body representing interests of its Commonwealth-licenced shark gillnet and shark hook members in the Gillnet Hook and Trap Fishery.	Activities are within the Southern and Eastern Scalefish and Shark Fishery management area and overlaps the SESSF Danish seine, trawl and gillnet hook and trap sectors where there has been effort. Engagement is via SETFIA.

RELEVANT PERSON	FUNCTIONS, INTERESTS OR ACTIVITIES	RELEVANCE
Trinsand Fisheries	Licence holder in southern squid jig fishery.	Activities are within the eastern zone of the Southern Squid Jig Fishery management.
Tuna Australia	Peak industry body representing the interests of members with licences in the Eastern Tuna and Billfish fishery, he Australian Skipjack fishery and the Southern Bluefin Tuna Industry (non-farming sector)	Activity is within the Eastern Tuna and Billfish fishery, the Australian Skipjack fishery and the Southern Bluefin Tuna fishery. (Australian Skipjack fishery not currently active)
Victorian Rock Lobster Association – via SETFIA	Peak body representing Victorian Rock Lobster fishers	Activity is being undertaken within the eastern zone of the Rock Lobster Fishery, however VFA data does not show any fishing in the Operational Area from 2011 to 2021. Represented by SIV
Victorian Scallop Fisherman's Association	A collective of the Scallop Fishing Families and associated support work force based in Lakes Entrance, Victoria. Represents interests of scallop fishermen operating within Australia's south east waters.	Activities are within the Bass Strait Scallop Fishery, however VFA data for the OA from 2011 to 2021 shows one vessel fished for one day in 2019. From previous EP consultations, the main concern is seismic surveys. Engagement via SIV
Conservation groups/ Environmental NGOs		
Australian Coastal Society	Interest in environment protection	Interests likely overlap Socio-economic EMBA
Australian Conservation Foundation	Interest in environment protection	Interests likely overlap Socio-economic EMBA
Australian Marine	Interest in environment protection	Interests likely overlap Socio-economic EMBA

RELEVANT PERSON	FUNCTIONS, INTERESTS OR ACTIVITIES	RELEVANCE
Conservation Society		
Environment Tasmania	Interest in environment protection	Interests likely overlap Socio-economic EMBA
Environment Victoria	Interest in environment protection	Interests likely overlap Socio-economic EMBA
Fathom Pacific (Vic)	Interest in environment protection	Interests likely overlap Socio-economic EMBA
Friends of the Earth Melbourne	Interest in environment protection	Interests likely overlap Socio-economic EMBA
Greenpeace Australia	Interest in environment protection	Interests likely overlap Socio-economic EMBA
Sea Shepherd Australia	Interest in environment protection	Interests likely overlap Socio-economic EMBA
Surfers for Climate	Interest in environment protection	Interests likely overlap Socio-economic EMBA
Whale and Dolphin Conservation Australia	Interest in environment protection	Interests likely overlap Socio-economic EMBA

RELEVANT PERSON	FUNCTIONS, INTERESTS OR ACTIVITIES	RELEVANCE
Wilderness Society	Interest in environment protection	Interests likely overlap Socio-economic EMBA
World Wildlife Fund Australia	Interest in environment protection	Interests likely overlap Socio-economic EMBA
Energy Industry and Port Operators		
Carnarvon Hibiscus	Energy operator	Possibility of overlapping operations
Amplitude Energy (previously Cooper Energy)	Energy operator	Possibility of overlapping operations
Esso	Energy operator	Possibility of overlapping operations
Flotation Energy	Offshore wind proponent	Possibility of overlapping operations
Qube Ports	Port operator	Possibility of overlapping operations
Oceanex	Offshore wind proponent	Possibility of overlapping operations
Port Anthony Renewables	Renewable energy developer	Possibility of overlapping operations
First Nations		

RELEVANT PERSON	FUNCTIONS, INTERESTS OR ACTIVITIES	RELEVANCE
Aboriginal Land Council of Tasmania	Supports interests of First Nations peoples in their area	Interests may overlap Socio-economic EMBA
Batemans Bay Local Aboriginal Land Council (NSW)	Under the NSW Aboriginal Land Rights Act 1983, under s52 in relation to Aboriginal Culture and Heritage, a Local Aboriginal Land Council has the following functions: (a) to take action to protect the culture and heritage of Aboriginal persons in the Council's area, subject to any other law, (b) to promote awareness in the community of the culture and heritage of Aboriginal persons in the Council's area. In accordance with s62 a function of the board of an LALC is to direct and control the affairs of the Council.	Interests may overlap Socio-economic EMBA
Bega Local Aboriginal Land Council (NSW ALC)	Under the NSW Aboriginal Land Rights Act 1983, under s52 in relation to Aboriginal Culture and Heritage, a Local Aboriginal Land Council has the following functions: (a) to take action to protect the culture and heritage of Aboriginal persons in the Council's area, subject to any other law, (b) to promote awareness in the community of the culture and heritage of Aboriginal persons in the Council's area. In accordance with s62 a function of the board of an LALC is to direct and control the affairs of the Council.	Interests may overlap Socio-economic EMBA
Bodalla Local Aboriginal Land Council (NSW)	Under the NSW Aboriginal Land Rights Act 1983, under s52 in relation to Aboriginal Culture and Heritage, a Local Aboriginal Land Council has the following functions:	Interests may overlap Socio-economic EMBA

RELEVANT PERSON	FUNCTIONS, INTERESTS OR ACTIVITIES	RELEVANCE
	(a) to take action to protect the culture and heritage of Aboriginal persons in the Council's area, subject to any other law, (b) to promote awareness in the community of the culture and heritage of Aboriginal persons in the Council's area. In accordance with s62 a function of the board of an LALC is to direct and control the affairs of the Council.	
Bunurong Land Council Aboriginal Corporation (VIC)	BLCAC is both a PBC and a RAP. Registered Aboriginal Parties (RAPs) are representative corporations, inclusive of all Traditional Owners of an identified Country. Before being granted RAP status, they have undergone a rigorous review process, in which their relationship to Country, the inclusivity of their membership and proven link to Apical Ancestors have been considered. Their registration as a RAP confirms their inherited and fundamental role to speak for Country and Culture within their registration area.	Interests may overlap Socio-economic EMBA
Cobowra Local Aboriginal Land Council (NSW)	Under the NSW Aboriginal Land Rights Act 1983, under s52 in relation to Aboriginal Culture and Heritage, a Local Aboriginal Land Council has the following functions: (a) to take action to protect the culture and heritage of Aboriginal persons in the Council's area, subject to any other law, (b) to promote awareness in the community of the culture and heritage of Aboriginal persons in the Council's area. In accordance with s62 a function of the board of an LALC is to direct and control the affairs of the Council.	Interests may overlap Socio-economic EMBA

RELEVANT PERSON	FUNCTIONS, INTERESTS OR ACTIVITIES	RELEVANCE
Eden Local Aboriginal Land Council (NSW)	Under the NSW Aboriginal Land Rights Act 1983, under s52 in relation to Aboriginal Culture and Heritage, a Local Aboriginal Land Council has the following functions: (a) to take action to protect the culture and heritage of Aboriginal persons in the Council's area, subject to any other law, (b) to promote awareness in the community of the culture and heritage of Aboriginal persons in the Council's area. In accordance with s62 a function of the board of an LALC is to direct and control the affairs of the Council.	Interests may overlap Socio-economic EMBA
Gunaikurnai Land & Waters Aboriginal Corporation	BLCAC is both a PBC and a RAP. Registered Aboriginal Parties (RAPs) are representative corporations, inclusive of all Traditional Owners of an identified Country. Before being granted RAP status, they have undergone a rigorous review process, in which their relationship to Country, the inclusivity of their membership and proven link to Apical Ancestors have been considered. Their registration as a RAP confirms their inherited and fundamental role to speak for Country and Culture within their registration area.	Interests may overlap Socio-economic EMBA
Illawarra Local Aboriginal Land Council (NSW)	Under the NSW Aboriginal Land Rights Act 1983, under s52 in relation to Aboriginal Culture and Heritage, a Local Aboriginal Land Council has the following functions: (a) to take action to protect the culture and heritage of Aboriginal persons in the Council's area, subject to any other law, (b) to promote awareness in the community of the culture and heritage of Aboriginal persons in the Council's area. In accordance with s62 a function of the board of an LALC is to direct and control the affairs of the Council.	Interests may overlap Socio-economic EMBA

RELEVANT PERSON	FUNCTIONS, INTERESTS OR ACTIVITIES	RELEVANCE
Jerrinja Local Aboriginal Land Council (NSW)	Under the NSW Aboriginal Land Rights Act 1983, under s52 in relation to Aboriginal Culture and Heritage, a Local Aboriginal Land Council has the following functions: (a) to take action to protect the culture and heritage of Aboriginal persons in the Council's area, subject to any other law, (b) to promote awareness in the community of the culture and heritage of Aboriginal persons in the Council's area. In accordance with s62 a function of the board of an LALC is to direct and control the affairs of the Council.	Interests may overlap Socio-economic EMBA
Merrimans Local Aboriginal Land Council (NSW)	Under the NSW Aboriginal Land Rights Act 1983, under s52 in relation to Aboriginal Culture and Heritage, a Local Aboriginal Land Council has the following functions: (a) to take action to protect the culture and heritage of Aboriginal persons in the Council's area, subject to any other law, (b) to promote awareness in the community of the culture and heritage of Aboriginal persons in the Council's area. In accordance with s62 a function of the board of an LALC is to direct and control the affairs of the Council.	Interests may overlap Socio-economic EMBA
Mogo Local Aboriginal Land Council (NSW)	Under the NSW Aboriginal Land Rights Act 1983, under s52 in relation to Aboriginal Culture and Heritage, a Local Aboriginal Land Council has the following functions: (a) to take action to protect the culture and heritage of Aboriginal persons in the Council's area, subject to any other law, (b) to promote awareness in the community of the culture and heritage of Aboriginal persons in the Council's area.	Interests may overlap Socio-economic EMBA

RELEVANT PERSON	FUNCTIONS, INTERESTS OR ACTIVITIES	RELEVANCE
	In accordance with s62 a function of the board of an LALC is to direct and control the affairs of the Council.	
New South Wales Aboriginal Land Council	Supports the functions of individual Local Aboriginal La	Interests of LALCsmay overlap Socio-economic EMBA
Ngambri Local Aboriginal Land Council (NSW)	Under the NSW Aboriginal Land Rights Act 1983, under s52 in relation to Aboriginal Culture and Heritage, a Local Aboriginal Land Council has the following functions: (a) to take action to protect the culture and heritage of Aboriginal persons in the Council's area, subject to any other law, (b) to promote awareness in the community of the culture and heritage of Aboriginal persons in the Council's area. In accordance with s62 a function of the board of an LALC is to direct and control the affairs of the Council.	Interests may overlap Socio-economic EMBA
Nowra Local Aboriginal Land Council (NSW)	Under the NSW Aboriginal Land Rights Act 1983, under s52 in relation to Aboriginal Culture and Heritage, a Local Aboriginal Land Council has the following functions: (a) to take action to protect the culture and heritage of Aboriginal persons in the Council's area, subject to any other law, (b) to promote awareness in the community of the culture and heritage of Aboriginal persons in the Council's area. In accordance with s62 a function of the board of an LALC is to direct and control the affairs of the Council.	Interests may overlap Socio-economic EMBA

RELEVANT PERSON	FUNCTIONS, INTERESTS OR ACTIVITIES	RELEVANCE
Tasmanian Aboriginal Centre	Supports interests of First Nations peoples in their area	Interests may overlap Socio-economic EMBA
Ulladulla Local Aboriginal Land Council (NSW)	Under the NSW Aboriginal Land Rights Act 1983, under s52 in relation to Aboriginal Culture and Heritage, a Local Aboriginal Land Council has the following functions: (a) to take action to protect the culture and heritage of Aboriginal persons in the Council's area, subject to any other law, (b) to promote awareness in the community of the culture and heritage of Aboriginal persons in the Council's area. In accordance with s62 a function of the board of an LALC is to direct and control the affairs of the Council.	Interests may overlap Socio-economic EMBA
Victorian Aboriginal Heritage Council	Supports interests of First Nations peoples in their area	Interests may overlap Socio-economic EMBA
Wagonga Local Aboriginal Land Council (NSW)	Under the NSW Aboriginal Land Rights Act 1983, under s52 in relation to Aboriginal Culture and Heritage, a Local Aboriginal Land Council has the following functions: (a) to take action to protect the culture and heritage of Aboriginal persons in the Council's area, subject to any other law, (b) to promote awareness in the community of the culture and heritage of Aboriginal persons in the Council's area. In accordance with s62 a function of the board of an LALC is to direct and control the affairs of the Council.	Interests may overlap Socio-economic EMBA

RELEVANT PERSON	FUNCTIONS, INTERESTS OR ACTIVITIES	RELEVANCE
Individual person		
Stakeholder # NM-01	May have interests within SEAE	Requested to be consulted
Stakeholder # JA-01	May have interests within SEAE	Requested to be consulted
Local Government		
Bega Valley Shire Council (NSW)	Local government authority	Possible overlap of ratepayers and residents' activities and interests with Socio-economic EMBA
Break O'Day Council (Tas)	Local government authority	Possible overlap of ratepayers and residents' activities and interests with Socio-economic EMBA
Dorset Council (Tas)	Local government authority	Possible overlap of ratepayers and residents' activities and interests with Socio-economic EMBA
Flinders Council (Tas)	Local government authority	Possible overlap of ratepayers and residents' activities and interests with Socio-economic EMBA
East Gippsland Shire Council (Vic)	Local government authority	Possible overlap of ratepayers and residents' activities and interests with Socio-economic EMBA
Eurobodalla Shire Council (NSW)	Local government authority	Possible overlap of ratepayers and residents' activities and interests with Socio-economic EMBA

RELEVANT PERSON	FUNCTIONS, INTERESTS OR ACTIVITIES	RELEVANCE
Shoalhaven Shire Council (NSW)	Local government authority	Possible overlap of ratepayers and residents' activities and interests with Socio-economic EMBA
South Gippsland Shire Council (Vic)	Local government authority	Possible overlap of ratepayers and residents' activities and interests with Socio-economic EMBA
Wellington Shire Council (Vic)	Local government authority	Possible overlap of ratepayers and residents' activities and interests with Socio-economic EMBA
Tourism and Recreation		
Australian Tourism Industry Council	Body representing tourism interests in designated region	Unplanned event such as hydrocarbon release might affect business interests
Boating Industry Association of Victoria (Vic)	Member based organisation representing interest of members who have common pursuits	Potential for activities to overlap the Socio-economic EMBA
Destination Gippsland (Vic)	Body representing tourism interests in designated region	Unplanned event such as hydrocarbon release might affect business interests
Destination NSW	Body representing tourism interests in designated region	Unplanned event such as hydrocarbon release might affect business interests

RELEVANT PERSON	FUNCTIONS, INTERESTS OR ACTIVITIES	RELEVANCE
iXblue	Member based organisation representing interest of members who have common pursuits	Potential for activities to overlap the Socio-economic EMBA
Major Projects	Member based organisation representing interest of members who have common pursuits	Potential for activities to overlap the Socio-economic EMBA
Marlo Angling Club (Vic)	Member based organisation representing interest of members who have common pursuits	Potential for activities to overlap the Socio-economic EMBA
Ocean Racing Club of Victoria (Vic)	Member based organisation representing interest of members who have common pursuits	Potential for activities to overlap the Socio-economic EMBA
Recreational Fishing Alliance of NSW (NSW)	Member based organisation representing interest of members who have common pursuits	Potential for activities to overlap the Socio-economic EMBA
Royal Yacht Club Victoria (Vic)	Member based organisation representing interest of members who have common pursuits	Potential for activities to overlap the Socio-economic EMBA
Scuba Divers Federation of Victoria (Vic)	Member based organisation representing interest of members who have common pursuits	Potential for activities to overlap the Socio-economic EMBA
Surf Life Saving Club Lakes Entrance (Vic)	Member based organisation representing interest of members who have common pursuits	Potential for activities to overlap the Socio-economic EMBA
Surfing Victoria	Member based organisation representing interest of members who have common pursuits	Potential for activities to overlap the Socio-economic EMBA

RELEVANT PERSON	FUNCTIONS, INTERESTS OR ACTIVITIES	RELEVANCE
Tasmanian Association for Recreational Fishing (Tas)	Member based organisation representing interest of members who have common pursuits	Potential for activities to overlap the Socio-economic EMBA
Tourism Tasmania	Body representing tourism interests in designated region	Unplanned event such as hydrocarbon release might affect business interests
Victoria Game Fishing Club (Vic)	Member based organisation representing interest of members who have common pursuits	Potential for activities to overlap the Socio-economic EMBA
Victorian Recreational Fishing	Member based organisation representing interest of members who have common pursuits	Potential for activities to overlap the Socio-economic EMBA
Victorian Tourism Industry Council	Body representing tourism interests in designated region	Unplanned event such as hydrocarbon release might affect business interests
Visit Northern Tasmania	Body representing tourism interests in designated region	Unplanned event such as hydrocarbon release might affect business interests
West by North West	Body representing tourism interests in designated region	Unplanned event such as hydrocarbon release might affect business interests
Windsurfing Victoria	Member based organisation representing interest of members who have common pursuits	Potential for activities to overlap the Socio-economic EMBA
Other Marine Based Businesses		

RELEVANT PERSON	FUNCTIONS, INTERESTS OR ACTIVITIES	RELEVANCE
Fathom Pacific (Vic)	AMP permit holder	Potential for activities to overlap the Socio-economic EMBA
iXblue	AMP permit holder	Potential for activities to overlap the Socio-economic EMBA
Major Projects	AMP permit holder	Potential for activities to overlap the Socio-economic EMBA

Table 7-3: Aspects and groups of relevant persons under Reg 25(1)(d)

RELEVANT PERSON GROUP	PLANNED							UNPLANNED				
	Seabed disturbance	Interaction with other users	Planned discharges – subsea	Planned discharges – surface	Emissions - light	Emissions - atmospheric	Emissions - sound	Physical presence - Interaction with marine fauna	Introduction of IMS	Accidental release – hazardous materials	Accidental release – vessel collision	Accidental release – low of well control
Conservation Groups / Environmental NGOs								✓			✓	✓
Energy and Port Operators		✓									✓	✓
First Nations					✓		✓	✓	✓		✓	✓
Local Government											✓	✓

Commercial Fisheries	✓					✓		✓		✓	✓
Tourism and Recreations	✓									✓	✓
Other marine based businesses	✓									✓	✓

7.1.3. Sufficient information

The Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2023 (OPGGS(E) require titleholders to give each relevant person sufficient information to allow the relevant person to make an informed assessment of the possible consequences of the activities on the functions, interests or activities of the relevant person.

Two versions of a standard information sheet were provided to relevant persons in addition to tailored information within correspondence emails (including tailored responses to feedback) where appropriate and as described in APPENDIX D . The information sheets were also posted on the corporate website and contained the following information:

Information sheet Version 0 and Version 1 (March 2023)

- Overview of Emperor Energy
- Purpose of the project
- Location and water depths of the project
- Proposed timing of project
- Email address for consultation
- Overview of proposed activities
- EP assessment steps including public comment
- Location map
- Description of high level impacts, risks and controls
- Description of a seabed survey
- Purpose of seabed seismic survey
- High level overview of drilling activities
- VSP overview
- Process of "plug and abandonment"

(No material difference between Version 0 and Version 1)

Information sheet Version 2

- Updated information sheet noting changed timing.
- Noted purpose of the project
- Consultation under Section 25 of the OPGGS(E)R
- Advised that the relevant person could request that any sensitive information provided not be published
- Requested advise of other relevant persons that might be known the relevant person
- Described the nature and location activities and proposed timing
- Provided information about the consultation process

- Noted potential high-level impacts and risks
- Provided link to NOPSEMA's brochure "Consultation on offshore petroleum environment plans – Information for the community"
- A clear avenue to additional information was provided through a contact email address

As described above the information sheets provided details on when and where the activities were proposed and were in simple English. They contained descriptions of high order impacts and risks, such as seismic noise, vessel interactions, interactions with marine fauna, and unplanned hydrocarbon releases, in sufficient detail whereby relevant persons could focus on areas of interest and seek further information on matters important to them. Simple imagery was provided to support complex concepts, such as geophysical and geotechnical surveys. The information provided allowed for an assessment of the possible consequences of the proposed activities on a relevant person's functions, interests or activities with clear pathways for further information or clarifications.

Simple English overviews were also provided in lay terms of how some key activities are carried out. Information was also provided to each relevant person regarding the consultation process itself, and each relevant person was provided a link to NOPSEMA's brochure "Consultation on offshore petroleum environment plans- information for the community" that provides further comprehensive information on the consultation process and Emperor Energy's obligations.

Clear contacts were provided that served as an avenue for further tailored information as required. There are no outstanding requests for further information.

Emperor Energy was flexible in how it carried out consultation so as to accommodate requirements of relevant persons. Consultation was generally via email and phone calls, with email and phone correspondence tailored to each relevant person. Online meetings were also held with a number of relevant persons. Importantly, Emperor Energy always provided an opportunity to meet with one of its senior corporate representatives at locations that were convenient for relevant persons.

In the case of First Nations Peoples, the opportunity was always available to meet on-country, with an organisation's members or management, and enquiries were made to endeavour to confirm the type of participatory model each organisation applied. Advice was always provided that information could be kept sensitive and not published if requested. This general approach provided a reasonable opportunity to highlight key cultural places, values and sensitives in a culturally safe manner if cultural knowledge holders wished to do so.

Details of calls, meetings and correspondence are captured in summary report (APPENDIX D) and the sensitive information file.

7.1.4. Relevant person consultation outcomes

APPENDIX D provides a summary of the stakeholder consultation undertaken as part of the development of the EP. The summary provides details of the information sent to stakeholders and any response received. It also details the assessment undertaken of any objection or claims.

7.1.5. Management of objections and claims

Where an objection or claim was raised by relevant persons, they were provided feedback as to how they were assessed and any measures adopted resulting from the consultation.

Where the objection or claim had merit, it was assessed as per the risk assessment process detail in Section 2.1 and controls applied where appropriate to manage impacts and risks to ALARP and an acceptable level.

Relevant persons were provided with feedback as to the merit of objections or claims had merit and if not why, and details of any measures adopted because of the consultation.

7.1.6. Public Comment

A draft of this EP will be published for Public Comment on the NOPSEMA website as per Regulation 30 of the OPGGS(E) Regulations. This section will be updated after public comment has concluded.

A report on public comment will be published upon resubmission of the draft EP to NOPSEM for assessment.

7.2. Ongoing Stakeholder Consultation

Appropriate ongoing consultation with relevant Commonwealth and state authorities and other relevant interested persons or organisations will be carried out as part of the implementation strategy. Any objections or claims raised from ongoing consultation will be assessed for merit, and any new measures to be adopted will be managed through the MOC process. The MOC process will also identify as to whether any matters arising through ongoing consultation may trigger a revision of the EP.

Consultation records of any ongoing consultation will be maintained. A notifications register will also be maintained noting any notifications required under this EP, whether they be a result of consultation carried out, or required by applicable regulations.

Ongoing consultation may be with any relevant interested persons or organisations, some of whom may be newly identified or may self-identify.

Table 7-4: Ongoing consultation requirements (basis of notifications register)

PERSON OR ORGANISATION	ONGOING REQUIREMENT	TIMING
Relevant interested persons or organisations	Ongoing engagement will include responding to reasonable requests from new or existing relevant persons or other interested persons and organisation.	As agreed during consultation
Relevant persons	As requested, and agreed during relevant persons consultation	As agreed during consultation
AHO	Drilling or vessel contractor to issue notification of activity for publication of notice to mariners. Information provided should detail: • Type of activity. • Geographical coordinates of the activity. • 500 m MODU safety exclusion zone and 2 km cautionary zone and requested clearance from other vessels. • Period that Notice to Mariner (NTM) will cover (start and finish date). • MODU and/or vessel details including MODU and vessel names, and communications details • Emperor Energy, MODU and vessel contractor contact details. Only need to update AHO of changes including if activity start or finish date changes. Do not need to provide cessation notification as long as NTM covers period of activity.	3 weeks prior to activity commencing
AMSA - JRRC	Drilling or vessel contractor to issue notification of activity for publication of Auscoast warning. Information provided should detail: • Type of activity. • Geographical coordinates of the activity. • 500 m rig safety exclusion zone and 2 km cautionary zone and requested clearance from other vessels. • Period that warning will cover (start and finish date).	48 – 24 hrs prior to activity commencing

	• MODU and/or vessel details including MODU and vessel names, and communications details. • Emperor Energy, MODU and vessel contractor contact details. Only need to update JRCC of changes including if activity start of finish date changes. Do not need to provide cessation notification as long as Auscoast warning covers period of activity.	
NOPSEMA	Regulatory notification of start of activity.	10 days prior to activity commencing
NOPSEMA	Regulatory notification of cessation of activity.	Within 10 days of activity completion

8. IMPLEMENTATION STRATEGY

As required by Regulations 22 of the OPGGS(E) Regulations, Emperor Energy has prepared this implementation strategy for the design and execution of the activity under the framework of Emperor Energy Health, Safety and Environment Policy (APPENDIX A . Contractors will be required to comply with all relevant requirements of Emperor Energy's Emperor Energy's Health, Safety and Environment Policy and commitments made in this EP, to ensure Emperor Energy's environmental performance outcomes are achieved.

8.1. Activity Management Arrangements

AGR Australia Pty Ltd (AGR) is the Drilling Management Contractor appointed to this project by Emperor Energy. AGR is responsible for providing project management and well delivery services for the seabed surveys and drilling of the Judith-2 well, including the preparation of all documents required for regulatory approvals and MODU and vessel hire.

AGR is the world's largest independent well management consulting group and since 2000 has drilled over 500 wells in 26 countries for over 100 operators without any major health, safety and environment incidents. In Australia, AGR has drilled over 40 offshore wells in all the major basins.

Emperor Energy retains full and ultimate responsibility as the Titleholder of the activity and is responsible for ensuring that the environmental performance outcomes and standards outlined throughout this EP are adequately implemented. Work instructions, procedures and plans will be used for the activity; these will be documented within Emperor Energy and the contractors' systems and manuals, as well as documents written specifically for the activity and bridging documents between Emperor Energy and contractor documents.

8.2.Activity Organisational Structure

Figure 8-1 provides an overview of the relationship between Emperor Energy, AGR, MODU contractor and vessel contractors for the activity.

AGR is responsible to Emperor Energy who has overall responsibility for the management of the activity to ensure that:

- Design and execution of the activity is in accordance with industry best practice and legislated standards.
- All regulatory approvals are obtained prior to activity commencement.
- Contractors have the appropriate resources and equipment to undertake the activity and have appropriate systems in place to ensure that these activities are undertaken in accordance with all legislative requirements and this EP.

- The environmental impacts and risks of the activity are of an acceptable level and are reduced to ALARP, and environmental performance is monitored.
- The day-to-day direction of work and the monitoring and auditing of work by contractors is undertaken in accordance with this EP.

The MODU contractor will have the day-to-day control and management of the MODU through the Offshore Installation Manager (OIM) and vessels through the respective Vessel Masters. The OIM and Vessel Masters have authority and responsibility to make decisions with respect to environment protection and pollution prevention and to request assistance as may be necessary.

Roles and responsibilities specific to the EP are outlined in : Key Emperor Energy and Contractor Personnel

Table 8-1. These will be communicated to all personnel involved in the activity. Emperor Energy retains full and ultimate responsibility as the Titleholder for the activity. As the Titleholder, Emperor Energy has entered into an agreement with AGR to provide the following ongoing services through this phase:

- Integrated Management System (i.e., health, safety and environment) and support (resource) services.
- Incident management capabilities associated with this activity.

Emperor Energy, AGR, the MODU and vessel contractors will undertake the activity as follows:

- Emperor Energy is the Titleholder for the permit and is the Permit Operator.
- AGR provides the necessary services and resources in order to act as the Project Manager for Emperor Energy.
- The relationship between the parties is governed by a Project Execution Plan (PEP), however the working relationship between the parties, both internal to them and externally, is seamless except where legislation requires otherwise.
- AGR has principal responsibility for the design of the Judith-2 well and the design and / or management of the contracting services.
- AGR will provide Emperor Energy with full technical, engineering and project management services.
- The MODU and vessel contractors are responsible for operating the MODU and vessels while conducting the activity and interfacing with service contractors at the operations level on the vessels.
- The MODU and vessel contractors are responsible for ensuring the safety of all personnel on board their respective facility and vessels.
- The MODU and vessel contractors are responsible for day-to-day implementation of this EP with AGR supervision.
- The MODU and vessel contractors are responsible for the offshore management of emergency incidents including oil spills from the MODU or vessels.
- AGR is responsible for the onshore management of emergency incidents.
- The AGR Drilling Supervisor will be the designated Emperor Energy representative on the MODU and will have a direct interface with the MODU Contractor OIM.

8.2.1. Contractor Management Systems

The MODU OIM and Vessel Masters have ultimate responsibility for their MODU or vessel and persons on board, including compliance with legal requirements and in situ control of emergency situations or incidents. Roles and responsibilities relating to emergency situations are documented in various locations such as station bills, the project-specific Incident Response Plan, OPEP and the vessel shipboard OPEP.

8.3.Roles and Responsibilities

The organisational structure for the activity consists of onshore and offshore AGR, MODU, vessel and other contractor personnel. The organisational structure for the activity is illustrated in Figure 8-1, while the roles and responsibilities of key project team members are summarised in : Key Emperor Energy and Contractor Personnel

Table 8-1.

Day-to-day implementation of the EP will occur on the MODU under the leadership of the OIM, and for the vessels under the leadership of the Vessel Masters. The AGR Project Manager will have oversight of the performance of the program against the EP and other project plans and will initiate reviews and audits as required.

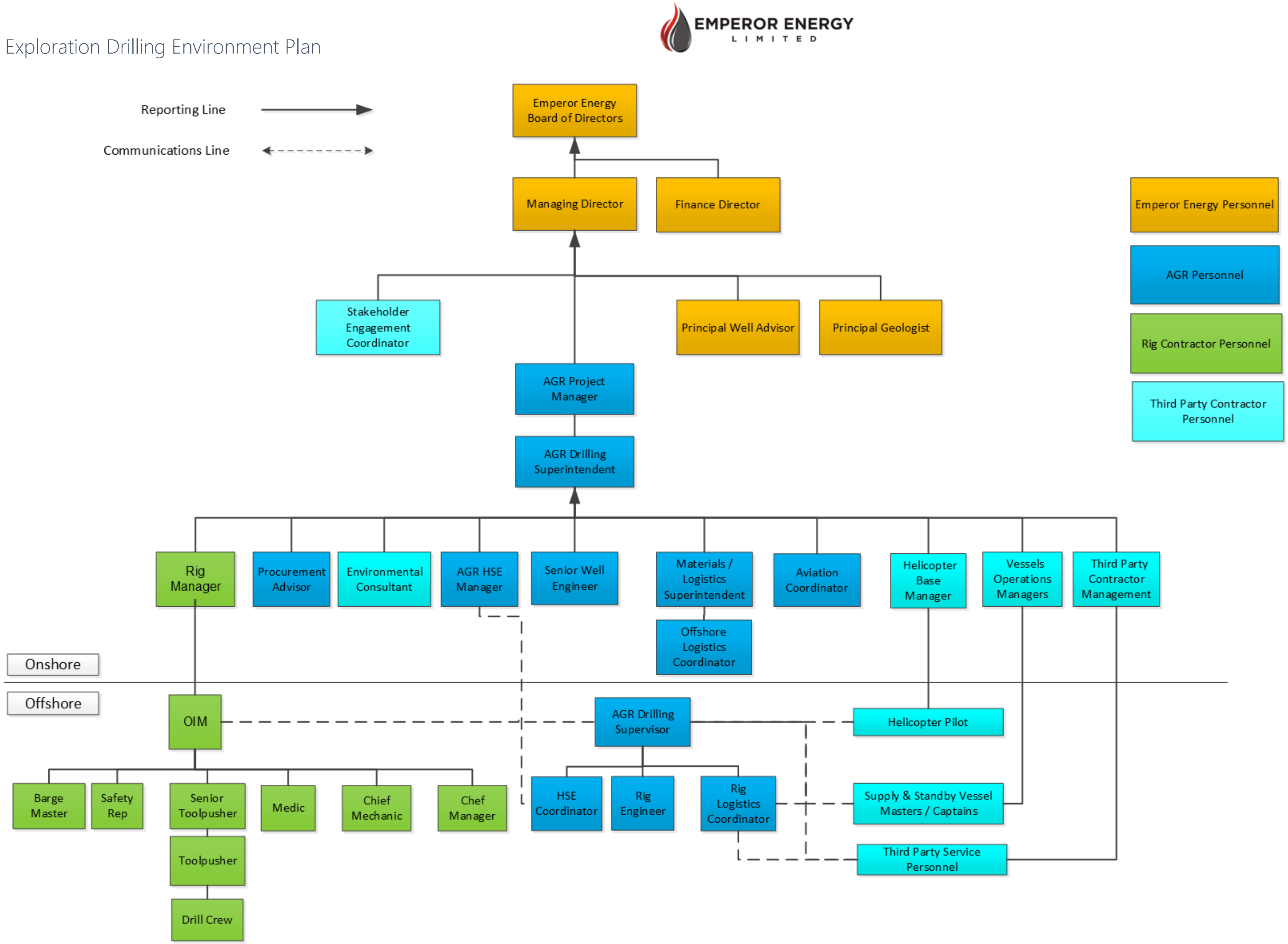

Figure 8-1: Key Emperor Energy and Contractor Personnel

Table 8-1: Key Roles and Responsibilities

ROLE	RESPONSIBILITY
Emperor Energy	
Emperor Energy Managing Director	• Provides direction on stakeholder consultation. • Liaises with and approves incident reports for submission to regulators. • Approves the Environmental Performance Report for submission to NOPSEMA. • Approves the commencement and end-of-activity notification for submission to NOPSEMA and DJPR. • Ensures Emperor Energy accommodates the activity, providing resources e.g., offices and personnel, to ensure the Activity achieves the desired technical, commercial and EHS outcomes. • Ensures AGR is adequately resourced to implement the performance standards in this EP. • Ensures that contractors have appropriate equipment and systems in place to undertake activities in accordance with industry best practice and this EP. • Attends daily operational meetings. • Approve major changes to operations. • Performs routine liaison with NOPSEMA. • Maintains and manages revisions of the EP as necessary. • Maintains and manages revisions of the OPEP as necessary. • Ensures written records of assurance assessment for identified spill response contractors. • Core member of the Emperor Energy's Crisis Management Team (CMT) in the event of an incident. • Reviews legislation and provides updates to the Emperor Energy team on legislative changes and implications for the activity. • Ensures all regulatory approvals are obtained before commencement of the activity. • Reviews environmental approvals documentation.
Emperor Energy Principle Well Advisor	• Primary technical interface between Emperor Energy Team and AGR Team. • Attends daily operational meetings. • Reviews any new or increased environmental impacts and risks (that are not addressed in this EP) in consultation with the Environment Consultant as soon as they are identified as part of the MoC process (see Section 8.9). • Reviews incident reports. • Supports the Emperor Energy Crisis Management Team (CMT) in the event of an incident. • Provides information back to Emperor Energy from the AGR Drilling Incident Management Team (IMT).

ROLE	RESPONSIBILITY
	• Reviews requests for changes to procedures via Emperor Energy Management of Change procedures.
Emperor Energy Environmental Consultant	• Reviews environmental approvals documentation. • Ensures this EP is prepared and revised as required. • Supports preparation of environmental induction and vessel / MODU inspection information as required. • Assists with review, investigation and reporting of environmental incidents. • Leads the investigation and reporting of any environmental incidents. • Monitors environmental performance to confirm that control measures detailed in the EP are effective in reducing the environmental risks of the activity to ALARP and acceptable levels, and the EPOs and EPSs are continually met. • Reviews any new or increased environmental impacts and risks (that are not addressed in this EP) in consultation with the Drilling Superintendent as soon as they are identified as part of the MoC process (see Section 8.9). • Supports stakeholder consultation undertaken as per the requirements of the EP. • Reviews operational reports and gathers evidence demonstrating that EPS have been met. • Prepares the end-of-activity notification for submission to the regulator. • Prepares and submits external regulatory reports required for the Activity, in line with environmental approval requirements and EHS incident reporting procedures. • Supports the AGR Incident Management Team (IMT) in the event of an incident. • Attends daily operational meetings. • Prepares monthly and end-of-activity environmental performance reports.
Emperor Energy Stakeholder Consultation Manager	• Ensures thorough and timely stakeholder consultation is undertaken prior to, during and after the activity. • Maintains a record of stakeholder communications. • Ensures ongoing stakeholder consultation undertaken as per Section 7. • Keeps relevant persons informed of emergency events that may impact their functions or interests.

ROLE	RESPONSIBILITY
AGR	
Project Drilling Manager	• Ensuring AGR's drilling operations perform to the highest required standards of HSEQ as defined by the AGR organisation, government regulators and clients. • Promoting a proactive HSEQ culture within AGR operations and attendance at Project HSE meetings. • Ensuring full and complete HSEQ compliance with client and government regulations. • Ensure that the Well Delivery Process is followed. • Focal Point for MODU selection and Contracting. • Ensuring complete client satisfaction with AGR operations and that AGR carries out its operations to the highest required standard. • Recruitment of onshore and offshore personnel for the operations teams. • Management and selection of operational contractors and service companies. • Leading any required HSEQ incident investigation. • Ensures the MODU and support vessels are appropriately inspected, certified and fit for purpose. • Ensures effective emergency response arrangements are in place for the activity. • Ensures all Emperor Energy and contractor personnel are inducted and are aware of their activity-specific environmental responsibilities. • Ensures all required plans, audits and reviews are undertaken in accordance with the regulatory requirements and as required by the EP.
Drilling Superintendent	• Facilitates clear communications between Emperor Energy, MODU and support vessel contractors during operations. • Ensures compliance with this EP. • Leadership of the Incident Management Team (IMT) • Conducts incident investigations. • Provides daily feedback on operations progress to the Emperor Energy Principle Well Advisor. • Reports all incidents to the AGR Project Drilling Manager and Emperor Energy Principle Well Advisor.
Drilling Supervisor	• Implements the Drilling Program on a daily basis while onboard the MODU. • Ensures third-party compliance with AGR and Emperor Energy Policies, standards and the requirements of this EP. • Identifies any new or increased environmental impacts and risks (that are not addressed in this EP) and communicate these to the AGR Drilling Superintendent as soon as they are identified as part of the MoC process (see Section 8.9).

ROLE	RESPONSIBILITY
	• Ensures all staff and contractors understand their obligations with respect to the management of environmental risk and are appropriately inducted, trained and competent in work activities undertaken. • Reports environmental incidents to the AGR Drilling Superintendent. • Assumes the role of On-scene Commander upon activation of the OPEP. • Maintains clear communication between AGR and the MODU contractor.
HSE Manager	• Manages the preparation of HSE regulatory approvals documents excluding the EP which is prepared by the Emperor Energy Environmental consultant. • Provides technical input to the EP. • Arranges for review of the MODU and vessel contractors' HSE management systems upon contract award. • Prepares the Judith-2 Bridging Emergency Response Plan and OPEP. • Reports recordable and reportable incidents to Emperor Energy via Emperor Energy Well Advisor. • Assists with review, investigation and reporting of environmental incidents.
Offshore HSE Coordinator	• Supports the AGR Drilling Supervisor to ensure the execution of all HSE commitments under the Judith-2 Drilling EP, Safety Case Revision, WOMP and HSE Management Plan. • Supports the AGR Drilling Supervisor in incident investigation. • Provides HSE technical support to the program and works with Rig HSE Officer.
MODU Contractor	
OIM	• Oversees all work activities and work programs ensuring work is undertaken in accordance with procedures, work instructions and in compliance with all legislative requirements and EP commitments. • Ensures all offshore personnel understand their obligations with respect to the management of environmental risk. • Ensures the MODU training matrix is fully implemented. • Ensure rig-entry HSE inductions are conducted. • Ensures waste disposal complies with MARPOL requirements. • Monitors closeout of non-conformances, corrective actions and audit recommendations. • Reports all incidents, near misses and dangerous occurrences to the AGR Drilling Supervisor in accordance with the incident reporting system. • Manages and coordinates offshore emergency response activities.
VSP contractor	• Maintains watch for cetaceans during VSP and implement CM 9. • Implement the EPBC Act Policy Statement 2.1 - Part A (Standard Management Procedures) during VSP.

ROLE	RESPONSIBILITY
	• Records megafauna sightings and interactions during VSP and provides these to AGR at the completion of VSP.
All MODU personnel	• Undertake work activities with reasonable care and in accordance with EP commitments to ensure no adverse impacts to the environment. • Report all new hazards, incidents, near-misses and dangerous occurrences to immediate supervisor as soon as possible. • Participate in the development of work procedures through job safety analysis (JSA) development. • Participate in workplace inspections. • Maintain high housekeeping standards.
Support vessel contractor/s	
Vessel Master/s	• Ensure full compliance with all applicable navigational safety standards and regulations. • Conduct emergency drills. • Supervise vessel crew to ensure they are fit for duty and undertaking work only within their area of qualification and training. • Monitor, report and take appropriate action to remedy any vessel or equipment defects that may impact on safety and environmental performance of the vessel. • Maintain logs of emissions and discharges in accordance with MARPOL regulations. • Ensure that all crew are appropriately qualified, trained and equipped for their roles on the vessel. • Ensure the vessel activities are in compliance with the requirements of this EP. • Report all incidents and near-misses to the Vessel Manager and AGR Drilling Supervisor, recording the details and taking initial actions to render the situation safe.
Vessel Crew	• Apply operating procedures in letter and in spirit. • Follow good housekeeping procedures and work practices. • Attend all necessary toolbox talks and HSE inductions. • Encourage improvement in environmental performance wherever possible. • Immediately report environmental incidents or near-misses to their Supervisor / Vessel Master.

8.4. Environmental Management System

Whilst Emperor Energy is the Titleholder for the activity, contractors such as AGR and the MODU and vessel contractors maintain operational control as per the requirements of their management system.

8.4.1. Emperor Energy HSE Management System

The Emperor Energy HSE Management System structure is summarised in its HSE Management System Manual (EE-HSE-MN01). APPENDIX A). The Emperor Energy HSE Management System will be employed and implemented at all phases of the project in order to demonstrate Emperor Energy commitment to promoting the health and safety of personnel, protection of the environment and the quality of services in line with international best practice and standards.

Emperor Energy is committed to the establishment and ongoing implementation of the HSE MS in all of its project activities.

The Emperor Energy HSE MS applies in full, without modification to all Emperor Energy owned and operated sites, offices and locations where Emperor Energy has operational control. All Emperor Energy employees, contractors and visitors to Emperor Energy operated locations will be required to comply with this HSE MS.

When contractors and subcontractors have been engaged by Emperor Energy to perform work on its behalf, and have operational control, Emperor Energy requires the contractor to have their own HSE MS that meets or exceeds these requirements.

The Emperor Energy HSE MS is structured in a hierarchy, with the Emperor Energy HSE Policy sitting at the top providing an overall statement regarding the importance of HSE and outlining key commitments and arrangements about how this will be achieved.

Supporting the HSE Policy, is the HSE MS Manual which provides details on the key tools and procedures will use to implement its HSE MS as well as act as a roadmap to the system for Emperor Energy and key contractor personnel.

There is a core set of corporate HSE MS policies and other system procedures that underpin the HSE MS, including:

- Hazard Identification and Risk Management (EE-HSE-PC01);
- Contractor HSE evaluation (EE-HSE-PC02);
- Incident reporting and investigation (EE-HSE-PC03);
- Document control (EE-SP-PC01);
- Management of Change (EE-SP-PC02); and
- Crisis and Emergency Control (EE-HSE-PL01).

Emperor Energy has distinguished these procedures as core to the HSE MS, to ensure that key fundamental HSE processes are observed in all of Emperor Energy's activities, whether on project or non-project-based work.

8.4.2. AGR HSE Management System

AGR's management system is accredited with ISO 9001:2015 and ISO 14001:2015 and governs all of the group business as documented in the AGR Management System Manual (AGR-HSEQ-M-01).

AGR uses a standardised management system process to ensure that project activities are planned and managed efficiently and with due consideration to good oilfield practice, local and international standards as they relate to well design, operations planning, construction and then subsequent suspension or abandonment operations. This process is known as the AGR Well Delivery Process (WDP). The AGR WDP is a central component of the AGR Management System and is being used by Emperor Energy for this drilling activity.

The AGR WDP is primarily split into 5 phases, namely:

- Phase 1 Project Scoping – describes the process from initial client contact through to the submission and approval of a formal proposal and the contract management responsibilities between AGR and the client or titleholder.
- Phase 2 Initial Planning – describes the initial engineering planning and design work in order to identify and select a preferred option.
- Phase 3 Detailed Planning – describes the detailed engineering planning and design work to take the preferred option through to the detailed operations guidelines.
- Phase 4 Operations – describes how AGR manage their daily operations on behalf of the titleholder.
- Phase 5 Reporting and Review – describes how AGR analyse and report on the performance of the well and the planning.

8.4.2.1. Well Operations

The AGR WDP is supported by the AGR Well Standard (AP-WDP-S01), which details the standards that apply to all operations planned and conducted by AGR. These are the minimum standards to be applied to the well within AGR unless standards stipulated by local legislation are more onerous. All well operations will be planned and performed in compliance with applicable legislation, regulations, and industry guidelines.

The well is designed, constructed, and operated to maintain well life cycle integrity and to ensure prevention of major accidents in line with the AGR Corporate Major Accident Prevention Policy (CMAPP, AP-HSEQ-S04).

Safety and Environmentally Critical Elements (SECE) can be defined as installation and well equipment and systems (including software) whose purpose is to prevent, limit or control the effects of a major accident or environmental event, or whose failure could cause or increase the risk of a major accident or environmental event.

Within respect to well construction, AGR has identified the following SECE within its control and measures to assure its fitness for purpose:

- Drilling Fluids
- Casing
- Cement Fluids
- Wellheads
- BOP and Drill-string internal BOP
- Rig Selection and Intake
- Managing Shallow Gas Potential
- Weather and Sea State Conditions
- Well Abandonment

Additional detail regarding the WDP will be provided in the WOMP.

During the activity, AGR will identify any new or increased environmental impacts and risks (that are not addressed in this EP) and communicate these to the Emperor Energy Principle Well Advisor as soon as they are identified as part of the MoC (see Section 8.9).

There are daily meetings, daily drilling reports, weekly meetings, and weekly reports between the AGR and Emperor Energy management teams to keep all management personnel appraised of project issues (technical or HSE) as they arise.

The alignment between Emperor Energy's and AGR's EMS components is summarised below in Table 8-2.

Table 8-2: Emperor Energy-AGR EMS Alignment

ISO14001:2015 FRAMEWORK	EMPEROR ENERGY	AGR ALIGNMENT
Environmental Policy		
Environmental policy	The Emperor Energy HSE Policy details Emperor Energy's commitment to the sustainable development of their assets. The HSE Policy is signed by the Executive Directors and is to be reviewed by them as part of the annual review. The HSE Policy is to be communicated to all Emperor Energy employees and contractors.	AGR is part of the ABL Group whose QHSE Policy, last revised in July 2023 is provided to all employees and contractors as part of their induction and is also provided on the company SharePoint site.
Planning		
Environmental aspects	An Environmental Aspects and Impacts Register has been developed by Emperor Energy during the preparation of the for the Judith-2 Exploration Drilling EP.	AGR has a corporate environmental aspects and risk register.
Legal and other requirements	Emperor Energy has prepared the activity-specific environmental legislative requirements addressed in this EP. The EP outlines various obligations of the titleholder which relates to the proposed drilling activities. The EP obligations are provided in the Emperor Energy Legal Obligations Register.	AGR has in place a corporate Legal Requirements Register.
Objectives, targets and programs	Objectives have been set against the significant environmental aspects and recorded in an Environmental Objectives and Targets within the EP. The register also lists actions, improvement programs and controls for achieving those objectives.	AGR has developed Annual HSEQ Objectives.
Implementation		

ISO14001:2015 FRAMEWORK	EMPEROR ENERGY	AGR ALIGNMENT
Resources, roles, responsibility and authority	The Emperor Energy resources including their roles, responsibilities and authority have been outlined in this EP.	AGR has an HSE Manager who is experienced in managing offshore petroleum activities and are responsible for advising the AGR Project Drilling Manager. They are also responsible for measuring and reporting on the performance against the EPO and EPS in this EP. Key subcontractor roles and responsibilities under AGR management are also outlined
Competence, training and awareness	Personnel and contractors are required to have the training, qualifications and competencies appropriate with their roles and responsibilities. contractors.	AGR has defined competency and training requirements for each of its project team member roles.
Communication	The Emperor Energy Judith-2 Principle Well Advisor, AGR Project Drilling Manager, AGR Drilling Superintendent and HSE Manager, attend weekly Project meetings to ensure that key environmental and stakeholder issues are identified and communicated to relevant project personnel to meet the EPOs and EPSs in this EP.	
Control of documents	The documents and records management process to detailed in the Emperor Energy Document Control procedure requires current versions of key documents are available and promptly removed from service when obsolete. HSE documents and records are to be stored in a manner that makes retrieval practicable.	The AGR Document and Data Control system is in use to ensure that all relevant controlled Judith-2 drilling design, planning and execution documents have a MoC process in place and that all changes go through a defined level of review and approval before being issued for use.
Operational control	The Emperor Energy Well Advisor, AGR Project Drilling Manager, AGR Drilling Superintendent with the assistance of the AGR HSE Manager and the Offshore HSE Coordinator, are responsible for the ensuring the EPOs and EPSs in this EP are communicated to and implemented by MODU and vessel personnel.	
Emergency preparedness and response	The Emperor Energy Crisis Management Team (CMT) forms to coordinate a company-wide strategic response to a crisis. Crisis events are those incidents which may threaten the company's reputation and/or the commercial viability of any of its activities/operations. A crisis may arise from a non-operational event (business) event, or from an operational emergency event threatening the safety and security of	AGR is responsible for the preparation of the activity-specific ERP and OPEP and provides the Drilling Incident Management Team (DIMT) resources required to manage any environmental incident and provides resources where required to the Emperor Energy

ISO14001:2015 FRAMEWORK	EMPEROR ENERGY	AGR ALIGNMENT
	Emperor Energy personnel, stakeholders and/or the environment. The Emperor Energy Crisis Management Plan (CMP) has been prepared to support and contribute to this commitment, by providing a standard mechanism for the Emperor Energy CMT.	CMT to manage any oil spill response effort.
Checking		
Monitoring and measurement	The Emperor Energy Performance Measurement and Monitoring process assesses HSE performance by gathering and analysing HSE data and reporting on performance. HSE information is effectively communicated as appropriate within Emperor Energy to ensure adjustments to priorities, updates to Management System and allocation of resources necessary to achieve HSE objectives. As part of the planning process for an activity, HSE data requirements are to be identified and processes put in place to obtain the appropriate data. This includes data required to be reported to regulators. The Empower Energy Principal Well Advisor is responsible for reviewing HSE data to effectively manage performance.	The AGR HSE Manager, supported by the AGR Offshore HSE Coordinator, is responsible for preparing the required monitoring program to ensure the activity-specific EPOs are achieved. They are also responsible for communicating these to the AGR Drilling Superintendent, Project Drilling Manager and Emperor Energy Principal Well Advisor during the implementation phase.
Evaluation of compliance	The Emperor Energy Principal Well Advisor is responsible for preparing the end-of-activity compliance report for submission to NOPSEMA.	The AGR HSE Manager supports the Emperor Energy compliance process by planning the drilling activity compliance assessment process and providing monitoring and audit reports to Emperor Energy on a timely basis.
Non-conformity, corrective and preventative action	Emperor Energy Incident Reporting, Investigation and Analysis is committed to preventing incidents and empowers personnel and contracts to "Stop the Job" if they feel there is a risk of harm to people, the environment, or assets. When incidents or near-misses occur, Emperor Energy will ensure that they are reported, recorded, investigated and actions implemented to prevent re-occurrence.	The AGR Incident Reporting and Investigation procedure (AGR-HSEQ-P05) and the Non-conformance and Corrective Action procedure (AGR-HSEQ-P03) will be used to record and manage all incidents and non-conformances with this EP. AGR will record all incidents and non-conformances in its GO Intranet as well as supply the information to Emperor Energy who will

ISO14001:2015 FRAMEWORK	EMPEROR ENERGY	AGR ALIGNMENT
		record the incident in the Incident and Action Tracking Register.
Control of records	The documents and records management process to detailed in the Emperor Energy Document Control procedure to ensure current versions of key documents are available and promptly removed from service when obsolete. HSE documents and records are to be stored in a manner that makes retrieval practicable.	The AGR Document and Data Control procedure will be used to record all supporting EMS documentation and records with copies supplied to Emperor Energy.
Internal audit	Emperor Energy undertakes audits to verify that legal and Emperor Energy Management System requirements are being undertaken by the company and its contractors. Audits will be scheduled based on legal requirements, as identified in the Obligations Register, or where there is a material risk to the company.	AGR has an internal audit schedule to ensure that the Well Delivery Process (WDP) is adhered to during activity management activities.
Management review	Emperor Energy Management reviews are conducted in a consistent and visible way as means of reviewing performance and effectiveness the Management System. Management reviews of environmental performance and of the implementation strategy should occur at planned intervals to ensure that the EMS is effective, adequate resources are available for implementing the EP and to identify and address any necessary changes to the management of environmental impacts and risks for the activity. An annual review is undertaken to evaluate the effectiveness of the management system in delivering performance outcomes and addressing any opportunities for improvement to the management system. The aim of the review is to ensure that the management system is effective, adequate resources are available for implementing the management system and any legal requirements such as the EP and WOMP and to identify and address any necessary changes to the management of the company's impacts and risks. The annual	AGR has an annual Management System Review in accordance with its ISO 14001 certification requirements. The AGR HSE Manager and AGR Offshore HSE Coordinator keep the Emperor Energy team informed of environmental issues for the planning and operations phase of the activity during weekly team meetings and internal reporting.

ISO14001:2015 FRAMEWORK	EMPEROR ENERGY	AGR ALIGNMENT
	management review is undertaken using the Management Review Form.	

8.4.3. MODU and Vessel Contractors

The MODU and vessel contractors will be required to have a Health, Safety and Environment Management System that meets the requirements of the Emperor Energy Policies as well as the requirements of the Emperor Energy and AGR contractor HSE selection process.

Contractors have specific duties as outlined in the EP and OPEP, and their local management will be specifically briefed on these obligations, as well as being provided with copies of the EP, the OPEP, and extracts of the EP commitment register that highlight their obligations.

Service companies and marine contractors providing the vessel are required to be included in general induction processes. Where their work provides some additional environmental risk (beyond that covered by existing processes), they will be briefed on the applicability of the EP to their operations and any performance requirement obligations.

Emperor Energy will use the following processes to share the responsibilities with the contractors to assess their capability:

- Campaign briefings.
- Desk-top exercises.
- Provision of copies of the EP and OPEP.
- Provision of EP commitment register.
- General contractor management (setting up contracts, the scope of work, face to face meetings).

Emergency response contractors are considered in the OPEP.

8.5. Competency, Training and Awareness

8.5.1. Competency and Training

A competent, fully resourced organisation, MODU and support vessels are a key component to ensure all personnel are aware of environmental obligations.

The Emperor Energy HSE Management System (EE-HSE-MN01) provides information for the effective management of contractors to ensure EHS performance for the life cycles of the contract, from the contractor selection process through to post-contract performance. The roles that require formal industry-recognised qualifications will be identified and the suitable certificates will be verified through audit of training records prior to the commencement of the activity. Certifications will be recorded in Emperor Energy's and its contractor records systems.

Environmental performance monitoring and audit (Section 8.10) will be used to ensure compliance and demonstrate competency. Where incidents or non-conformances are identified, corrective actions to prevent reoccurrence will address, where appropriate, competency issues such as the need for additional training and awareness.

8.5.1.1. Contractor Competency

AGR will conduct a due diligence review during the contractor selection process to ensure that the chosen MODU and vessel contractors have policies and procedures in place to ensure the correct selection, placement, training, and ongoing assessment of employees, with position descriptions (including a description of HSE responsibilities) for key personnel being readily available.

This process is addressed in AGR's Contractor Evaluation Procedure (AGR-LCSM-P-02) procedure which focuses on areas of policies, organisation, risk assessment planning and performance.

8.5.1.2. AGR Personnel Competencies

AGR's Wells Competency Management System (AP-WDP-M16) describes how it manages the competence of individuals and teams to carry on their work and associated risks. This includes staff, consultants, associates, and third-party suppliers.

Importantly, this system specifies the roles and responsibilities and qualifications and training requirements for safety and environmentally critical positions (SECP) including the Drilling Supervisor, HSE Manager, Principal Engineer, Senior Completions Engineer and so forth. Position-specific competence matrices are available for these roles and are used to guide and record assessments of skills.

8.5.1.3. Drilling Supervisors

AGR's Operations Supervision Manual (AP-WDP-M13) provides detailed guidance for all AGR Well Management Supervisors (i.e., Drilling Supervisors) to ensure that drilling is undertaken in accordance with AGR standards and policies. It specifies that people in this role have a Subsea Supervisor International Well Control Certificate, offshore survival training, industry safety training, oil spill training and offshore medical training at a minimum. This manual provides the minimum standards required to ensure well control is maintained, and provides specifications for optimising drilling parameters, adequate bulk and drilling fluids, coring operations, casing/wellhead operations, cementing, formation strength tests, wireline logging, well testing and completions, and well abandonment.

8.5.2. Environmental Induction and Awareness

Each employee responsible for the implementation of task-specific control measures during operational activities shall be aware of their specific responsibilities detailed in this EP as per Regulation 22(3)(4) of the OPGGS(E) Regulations. People who hold responsibilities relating to the implementation of this EP are hired by Emperor Energy on the basis of their particular qualifications, experience, and competencies.

Personnel with specific responsibilities under this EP will be made aware of the environmental requirements via a project-specific induction prior to commencing the activity.

All MODU and support vessel crews, including subcontractors, will attend an induction that includes an overview of this EP. This induction fosters environmental stewardship amongst all personnel and ensures that they are aware of the control measures implemented to minimise the potential impact on the environment, before commencing operations.

8.5.2.1. Activity-specific Induction

An activity specific HSE induction for all personnel working on the activity will be undertaken prior to commencement. This is likely to take place during a pre-spud meeting, with additional inductions undertaken on the MODU and support vessels to take account of any crew change-outs.

The environmental component of the induction will include information on the following environmental issues:

- Awareness of Emperor Energy HSE Management System.
- Description of the environmental sensitivities, conservation, and heritage values of the EMBA.
- An outline of the control measures in this EP to achieve the environmental performance outcomes.
- Importance of following procedures and using JSAs to identify environmental risks and mitigation measures.
- Procedures for responding to and reporting environmental hazards or incidents.
- Overview of emergency response and spill management procedures.
- Overview of the waste management requirements.
- Roles and environmental responsibilities of key personnel aboard the MODU and vessels.

The AGR Drilling Supervisor is responsible for ensuring personnel receive this induction prior to the commencement of the activity and will be supported by the Offshore HSE Coordinator. All personnel are required to sign an attendance sheet to confirm their participation in and understanding of the induction.

8.5.2.2. Facility-specific Induction

The MODU and vessel contractors will conduct their own company and vessel-specific inductions independently of the activity-specific HSE induction.

8.5.3. Oil Spill Response Training

Quarterly training of MODU and vessel crews in Vessel Shipboard Marine Pollution Emergency Plan (SMPEP) procedures is a MARPOL requirement for vessels over 400 GRT (Annex 1, Regulation 37).

During its contractor audit process, Emperor Energy will assess the MODU and vessel contractors' implementation of their SMPEPs (or equivalent, relevant to class).

Oil spill response capability and competencies are detailed in Section 6 of the Judith-2 Exploration Well OPEP.

Oil spill response exercises will be conducted as detailed in Section 3 of the Judith-2 Exploration Well OPEP.

8.5.4. Toolbox Talks and HSE Meetings

Environmental matters will be included in daily toolbox talks as required by the specific task being risk assessed (e.g., waste management).

Environmental issues will also be addressed in daily operations meetings and weekly HSE meetings, where each shift will participate with the AGR Drilling Supervisor, Offshore HSE Coordinator and support vessel Masters in discussing HSE matters that have arisen in the previous week, and issues to consider for the following week.

Records associated with activity-specific training, environmental training, inductions and attendance at toolbox meetings will be recorded and maintained on board the vessel.

8.5.5. Communications

The MODU contractor, support vessel Masters and AGR Drilling Supervisor are jointly responsible for keeping their personnel informed about HSE issues, acting as a focal point for personnel to raise issues and concerns, and consulting and involving all personnel in the following:

- Issues associated with the implementation of the EP.
- Any proposed changes to equipment, systems, or methods of operation of equipment, where these may have HSE implications.
- Any proposals for the continuous improvement of environmental protection, including the setting of environmental objectives and training schemes.

Table 8-3: Key Meetings Proposed to Take Place Onshore and Offshore During the Activity

MEETING	INDICATIVE FREQUENCY	ATTENDEES
Onshore		
Emperor Energy AGR Project Management	Daily	• Emperor Energy – Principal Well Adviser, AGR – Drilling Project Manager, Drilling Superintendent, Senior Drilling Engineer, Logistics Superintendent, HSE Manager, Drilling Supervisor, HSE Coordinator • MODU - OIM • Vessels – Masters • Third Party Contractors – as required depending on phase.
Offshore		
Operations	Daily	OIM, MODU Department Heads, AGR Drilling Supervisor, HSE Coordinator
Pre-start safety meeting Toolbox	Daily, prior to each shift	All personnel
HSE	Weekly	All personnel
Pre-start safety meeting Toolbox	As required, based on identified safety issues	Task personnel

8.6. Environmental Emergencies and Preparedness

In the event of an emergency of any type, the MODU OIM and support vessel Master will assume overall onsite command and act as the Emergency Response Coordinator (ERC). All persons aboard the MODU and support vessels will be required to act under the ERC's directions. The AGR Drilling Supervisor will maintain communications with AGR Drilling Incident Management Team (DIMT) in the event of an emergency involving an oil spill, who will then liaise with the Emperor Crisis Management Team. Oil spill emergency response support will be provided by the AGR DIMT. Overall emergency management will be via AGR's DIMT based in AGR's office during program execution. For further details refer to the Judith-2 Exploration Well OPEP.

8.6.1. Adverse Weather Protocols

It is the duty of the MODU OIM and the Vessel Master to act as the central point for all actions and communications with regards to any emergency, including response to extreme weather or sea state, to safeguard the vessel, all personnel onboard, and the environment.

During adverse weather, the MODU OIM and Vessel Masters are responsible for the following:

- Ensuring the safety of all personnel onboard.
- Monitoring all available weather forecasts and predictions.
- Initiating the safety management systems, HSE procedures and / or ERP (Emergency Response Plan).
- Keeping the AGR Drilling Supervisor fully informed of the prevailing situation and intended action to be taken.
- Assessing and maintaining security, watertight integrity, and stability of the MODU and vessels.
- Proceeding to identified shelter location(s) as appropriate.

Other appropriate responsibilities shall be taken into consideration as dictated by the situation.

In addition to using Very High Frequency (VHF) Marine Radio Weather Services, the MODU and support vessel contractors will obtain daily weather forecasting from the Bureau of Meteorology to monitor weather within the activity area in the lead up to and for the duration of the activity.

8.6.2. MODU and Support Vessel Emergencies and Oil Spills

Activity-specific emergency response procedures will be included in the MODU and vessel contractors' ERPs. The ERPs will contain instructions for MODU and support vessel emergency, medical emergency, search and rescue, reportable incidents, incident notification and emergency contact information.

AGR will ensure that the MODU and vessel contractors have appropriate emergency plans in place for all relevant environmental emergency events (including the assignment of emergency management roles for particular events). Environmental emergencies that will be considered will include (but not be limited to):

- Introduction of animal diseases into aquaculture (no aquaculture operations in or around activity area).
- IMS incursions (addressed in this EP).
- Cetacean stranding and vessel strike (addressed in this EP).
- Maritime casualties, requiring salvage and intervention, emergency towage and requests for a place of refuge.
- Marine pollution from floating or sunken containers of hazardous materials.
- Debris originating from a maritime casualty.
- Physical damage caused by vessels.

- Fire or explosion on the vessel.
- Hijack/terrorism.
- Adverse weather.

SMPEPs and ERPs typically include MODU- and vessel-specific procedures for the following:

- Fire and explosion.
- Incidents – collision, grounding, hull damage, man overboard, equipment failure.
- Helicopter crash.
- Waste management.
- Hazardous materials and handling.
- Hydrocarbon and chemical spills.

The SMPEP includes information about initial response, reporting requirements and arrangements for the involvement of third parties having the appropriate skills and facilities necessary to respond effectively to oil spill issues. The MODU ERP and vessels' SMPEP will be the principal working documents for the MODU and vessel crews in the event of a marine oil spill incident. These documents will include specific emergency procedures including steps to control discharges for bunkering spills, hull damage, grounding and stranding, fire and explosion, collisions, MODU/vessel list, tank failure, sinking and vapour releases. The SMPEP also includes requirements for regular drills of the plan and revision following drills or incidents.

The Judith-2 Exploration Well OPEP will be implemented (and supplements the MODU and support vessel-specific SMPEPs) in the event of a Level 2 or Level 3 hydrocarbon spill that requires response resources beyond those immediately available to the MODU or vessels. The Judith-2 Exploration Well OPEP details the response actions aimed at minimising the impacts of subsea well loss of containment or an MDO spill on sensitive resources.

The MODU OIM and Vessel Masters will ensure that their crews are fully aware of their requirements and that exercises for MODU or vessel-related incidents are conducted.

8.6.3. Emergency Response Training

8.6.3.1. Activity-specific training

The readiness and competency of Emperor Energy, AGR, MODU contractor and vessel contractors to respond to incidents and emergencies will be tested by conducting a desktop emergency response exercise as detailed in Section 3 of the Judith-2 Exploration Well OPEP.

The scenario chosen may combine an emergency with risk to human life (such as fire) and risk to the environment (large hydrocarbon spill). This way several plans (i.e., the ERP and OPEP) can be tested simultaneously.

8.6.3.2. MODU-specific training

The MODU OIM is responsible for ensuring that personnel fulfilling emergency response roles are competent in crisis and emergency procedures related to the protection of health, safety, environment and integrity. The level of training and associated competency demonstration is dependent on individual roles in a crisis or emergency situation.

The MODU OIM is also responsible for ensuring relevant personnel undertake oil spill preparedness and response training in line with the MODU's personnel training and qualifications matrix. This includes identification and development of approved competency and non-competency-based courses and ensuring training is undertaken to schedule and records are maintained.

8.7.Recording and Reporting

8.7.1. Internal Recording and Reporting

Routine internal recording and reporting of activity HSE matters will encompass the following:

- Daily teleconferences – held between the MODU OIM, Vessel Masters, AGR, and Emperor Energy personnel each morning for an update on progress from the previous day and the forward plan, including any HSE matters that have arisen.
- Daily operations reports – the AGR Drilling Supervisor will prepare a Daily Drilling Report, including data on activities conducted for the day and any HSE issues arising and distributed to the extended project team.
- HSE reporting – the AGR Offshore HSE Coordinator will collate key HSE performance statistics on a daily basis and report those to the wider project team during daily teleconferences.

8.7.2. External Recording and Reporting

Routine external recording and reporting of activity HSE matters to be undertaken by Emperor Energy are detailed in Table 8-4. Activity notification and stakeholder requirements are detail in Section 7.2 and incident reporting requirements are detailed in Section 8.7.3.

Table 8-4: External Routine Reporting Requirements

REQUIREMENT	TIMING	DETAILS
Activity environmental performance report	Within 3 months of activity completion	An environmental performance report that details the outcomes of each EPO and EPS in the EP (in accordance with OPGGS(E) Regulation 26C(1)) will be submitted to NOPSEMA within 3 months of completion of the activity.
Provide marine fauna observation data to DCCEEW	Within 3 months of activity completion	For drilling: Upload information via the online National Marine Mammal Data Portal https://data.marinemammals.gov.au/report/sighting For site surveys: Upload via the online Cetacean Sightings Application https://data.marinemammals.gov.au/csa

8.7.3. Incident Recording and Reporting

All environmental near-misses and incidents, including non-compliance with the EP EPOs and EPSs, must be communicated immediately to AGR's HSE Manager, who will report to the Emperor Energy Principle Well Advisor. The expectation of incident reporting will be reinforced at inductions, daily toolbox meetings and weekly HSE meetings.

All environmental near-misses and incidents will be recorded in the Emperor Energy incident management system. The MODU OIM and/or Vessel Master will lead an investigation into the cause, effects, and learnings of the incident as per the contractor's investigation procedures. Where circumstances warrant it, an investigation will be conducted jointly with the AGR Drilling Supervisor. Following an investigation, the MODU and/or vessel contractor and Emperor Energy will develop remedial actions and communicate these to project personnel (and broader organisations, as appropriate) to prevent a recurrence. Incident recording and reporting actions will be tracked to completion.

Section 5 of the OPGGS(E) defines the following incident types:

- Recordable incident – a breach of an EPO or EPS in the EP that is not a reportable incident.
- Reportable incident – an incident relating to the activity that has caused, or has the potential to cause, moderate to significant environmental damage.

Emperor Energy interprets 'moderate to significant' environmental damage as being those hazards identified through the impact and risk assessment process (Section 5) as having an inherent or residual impact consequence of 'medium', 'significant' or 'high', or an inherent or residual risk ranking of 'significant' or 'high.' Impacts and risks with these ratings (as outlined throughout Section 5) are:

- Introduction of IMS
- Accidental Release - Vessel Collision
- Accidental Release – Loss of Well Control

As such, incidents relating to these matters are defined as reportable incidents.

Part 5 of the OPGGS(E) describes the requirements for verbal notifications and written reporting of recordable and reportable incidents. Table 8-5 outlines the incident reporting obligations that Emperor Energy will undertake with external organisations.

Table 8-5: Incident Reporting Requirements

RECORDABLE INCIDENT REPORTING – REGULATION 26B	
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 environmental performance outcomes and standards.	
REPORTING REQUIREMENTS	**REPORT TO / TIMING**
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.	Submit written report to NOPSEMA by the 15th of each month.

- If no recordable incidents occur during the reporting month, a 'nil report' will be submitted.

REPORTABLE INCIDENT REPORTING – REGULATION 50 AND 51	
Legislative definition of 'reportable incident': *'Reportable incident, for an activity means an incident relating to an activity that has caused or has the potential to cause an adverse environmental impact; and under the environmental risk assessment process the environmental impact is categorised as moderate to significant environmental damage.'* Therefore, reportable incidents under this EP are those unplanned events that have a severe or greater impact severity or medium or greater risk level. In accordance with this definition, the reportable incidents identified under this EP are: • Introduction of IMS • Accidental Release - Vessel Collision • Accidental Release – Loss of Well Control	
REPORTING REQUIREMENTS	**REPORT TO / TIMING**
Verbal notification that must contain: • All material facts and circumstances concerning the incident. • Any action taken to avoid or mitigate the adverse environmental impact of the incident. • The corrective action that has been taken or is proposed to be taken to stop control or remedy the reportable incident. Verbal notification of a reportable incident to the regulator must be followed by a written report. As a minimum, the written incident report will include: • The incident and all material facts and circumstances concerning the incident. • Actions taken to avoid or mitigate any adverse environmental impacts. • The corrective actions that have been taken, or may be taken, to prevent a recurrence of the incident. • The action that has been taken or is proposed to be taken to prevent a similar incident occurring in the future.	Verbal notification within two hours of the incident occurring or becoming aware of the incident. Report verbally to NOPSEMA within two hours or as soon as practicable and provide written record of notification by email. Phone: 1300 674 472 Written report to be provided to NOPSEMA not later than 3 days after the first occurrence of the incident. Email: submissions@nopsema.gov.au Written report to be provided NOPTA and Vic DJPR within 7 days of written report submission to NOPSEMA. Email: reporting@nopta.gov.au Email: marine.pollution@ecodev.vic.gov.au
ADDITIONAL REPORTING REQUIREMENTS	
REPORTING REQUIREMENTS	**REPORT TO**

All discharges /spills or probable discharges/spills to the marine environment of oil or oily mixtures, or noxious liquid substances in the marine environment from vessels. Reporting info: http://www.amsa.gov.au/forms-and-publications/AMSA1522.pdf	Immediate notification by the Vessel Master to AMSA. Follow-up with Marine Pollution Report (POLREP). Phone: 1800 641 792 Email: rccaus@amsa.gov.au AMSA POLREP: https://amsa-forms.nogginoca.com/public/
In the event an AMP may be exposed to hydrocarbons. Notification must be provided to the Director of National Parks and include: • Titleholder details. • Time and location of the incident including name of marine park likely to be affected. • Proposed response arrangement. • Confirmation of providing access to relevant monitoring and evaluation reports when available. • Contact details for the response coordinator.	Verbal notification ASAP. 24 hr Marine Compliance Duty Officer Phone: 0419 293 465
Death or injury to an EPBC Act Listed Species as a result of the petroleum activity	Report within seven business days to DCCEEW. Phone: 1800 803 772 Email: EPBC.Permits@environment.gov.au
Vessel collision with marine mammals (whales)	ASAP for cetacean injury assistance report to Whale and Dolphin Emergency Hotline Phone: 1300 136 017 Within 72 hours report to DCCEEW – online National Ship Strike Database https://data.marinemammals.gov.au/report/shipstrike
Presence of any suspected marine pest or disease within 24 hours	Verbal notification ASAP. Email: marine.pests@agriculture.vic.gov.au Phone: 136 186
Identification of any historic shipwrecks, aircraft or relics	Written notification within 1 week. Written notification via the notification of discovery of an historic shipwreck or relic online submission form. https://environment.gov.au/shipwreck/public/forms/notification.do?mode=add

8.8. Record Keeping

All records relevant to the EP will be stored and made available as per Regulation 52 and 53 of the OPGGS(E) Regulations. Emperor Energy will generate and keep records for five years upon completion of the activity, including the items detailed in Regulation 52 of the OPGGS(E) Regulations.

8.9. Management of Change

8.9.1. Changes to EP Scope

Identification and potential approval of changes to scope (e.g., timing or operational details described in this EP) is the responsibility of Emperor Energy Principal Well Advisor, in conjunction with the Emperor Energy Development Manager. A risk assessment will be undertaken for any change in scope to assess the potential impacts of the change. If the change represents a significant modification that is not provided for in the accepted EP in force for the activity, a revision of the EP will be conducted in accordance with Regulation 39 of the OPGGS(E) Regulations.

Emperor Energy's Management of Change (MoC) provides direction for management of change for Emperor Energy's activities. It shall be used to ensure changes to approved work programs (e.g., systems, legislation, procedures, equipment, products, materials and planning etc.) are appropriately considered, and approved if acceptable, by the appropriate personnel.

8.9.2. Emperor Energy MoC Process

Adjustments to management systems, approved work programs and any related information (e.g., details of the environment and legislative requirements) are to be routinely reviewed and assessed to identify and manage internal implications and to be approved if acceptable. Relevant changes are required to be assessed to ensure that new or increased company or HSE impacts and risks are identified and managed.

Relevant changes include:

- New activities, assets, equipment, processes, or procedures proposed to be undertaken or implemented that have company or HSE impacts or risks and have not been.
    - Previously assessed, in accordance with the requirements of the Emperor Management System.
    - Authorised in the Emperor Energy Management System or existing approvals, management plans, procedures, work instructions, or other plans.
- Proposed changes to activities, assets, equipment, processes, or procedures that have the potential to impact on the company, people, the environment, community, or stakeholders.
- Changes to requirements of an existing external approval such as the WOMP and/or Environment Plan.
- New information or information changes from research, stakeholders, legal and other requirements, and any other sources used to inform internal processes, procedures or decisions and external approvals such as the Environment Plan.

Relevant changes are to be assessed using the Management of Change Form. If a change is identified that is relevant to an accepted Environment Plan, the Management of Change Procedure will be followed, to determine if the change triggers a legislative requirement to resubmit the Environment Plan.

8.9.3. AGR MoC Process

Emperor Energy will utilise the AGR Management of Change (AP-WDP-M 09) for all changes in activity throughout the planning and drilling of the Judith 2 exploration well. This will include changes to regulatory documentation such as this EP, any changes to the program that may impact environmental performance, any new environmental impacts, and risks, and will evaluate if there is any impact from these changes that may trigger a revision to the EP. AGR, in conjunction with the Emperor Energy Principal Well Advisor, will ensure any changes triggering an EP revision as per the OPGGS(E) Regulations are captured as part of the

MoC process. Emperor Energy has evaluated AGR's MoC procedure and verified that it meets its requirements as the Titleholder and the OPGGS(E) Regulations.

The process is applied after the approval of the Detailed Drilling Guidelines to all changes and deviations for the activity until the completion of activity.

Permanent or temporary changes to organisation, equipment, plant, standards, or procedures that have potential HSE and/or integrity impacts are subject to formal review and approval prior to initiating the change to ensure impacts and risks remain acceptable and are reduced to ALARP. The level of management approval for each change is commensurate with the risk.

Changes are classified as minor, significant, or major and are described below.

8.9.3.1. Minor Change

A minor change is a change to an approved plan, work programme (or a procedure referenced in it) that has no safety, environmental or well integrity implication, adds less than AUD$100,000 to the cost of the operation and has no impact on the operation's objectives (e.g., additional core sample/s).

Minor changes to the activity will be discussed and agreed at the daily operations meeting. All activity changes will be confirmed by email from the AGR Drilling Superintendent, or designate, to the AGR Drilling Supervisor.

When operations are being conducted, the AGR Drilling Superintendent must provide approval. All minor changes must be confirmed via email and approved by the AGR Drilling Superintendent.

8.9.3.2. Significant Change

A significant change is defined as a change to an approved plan or work programme that does not impact the operation's objectives but could have a direct implication to safety, the environment (i.e., increase in impact or risk profile above that of the originally planned program), and/or increase the cost of the operation by more than AUD$100,000 but less than AUD$250,000.

Significant changes to the plan or programme, or significant operations not included in the programme, will be discussed, impact and risk will be assessed and agreed by the onshore and offshore teams and confirmed in writing with an approved Programme Supplement or Amendment. This will be issued prior to commencing the change in programme. The AGR Drilling Superintendent will discuss the proposed change with the Emperor Energy Principal Well Advisor, the MODU Manager/OIM and the Vessel Masters. The Supplement or Amendment is developed by the relevant engineer and approved by the AGR Drilling Superintendent, AGR Project Manager, or his delegate and the Emperor Energy Principal Well Advisor and issued to the team.

All changes will be assessed to ensure any new impacts or risks, or significant change in impact or risk level, are identified.

If the change influences environmental aspects of the activity, the Emperor Energy Principal Well Advisor and the AGR HSE Manager must be consulted to determine whether an EP revision is triggered and to follow Emperor Energy's process for environmental change.

Following this MoC process, Emperor Energy will assess and undertake the necessary revision/resubmission of the EP as described in Section 8.9.1 assisted by the AGR project team as required.

8.9.3.3. Major Change

A major deviation from plan that results in a deviation from the Judith-2 exploration drilling activity, Emperor Energy policies and standards, has a direct safety or environmental implication (i.e., an increase in risk profile above that of the originally planned program), an EP revision being triggered, the design of the investigation program changing and/or will result in the Authority for Expenditure being exceeded.

Changes affecting the approved activity require an approved Program Supplement or Amendment to be issued. The AGR Drilling Superintendent will discuss the proposed change with the Emperor Energy Principal Well Advisor, AGR Drilling Project Manager and the MODU Manager/OIM. The Supplement or Amendment is developed by the relevant engineer and approved by the Emperor Energy Principal Well Advisor and the AGR Drilling Project Manager, or his delegate.

Exceptionally, if conditions demand an immediate response to safeguard the MODU or a vessel, then the AGR Drilling Supervisor is authorised to implement any necessary changes to the program with the agreement of the MODU Manager/OIM or Vessel Masters. Contact with the AGR Drilling Superintendent or their delegate should be made as soon as reasonably practicable. A Programme Supplement or Amendment should be prepared the next working day.

All changes are assessed to ensure any new impacts or risks, or significant changes in risk level are identified.

If the change influences the activity's environmental aspect, the Emperor Energy Principal Well Advisor and the AGR HSE Manager must be consulted to determine whether an EP revision is triggered.

Following this MoC process, Emperor Energy will assess and undertake the necessary revision/resubmission of the EP as described in Section 8.9.1 assisted by the AGR project team as required.

8.10. Monitoring and Audit

8.10.1. Field Environmental Monitoring

Emperor Energy will maintain a quantitative record of emissions and discharges and other environmental matters generated on location during the activity, as required under Regulation 22(6) of the OPGGS(E) Regulations.

The MODU and vessel contractors are responsible for collecting and reporting the required data to the AGR Drilling Supervisor. The collection and reporting of data is facilitated, in part, by completing a daily environmental monitoring register that AGR will provide to the contractor, which captures the commitments made in Section 5.7. The monitoring and recording requirements for the activity are detailed in Table 8-6 and emission and discharge reporting requirements are detailed in Table 8-7. Where applicable this data will be used to determine the activity's performance against the EPOs and EPSs.

Table 8-6: Monitoring and Recording Requirements for the Activity

ACTIVITY	MONITORING	RECORD KEEPING
Training	Details of crew environmental inductions.	Induction Record Sheets.
Waste management	Quantities of waste landfilled, recycled, and discharged.	Waste Log Garbage Record Book,

		Spill response operations – waste transfer logs.
Fauna interactions	Fauna sightings. Any interactions between marine fauna and vessels.	DCCEEW fauna sightings report forms and records of transmittal to DCCEEW.
Incident reporting	Number and details of environmental incidents.	EHS incident reports.
Compliance reporting	Compliance with EP EPOs and EPSs.	Completed environmental inspection / audit check sheet.
Maintenance	Maintenance schedule for applicable equipment.	PMS records.
On-going Consultation	Records of consultation with stakeholders.	Transmittals to stakeholders and responses.

Table 8-7: Emissions and Discharges to be Recorded for the Activity

EMISSION OR DISCHARGE	INFORMATION RECORDED	BY WHOM AND WHEN	RECORDS AND REPORTING
MODU/Vessel			
Bilge water	Volume, location and vessel speed	Vessel Master, as required.	Oil Record Book
Ballast water discharges	Volume, location	Vessel Master, as required.	Ballast Water Record System
Chemical discharges to marine environment	Chemical name, type, use and volume	Drilling Contractor, after each batch discharge or daily for ongoing.	Daily Report
Fuel use	Volume of fuel used.	Vessel Master / OIM, daily.	Daily Report
Oil in water discharged overboard from vessels >400 tonnes	Volume and concentration of oil discharged.	Chief Engineer, after each batch discharge or daily for ongoing.	Oil Record Book.
Sewage from vessels >400 tonnes	Volumes discharged overboard.	Chief Engineer, estimates daily.	Garbage Record Book
Waste	Quantities and types of waste backloaded to shore.	Chief Engineer, after each backload.	Garbage Record Book
Drilling			

EMISSION OR DISCHARGE	INFORMATION RECORDED	BY WHOM AND WHEN	RECORDS AND REPORTING
Cement	Nature of discharge, volume, and location	Drilling Contractor, after each batch discharge or daily for ongoing.	Daily Drilling Report
Drill cuttings and mud	Fluid type, fluid volume and % oil on cuttings	Drilling Contractor, after each batch discharge or daily for ongoing.	Daily Drilling Report
Incidents			
Accidental release or losses overboard	Nature of the discharge material, and volume / amount	Vessel Master / OIM, as required.	Incident Report Daily Report
Dropped objects	Type, location, quantity.	Vessel Master / OIM, as required.	Incident Report Daily Report
Spill	Volume, chemical / oil type	Vessel Master / OIM, as required.	Incident Report Daily Report

8.10.2. Contractor Monitoring and Review

The vessel and MODU contractors will have specific contractual compliance obligations associated with implementing the EP, OPEP, and other applicable plans. Emperor Energy will monitor the contractors against these obligations both in terms of deliverables and quality.

AGR will have in place commitments registers to assist in monitoring these plans.

8.10.3. Auditing, Assurance, and Inspections

Emperor Energy conducts reviews and audits of contractors at various stages using the AGR Contractor Selection procedure, including pre-award of contract in accordance with its HSE Management System. Audits will be documented, and corrective actions will be tracked to completion.

Each contractor's internal environmental performance monitoring and auditing commitments are detailed in its EHS Management System, including identification and management of non-conformance. These processes will ensure that continual monitoring and improvement occurs so that EHS performance meets the requirements of the organisation's EHS policies and Safety Case (if relevant), as well as applicable requirements from the EP (as documented in the Commitments Register).

Environmental performance assurance of the activity will be undertaken in several ways. Performance assurance is undertaken to ensure that:

- EPOs, EPSs and implementation strategy requirements are met.
- Controls measures are effective in reducing the environmental impacts and risks of the activity to ALARP and acceptable levels.
- Any additional, or increased, impacts or risks are identified.

- Potential non-compliances and opportunities for improvement are identified.
- Environmental monitoring requirements have been met before completing the activity.

EPOs, EPSs and implementation strategy requirements will be documented in a Judith-2 Exploration Well EP Commitment Register that will be used when undertaking audits and inspections.

The findings and recommendations from audits and inspections will be documented and distributed to relevant personnel for comment. Any non-compliances or opportunities for improvement will be communicated to the MODU OIM, Vessel Masters and AGR Drilling Supervisor at the time of the inspection or audit to ensure there is adequate time to implement corrective actions. Outcomes from audits and inspections will be used to determine the activity's performance against the EPOs and EPSs.

Any non-compliance with the EPS outlined in this EP will be internally and externally reported and subject to investigation and follow-up action as detailed in Section 8.10.3.

The following arrangements will be established to ensure environmental performance aligns with this EP.

8.10.3.1. Pre-activity HSE Due Diligence Inspection

AGR will undertake pre-activity (and post- award) inspections of the MODU and vessels to ensure that procedures and equipment for managing routine discharges and emissions are in place to enable compliance with the EP. This will be undertaken in accordance with AGR's Contractor Evaluation Procedure (AGR-LCSM-P-02).

8.10.3.2. Onboard Environmental Audit

AGR will undertake an environmental compliance audit against the Judith-2 Exploration Well EP Commitment Register onboard the MODU during drilling operations to assess compliance with this EP. This will be undertaken by appropriately qualified and experienced personnel familiar with MODU operations and environmental management.

An AGR representative will undertake an audit of vessels while in the dock, or if logistics do not allow for this, AGR will provide Judith-2 Exploration Well EP Commitment Register to the Vessel Masters to complete and provide evidence of implementation of requirements to AGR to confirm.

8.10.3.3. Onboard Inspections

The AGR Drilling Supervisor will continuously supervise the activity, ensuring adherence to the environmental controls specified in this EP. This will be facilitated by completing an Environmental Inspection Checklist developed by the AGR HSE Manager. A completed checklist will be provided to the AGR HSE Manager on a weekly basis so that environmental compliance is continuously monitored. This provides ongoing assurance that the EP commitments are met, as a one-off audit only provides a 'snapshot in time' perspective of environmental management.

8.11. Management of Non-Conformance

Non-conformances include incidents, audit and inspection findings, failure to meet defined outcomes and objectives including EPOs and EPSs, and deviations from standards and procedures. Other potential improvements may be identified via observations of potential reductions to impacts (s) and risk(s) or improved performance. Methods for identifying and managing non-conformances associated with the activity include:

- Audits and inspections conducted before or during the activity.

- Incident reports.
- Reports from personnel (e.g., hazard observations).
- Incidents (e.g., spills).

The daily meeting is a pivotal tool to resolve potential non-conformances, whereby the AGR Drilling Supervisor will communicate these items to Emperor Energy onshore management. Depending on the nature and level of non-conformance, the issue may be recorded in the Drilling Contractor's and/or Emperor Energy's non-conformance process (Corrective Actions Register). For example, a low-risk observation around waste segregation identified offshore by a vessel contractor may only be recorded in the contractor's non-conformance process. An oil spill to sea will be of greater concern (risk) and benefit in Emperor Energy following up and recording through its systems. It is the responsibility of the Emperor Energy Principal Well Advisor and Emperor Energy Environment Manager considering the level of risk to determine the appropriate recording of the incident with regard to Emperor Energy's HSE Management System.

8.12. Oil Pollution Emergency Plan

Regulation 22(8) to Regulation 22(16) of the OPGGS(E) Regulations requires the implementation strategy to contain an OPEP and the provision for the OPEP to be updated. Oil spill response arrangements for responding to and monitoring an oil spill are detailed in the Judith-2 Exploration Well OPEP.

OPEP review triggers and testing arrangements and objectives appropriate to the nature and scale of Emperor Energy's activities are detailed in Section 7 of the Judith-2 Exploration Well OPEP.

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APPENDIX A EMPEROR ENERGY HEALTH, SAFETY AND ENVIRONMENT POLICY

EMPEROR ENERGY
LIMITED

Emperor Energy Limited
Health, Safety and Environmental Policy

As a petroleum exploration company, Emperor Energy Limited (Emperor Energy) is committed to promoting the health and safety of personnel, protection of the environment and the quality of its operations in line with international best practice and standards.

Through continuous improvement, risk assessment, rules and procedures, Health, Safety and Environment is a priority at every level of Emperor Energy. Our employees are the ambassadors of this culture.

HSE Manual

Emperor Energy maintains a Health, Safety and Environment Management System (HSE-MS) clearly documented in an operating manual that outlines the processes that will be employed and implemented at all phases of project development. This manual is also designed to meet the international best practice standards for Health, Safety and Environment.

The Emperor Energy HSE-MS applies in full, without modification to all Emperor Energy owned and operated sites, offices and locations where Emperor Energy has operational control. All Emperor Energy employees, contractors and visitors to Emperor Energy operated locations will be required to comply with this HSE MS.

Contractor Management

When contractors and subcontractors have been engaged by Emperor Energy to perform work on its behalf, working at their own offices or site locations, Emperor Energy requires the contractor to have their own HSE MS that meets or exceeds these requirements.

Risk Management

Risks to Emperor Energy personnel and its contractors are managed by identifying hazards, assessing consequences and probabilities, and evaluating and implementing prevention and mitigation measures. Emperor Energy conducts risk assessments for ongoing activities, operations and for projects in order to identify and address potential hazards to personnel, facilities, the public and the environment.

Environmental Management

All Emperor Energy personnel are encouraged and empowered to work in a manner that promotes conservation of the environment and to continually drive for improvements in our environmental performance. Environmental targets and objectives are included as part of the annual HSE plan.

For Emperor Energy project activities, environmental impacts are captured on the relevant project risk register where applicable and will include at a minimum the controls in place to ensure that:

- Any impact from Emperor Energy activities on the environment is minimised and includes where relevant, consideration of the sensitivity of habitat, flora and fauna at each site before starting work;
- Consideration of any materials, waste, or emissions that may affect or degrade water supply or soil and any other impacts identified.
- Observation of local rules for restricted or protected areas, any fire restrictions in place and at all times minimise or eliminate and disruption to wildlife.

Where required individual project risk assessments will take into account environmental considerations.

Continuous Improvement

Emperor Energy commits to a continual improvement program to develop and improve its Health, Safety and Environment systems, practices and procedures. This is an important part of our operating strategy as we recognise the need to verify progress and identify issues or areas that require strengthening in respect to HSE management.

Philip McNamara
Director - Emperor Energy
24th March 2025

APPENDIX B EPBC PROTECTED MATTERS SEARCH TOOL RESULTS

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: 29-Oct-2024

- Summary
- Details
  - Matters of NES
  - Other Matters Protected by the EPBC Act
  - Extra Information
- Caveat
- Acknowledgements

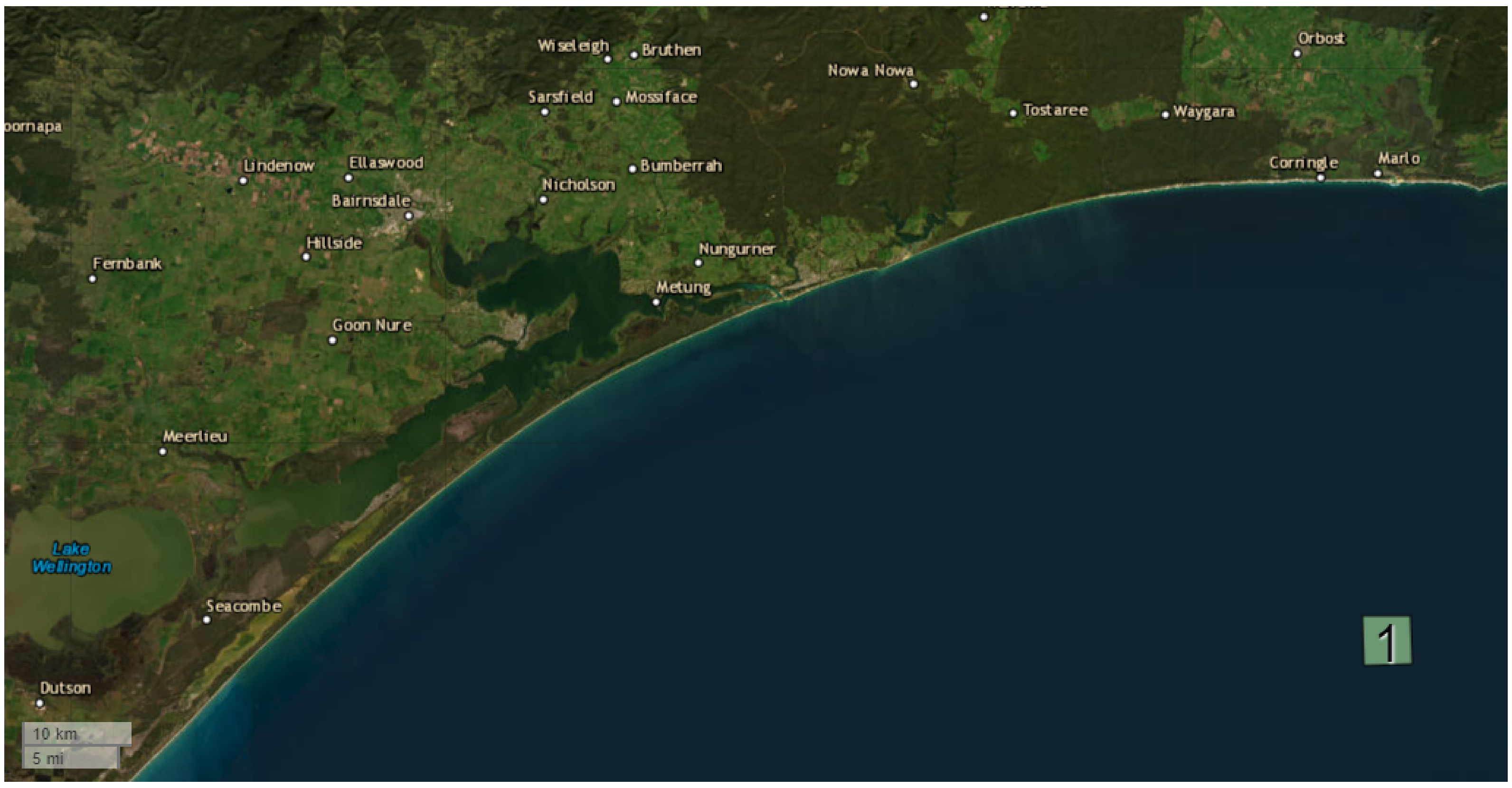

Figure 1: Operational Area (number one)

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:	43
Listed Migratory Species:	44

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:	62
Whales and Other Cetaceans:	28
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

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:	17
Key Ecological Features (Marine):	1
Biologically Important Areas:	10
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
Commonwealth Marine Areas (EPBC Act)

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		
Ardenna grisea Sooty Shearwater [82651]	Vulnerable	Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea antipodensis gibsoni Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	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
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033]	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
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Species or species habitat may occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
Thalassarche salvini		
Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi		
White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
FISH		
Hoplostethus atlanticus		
Orange Roughy, Deep-sea Perch, Red Roughy [68455]	Conservation Dependent	Species or species habitat likely to occur within area
Rexea solandri (eastern Australian population)		
Eastern Gemfish [76339]	Conservation Dependent	Species or species habitat likely to occur within area
Seriolella brama		
Blue Warehou [69374]	Conservation Dependent	Species or species habitat 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	Species or species habitat likely to occur within area
Balaenoptera physalus		
Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Eubalaena australis		
Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area
REPTILE		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Chelonia mydas		
Green Turtle [1765]	Vulnerable	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
SHARK		
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Migration route known to occur within area
Centrophorus harrissoni		
Harrisson's Dogfish, Endeavour Dogfish, Dumb Gulper Shark, Harrison's Deepsea Dogfish [68444]	Conservation Dependent	Species or species habitat likely to occur within area
Centrophorus uyato		
Little Gulper Shark [68446]	Conservation Dependent	Species or species habitat likely to occur within area
Galeorhinus galeus		
School Shark, Eastern School Shark, Snapper Shark, Tope, Soupfin Shark [68453]	Conservation Dependent	Species or species habitat likely to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		
Ardenna carneipes		
Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area
Ardenna grisea		
Sooty Shearwater [82651]	Vulnerable	Species or species habitat may occur within area
Diomedea antipodensis		
Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Migratory Marine Species		
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 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	Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
Caperea marginata		
Pygmy Right Whale [39]		Foraging, feeding or related behaviour likely to occur within area
Carcharhinus longimanus		
Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
Carcharias taurus		
Grey Nurse Shark [64469]		Species or species habitat may occur within area
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Migration route known to occur within area
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Species or species habitat may occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to occur within area
Eubalaena australis as Balaena glacialis australis		
Southern Right Whale [40]	Endangered	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
Lagenorhynchus obscurus		
Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lamna nasus		
Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat known to occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat may occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat may occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat may occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat may occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area

Other Matters Protected by the EPBC Act

Listed Marine Species		[Resource Information]
Scientific Name	Threatened Category	Presence Text
Bird		
Actitis hypoleucos		
Common Sandpiper [59309]		Species or species habitat may occur within area
Ardenna carneipes as Puffinus carneipes		
Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Species or species habitat likely to occur within area
Ardenna grisea as Puffinus griseus		
Sooty Shearwater [82651]	Vulnerable	Species or species habitat may occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat may occur within area
Calidris canutus		
Red Knot, Knot [855]	Vulnerable	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
Diomedea antipodensis		
Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea antipodensis gibsoni as Diomedea gibsoni		
Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	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
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat may occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area
Pterodroma cervicalis White-necked Petrel [59642]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Stercorarius antarcticus as Catharacta skua		
Brown Skua [85039]		Species or species habitat may occur within area
Sterna striata		
White-fronted Tern [799]		Migration route may occur within area
Thalassarche bulleri		
Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area
Thalassarche bulleri platei as Thalassarche sp. nov.		
Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Species or species habitat may occur within area
Thalassarche carteri		
Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta		
Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma		
Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche eremita		
Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour may occur within area
Thalassarche impavida		
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Fish		
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus abdominalis Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Hippocampus minotaur Bullneck Seahorse [66705]		Species or species habitat may occur within area
Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Hypselognathus rostratus Knifesnout Pipefish, Knife-snouted Pipefish [66245]		Species or species habitat may occur within area
Kaupus costatus Deepbody Pipefish, Deep-bodied Pipefish [66246]		Species or species habitat may occur within area
Kimblaeus bassensis Trawl Pipefish, Bass Strait Pipefish [66247]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Leptoichthys fistularius Brushtail Pipefish [66248]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys semistriatus Halfbanded Pipefish [66261]		Species or species habitat may occur within area
Mitotichthys tuckeri Tucker's Pipefish [66262]		Species or species habitat may occur within area
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Solegnathus robustus Robust Pipehorse, Robust Spiny Pipehorse [66274]		Species or species habitat may occur within area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Stipecampus cristatus Ringback Pipefish, Ring-backed Pipefish [66278]		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
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammal		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal [21]		Species or species habitat may occur within area
Reptile		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat likely to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat may occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Species or species habitat likely to 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 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	Foraging, feeding or related behaviour likely to occur within area
Berardius arnuxii Arnoux's Beaked Whale [70]		Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area

Current Scientific Name	Status	Type of Presence
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia sima Dwarf Sperm Whale [85043]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lissodelphis peronii Southern Right Whale Dolphin [44]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat known to occur within area
Mesoplodon bowdoini Andrew's Beaked Whale [73]		Species or species habitat may occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon hectori Hector's Beaked Whale [76]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area
Mesoplodon mirus True's Beaked Whale [54]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to 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
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Extra Information

EPBC Act Referrals [Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
2004/2005 drilling program for exploration and production (VIC 01-06, 09-11, 16, 18 & 19 and VIC/RL	2003/1282	Not Controlled Action	Completed
2D seismic Survey in VIC/P55, VIC/RL2 and VIC/P41	2004/1876	Not Controlled Action	Completed
Basker-Manta-Gummy Oil Development	2011/6052	Not Controlled Action	Completed
Basker-Manta Oil Field Development	2005/2026	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Development of Kipper gas field within Vic/L3, Vic/L4 Vic/RL2	2005/2484	Not Controlled Action	Completed
Drilling and side track completion at Baleen gas production well in Production Licence area VIC/L21	2004/1535	Not Controlled Action	Completed
Drilling of 'Culverin' oil exploration well, permit VIC/P56	2005/2279	Not Controlled Action	Completed
Drilling of Scallop-1 Exploration Well	2003/917	Not Controlled Action	Completed
East Pilchard exploration well	2001/137	Not Controlled Action	Completed
Gippsland Basin Seismic Programme	2004/1866	Not Controlled Action	Completed
INDIGO Central Submarine Telecommunications Cable	2017/8127	Not Controlled Action	Completed
Not controlled action (particular manner)			
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval
Inspection of project vessels for presence of invasive marine pests in Commonwealth waters off Victo	2012/6362	Not Controlled Action (Particular Manner)	Post-Approval
Northern Fields 3D Seismic Survey	2001/140	Not Controlled Action (Particular Manner)	Post-Approval
Seismic Exploration in Permit VIC/P41	2001/267	Not Controlled Action (Particular Manner)	Post-Approval
Southern Margins 3D Seismic Survey VIC/P55	2007/3780	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
Shark 3D Seismic Survey	2007/3294	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
Upwelling East of Eden	South-east

Biologically Important Areas [Resource Information]

Scientific Name	Behaviour	Presence
Seabirds		
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Foraging	Known to occur
Diomedea exulans antipodensis Antipodean Albatross [82269]	Foraging	Known to occur
Pelagodroma marina White-faced Storm-petrel [1016]	Foraging	Known to occur
Pelecanoides urinatrix Common Diving-petrel [1018]	Foraging	Known to occur
Thalassarche bulleri Bullers Albatross [64460]	Foraging	Known to occur
Thalassarche cauta cauta Shy Albatross [82345]	Foraging likely	Likely to occur
Thalassarche chlororhynchos bassi Indian Yellow-nosed Albatross [85249]	Foraging	Known to occur
Thalassarche melanophris Black-browed Albatross [66472]	Foraging	Known to occur
Thalassarche melanophris impavida Campbell Albatross [82449]	Foraging	Known to occur
Whales		
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Foraging	Likely to be present

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 is 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 on the contents of this report.

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 point locations and environmental data layers.

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 when time permits.

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 breeding sites; and
- 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: 21-Nov-2024

- Summary
- Details
  - Matters of NES
  - Other Matters Protected by the EPBC Act
  - Extra Information
- Caveat
- Acknowledgements

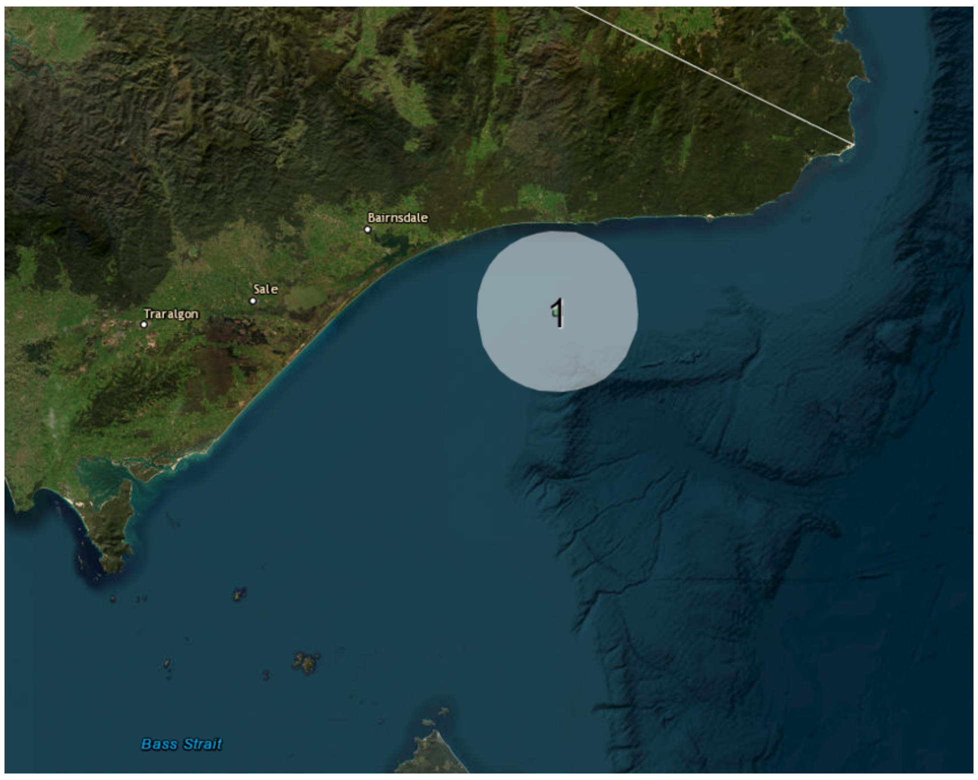

Figure 1: Light EMBA (Flaring buffer (36km from proposed well location))

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:	2
Listed Threatened Ecological Communities:	3
Listed Threatened Species:	90
Listed Migratory Species:	56

Other Matters Protected by the EPBC Act

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

The EPBC Act protects the environment on Commonwealth land, the environment from the actions taken on Commonwealth land, and the environment from actions taken by Commonwealth agencies. As heritage values of a place are part of the 'environment', these aspects of the EPBC Act protect the Commonwealth Heritage values of a Commonwealth Heritage place. Information on the new heritage laws can be found at 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:	86
Whales and Other Cetaceans:	30
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	None
Australian Marine Parks:	None
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	3
Regional Forest Agreements:	1
Nationally Important Wetlands:	3
EPBC Act Referrals:	43
Key Ecological Features (Marine):	1
Biologically Important Areas:	11
Bioregional Assessments:	1
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	Buffer Status
Commonwealth Marine Areas (EPBC Act)	In buffer area only
Commonwealth Marine Areas (EPBC Act)	In feature area

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text	Buffer Status
Littoral Rainforest and Coastal Vine Thickets of Eastern Australia	Critically Endangered	Community likely to occur within area	In buffer area only
River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria	Critically Endangered	Community likely to occur within area	In buffer area only
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area	In buffer area only

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	Buffer Status
BIRD			
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area	In buffer area only
Ardenna grisea Sooty Shearwater [82651]	Vulnerable	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area	In buffer area only
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat known to occur within area	In feature area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat known to occur within area	In feature area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Callocephalon fimbriatum Gang-gang Cockatoo [768]	Endangered	Species or species habitat known to occur within area	In buffer area only
Calyptorhynchus lathami lathami South-eastern Glossy Black-Cockatoo [67036]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Climacteris picumnus victoriae Brown Treecreeper (south-eastern) [67062]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat may occur within area	In buffer area only
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Diomedea antipodensis gibsoni Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In feature area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area	In feature area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area	In buffer area only
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Endangered	Species or species habitat known to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	In feature area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Melanodryas cucullata cucullata South-eastern Hooded Robin, Hooded Robin (south-eastern) [67093]	Endangered	Species or species habitat may occur within area	In buffer area only
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat may occur within area	In buffer area only
Neophema chrysostoma Blue-winged Parrot [726]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area	In feature area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area	In feature area
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Species or species habitat may occur within area	In feature area
Pycnoptilus floccosus Pilotbird [525]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Stagonopleura guttata Diamond Firetail [59398]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat known to occur within area	In feature area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area	In feature area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Species or species habitat may occur within area	In feature area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In feature area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area	In feature area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour may occur within area	In feature area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Thalassarche salvini			
Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Thalassarche steadi			
White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In feature area
Thinornis cucullatus cucullatus			
Eastern Hooded Plover, Eastern Hooded Plover [90381]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Tringa nebularia			
Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to occur within area	In buffer area only
CRUSTACEAN			
Euastacus diversus			
Orbost Spiny Crayfish [66782]	Endangered	Species or species habitat may occur within area	In buffer area only
FISH			
Hoplostethus atlanticus			
Orange Roughy, Deep-sea Perch, Red Roughy [68455]	Conservation Dependent	Species or species habitat likely to occur within area	In feature area
Prototroctes maraena			
Australian Grayling [26179]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Rexea solandri (eastern Australian population)			
Eastern Gemfish [76339]	Conservation Dependent	Species or species habitat likely to occur within area	In feature area
Seriolella brama			
Blue Warehou [69374]	Conservation Dependent	Species or species habitat known to occur within area	In feature area
FROG			
Heleioporus australiacus			
Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat may occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Litoria aurea			
Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Litoria raniformis			
Southern Bell Frog,, Growling Grass Frog, Green and Golden Frog, Warty Swamp Frog, Golden Bell Frog [1828]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Uperoleia martini			
Martin's Toadlet [1873]	Endangered	Species or species habitat known to occur within area	In buffer area only
MAMMAL			
Balaenoptera borealis			
Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Balaenoptera musculus			
Blue Whale [36]	Endangered	Species or species habitat likely to occur within area	In feature area
Balaenoptera physalus			
Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Dasyurus maculatus maculatus (SE mainland population)			
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat may occur within area	In buffer area only
Eubalaena australis			
Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area	In feature area
Isoodon obesulus obesulus			
Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern) [68050]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Petauroides volans			
Greater Glider (southern and central) [254]	Endangered	Species or species habitat may occur within area	In buffer area only
Petaurus australis australis			
Yellow-bellied Glider (south-eastern) [87600]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Potorous tridactylus trisulcatus			
Long-nosed Potoroo (southern mainland) [86367]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Pseudomys fumeus			
Smoky Mouse, Konoom [88]	Endangered	Species or species habitat may occur within area	In buffer area only
Pseudomys novaehollandiae			
New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat may occur within area	In buffer area only
Pteropus poliocephalus			
Grey-headed Flying-fox [186]	Vulnerable	Foraging, feeding or related behaviour may occur within area	In buffer area only
PLANT			
Amphibromus fluitans			
River Swamp Wallaby-grass, Floating Swamp Wallaby-grass [19215]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Caladenia tessellata			
Thick-lipped Spider-orchid, Daddy Long-legs [2119]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Calochilus pulchellus			
Pretty Beard Orchid, Pretty Beard-orchid [84677]	Endangered	Species or species habitat may occur within area	In buffer area only
Commersonia prostrata			
Dwarf Kerrawang [87152]	Endangered	Species or species habitat may occur within area	In buffer area only
Cryptostylis hunteriana			
Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Dianella amoena			
Matted Flax-lily [64886]	Endangered	Species or species habitat may occur within area	In buffer area only
Prasophyllum spicatum			
Dense Leek-orchid [55146]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Pterostylis chlorogramma Green-striped Greenhood [56510]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Thelymitra matthewsii Spiral Sun-orchid [4168]	Endangered	Species or species habitat likely to occur within area	In buffer area only
Xerochrysum palustre Swamp Everlasting, Swamp Paper Daisy [76215]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
REPTILE			
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area	In feature area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area	In feature area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area	In feature area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Lissolepis coventryi Swamp Skink, Eastern Mourning Skink [84053]	Endangered	Species or species habitat likely to occur within area	In buffer area only
SHARK			
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Migration route known to occur within area	In feature area
Centrophorus harrissoni Harrisson's Dogfish, Endeavour Dogfish, Dumb Gulper Shark, Harrison's Deepsea Dogfish [68444]	Conservation Dependent	Species or species habitat likely to occur within area	In feature area
Centrophorus uyato Little Gulper Shark [68446]	Conservation Dependent	Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Galeorhinus galeus			
School Shark, Eastern School Shark, Snapper Shark, Tope, Soupfin Shark [68453]	Conservation Dependent	Species or species habitat likely to occur within area	In feature area
Rhincodon typus			
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area	In feature area

Listed Migratory Species

[Resource Information]

Scientific Name	Threatened Category	Presence Text	Buffer Status
Migratory Marine Birds			
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area	In buffer area only
Ardenna carneipes			
Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area	In feature area
Ardenna grisea			
Sooty Shearwater [82651]	Vulnerable	Species or species habitat may occur within area	In feature area
Diomedea antipodensis			
Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Diomedea epomophora			
Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Diomedea exulans			
Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Diomedea sanfordi			
Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	In feature area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area	In feature area
Sternula albifrons Little Tern [82849]		Breeding known to occur within area	In buffer area only
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area	In feature area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In feature area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area	In feature area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour may occur within area	In feature area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In feature area
Migratory Marine Species			
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area	In feature area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area	In feature area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area	In feature area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour likely to occur within area	In feature area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Carcharias taurus Grey Nurse Shark [64469]		Species or species habitat may occur within area	In feature area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Migration route known to occur within area	In feature area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area	In feature area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area	In feature area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area	In feature area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only
Eubalaena australis as Balaena glacialis australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area	In feature area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area	In feature area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area	In feature area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area	In feature area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat known to occur within area	In feature area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Physeter macrocephalus			
Sperm Whale [59]		Species or species habitat may occur within area	In feature area
Rhincodon typus			
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area	In feature area
Migratory Terrestrial Species			
Hirundapus caudacutus			
White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Migratory Wetlands Species			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Calidris acuminata			
Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat known to occur within area	In feature area
Calidris canutus			
Red Knot, Knot [855]	Vulnerable	Species or species habitat known to occur within area	In feature area
Calidris ferruginea			
Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Calidris melanotos			
Pectoral Sandpiper [858]		Species or species habitat may occur within area	In feature area
Charadrius leschenaultii			
Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Gallinago hardwickii			
Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
Gallinago megala			
Swinhoe's Snipe [864]		Foraging, feeding or related behaviour likely to occur within area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Gallinago stenura			
Pin-tailed Snipe [841]		Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Limosa lapponica			
Bar-tailed Godwit [844]		Species or species habitat known to occur within area	In buffer area only
Numenius madagascariensis			
Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Numenius minutus			
Little Curlew, Little Whimbrel [848]		Foraging, feeding or related behaviour likely to occur within area	In buffer area only
Pandion haliaetus			
Osprey [952]		Species or species habitat known to occur within area	In buffer area only
Tringa nebularia			
Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to occur within area	In buffer area only

Other Matters Protected by the EPBC Act

Listed Marine Species			[Resource Information]
Scientific Name	Threatened Category	Presence Text	Buffer Status
Bird			
Actitis hypoleucos			
Common Sandpiper [59309]		Species or species habitat known to occur within area	In feature area
Apus pacificus			
Fork-tailed Swift [678]		Species or species habitat likely to occur within area overfly marine area	In buffer area only
Ardenna carneipes as Puffinus carneipes			
Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
[Ardenna grisea as Puffinus griseus](#) Sooty Shearwater [82651]	Vulnerable	Species or species habitat may occur within area	In feature area
[Bubulcus ibis as Ardea ibis](#) Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area	In buffer area only
[Calidris acuminata](#) Sharp-tailed Sandpiper [874]	Vulnerable	Species or species habitat known to occur within area	In feature area
[Calidris canutus](#) Red Knot, Knot [855]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In feature area
[Calidris ferruginea](#) Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area overfly marine area	In feature area
[Calidris melanotos](#) Pectoral Sandpiper [858]		Species or species habitat may occur within area overfly marine area	In feature area
[Charadrius leschenaultii](#) Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area	In buffer area only
[Diomedea antipodensis](#) Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
[Diomedea antipodensis gibsoni as Diomedea gibsoni](#) Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
[Diomedea epomophora](#) Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In feature area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In buffer area only
Gallinago megala Swinhoe's Snipe [864]		Foraging, feeding or related behaviour likely to occur within area overfly marine area	In buffer area only
Gallinago stenura Pin-tailed Snipe [841]		Foraging, feeding or related behaviour likely to occur within area overfly marine area	In buffer area only
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Species or species habitat known to occur within area	In buffer area only
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area	In feature area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In buffer area only
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area overfly marine area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area	In buffer area only
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Species or species habitat may occur within area	In feature area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area	In buffer area only
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area overfly marine area	In buffer area only
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area overfly marine area	In buffer area only
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat may occur within area overfly marine area	In buffer area only
Neophema chrysostoma Blue-winged Parrot [726]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In buffer area only
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area	In feature area
Numenius minutus Little Curlew, Little Whimbrel [848]		Foraging, feeding or related behaviour likely to occur within area overfly marine area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area	In feature area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area	In buffer area only
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat may occur within area	In feature area
Pterodroma cervicalis White-necked Petrel [59642]		Species or species habitat may occur within area	In feature area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area overfly marine area	In buffer area only
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat likely to occur within area overfly marine area	In buffer area only
Stercorarius antarcticus as Catharacta skua Brown Skua [85039]		Species or species habitat may occur within area	In feature area
Sterna striata White-fronted Tern [799]		Foraging, feeding or related behaviour likely to occur within area	In feature area
Sternula albifrons as Sterna albifrons Little Tern [82849]		Breeding known to occur within area	In buffer area only
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Species or species habitat may occur within area	In feature area
Thalassarche bulleri platei as Thalassarche sp. nov. Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area	In feature area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area	In feature area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area	In feature area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour may occur within area	In feature area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour known to occur within area	In feature area
Thinornis cucullatus as Thinornis rubricollis Hooded Plover, Hooded Dotterel [87735]		Species or species habitat known to occur within area overfly marine area	In buffer area only
Thinornis cucullatus cucullatus as Thinornis rubricollis rubricollis Eastern Hooded Plover, Eastern Hooded Plover [90381]	Vulnerable	Species or species habitat known to occur within area overfly marine area	In buffer area only

Scientific Name	Threatened Category	Presence Text	Buffer Status
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat likely to occur within area overfly marine area	In buffer area only
Fish			
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area	In feature area
Hippocampus abdominalis Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area	In feature area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area	In feature area
Hippocampus minotaur Bullneck Seahorse [66705]		Species or species habitat may occur within area	In feature area
Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area	In feature area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area	In feature area
Hypselognathus rostratus Knifesnout Pipefish, Knife-snouted Pipefish [66245]		Species or species habitat may occur within area	In feature area
Kaupus costatus Deepbody Pipefish, Deep-bodied Pipefish [66246]		Species or species habitat may occur within area	In feature area
Kimblaeus bassensis Trawl Pipefish, Bass Strait Pipefish [66247]		Species or species habitat may occur within area	In feature area
Leptoichthys fistularius Brushtail Pipefish [66248]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area	In feature area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area	In feature area
Mitotichthys semistriatus Halfbanded Pipefish [66261]		Species or species habitat may occur within area	In feature area
Mitotichthys tuckeri Tucker's Pipefish [66262]		Species or species habitat may occur within area	In feature area
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area	In feature area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area	In feature area
Solegnathus robustus Robust Pipehorse, Robust Spiny Pipehorse [66274]		Species or species habitat may occur within area	In feature area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area	In feature area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area	In feature area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area	In feature area
Stipecampus cristatus Ringback Pipefish, Ring-backed Pipefish [66278]		Species or species habitat may occur within area	In feature area

Scientific Name	Threatened Category	Presence Text	Buffer Status
Syngnathoides biaculeatus Double-end Pipehorse, Double-ended Pipehorse, Alligator Pipefish [66279]		Species or species habitat may occur within area	In feature area
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area	In feature area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area	In feature area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area	In feature area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area	In feature area
Mammal			
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area	In feature area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal [21]		Species or species habitat may occur within area	In feature area
Reptile			
Caretta caretta Loggerhead Turtle [1763]	Endangered	Breeding likely to occur within area	In feature area
Chelonia mydas Green Turtle [1765]	Vulnerable	Species or species habitat known to occur within area	In feature area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Breeding likely to occur within area	In feature area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Species or species habitat likely to occur within area	In buffer area only

Whales and Other Cetaceans [Resource Information]

Current Scientific Name	Status	Type of Presence	Buffer Status

Current Scientific Name	Status	Type of Presence	Buffer Status
Mammal			
Balaenoptera acutorostrata Minke Whale [33]		Species or species habitat may occur within area	In feature area
Balaenoptera bonaerensis Antarctic Minke Whale, Dark-shoulder Minke Whale [67812]		Species or species habitat likely to occur within area	In feature area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Balaenoptera edeni Bryde's Whale [35]		Species or species habitat may occur within area	In feature area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area	In feature area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area	In feature area
Berardius arnuxii Arnoux's Beaked Whale [70]		Species or species habitat may occur within area	In feature area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour likely to occur within area	In feature area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area	In feature area
Eubalaena australis Southern Right Whale [40]	Endangered	Species or species habitat known to occur within area	In feature area

Current Scientific Name	Status	Type of Presence	Buffer Status
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area	In feature area
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area	In feature area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area	In feature area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area	In feature area
Kogia sima Dwarf Sperm Whale [85043]		Species or species habitat may occur within area	In feature area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area	In feature area
Lissodelphis peronii Southern Right Whale Dolphin [44]		Species or species habitat may occur within area	In feature area
Megaptera novaeangliae Humpback Whale [38]		Species or species habitat known to occur within area	In feature area
Mesoplodon bowdoini Andrew's Beaked Whale [73]		Species or species habitat may occur within area	In feature area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area	In feature area
Mesoplodon grayi Gray's Beaked Whale, Scamperdown Whale [75]		Species or species habitat may occur within area	In buffer area only

Current Scientific Name	Status	Type of Presence	Buffer Status
Mesoplodon hectori Hector's Beaked Whale [76]		Species or species habitat may occur within area	In feature area
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area	In feature area
Mesoplodon mirus True's Beaked Whale [54]		Species or species habitat may occur within area	In feature area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to occur within area	In feature area
Physeter macrocephalus Sperm Whale [59]		Species or species habitat may occur within area	In feature area
Pseudorca crassidens False Killer Whale [48]		Species or species habitat likely to occur within area	In feature area
Tursiops aduncus Indian Ocean Bottlenose Dolphin, Spotted Bottlenose Dolphin [68418]		Species or species habitat likely to occur within area	In buffer area only
Tursiops truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area	In feature area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area	In feature area

Extra Information

State and Territory Reserves			[Resource Information]
Protected Area Name	Reserve Type	State	Buffer Status
Cape Conran Coastal Park	Conservation Park	VIC	In buffer area only
Ewing Morass W.R	Natural Features Reserve	VIC	In buffer area only
Snowy River	Heritage River	VIC	In buffer area only

Regional Forest Agreements

[Resource Information]

Note that all areas with completed RFAs have been included. Please see the associated resource information for specific caveats and use limitations associated with RFA boundary information.

RFA Name	State	Buffer Status
East Gippsland RFA	Victoria	In buffer area only

Nationally Important Wetlands

[Resource Information]

Wetland Name	State	Buffer Status
Ewing's Marsh (Morass)	VIC	In buffer area only
Lower Snowy River Wetlands System	VIC	In buffer area only
Snowy River	VIC	In buffer area only

EPBC Act Referrals

[Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Gippsland Offshore Wind Farm Marine Survey Investigations	2023/09682		Completed	In buffer area only
Not controlled action				
2004/2005 drilling program for exploration and production (VIC 01-06, 09-11, 16, 18 & 19 and VIC/RL	2003/1282	Not Controlled Action	Completed	In feature area
2D seismic Survey in VIC/P55, VIC/RL2 and VIC/P41	2004/1876	Not Controlled Action	Completed	In feature area
Basker-Manta-Gummy Oil Development	2011/6052	Not Controlled Action	Completed	In feature area
Basker-Manta Oil Field Development	2005/2026	Not Controlled Action	Completed	In feature area
Biodiversity Impacts Audit	2011/6191	Not Controlled Action	Completed	In buffer area only
Development of Kipper gas field within Vic/L3, Vic/L4 Vic/RL2	2005/2484	Not Controlled Action	Completed	In feature area
Development of Turrum Oil Field and associated infrastructure	2003/1204	Not Controlled Action	Completed	In buffer area only
Drilling and side track completion at Baleen gas production well in Production Licence area VIC/L21	2004/1535	Not Controlled Action	Completed	In feature area
Drilling of 'Culverin' oil exploration well, permit VIC/P56	2005/2279	Not Controlled Action	Completed	In feature area
Drilling of Scallop-1 Exploration Well	2003/917	Not Controlled Action	Completed	In feature area

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action				
East Pilchard exploration well	2001/137	Not Controlled Action	Completed	In feature area
Gippsland Basin Seismic Programme	2004/1866	Not Controlled Action	Completed	In feature area
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed	In buffer area only
INDIGO Central Submarine Telecommunications Cable	2017/8127	Not Controlled Action	Completed	In feature area
Longtom-3 Gas Appraisal Well, VIC/P54	2005/2494	Not Controlled Action	Completed	In buffer area only
Longtom Gas Pipeline Development, VIC/P54	2006/3072	Not Controlled Action	Completed	In buffer area only
Marlin-Snapper Gas Pipeline Project	2006/3197	Not Controlled Action	Completed	In buffer area only
Offshore Petroleum Exploration	2001/289	Not Controlled Action	Completed	In buffer area only
Offshore Seismic Survey	2001/498	Not Controlled Action	Completed	In buffer area only
Sole-2 appraisal gas well, VIC/RL3	2002/636	Not Controlled Action	Completed	In buffer area only
Sole gas field development	2003/937	Not Controlled Action	Completed	In buffer area only
Turrum Phase 2 Development Project	2008/4191	Not Controlled Action	Completed	In buffer area only
West Triton Drilling Program - Gippsland Basin	2007/3915	Not Controlled Action	Completed	In buffer area only
Not controlled action (particular manner)				
2D seismic survey in the Sole gas field and adjacent acreage in the Gippsland Basin (VIC RL/3 & VIC/	2002/871	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
2D seismic survey Permit Area VIC/P49	2006/2943	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
2D Seismic Survey Program in Bass Strait	2008/4040	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action (particular manner)				
Apache 3D seismic exploration survey	2006/3146	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval	In feature area
Inspection of project vessels for presence of invasive marine pests in Commonwealth waters off Victo	2012/6362	Not Controlled Action (Particular Manner)	Post-Approval	In feature area
Longtom-5 Offshore Production Drilling (Vic/L29), VIC	2012/6498	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Longtom South -1 Exploration Drilling	2011/6217	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Non-exclusive 3-D Marine Seismic Survey, Bass Strait	2002/775	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Northern Fields 3D Seismic Survey	2001/140	Not Controlled Action (Particular Manner)	Post-Approval	In feature area
Seismic Exploration in Permit VIC/P41	2001/267	Not Controlled Action (Particular Manner)	Post-Approval	In feature area
Seismic survey, Gippsland Basin	2001/525	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Southern Flanks 2D Marine Seismic Survey	2010/5288	Not Controlled Action (Particular Manner)	Post-Approval	In buffer area only
Southern Margins 3D Seismic Survey VIC/P55	2007/3780	Not Controlled Action (Particular Manner)	Post-Approval	In feature area
Tuskfish 3D Seismic Survey, Bass Strait	2002/864	Not Controlled Action (Particular	Post-Approval	In buffer area only

Title of referral	Reference	Referral Outcome	Assessment Status	Buffer Status
Not controlled action (particular manner)				
		Manner)		
Referral decision				
Longtom 5 Offshore Production Drilling (VIC/L29)	2012/6404	Referral Decision	Completed	In buffer area only
Longtom-5 Offshore Production Drilling (Vic/L29)	2012/6413	Referral Decision	Completed	In buffer area only
Shark 3D Seismic Survey	2007/3294	Referral Decision	Completed	In feature area
Stanton 3D Marine Seismic Survey	2013/6764	Referral Decision	Completed	In buffer area only

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	Buffer Status
Upwelling East of Eden	South-east	In feature area

Biologically Important Areas [Resource Information]

Scientific Name	Behaviour	Presence	Buffer Status
Seabirds			
Ardenna tenuirostris Short-tailed Shearwater [82652]	Foraging	Known to occur	In buffer area only
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Foraging	Known to occur	In feature area
Diomedea exulans antipodensis Antipodean Albatross [82269]	Foraging	Known to occur	In feature area
Pelagodroma marina White-faced Storm-petrel [1016]	Foraging	Known to occur	In feature area
Pelecanoides urinatrix Common Diving-petrel [1018]	Foraging	Known to occur	In feature area
Thalassarche bulleri Bullers Albatross [64460]	Foraging	Known to occur	In feature area
Thalassarche cauta cauta Shy Albatross [82345]	Foraging likely	Likely to occur	In feature area

Scientific Name	Behaviour	Presence	Buffer Status
Thalassarche chlororhynchos bassi Indian Yellow-nosed Albatross [85249]	Foraging	Known to occur	In feature area
Thalassarche melanophris Black-browed Albatross [66472]	Foraging	Known to occur	In feature area
Thalassarche melanophris impavida Campbell Albatross [82449]	Foraging	Known to occur	In feature area
Whales			
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Foraging	Likely to be present	In feature area

Bioregional Assessments

[Resource Information]

SubRegion	BioRegion	Website	Buffer Status
Gippsland	Gippsland Basin	BA website	In buffer area only

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 is 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 on the contents of this report.

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 point locations and environmental data layers.

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 when time permits.

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 breeding sites; and
- 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: 21-Nov-2024

- Summary
- Details
  - Matters of NES
  - Other Matters Protected by the EPBC Act
  - Extra Information
- Caveat
- Acknowledgements

Figure 1: Maine Diesel Oil (MDO) environment may be affected (EMBA)

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	4
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	4
Listed Threatened Ecological Communities:	16
Listed Threatened Species:	167
Listed Migratory Species:	86

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:	25
Commonwealth Heritage Places:	11
Listed Marine Species:	136
Whales and Other Cetaceans:	36
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	2
Australian Marine Parks:	9
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	81
Regional Forest Agreements:	5
Nationally Important Wetlands:	30
EPBC Act Referrals:	108
Key Ecological Features (Marine):	5
Biologically Important Areas:	45
Bioregional Assessments:	2
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

Wetlands of International Importance (Ramsar Wetlands) [Resource Information]

Ramsar Site Name	Proximity
Corner inlet	Within 10km of Ramsar site
East coast cape barren island lagoons	Within Ramsar site
Gippsland lakes	Within Ramsar site
Logan lagoon	Within Ramsar site

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside 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
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text
Araluen Scarp Grassy Forest	Endangered	Community may occur within area
Brogo Vine Forest of the South East Corner Bioregion	Endangered	Community likely to occur within area
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community likely to occur within area
Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland	Endangered	Community likely to occur within area

Community Name	Threatened Category	Presence Text
Giant Kelp Marine Forests of South East Australia	Endangered	Community likely to occur within area
Gippsland Red Gum (Eucalyptus tereticornis subsp. mediana) Grassy Woodland and Associated Native Grassland	Critically Endangered	Community likely to occur within area
Illawarra and south coast lowland forest and woodland ecological community	Critically Endangered	Community likely to occur within area
Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion	Critically Endangered	Community likely to occur within area
Littoral Rainforest and Coastal Vine Thickets of Eastern Australia	Critically Endangered	Community likely to occur within area
Lowland Grassy Woodland in the South East Corner Bioregion	Critically Endangered	Community likely to occur within area
Natural Damp Grassland of the Victorian Coastal Plains	Critically Endangered	Community may occur within area
River-flat eucalypt forest on coastal floodplains of southern New South Wales and eastern Victoria	Critically Endangered	Community likely to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area
Tasmanian Forests and Woodlands dominated by black gum or Brookers gum (Eucalyptus ovata / E. brookeriana)	Critically Endangered	Community likely to occur within area
Tasmanian white gum (Eucalyptus viminalis) wet forest	Critically Endangered	Community likely to occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community may occur within area

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		
Anthochaera phrygia		
Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Aphelocephala leucopsis Southern Whiteface [529]	Vulnerable	Species or species habitat may occur within area
Aquila audax fleayi Tasmanian Wedge-tailed Eagle, Wedge-tailed Eagle (Tasmanian) [64435]	Endangered	Breeding likely to occur within area
Ardenna grisea Sooty Shearwater [82651]	Vulnerable	Breeding known to occur within area
Arenaria interpres Ruddy Turnstone [872]	Vulnerable	Roosting known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Vulnerable	Roosting known to occur within area
Callocephalon fimbriatum Gang-gang Cockatoo [768]	Endangered	Species or species habitat known to occur within area
Calyptorhynchus lathami lathami South-eastern Glossy Black-Cockatoo [67036]	Vulnerable	Species or species habitat known to occur within area
Ceyx azureus diemenensis Tasmanian Azure Kingfisher [25977]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Climacteris picumnus victoriae Brown Treecreeper (south-eastern) [67062]	Vulnerable	Species or species habitat known to occur within area
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea antipodensis gibsoni Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat known to occur within area
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat known to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Endangered	Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]	Endangered	Species or species habitat known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
Melanodryas cucullata cucullata South-eastern Hooded Robin, Hooded Robin (south-eastern) [67093]	Endangered	Species or species habitat likely to occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat may occur within area
Neophema chrysostoma Blue-winged Parrot [726]	Vulnerable	Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Pardalotus quadragintus Forty-spotted Pardalote [418]	Endangered	Species or species habitat likely to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pluvialis squatarola Grey Plover [865]	Vulnerable	Species or species habitat known to occur within area
Pterodroma heraldica Herald Petrel [66973]	Critically Endangered	Species or species habitat likely to occur within area
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Breeding known to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Pterodroma neglecta neglecta Kermadec Petrel (western) [64450]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Pycnoptilus floccosus Pilotbird [525]	Vulnerable	Species or species habitat known to occur within area
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area
Stagonopleura guttata Diamond Firetail [59398]	Vulnerable	Species or species habitat known to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat known to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Thinornis cucullatus cucullatus Eastern Hooded Plover, Eastern Hooded Plover [90381]	Vulnerable	Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat known to occur within area
Tyto novaehollandiae castanops (Tasmanian population) Masked Owl (Tasmanian) [67051]	Vulnerable	Species or species habitat known to occur within area
Xenus cinereus Terek Sandpiper [59300]	Vulnerable	Species or species habitat known to occur within area
CRUSTACEAN		
Engaeus martigener Furneaux Burrowing Crayfish [67220]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Euastacus bidawalus		
Bidhawal Crayfish, Bidawal Crayfish, East Gippsland Spiny Crayfish [83136]	Endangered	Species or species habitat known to occur within area
Euastacus diversus		
Orbost Spiny Crayfish [66782]	Endangered	Species or species habitat may occur within area
FISH		
Brachiopsilus ziebelli		
Ziebell's Handfish, Waterfall Bay Handfish [83757]	Vulnerable	Species or species habitat may occur within area
Epinephelus daemelii		
Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area
Galaxiella pusilla		
Eastern Dwarf Galaxias, Dwarf Galaxias [56790]	Endangered	Species or species habitat may occur within area
Hippocampus whitei		
White's Seahorse, Crowned Seahorse, Sydney Seahorse [66240]	Endangered	Species or species habitat known to occur within area
Hoplostethus atlanticus		
Orange Roughy, Deep-sea Perch, Red Roughy [68455]	Conservation Dependent	Species or species habitat likely to occur within area
Mordacia praecox		
Non-parasitic Lamprey, Precocious Lamprey [81530]	Endangered	Species or species habitat likely to occur within area
Prototroctes maraena		
Australian Grayling [26179]	Vulnerable	Species or species habitat known to occur within area
Rexea solandri (eastern Australian population)		
Eastern Gemfish [76339]	Conservation Dependent	Species or species habitat likely to occur within area
Seriolella brama		
Blue Warehou [69374]	Conservation Dependent	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Thymichthys politus Red Handfish [83756]	Critically Endangered	Species or species habitat may occur within area
FROG		
Heleioporus australiacus Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat known to occur within area
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat known to occur within area
Litoria raniformis Southern Bell Frog,, Growling Grass Frog, Green and Golden Frog, Warty Swamp Frog, Golden Bell Frog [1828]	Vulnerable	Species or species habitat known to occur within area
Litoria watsoni Southern Heath Frog, Watson's Tree Frog [91509]	Endangered	Species or species habitat known to occur within area
Mixophyes balbus Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat may occur within area
Uperoleia martini Martin's Toadlet [1873]	Endangered	Species or species habitat known to occur within area
INSECT		
Antipodia chaostola leucophaea Tasmanian Chaostola Skipper, Heath-sand Skipper [77672]	Endangered	Species or species habitat may 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	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Balaenoptera physalus		
Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Chalinolobus dwyeri		
Large-eared Pied Bat, Large Pied Bat [183]	Endangered	Species or species habitat likely to occur within area
Dasyurus maculatus maculatus (SE mainland population)		
Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Dasyurus viverrinus		
Eastern Quoll, Luaner [333]	Endangered	Species or species habitat likely to occur within area
Eubalaena australis		
Southern Right Whale [40]	Endangered	Breeding known to occur within area
Isoodon obesulus obesulus		
Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern) [68050]	Endangered	Species or species habitat known to occur within area
Petauroides volans		
Greater Glider (southern and central) [254]	Endangered	Species or species habitat known to occur within area
Petaurus australis australis		
Yellow-bellied Glider (south-eastern) [87600]	Vulnerable	Species or species habitat known to occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT)		
Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Endangered	Species or species habitat known to occur within area
Potorous longipes		
Long-footed Potoroo [217]	Endangered	Species or species habitat known to occur within area
Potorous tridactylus trisulcatus		
Long-nosed Potoroo (southern mainland) [86367]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Pseudomys fumeus Smoky Mouse, Konoom [88]	Endangered	Species or species habitat may occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat known to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area
OTHER		
Dendronephthya australis Cauliflower Soft Coral [90325]	Endangered	Species or species habitat known to occur within area
PLANT		
Acacia caerulescens Limestone Blue Wattle, Buchan Blue, Buchan Blue Wattle [21883]	Vulnerable	Species or species habitat known to occur within area
Acacia constablei Narrabarba Wattle [10798]	Critically Endangered	Species or species habitat known to occur within area
Acacia georgensis Bega Wattle [9848]	Vulnerable	Species or species habitat known to occur within area
Acacia lanigera var. gracilipes [31652]	Endangered	Species or species habitat may occur within area
Amphibromus fluitans River Swamp Wallaby-grass, Floating Swamp Wallaby-grass [19215]	Vulnerable	Species or species habitat likely to occur within area
Astrotricha crassifolia Thick-leaf Star-hair [10352]	Vulnerable	Species or species habitat may occur within area
Astrotricha sp. Howe Range (D.E.Albrecht 1054) Long-leaf Star-hair [85676]	Critically Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Astrotricha sp. Wingan Inlet (J.A.Jeanes 2268)		
Wingan Star-hair [85675]	Endangered	Species or species habitat known to occur within area
Banksia vincentia		
[88276]	Critically Endangered	Species or species habitat likely to occur within area
Caladenia caudata		
Tailed Spider-orchid [17067]	Vulnerable	Species or species habitat may occur within area
Caladenia tessellata		
Thick-lipped Spider-orchid, Daddy Long-legs [2119]	Vulnerable	Species or species habitat known to occur within area
Calochilus pulchellus		
Pretty Beard Orchid, Pretty Beard-orchid [84677]	Endangered	Species or species habitat likely to occur within area
Commersonia prostrata		
Dwarf Kerrawang [87152]	Endangered	Species or species habitat known to occur within area
Conospermum hookeri		
Variable Smoke-bush [68161]	Vulnerable	Species or species habitat likely to occur within area
Correa baeuerlenii		
Chef's Cap [17007]	Vulnerable	Species or species habitat known to occur within area
Correa lawrenceana var. genoensis		
Genoa River Correa [66626]	Endangered	Species or species habitat may occur within area
Corunastylis vernalis listed as Genoplesium vernale		
East Lynne Midge-orchid [78699]	Vulnerable	Species or species habitat known to occur within area
Cryptostylis hunteriana		
Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Cynanchum elegans White-flowered Wax Plant [12533]	Endangered	Species or species habitat may occur within area
Deyeuxia ramosa Climbing Bent-grass [87970]	Critically Endangered	Species or species habitat known to occur within area
Dianella amoena Matted Flax-lily [64886]	Endangered	Species or species habitat likely to occur within area
Dodonaea procumbens Trailing Hop-bush [12149]	Vulnerable	Species or species habitat likely to occur within area
Epacris barbata Bearded Heath, Freycinet Heath [17625]	Endangered	Species or species habitat likely to occur within area
Eucalyptus stenostoma Jillaga Ash [3976]	Endangered	Species or species habitat may occur within area
Genoplesium baueri Yellow Gnat-orchid, Bauer's Midge Orchid, Brittle Midge Orchid [7528]	Endangered	Species or species habitat known to occur within area
Glycine latrobeana Clover Glycine, Purple Clover [13910]	Vulnerable	Species or species habitat likely to occur within area
Haloragis exalata subsp. exalata Wingless Raspwort, Square Raspwort [24636]	Vulnerable	Species or species habitat known to occur within area
Melaleuca biconvexa Biconvex Paperbark [5583]	Vulnerable	Species or species habitat likely to occur within area
Persicaria elatior Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Pomaderris brunnea Rufous Pomaderris, Brown Pomaderris [16845]	Vulnerable	Species or species habitat may occur within area
Pomaderris cotoneaster Cotoneaster Pomaderris [2043]	Endangered	Species or species habitat may occur within area
Pomaderris parrisiae Parris' Pomaderris [22119]	Vulnerable	Species or species habitat known to occur within area
Prasophyllum affine Jervis Bay Leek Orchid, Culburra Leek-orchid, Kinghorn Point Leek-orchid [2210]	Endangered	Species or species habitat known to occur within area
Prasophyllum frenchii Maroon Leek-orchid, Slaty Leek-orchid, Stout Leek-orchid, French's Leek-orchid, Swamp Leek-orchid [9704]	Endangered	Species or species habitat may occur within area
Prasophyllum spicatum Dense Leek-orchid [55146]	Vulnerable	Species or species habitat known to occur within area
Prostanthera densa Villous Mintbush [12233]	Vulnerable	Species or species habitat known to occur within area
Pterostylis chlorogramma Green-striped Greenhood [56510]	Vulnerable	Species or species habitat likely to occur within area
Pterostylis gibbosa Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood [4562]	Endangered	Species or species habitat may occur within area
Rhizanthella slateri Eastern Underground Orchid [11768]	Endangered	Species or species habitat may occur within area
Rhodamnia rubescens Scrub Turpentine, Brown Malletwood [15763]	Critically Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Rhodomyrtus psidioides Native Guava [19162]	Critically Endangered	Species or species habitat may occur within area
Senecio psilocarpus Swamp Fireweed, Smooth-fruited Groundsel [64976]	Vulnerable	Species or species habitat likely to occur within area
Spyridium cinereum Tiny Spyridium [13564]	Endangered	Species or species habitat known to occur within area
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat known to occur within area
Thelymitra epipactoides Metallic Sun-orchid [11896]	Endangered	Species or species habitat likely to occur within area
Thelymitra jonesii Sky-blue Sun-orchid [76352]	Endangered	Species or species habitat likely to occur within area
Thelymitra matthewsii Spiral Sun-orchid [4168]	Endangered	Species or species habitat likely to occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat known to occur within area
Triplarina nowraensis Nowra Heath-myrtle [64544]	Endangered	Species or species habitat known to occur within area
Westringia davidii [19079]	Vulnerable	Species or species habitat may occur within area
Xerochrysum palustre Swamp Everlasting, Swamp Paper Daisy [76215]	Vulnerable	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Zieria tuberculata Warty Zieria [56736]	Vulnerable	Species or species habitat known to occur within area
REPTILE		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Hoplocephalus bungaroides Broad-headed Snake [1182]	Endangered	Species or species habitat likely to occur within area
Lissolepis coventryi Swamp Skink, Eastern Mourning Skink [84053]	Endangered	Species or species habitat known to occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
SHARK		
Carcharias taurus (east coast population) Grey Nurse Shark (east coast population) [68751]	Critically Endangered	Congregation or aggregation known to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Centrophorus harrissoni		
Harrisson's Dogfish, Endeavour Dogfish, Dumb Gulper Shark, Harrison's Deepsea Dogfish [68444]	Conservation Dependent	Species or species habitat likely to occur within area
Centrophorus uyato		
Little Gulper Shark [68446]	Conservation Dependent	Species or species habitat likely to occur within area
Galeorhinus galeus		
School Shark, Eastern School Shark, Snapper Shark, Tope, Soupfin Shark [68453]	Conservation Dependent	Species or species habitat likely to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sphyrna lewini		
Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat may 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]		Foraging, feeding or related behaviour likely to occur within area
Ardenna grisea		
Sooty Shearwater [82651]	Vulnerable	Breeding known to occur within area
Ardenna pacifica		
Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Ardenna tenuirostris		
Short-tailed Shearwater [82652]		Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely 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	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Sternula albifrons Little Tern [82849]		Breeding known to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Migratory Marine Species		
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	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat may occur within area
Carcharias taurus Grey Nurse Shark [64469]		Congregation or aggregation known to occur within area

Scientific Name	Threatened Category	Presence Text
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Breeding known 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	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Dugong dugon Dugong [28]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Eubalaena australis as Balaena glacialis australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Isurus oxyrinchus Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lamna nasus Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Megaptera novaeangliae Humpback Whale [38]		Foraging, feeding or related behaviour known to occur within area

Scientific Name	Threatened Category	Presence Text
Mobula birostris as Manta birostris		
Giant Manta Ray [90034]		Species or species habitat known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Orcinus orca		
Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus		
Sperm Whale [59]		Species or species habitat may occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
Cuculus optatus		
Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat known to occur within area
Hirundapus caudacutus		
White-throated Needletail [682]	Vulnerable	Species or species habitat known to 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
Arenaria interpres		
Ruddy Turnstone [872]	Vulnerable	Roosting known to occur within area
Calidris acuminata		
Sharp-tailed Sandpiper [874]	Vulnerable	Roosting known to occur within area

Scientific Name	Threatened Category	Presence Text
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat likely to occur within area
Calidris pugnax as Philomachus pugnax Ruff [91256]		Species or species habitat known to occur within area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Vulnerable	Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area

Scientific Name	Threatened Category	Presence Text
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat may occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]	Endangered	Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Species or species habitat known to occur within area
Pluvialis squatarola Grey Plover [865]	Vulnerable	Species or species habitat known to occur within area
Thalasseus bergii Greater Crested Tern [83000]		Breeding known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Tringa glareola Wood Sandpiper [829]		Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area
Xenus cinereus Terek Sandpiper [59300]	Vulnerable	Species or species habitat known 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
Communications, Information Technology and the Arts - Australian Postal Corporation	
Commonwealth Land - Australian Postal Commission [12052]	NSW
Communications, Information Technology and the Arts - Telstra Corporation Limited	
Commonwealth Land - Australian Telecommunications Commission [12050]	NSW
Commonwealth Land - Australian Telecommunications Commission [12053]	NSW
Commonwealth Land - Australian Telecommunications Commission [15611]	NSW
Commonwealth Land - Australian Telecommunications Commission [12025]	NSW
Commonwealth Land - Telstra Corporation Limited [12051]	NSW
Commonwealth Land - Telstra Corporation Limited [15888]	NSW
Defence	
Defence - BEECROFT RAPIER RANGE [10048]	NSW
Defence - BEECROFT RAPIER RANGE [10049]	NSW

Commonwealth Land Name	State
Defence - BEECROFT RAPIER RANGE [10051]	NSW
Defence - BEECROFT RAPIER RANGE [10050]	NSW
Defence - SUSSEX INLET - DEFENCE RESERVE [11233]	NSW
Environment and Heritage	
Commonwealth Land - Booderee National Park [91003]	JBT
Commonwealth Land - Booderee National Park [91004]	JBT
Commonwealth Land - Booderee National Park [91001]	JBT
Commonwealth Land - Booderee National Park [91002]	JBT
Commonwealth Land - Booderee National Park [91005]	JBT
Unknown	
Commonwealth Land - [21496]	VIC
Commonwealth Land - [21491]	VIC
Commonwealth Land - [21490]	VIC
Commonwealth Land - [21498]	VIC
Commonwealth Land - [12041]	NSW
Commonwealth Land - [21489]	VIC
Commonwealth Land - [21497]	VIC
Commonwealth Land - [12042]	NSW

Commonwealth Heritage Places

[Resource Information]

Name	State	Status
Historic		
Cape St George Lighthouse Ruins & Curtilage	ACT	Listed place
Christians Minde Settlement	ACT	Listed place
Gabo Island Lighthouse	VIC	Listed place
Jervis Bay Botanic Gardens	ACT	Listed place
Montague Island Lighthouse	NSW	Listed place
Point Perpendicular Lightstation	NSW	Listed place
Royal Australian Naval College	ACT	Listed place
Indigenous		

Name	State	Status
Crocodile Head Area	NSW	Within listed place
Currarong Rockshelters Area	NSW	Within listed place
Jervis Bay Territory	ACT	Listed place
Natural		
Beecroft Peninsula	NSW	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]		Foraging, feeding or related behaviour likely to occur within area
Ardenna grisea as Puffinus griseus Sooty Shearwater [82651]	Vulnerable	Breeding known to occur within area
Ardenna pacifica as Puffinus pacificus Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Ardenna tenuirostris as Puffinus tenuirostris Short-tailed Shearwater [82652]		Breeding known to occur within area
Arenaria interpres Ruddy Turnstone [872]	Vulnerable	Roosting known to occur within area
Bubulcus ibis as Ardea ibis Cattle Egret [66521]		Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	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 likely to occur within area overfly marine area
Calidris pugnax as Philomachus pugnax Ruff [91256]		Species or species habitat known to occur within area overfly marine area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area overfly marine area
Calidris tenuirostris Great Knot [862]	Vulnerable	Roosting known to occur within area overfly marine area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat likely to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting 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

Scientific Name	Threatened Category	Presence Text
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Species or species habitat known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area overfly marine area
Chroicocephalus novaehollandiae as Larus novaehollandiae Silver Gull [82326]		Breeding known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea antipodensis gibsoni as Diomedea gibsoni Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Eudyptula minor Little Penguin [1085]		Breeding known to occur within area
Fregata ariel Lesser Frigatebird, Least Frigatebird [1012]		Species or species habitat likely to occur within area
Fregata minor Great Frigatebird, Greater Frigatebird [1013]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat known to occur within area overfly marine area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area overfly marine area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area overfly marine area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Breeding known to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Foraging, feeding or related behaviour known to occur within area overfly marine area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area overfly marine area
Hydroprogne caspia as Sterna caspia Caspian Tern [808]		Breeding known to occur within area
Larus pacificus Pacific Gull [811]		Breeding known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Species or species habitat known to occur within area overfly marine area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]	Endangered	Species or species habitat known to occur within area overfly marine area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area overfly marine area
Morus serrator Australasian Gannet [1020]		Breeding known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat may occur within area overfly marine area
Myiagra cyanoleuca Satin Flycatcher [612]		Species or species habitat known to occur within area overfly marine area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat may occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Neophema chrysostoma Blue-winged Parrot [726]	Vulnerable	Species or species habitat known to 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
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting likely to occur within area overfly marine area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Onychoprion fuscatus as Sterna fuscata Sooty Tern [90682]		Breeding known to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Pelagodroma marina White-faced Storm-Petrel [1016]		Breeding known to occur within area
Pelecanoides urinatrix Common Diving-Petrel [1018]		Breeding known to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat may occur within area
Phalacrocorax fuscescens Black-faced Cormorant [59660]		Breeding known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Pluvialis fulva Pacific Golden Plover [25545]		Species or species habitat known to occur within area
Pluvialis squatarola Grey Plover [865]	Vulnerable	Species or species habitat known to occur within area overfly marine area
Pterodroma cervicalis White-necked Petrel [59642]		Breeding likely to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Species or species habitat known to occur within area overfly marine area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area overfly marine area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area overfly marine area
Stercorarius antarcticus as Catharacta skua Brown Skua [85039]		Species or species habitat may occur within area
Sterna striata White-fronted Tern [799]		Breeding known to occur within area
Sternula albifrons as Sterna albifrons Little Tern [82849]		Breeding known to occur within area
Sternula nereis as Sterna nereis Fairy Tern [82949]		Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Symposiachrus trivirgatus as Monarcha trivirgatus		
Spectacled Monarch [83946]		Species or species habitat known to occur within area overfly marine area
Thalassarche bulleri		
Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche bulleri platei as Thalassarche sp. nov.		
Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche carteri		
Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta		
Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma		
Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche eremita		
Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour may occur within area
Thalassarche impavida		
Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris		
Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini		
Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
Thalassarche steadi		
White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Thalasseus bergii as Sterna bergii		
Greater Crested Tern [83000]		Breeding known to occur within area
Thinornis cucullatus as Thinornis rubricollis		
Hooded Plover, Hooded Dotterel [87735]		Species or species habitat known to occur within area overfly marine area
Thinornis cucullatus cucullatus as Thinornis rubricollis rubricollis		
Eastern Hooded Plover, Eastern Hooded Plover [90381]	Vulnerable	Species or species habitat known to occur within area overfly marine area
Tringa brevipes as Heteroscelus brevipes		
Grey-tailed Tattler [851]		Species or species habitat known to occur within area
Tringa glareola		
Wood Sandpiper [829]		Species or species habitat known to occur within area overfly marine area
Tringa nebularia		
Common Greenshank, Greenshank [832]	Endangered	Species or species habitat known to occur within area overfly marine area
Tringa stagnatilis		
Marsh Sandpiper, Little Greenshank [833]		Species or species habitat known to occur within area overfly marine area
Xenus cinereus		
Terek Sandpiper [59300]	Vulnerable	Species or species habitat known to occur within area overfly marine area
Fish		
Acentronura tentaculata		
Shortpouch Pygmy Pipehorse [66187]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Cosmocampus howensis Lord Howe Pipefish [66208]		Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippocampus abdominalis Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Hippocampus minotaur Bullneck Seahorse [66705]		Species or species habitat may occur within area
Hippocampus whitei White's Seahorse, Crowned Seahorse, Sydney Seahorse [66240]	Endangered	Species or species habitat known to occur within area
Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Hypselognathus rostratus Knifesnout Pipefish, Knife-snouted Pipefish [66245]		Species or species habitat may occur within area
Kaupus costatus Deepbody Pipefish, Deep-bodied Pipefish [66246]		Species or species habitat may occur within area
Kimblaeus bassensis Trawl Pipefish, Bass Strait Pipefish [66247]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Leptoichthys fistularius Brushtail Pipefish [66248]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys mollisoni Mollison's Pipefish [66260]		Species or species habitat may occur within area
Mitotichthys semistriatus Halfbanded Pipefish [66261]		Species or species habitat may occur within area
Mitotichthys tuckeri Tucker's Pipefish [66262]		Species or species habitat may occur within area
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Solegnathus robustus Robust Pipehorse, Robust Spiny Pipehorse [66274]		Species or species habitat may occur within area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275]		Species or species habitat may occur within area
Solenostomus cyanopterus Robust Ghostpipefish, Blue-finned Ghost Pipefish, [66183]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Stipecampus cristatus Ringback Pipefish, Ring-backed Pipefish [66278]		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
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammal		

Scientific Name	Threatened Category	Presence Text
Arctocephalus forsteri		
Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus		
Australian Fur-seal, Australo-African Fur-seal [21]		Breeding known to occur within area
Dugong dugon		
Dugong [28]		Species or species habitat may occur within area
Reptile		
Caretta caretta		
Loggerhead Turtle [1763]	Endangered	Species or species habitat known to occur within area
Chelonia mydas		
Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea		
Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata		
Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to 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

Current Scientific Name	Status	Type of Presence
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	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Berardius arnuxii Arnoux's Beaked Whale [70]		Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Hyperoodon planifrons Southern Bottlenose Whale [71]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia sima Dwarf Sperm Whale [85043]		Species or species habitat may occur within area
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lissodelphis peronii Southern Right Whale Dolphin [44]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]		Foraging, feeding or related behaviour known to occur within area
Mesoplodon bowdoini Andrew's Beaked Whale [73]		Species or species habitat may occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon ginkgodens Gingko-toothed Beaked Whale, Gingko-toothed Whale, Gingko Beaked Whale [59564]		Species or species habitat may occur within area
Mesoplodon grayi Gray's Beaked Whale, Scamperdown Whale [75]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Mesoplodon hectori Hector's Beaked Whale [76]		Species or species habitat may occur within area
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area
Mesoplodon mirus True's Beaked Whale [54]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to 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
Steno bredanensis Rough-toothed Dolphin [30]		Species or species habitat may occur within area
Tasmacetus shepherdi Shepherd's Beaked Whale, Tasman Beaked Whale [55]		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 truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Commonwealth Reserves Terrestrial [Resource Information]

Name	State	Type
Booderee	JBT	Botanic Gardens (Commonwealth)
Booderee	JBT	National Park (Commonwealth)

Australian Marine Parks [Resource Information]

Park Name	Zone & IUCN Categories
Jervis	Habitat Protection Zone (IUCN IV)
Flinders	Marine National Park Zone (IUCN II)
Freycinet	Marine National Park Zone (IUCN II)
Beagle	Multiple Use Zone (IUCN VI)
East Gippsland	Multiple Use Zone (IUCN VI)
Flinders	Multiple Use Zone (IUCN VI)
Freycinet	Multiple Use Zone (IUCN VI)
Freycinet	Recreational Use Zone (IUCN IV)
Jervis	Special Purpose Zone (Trawl) (IUCN VI)

Extra Information

State and Territory Reserves [Resource Information]

Protected Area Name	Reserve Type	State
Baawang	Reference Area	VIC
Babel Island	Indigenous Protected Area	TAS
Bancroft Bay - Kalimna G.L.R.	Natural Features Reserve	VIC
Bass Pyramid	Nature Reserve	TAS

Protected Area Name	Reserve Type	State
Batemans	Marine Park	NSW
Bemm, Goolengook, Arte and Errinundra Rivers	Heritage River	VIC
Ben Boyd	National Park	NSW
Benedore River	Reference Area	VIC
Beware Reef	Marine Sanctuary	VIC
Biamanga	National Park	NSW
Blond Bay W.R.	Natural Features Reserve	VIC
Blyth Point	Conservation Area	TAS
Bournda	National Park	NSW
Brodribb River F.F.R	Nature Conservation Reserve	VIC
Brush Island	Nature Reserve	NSW
Cabbage Tree Creek F.R	Nature Conservation Reserve	VIC
Cape Conran Coastal Park	Conservation Park	VIC
Cape Howe	Wilderness Zone	VIC
Cape Howe	Marine National Park	VIC
Cat Island	Conservation Area	TAS
Conjola	National Park	NSW
Craggy Island	Conservation Area	TAS
Croajingolong	National Park	VIC
Double Creek	Natural Catchment Area	VIC
East Gippsland Coastal streams	Natural Catchment Area	VIC
Eurobodalla	National Park	NSW
Ewing Morass W.R	Natural Features Reserve	VIC
First and Second Islands F.R.	Nature Conservation Reserve	VIC

Protected Area Name	Reserve Type	State
Flannagan Island G.L.R.	Natural Features Reserve	VIC
Fraser Island G.L.R.	Natural Features Reserve	VIC
Freycinet	National Park	TAS
Gippsland Lakes Coastal Park	Conservation Park	VIC
Gull Island	Conservation Area	TAS
Hogan Group	Conservation Area	TAS
Jacksons Cove	Conservation Area	TAS
Jervis Bay	National Park	NSW
Jervis Bay	Marine Park	NSW
Kent Group	National Park	TAS
Killiecrankie	Nature Recreation Area	TAS
Lake Corringle W.R	Natural Features Reserve	VIC
Lake Curlip W.R.	Natural Features Reserve	VIC
Lake Tyers S.P.	State Park	VIC
Little Island	Conservation Area	TAS
Logan Lagoon	Conservation Area	TAS
Low Point	Conservation Area	TAS
Mallacoota B.R.	Natural Features Reserve	VIC
Meroo	National Park	NSW
Mimosa Rocks	National Park	NSW
Montague Island	Nature Reserve	NSW
Mortimers Paddock B.R.	Natural Features Reserve	VIC
Mount Tanner	Nature Recreation Area	TAS
Mumbulla	Flora Reserve	NSW

Protected Area Name	Reserve Type	State
Murrah	Flora Reserve	NSW
Murramarang	National Park	NSW
Nadgee	Nature Reserve	NSW
Narrawallee Creek	Nature Reserve	NSW
North East Islet	Nature Reserve	TAS
Nyerimilang Park G.L.R.	Natural Features Reserve	VIC
Palana Beach	Nature Recreation Area	TAS
Pasco Group	Conservation Area	TAS
Patriarchs	Conservation Area	TAS
Point Hicks	Marine National Park	VIC
Prime Seal Island	Conservation Area	TAS
Rame Head	Remote and Natural Area - Schedule 6, National Parks Act	VIC
Raymond Island G.L.R.	Natural Features Reserve	VIC
Rigby Island G.L.R.	Natural Features Reserve	VIC
Sandpatch	Wilderness Zone	VIC
Seal Creek	Reference Area	VIC
Seal Islands W.R.	Nature Conservation Reserve	VIC
Sellars Lagoon	Game Reserve	TAS
Sentinel Island	Conservation Area	TAS
Sister Islands	Conservation Area	TAS
Snowy River	Heritage River	VIC
Steel Bay - Newland Backwater G.L.R.	Natural Features Reserve	VIC
Storehouse Island	Conservation Area	TAS
Sugarloaf Rock	Conservation Area	TAS

Protected Area Name	Reserve Type	State
Tanja	Flora Reserve	NSW
The Lakes	National Park	VIC
Vansittart Island	Conservation Area	TAS
William Hunter F.R	Nature Conservation Reserve	VIC
Wright Rock	Nature Reserve	TAS

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included. Please see the associated resource information for specific caveats and use limitations associated with RFA boundary information.

RFA Name	State
East Gippsland RFA	Victoria
Eden RFA	New South Wales
Gippsland RFA	Victoria
Southern RFA	New South Wales
Tasmania RFA	Tasmania

Nationally Important Wetlands [Resource Information]

Wetland Name	State
Beecroft Peninsula	NSW
Benedore River	VIC
Bondi Lake	NSW
Coila Creek Delta	NSW
Ewing's Marsh (Morass)	VIC
Jervis Bay	NSW
Jervis Bay Sea Cliffs	NSW
Lake Bunga	VIC
Lake King Wetlands	VIC
Lake Tyers	VIC
Lake Victoria Wetlands	VIC

Wetland Name	State
Little Thirsty Lagoon	TAS
Logan Lagoon	TAS
Lower Snowy River Wetlands System	VIC
Mallacoota Inlet Wetlands	VIC
Merimbula Lake	NSW
Nadgee Lake and tributary wetlands	NSW
Nargal Lake	NSW
Nelson Lagoon	NSW
Sellars Lagoon	TAS
Snowy River	VIC
St Georges Basin	NSW
Swan Lagoon	NSW
Sydenham Inlet Wetlands	VIC
Tamboon Inlet Wetlands	VIC
Thurra River	VIC
Tuross River Estuary	NSW
Unnamed Wetland	TAS
Wallaga Lake	NSW
Wallagoot Lagoon (Wallagoot Lake)	NSW

EPBC Act Referrals

[Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Aurora Green Offshore Wind Farm Preliminary Surveys	2024/09968		Referral Decision
Blue Mackerel North Offshore Wind Farm Marine Surveys	2024/09934		Referral Decision
Blue Marlin Offshore Wind Energy Project	2023/09532		Referral Decision
Eurobodalla Regional Hospital	2023/09506		Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Gippsland Offshore Wind Farm Marine Survey Investigations	2023/09682		Completed
Greater Gippsland Offshore Wind Project	2022/09379		Assessment
Greater Gippsland Offshore Wind Project Initial Marine Field Investigations	2022/09374		Completed
Marine Route Survey for Subsea Fibre Optic Data Cable System - Australia East	2024/09795		Completed
Preliminary Site Investigations for Great Eastern Offshore Wind Project	2024/09890		Referral Decision
Residential Development, Lot 172 DP 755923 and Lot 823 DP 247285, Manyana, NSW	2020/8704		Post-Approval
Seadragon Offshore Wind, Early Marine Surveys	2023/09670		Completed
South East Australia Carbon Capture and Storage Project, Commonwealth waters	2023/09732		Referral Decision
Controlled action			
Gippsland Lakes Mosquito Control Aerial /Hovercraft Spraying	2001/491	Controlled Action	Completed
Gippsland Regional Port Project	2020/8667	Controlled Action	Assessment Approach
North Manyana Subdivision, NSW	2021/8948	Controlled Action	Further Information Request
Star of the South Offshore Wind Farm Project	2020/8650	Controlled Action	Guidelines Issued
Not controlled action			
2004/2005 drilling program for exploration and production (VIC 01-06, 09-11, 16, 18 & 19 and VIC/RL	2003/1282	Not Controlled Action	Completed
2D seismic Survey in VIC/P55, VIC/RL2 and VIC/P41	2004/1876	Not Controlled Action	Completed
55m lattice tower & infrastructure	2003/1159	Not Controlled Action	Completed
Acquistion of 2D seismic data in State Waters adjacent to Ninety Mile Beach-VIC/P39(V)	2004/1889	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Angas and Galloway Exploration Wells VIC/P39(v)	2005/2330	Not Controlled Action	Completed
Basker-Manta-Gummy Oil Development	2011/6052	Not Controlled Action	Completed
Basker-Manta-Gummy Oil Field Development	2007/3402	Not Controlled Action	Completed
Basker-Manta Oil Field Development	2005/2026	Not Controlled Action	Completed
Beardie-1 Field wildcat oil well	2001/505	Not Controlled Action	Completed
Biodiversity Impacts Audit	2011/6191	Not Controlled Action	Completed
Caswell Street - Moruya East	2020/8781	Not Controlled Action	Completed
Clearance of native vegetation to create fire breaks	2004/1534	Not Controlled Action	Completed
Construction of an ocean access boat ramp at Bastion Point	2004/1407	Not Controlled Action	Completed
Cunninghame Arm Redevelopment (Stage 3)	2002/618	Not Controlled Action	Completed
Development of Kipper gas field within Vic/L3, Vic/L4 Vic/RL2	2005/2484	Not Controlled Action	Completed
Development of Turrum Oil Field and associated infrastructure	2003/1204	Not Controlled Action	Completed
Dredging of Tuross Lake channel and depositon of spoil in lake	2004/1554	Not Controlled Action	Completed
Drilling and side track completion at Baleen gas production well in Production Licence area VIC/L21	2004/1535	Not Controlled Action	Completed
Drilling of 'Culverin' oil exploration well, permit VIC/P56	2005/2279	Not Controlled Action	Completed
Drilling of Scallop-1 Exploration Well	2003/917	Not Controlled Action	Completed
East Pilchard exploration well	2001/137	Not Controlled Action	Completed
Gippsland Basin Seismic Programme	2004/1866	Not Controlled Action	Completed
Gippsland Lakes Composting Toilet Program	2000/66	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Golf Course Extension	2001/215	Not Controlled Action	Completed
Hemingway1/Oil Exploration	2001/177	Not Controlled Action	Completed
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed
INDIGO Central Submarine Telecommunications Cable	2017/8127	Not Controlled Action	Completed
Longtom-3 Gas Appraisal Well, VIC/P54	2005/2494	Not Controlled Action	Completed
Longtom Gas Pipeline Development, VIC/P54	2006/3072	Not Controlled Action	Completed
Marlin-Snapper Gas Pipeline Project	2006/3197	Not Controlled Action	Completed
Melville 1 Oil Exploration Well	2001/167	Not Controlled Action	Completed
Milton/Ulladulla Sewerage Scheme	2001/251	Not Controlled Action	Completed
Northright-1 Exploration Well	2001/209	Not Controlled Action	Completed
Offshore Petroleum Exploration	2001/289	Not Controlled Action	Completed
Offshore Seismic Survey	2001/498	Not Controlled Action	Completed
Pump station upgrades and rising main construction, Lakes Entrance, Victoria	2016/7646	Not Controlled Action	Completed
Ship to ship crude oil lightering	2008/4279	Not Controlled Action	Completed
Ship to Ship Crude Oil Lightering	2001/271	Not Controlled Action	Completed
Sole-2 appraisal gas well, VIC/RL3	2002/636	Not Controlled Action	Completed
Sole gas field development	2003/937	Not Controlled Action	Completed
Turrum Phase 2 Development Project	2008/4191	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
wastewater collection systems and pumping stations	2001/511	Not Controlled Action	Completed
West Triton Drilling Program - Gippsland Basin	2007/3915	Not Controlled Action	Completed
Wreck Bay Housing Development	2001/299	Not Controlled Action	Completed
Not controlled action (particular manner)			
2D Seismic Aquisition Survey	2008/4041	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Survey	2008/4131	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Survey	2008/4066	Not Controlled Action (Particular Manner)	Post-Approval
2D seismic survey in the Sole gas field and adjacent acreage in the Gippsland Basin (VIC RL/3 & VIC/	2002/871	Not Controlled Action (Particular Manner)	Post-Approval
2D seismic survey Permit Area VIC/P49	2006/2943	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Survey Program in Bass Strait	2008/4040	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey	2008/4528	Not Controlled Action (Particular Manner)	Post-Approval
Apache 3D seismic exploration survey	2006/3146	Not Controlled Action (Particular Manner)	Post-Approval
Bass Basin 2D and 3D seismic surveys (T/38P & T/37P)	2007/3650	Not Controlled Action (Particular Manner)	Post-Approval
Bream 3D seismic survey	2006/2556	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Dalrymple 3D Seismic Survey	2010/5680	Not Controlled Action (Particular Manner)	Post-Approval
Eden Breakwater Wharf extension, NSW	2015/7582	Not Controlled Action (Particular Manner)	Post-Approval
Eden Breakwater Wharf Extension, NSW	2016/7828	Not Controlled Action (Particular Manner)	Completed
Gas Pipeline	2000/20	Not Controlled Action (Particular Manner)	Post-Approval
Gippsland 2D Marine Seismic Survey - VIC/P-63, VIC/P-64 and T/46P	2009/5241	Not Controlled Action (Particular Manner)	Post-Approval
Golden Beach gas field development	2003/1031	Not Controlled Action (Particular Manner)	Post-Approval
Hawaiki Fibre-Optic Submarine Cable installation	2016/7765	Not Controlled Action (Particular Manner)	Post-Approval
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval
Inspection of project vessels for presence of invasive marine pests in Commonwealth waters off Victo	2012/6362	Not Controlled Action (Particular Manner)	Post-Approval
International fibre optic submarine cable installation, between Sydney and Honiara, Solomon Islands	2015/7502	Not Controlled Action (Particular Manner)	Post-Approval
Lakes Entrance Sand Management Program Trial Dredging	2007/3852	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Lakes Entrance Sand Management Program Trial Dredging	2007/3694	Not Controlled Action (Particular Manner)	Completed
Longtom-5 Offshore Production Drilling (Vic/L29), VIC	2012/6498	Not Controlled Action (Particular Manner)	Post-Approval
Longtom South -1 Exploration Drilling	2011/6217	Not Controlled Action (Particular Manner)	Post-Approval
Maintenance Dredging of Oceanic Sand	2011/5932	Not Controlled Action (Particular Manner)	Post-Approval
Non-exclusive 3-D Marine Seismic Survey, Bass Strait	2002/775	Not Controlled Action (Particular Manner)	Post-Approval
Northern Fields 3D Seismic Survey	2001/140	Not Controlled Action (Particular Manner)	Post-Approval
Pelican 3D Marine Seismic Survey, Gippsland Basin, Vic	2017/8097	Not Controlled Action (Particular Manner)	Post-Approval
Seismic Exploration in Permit VIC/P41	2001/267	Not Controlled Action (Particular Manner)	Post-Approval
Seismic Survey	2001/206	Not Controlled Action (Particular Manner)	Post-Approval
Seismic survey, Gippsland Basin	2001/525	Not Controlled Action (Particular Manner)	Post-Approval
Southern Flanks 2D Marine Seismic Survey	2010/5288	Not Controlled Action (Particular Manner)	Post-Approval
Southern Margins 3D Seismic Survey VIC/P55	2007/3780	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
supersonic missile launch facility	2000/120	Not Controlled Action (Particular Manner)	Post-Approval
Tuskfish 3D Seismic Survey, Bass Strait	2002/864	Not Controlled Action (Particular Manner)	Post-Approval
Waterfront Facility at HMAS Creswell	2002/658	Not Controlled Action (Particular Manner)	Post-Approval
West Seahorse Oil Development Project, Commonwealth waters offshore Victoria	2013/6973	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
Beardie-1 Field wildcat oil well	2001/469	Referral Decision	Completed
Beecroft Weapons Range Visitors Centre	2004/1322	Referral Decision	Completed
Breeding program for Grey Nurse Sharks	2007/3245	Referral Decision	Completed
Darymple 3D Seismic Survey, Petroleum Exploration Permit T/41P	2010/5322	Referral Decision	Completed
Enlargement of existing farm dam to irrigate a vineyard	2004/1853	Referral Decision	Completed
Holloman 2010 Vic/P60 3D Seismic Acquisition Survey Program	2009/5251	Referral Decision	Completed
Longtom 5 Offshore Production Drilling (VIC/L29)	2012/6404	Referral Decision	Completed
Longtom-5 Offshore Production Drilling (Vic/L29)	2012/6413	Referral Decision	Completed
Shark 3D Seismic Survey	2007/3294	Referral Decision	Completed
Stanton 3D Marine Seismic Survey	2013/6764	Referral Decision	Completed
Upgrade of Corringle Road	2009/4825	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
Big Horseshoe Canyon	South-east
Canyons on the eastern continental slope	Temperate east
Seamounts South and east of Tasmania	South-east
Shelf rocky reefs	Temperate east
Upwelling East of Eden	South-east

Biologically Important Areas [Resource Information]

Scientific Name	Behaviour	Presence
Dolphins		
Tursiops aduncus Indo-Pacific/Spotted Bottlenose Dolphin [68418]	Breeding	Likely to occur
Tursiops aduncus Indo-Pacific/Spotted Bottlenose Dolphin [68418]	Breeding	Known to occur
Seabirds		
Ardenna carneipes Flesh-footed Shearwater [82404]	Foraging	Known to occur
Ardenna grisea Sooty Shearwater [82651]	Breeding	Known to occur
Ardenna grisea Sooty Shearwater [82651]	Foraging	Likely to occur
Ardenna grisea Sooty Shearwater [82651]	Foraging	Known to occur
Ardenna pacifica Wedge-tailed Shearwater [84292]	Breeding	Known to occur
Ardenna tenuirostris Short-tailed Shearwater [82652]	Breeding	Known to occur
Ardenna tenuirostris Short-tailed Shearwater [82652]	Foraging	Likely to occur

Scientific Name	Behaviour	Presence
Ardenna tenuirostris Short-tailed Shearwater [82652]	Foraging	Known to occur
Ardenna tenuirostris Short-tailed Shearwater [82652]	Foraging	Likely to occur
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Foraging	Known to occur
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Foraging	Likely to occur
Diomedea exulans antipodensis Antipodean Albatross [82269]	Foraging	Known to occur
Eudyptula minor Little Penguin [1085]	Breeding	Known to occur
Eudyptula minor Little Penguin [1085]	Breeding	Likely to occur
Eudyptula minor Little Penguin [1085]	Foraging	Known to occur
Macronectes giganteus Southern Giant Petrel [1060]	Foraging	Known to occur
Macronectes halli Northern Giant Petrel [1061]	Foraging	Known to occur
Oceanites oceanites Wilsons Storm Petrel [1034]	Migration	Known to occur
Pelagodroma marina White-faced Storm-petrel [1016]	Breeding	Known to occur
Pelagodroma marina White-faced Storm-petrel [1016]	Foraging	Known to occur
Pelecanoides urinatrix Common Diving-petrel [1018]	Breeding	Known to occur
Pelecanoides urinatrix Common Diving-petrel [1018]	Foraging	Known to occur

Scientific Name	Behaviour	Presence
Phalacrocorax fuscescens Black-faced Cormorant [59660]	Breeding	Known to occur
Phalacrocorax fuscescens Black-faced Cormorant [59660]	Foraging	Known to occur
Procellaria parkinsoni Black Petrel [1048]	Foraging	Likely to occur
Pterodroma macroptera Great-winged Petrel [1035]	Foraging	Likely to occur
Pterodroma mollis Soft-plumaged Petrel [1036]	Foraging	Known to occur
Sterna striata White-fronted Tern [799]	Foraging	Known to occur
Thalassarche bulleri Bullers Albatross [64460]	Foraging	Known to occur
Thalassarche cauta cauta Shy Albatross [82345]	Foraging likely	Likely to occur
Thalassarche cauta steadi White-capped Albatross [82344]	Foraging	Known to occur
Thalassarche chlororhynchos bassi Indian Yellow-nosed Albatross [85249]	Foraging	Known to occur
Thalassarche melanophris Black-browed Albatross [66472]	Foraging	Known to occur
Thalassarche melanophris impavida Campbell Albatross [82449]	Foraging	Known to occur
Thalassarche melanophris impavida Campbell Albatross [82449]	Foraging	Likely to occur
Thalasseus bergii Crested Tern [83000]	Breeding	Known to occur
Thalasseus bergii Crested Tern [83000]	Foraging	Likely to occur

Scientific Name	Behaviour	Presence
Sharks		
Carcharias taurus Grey Nurse Shark [64469]	Foraging	Known to occur
Carcharias taurus Grey Nurse Shark [64469]	Reproduction	Known to occur
Carcharodon carcharias White Shark [64470]	Breeding (nursery area)	Known to occur
Carcharodon carcharias White Shark [64470]	Foraging	Known to occur
Whales		
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Foraging	Likely to be present
Megaptera novaeangliae Humpback Whale [38]	Migration (north and south)	Known to occur

Bioregional Assessments [Resource Information]

SubRegion	BioRegion	Website
Gippsland	Gippsland Basin	BA website
Sydney	Sydney Basin	BA website

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 is 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 on the contents of this report.

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 point locations and environmental data layers.

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 when time permits.

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 breeding sites; and
- 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: 21-Nov-2024

- Summary
- Details
  - Matters of NES
  - Other Matters Protected by the EPBC Act
  - Extra Information
- Caveat
- Acknowledgements

Figure 1: Loss of Well Control (LOWC) Environment may be affected (EMBA)

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:	3
National Heritage Places:	14
Wetlands of International Importance (Ramsar	8
Great Barrier Reef Marine Park:	None
Commonwealth Marine Area:	6
Listed Threatened Ecological Communities:	29
Listed Threatened Species:	232
Listed Migratory Species:	92

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:	507
Commonwealth Heritage Places:	79
Listed Marine Species:	148
Whales and Other Cetaceans:	39
Critical Habitats:	None
Commonwealth Reserves Terrestrial:	2
Australian Marine Parks:	11
Habitat Critical to the Survival of Marine Turtles:	None

Extra Information

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

State and Territory Reserves:	266
Regional Forest Agreements:	5
Nationally Important Wetlands:	71
EPBC Act Referrals:	281
Key Ecological Features (Marine):	7
Biologically Important Areas:	49
Bioregional Assessments:	2
Geological and Bioregional Assessments:	None

Details

Matters of National Environmental Significance

World Heritage Properties [Resource Information]

Name	State	Legal Status
Australian Convict Sites (Darlington Probation Station)	TAS	Declared property
Australian Convict Sites (Hyde Park Barracks)	NSW	Declared property
Sydney Opera House	NSW	Declared property

National Heritage Places [Resource Information]

Name	State	Legal Status
Historic		
Bondi Beach	NSW	Listed place
Bondi Surf Pavilion	NSW	Within listed place
Centennial Park	NSW	Listed place
First Government House Site	NSW	Listed place
Governors' Domain and Civic Precinct	NSW	Listed place
Hyde Park Barracks	NSW	Listed place
Kamay Botany Bay: botanical collection sites	NSW	Listed place
Kurnell Peninsula Headland	NSW	Listed place
North Head - Sydney	NSW	Listed place
Sydney Harbour Bridge	NSW	Listed place
Sydney Opera House	NSW	Listed place
Darlington Probation Station	TAS	Listed place
Indigenous		
Cyprus Hellene Club - Australian Hall	NSW	Listed place
Natural		
Royal National Park and Garawarra State Conservation Area	NSW	Listed place

Wetlands of International Importance (Ramsar Wetlands) [Resource Information]

Ramsar Site Name	Proximity
Corner inlet	Within Ramsar site

Ramsar Site Name	Proximity
East coast cape barren island lagoons	Within Ramsar site
Flood plain lower ringarooma river	Within 10km of Ramsar site
Gippsland lakes	Within Ramsar site
Jocks lagoon	Within Ramsar site
Little waterhouse lake	Within 10km of Ramsar site
Logan lagoon	Within Ramsar site
Towra point nature reserve	Within Ramsar site

Commonwealth Marine Area [Resource Information]

Approval is required for a proposed activity that is located within the Commonwealth Marine Area which has, will have, or is likely to have a significant impact on the environment. Approval may be required for a proposed action taken outside 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
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)
Commonwealth Marine Areas (EPBC Act)

Listed Threatened Ecological Communities [Resource Information]

For threatened ecological communities where the distribution is well known, maps are derived from recovery plans, State vegetation maps, remote sensing imagery and other sources. Where threatened ecological community distributions are less well known, existing vegetation maps and point location data are used to produce indicative distribution maps.
Status of Vulnerable, Disallowed and Ineligible are not MNES under the EPBC Act.

Community Name	Threatened Category	Presence Text
Alpine Sphagnum Bogs and Associated Fens	Endangered	Community may occur within area
Araluen Scarp Grassy Forest	Endangered	Community may occur within area
Assemblages of species associated with open-coast salt-wedge estuaries of western and central Victoria ecological community	Endangered	Community likely to occur within area

Community Name	Threatened Category	Presence Text
Brogo Vine Forest of the South East Corner Bioregion	Endangered	Community likely to occur within area
Castlereagh Scribbly Gum and Agnes Banks Woodlands of the Sydney Basin Bioregion	Endangered	Community may occur within area
Coastal Swamp Oak (Casuarina glauca) Forest of New South Wales and South East Queensland ecological community	Endangered	Community likely to occur within area
Coastal Swamp Sclerophyll Forest of New South Wales and South East Queensland	Endangered	Community likely to occur within area
Coastal Upland Swamps in the Sydney Basin Bioregion	Endangered	Community likely to occur within area
Cooks River/Castlereagh Ironbark Forest of the Sydney Basin Bioregion	Critically Endangered	Community may occur within area
Eastern Suburbs Banksia Scrub of the Sydney Region	Critically Endangered	Community likely to occur within area
Giant Kelp Marine Forests of South East Australia	Endangered	Community likely to occur within area
Gippsland Red Gum (Eucalyptus tereticornis subsp. mediana) Grassy Woodland and Associated Native Grassland	Critically Endangered	Community likely to occur within area
Illawarra and south coast lowland forest and woodland ecological community	Critically Endangered	Community likely to occur within area
Illawarra-Shoalhaven Subtropical Rainforest of the Sydney Basin Bioregion	Critically Endangered	Community likely to occur within area
Littoral Rainforest and Coastal Vine Thickets of Eastern Australia	Critically Endangered	Community likely to occur within area
Lowland Grassy Woodland in the South East Corner Bioregion	Critically Endangered	Community likely to occur within area
Lowland Native Grasslands of Tasmania	Critically Endangered	Community likely to occur within area
Natural Damp Grassland of the Victorian Coastal Plains	Critically Endangered	Community likely to occur within area
Posidonia australis seagrass meadows of the Manning-Hawkesbury ecoregion	Endangered	Community likely to occur within area
River-flat eucalypt forest on coastal floodplains of southern New South	Critically Endangered	Community likely to occur within area

Community Name	Threatened Category	Presence Text
Wales and eastern Victoria		
Robertson Rainforest in the Sydney Basin Bioregion	Critically Endangered	Community likely to occur within area
Shale Sandstone Transition Forest of the Sydney Basin Bioregion	Critically Endangered	Community likely to occur within area
Subtropical and Temperate Coastal Saltmarsh	Vulnerable	Community likely to occur within area
Tasmanian Forests and Woodlands dominated by black gum or Brookers gum (Eucalyptus ovata / E. brookeriana)	Critically Endangered	Community likely to occur within area
Tasmanian white gum (Eucalyptus viminalis) wet forest	Critically Endangered	Community likely to occur within area
Turpentine-Ironbark Forest of the Sydney Basin Bioregion	Critically Endangered	Community likely to occur within area
Upland Basalt Eucalypt Forests of the Sydney Basin Bioregion	Endangered	Community may occur within area
Western Sydney Dry Rainforest and Moist Woodland on Shale	Critically Endangered	Community may occur within area
White Box-Yellow Box-Blakely's Red Gum Grassy Woodland and Derived Native Grassland	Critically Endangered	Community may occur within area

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		
Anthochaera phrygia Regent Honeyeater [82338]	Critically Endangered	Species or species habitat known to occur within area
Aphelocephala leucopsis Southern Whiteface [529]	Vulnerable	Species or species habitat may occur within area
Aquila audax fleayi Tasmanian Wedge-tailed Eagle, Wedge-tailed Eagle (Tasmanian) [64435]	Endangered	Breeding likely to occur within area
Ardenna grisea Sooty Shearwater [82651]	Vulnerable	Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Arenaria interpres Ruddy Turnstone [872]	Vulnerable	Roosting known to occur within area
Botaurus poiciloptilus Australasian Bittern [1001]	Endangered	Species or species habitat known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris tenuirostris Great Knot [862]	Vulnerable	Roosting known to occur within area
Callocephalon fimbriatum Gang-gang Cockatoo [768]	Endangered	Species or species habitat known to occur within area
Calyptorhynchus lathami lathami South-eastern Glossy Black-Cockatoo [67036]	Vulnerable	Species or species habitat known to occur within area
Ceyx azureus diemenensis Tasmanian Azure Kingfisher [25977]	Endangered	Species or species habitat known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Climacteris picumnus victoriae Brown Treecreeper (south-eastern) [67062]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Dasyornis brachypterus Eastern Bristlebird [533]	Endangered	Species or species habitat known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea antipodensis gibsoni Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Erythrotriorchis radiatus Red Goshawk [942]	Endangered	Species or species habitat may occur within area
Falco hypoleucos Grey Falcon [929]	Vulnerable	Species or species habitat likely to occur within area
Fregetta grallaria grallaria White-bellied Storm-Petrel (Tasman Sea), White-bellied Storm-Petrel (Australasian) [64438]	Vulnerable	Species or species habitat likely to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Grantiella picta Painted Honeyeater [470]	Vulnerable	Species or species habitat known to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Breeding known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica baueri Nunivak Bar-tailed Godwit, Western Alaskan Bar-tailed Godwit [86380]	Endangered	Species or species habitat known to occur within area
Limosa limosa Black-tailed Godwit [845]	Endangered	Roosting known to occur within area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Melanodryas cucullata cucullata South-eastern Hooded Robin, Hooded Robin (south-eastern) [67093]	Endangered	Species or species habitat likely to occur within area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Neophema chrysostoma Blue-winged Parrot [726]	Vulnerable	Species or species habitat known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Pachyptila turtur subantarctica Fairy Prion (southern) [64445]	Vulnerable	Species or species habitat known to occur within area
Pardalotus quadragintus Forty-spotted Pardalote [418]	Endangered	Foraging, feeding or related behaviour known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pluvialis squatarola Grey Plover [865]	Vulnerable	Roosting known to occur within area
Pterodroma heraldica Herald Petrel [66973]	Critically Endangered	Species or species habitat likely to occur within area
Pterodroma leucoptera leucoptera Gould's Petrel, Australian Gould's Petrel [26033]	Endangered	Breeding known to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Pterodroma neglecta neglecta Kermadec Petrel (western) [64450]	Vulnerable	Foraging, feeding or related behaviour may occur within area
Pycnoptilus floccosus Pilotbird [525]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Rostratula australis Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area
Stagonopleura guttata Diamond Firetail [59398]	Vulnerable	Species or species habitat known to occur within area
Sternula nereis nereis Australian Fairy Tern [82950]	Vulnerable	Species or species habitat known to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche bulleri platei Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Thinornis cucullatus cucullatus Eastern Hooded Plover, Eastern Hooded Plover [90381]	Vulnerable	Species or species habitat known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat known to occur within area
Tyto novaehollandiae castanops (Tasmanian population) Masked Owl (Tasmanian) [67051]	Vulnerable	Species or species habitat known to occur within area
Xenus cinereus Terek Sandpiper [59300]	Vulnerable	Roosting known to occur within area
CRUSTACEAN		
Astacopsis gouldi Giant Freshwater Crayfish, Tasmanian Giant Freshwater Lobster [64415]	Vulnerable	Species or species habitat may occur within area
Engaeus martigener Furneaux Burrowing Crayfish [67220]	Endangered	Species or species habitat known to occur within area
Euastacus bidawalus Bidhawal Crayfish, Bidawal Crayfish, East Gippsland Spiny Crayfish [83136]	Endangered	Species or species habitat known to occur within area
Euastacus diversus Orbost Spiny Crayfish [66782]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
FISH		
Brachiopsilus ziebelli		
Ziebell's Handfish, Waterfall Bay Handfish [83757]	Vulnerable	Species or species habitat may occur within area
Epinephelus daemelii		
Black Rockcod, Black Cod, Saddled Rockcod [68449]	Vulnerable	Species or species habitat likely to occur within area
Galaxiella pusilla		
Eastern Dwarf Galaxias, Dwarf Galaxias [56790]	Endangered	Species or species habitat known to occur within area
Hippocampus whitei		
White's Seahorse, Crowned Seahorse, Sydney Seahorse [66240]	Endangered	Species or species habitat known to occur within area
Hoplostethus atlanticus		
Orange Roughy, Deep-sea Perch, Red Roughy [68455]	Conservation Dependent	Species or species habitat likely to occur within area
Maccullochella peelii		
Murray Cod [66633]	Vulnerable	Translocated population known to occur within area
Macquaria australasica		
Macquarie Perch [66632]	Endangered	Translocated population known to occur within area
Mordacia praecox		
Non-parasitic Lamprey, Precocious Lamprey [81530]	Endangered	Species or species habitat likely to occur within area
Prototroctes maraena		
Australian Grayling [26179]	Vulnerable	Species or species habitat known to occur within area
Rexea solandri (eastern Australian population)		
Eastern Gemfish [76339]	Conservation Dependent	Species or species habitat likely to occur within area
Seriolella brama		
Blue Warehou [69374]	Conservation Dependent	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Thymichthys politus Red Handfish [83756]	Critically Endangered	Species or species habitat may occur within area
FROG		
Heleioporus australiacus Giant Burrowing Frog [1973]	Vulnerable	Species or species habitat known to occur within area
Litoria aurea Green and Golden Bell Frog [1870]	Vulnerable	Species or species habitat known to occur within area
Litoria littlejohni Northern Heath Frog, Littlejohn's Tree Frog [64733]	Endangered	Species or species habitat known to occur within area
Litoria raniformis Southern Bell Frog,, Growling Grass Frog, Green and Golden Frog, Warty Swamp Frog, Golden Bell Frog [1828]	Vulnerable	Species or species habitat known to occur within area
Litoria watsoni Southern Heath Frog, Watson's Tree Frog [91509]	Endangered	Species or species habitat known to occur within area
Mixophyes balbus Stuttering Frog, Southern Barred Frog (in Victoria) [1942]	Vulnerable	Species or species habitat known to occur within area
Uperoleia martini Martin's Toadlet [1873]	Endangered	Species or species habitat known to occur within area
INSECT		
Antipodia chaostola leucophaea Tasmanian Chaostola Skipper, Heath-sand Skipper [77672]	Endangered	Species or species habitat known to occur within area
Austrocordulia leonardi Sydney Hawk Dragonfly [84741]	Endangered	Species or species habitat likely to occur within area
Lissotes latidens Broad-toothed Stag Beetle, Wielangta Stag Beetle [66760]	Endangered	Species or species habitat known to occur within area
MAMMAL		

Scientific Name	Threatened Category	Presence Text
Antechinus minimus maritimus Swamp Antechinus (mainland) [83086]	Vulnerable	Species or species habitat known to occur within area
Balaenoptera borealis Sei Whale [34]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Balaenoptera musculus Blue Whale [36]	Endangered	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Chalinolobus dwyeri Large-eared Pied Bat, Large Pied Bat [183]	Endangered	Species or species habitat known to occur within area
Dasyurus maculatus maculatus (SE mainland population) Spot-tailed Quoll, Spotted-tail Quoll, Tiger Quoll (southeastern mainland population) [75184]	Endangered	Species or species habitat known to occur within area
Dasyurus maculatus maculatus (Tasmanian population) Spotted-tail Quoll, Spot-tailed Quoll, Tiger Quoll (Tasmanian population) [75183]	Vulnerable	Species or species habitat known to occur within area
Dasyurus viverrinus Eastern Quoll, Luaner [333]	Endangered	Species or species habitat known to occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Isoodon obesulus obesulus Southern Brown Bandicoot (eastern), Southern Brown Bandicoot (south-eastern) [68050]	Endangered	Species or species habitat known to occur within area
Mastacomys fuscus mordicus Broad-toothed Rat (mainland), Tooarrana [87617]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Notamacropus parma Parma Wallaby [89289]	Vulnerable	Species or species habitat may occur within area
Perameles gunnii gunnii Eastern Barred Bandicoot (Tasmania) [66651]	Vulnerable	Species or species habitat known to occur within area
Petauroides volans Greater Glider (southern and central) [254]	Endangered	Species or species habitat known to occur within area
Petaurus australis australis Yellow-bellied Glider (south-eastern) [87600]	Vulnerable	Species or species habitat known to occur within area
Petrogale penicillata Brush-tailed Rock-wallaby [225]	Vulnerable	Species or species habitat may occur within area
Phascolarctos cinereus (combined populations of Qld, NSW and the ACT) Koala (combined populations of Queensland, New South Wales and the Australian Capital Territory) [85104]	Endangered	Species or species habitat known to occur within area
Potorous longipes Long-footed Potoroo [217]	Endangered	Species or species habitat known to occur within area
Potorous tridactylus trisulcatus Long-nosed Potoroo (southern mainland) [86367]	Vulnerable	Species or species habitat known to occur within area
Pseudomys fumeus Smoky Mouse, Konoom [88]	Endangered	Species or species habitat likely to occur within area
Pseudomys novaehollandiae New Holland Mouse, Pookila [96]	Vulnerable	Species or species habitat known to occur within area
Pteropus poliocephalus Grey-headed Flying-fox [186]	Vulnerable	Roosting known to occur within area

Scientific Name	Threatened Category	Presence Text
Sarcophilus harrisii Tasmanian Devil [299]	Endangered	Translocated population known to occur within area
OTHER		
Dendronephthya australis Cauliflower Soft Coral [90325]	Endangered	Species or species habitat known to occur within area
PLANT		
Acacia baueri subsp. aspera [18662]	Endangered	Species or species habitat known to occur within area
Acacia bynoeana Bynoe's Wattle, Tiny Wattle [8575]	Vulnerable	Species or species habitat likely to occur within area
Acacia caerulescens Limestone Blue Wattle, Buchan Blue, Buchan Blue Wattle [21883]	Vulnerable	Species or species habitat known to occur within area
Acacia constablei Narrabarba Wattle [10798]	Critically Endangered	Species or species habitat known to occur within area
Acacia georgensis Bega Wattle [9848]	Vulnerable	Species or species habitat known to occur within area
Acacia lanigera var. gracilipes [31652]	Endangered	Species or species habitat may occur within area
Acacia pubescens Downy Wattle, Hairy Stemmed Wattle [18800]	Vulnerable	Species or species habitat known to occur within area
Acacia terminalis subsp. Eastern Sydney (G.P.Phillips 126) listed as Acacia terminalis subsp. terminalis MS Sunshine Wattle (Sydney region) [91564]	Endangered	Species or species habitat known to occur within area
Allocasuarina glareicola [21932]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Allocasuarina portuensis Nielsen Park She-oak [21937]	Endangered	Species or species habitat known to occur within area
Amphibromus fluitans River Swamp Wallaby-grass, Floating Swamp Wallaby-grass [19215]	Vulnerable	Species or species habitat known to occur within area
Asterolasia elegans [56780]	Endangered	Species or species habitat may occur within area
Astrotricha crassifolia Thick-leaf Star-hair [10352]	Vulnerable	Species or species habitat known to occur within area
Astrotricha sp. Howe Range (D.E.Albrecht 1054) Long-leaf Star-hair [85676]	Critically Endangered	Species or species habitat known to occur within area
Astrotricha sp. Wingan Inlet (J.A.Jeanes 2268) Wingan Star-hair [85675]	Endangered	Species or species habitat known to occur within area
Banksia vincentia [88276]	Critically Endangered	Species or species habitat known to occur within area
Caladenia caudata Tailed Spider-orchid [17067]	Vulnerable	Species or species habitat known to occur within area
Caladenia orientalis Eastern Spider Orchid [83410]	Endangered	Species or species habitat likely to occur within area
Caladenia tessellata Thick-lipped Spider-orchid, Daddy Long-legs [2119]	Vulnerable	Species or species habitat known to occur within area
Calochilus pulchellus Pretty Beard Orchid, Pretty Beard-orchid [84677]	Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Cassinia rugata		
Wrinkled Cassinia, Wrinkled Dollybush [21885]	Vulnerable	Species or species habitat may occur within area
Commersonia prostrata		
Dwarf Kerrawang [87152]	Endangered	Species or species habitat known to occur within area
Conospermum hookeri		
Variable Smoke-bush [68161]	Vulnerable	Species or species habitat likely to occur within area
Correa baeuerlenii		
Chef's Cap [17007]	Vulnerable	Species or species habitat known to occur within area
Correa lawrenceana var. genoensis		
Genoa River Correa [66626]	Endangered	Species or species habitat may occur within area
Corunastylis rhyolitica listed as Genoplesium rhyoliticum		
Pambula Midge-orchid, Rhyolite Midge Orchid [78697]	Endangered	Species or species habitat likely to occur within area
Corunastylis vernalis listed as Genoplesium vernale		
East Lynne Midge-orchid [78699]	Vulnerable	Species or species habitat known to occur within area
Cryptostylis hunteriana		
Leafless Tongue-orchid [19533]	Vulnerable	Species or species habitat known to occur within area
Cynanchum elegans		
White-flowered Wax Plant [12533]	Endangered	Species or species habitat known to occur within area
Daphnandra johnsonii		
Illawarra Socketwood [67186]	Endangered	Species or species habitat known to occur within area
Darwinia biflora		
[14619]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Deyeuxia ramosa Climbing Bent-grass [87970]	Critically Endangered	Species or species habitat known to occur within area
Dianella amoena Matted Flax-lily [64886]	Endangered	Species or species habitat known to occur within area
Dodonaea procumbens Trailing Hop-bush [12149]	Vulnerable	Species or species habitat known to occur within area
Epacris barbata Bearded Heath, Freycinet Heath [17625]	Endangered	Species or species habitat likely to occur within area
Epacris graniticola Mt Cameron Heath, Granite Heath [82822]	Critically Endangered	Species or species habitat may occur within area
Eucalyptus camfieldii Camfield's Stringybark [15460]	Vulnerable	Species or species habitat known to occur within area
Eucalyptus stenostoma Jillaga Ash [3976]	Endangered	Species or species habitat may occur within area
Eucalyptus strzeleckii Strzelecki Gum [55400]	Vulnerable	Species or species habitat may occur within area
Genoplesium baueri Yellow Gnat-orchid, Bauer's Midge Orchid, Brittle Midge Orchid [7528]	Endangered	Species or species habitat known to occur within area
Glycine latrobeana Clover Glycine, Purple Clover [13910]	Vulnerable	Species or species habitat known to occur within area
Haloragis exalata subsp. exalata Wingless Raspwort, Square Raspwort [24636]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Haloragodendron lucasii Hal [6480]	Endangered	Species or species habitat likely to occur within area
Hibbertia acaulothrix [87409]	Endangered	Species or species habitat may occur within area
Irenepharsus trypherus Delicate Cress, Illawarra Irene [14664]	Endangered	Species or species habitat may occur within area
Kunzea rupestris [8798]	Vulnerable	Species or species habitat may occur within area
Lasiopetalum joyceae [20311]	Vulnerable	Species or species habitat known to occur within area
Leionema ralstonii [64926]	Vulnerable	Species or species habitat known to occur within area
Lepidium hyssopifolium Basalt Pepper-cress, Peppercress, Rubble Pepper-cress, Pepperweed [16542]	Endangered	Species or species habitat likely to occur within area
Leptospermum deanei Deane's Tea-tree [21777]	Vulnerable	Species or species habitat may occur within area
Leucochrysum albicans subsp. tricolor Hoary Sunray, Grassland Paper-daisy [89104]	Endangered	Species or species habitat may occur within area
Leucopogon exolasius Woronora Beard-heath [14251]	Vulnerable	Species or species habitat known to occur within area
Melaleuca biconvexa Biconvex Paperbark [5583]	Vulnerable	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Melaleuca deanei Deane's Melaleuca [5818]	Vulnerable	Species or species habitat known to occur within area
Persicaria elatior Knotweed, Tall Knotweed [5831]	Vulnerable	Species or species habitat known to occur within area
Persoonia bargoensis Bargo Geebung [56267]	Endangered	Species or species habitat may occur within area
Persoonia hirsuta Hairy Geebung, Hairy Persoonia [19006]	Endangered	Species or species habitat known to occur within area
Persoonia nutans Nodding Geebung [18119]	Endangered	Species or species habitat known to occur within area
Persoonia oxycoccoides [16114]	Endangered	Species or species habitat may occur within area
Phebalium daviesii Davies' Waxflower, St Helens Waxflower [16959]	Critically Endangered	Species or species habitat known to occur within area
Pimelea curviflora var. curviflora [4182]	Vulnerable	Species or species habitat known to occur within area
Pimelea spicata Spiked Rice-flower [20834]	Endangered	Species or species habitat known to occur within area
Pomaderris brunnea Rufous Pomaderris, Brown Pomaderris [16845]	Vulnerable	Species or species habitat likely to occur within area
Pomaderris cotoneaster Cotoneaster Pomaderris [2043]	Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Pomaderris parrisiae Parris' Pomaderris [22119]	Vulnerable	Species or species habitat known to occur within area
Prasophyllum affine Jervis Bay Leek Orchid, Culburra Leek-orchid, Kinghorn Point Leek-orchid [2210]	Endangered	Species or species habitat known to occur within area
Prasophyllum apoxychilum Tapered Leek-orchid [64947]	Endangered	Species or species habitat known to occur within area
Prasophyllum frenchii Maroon Leek-orchid, Slaty Leek-orchid, Stout Leek-orchid, French's Leek-orchid, Swamp Leek-orchid [9704]	Endangered	Species or species habitat known to occur within area
Prasophyllum secutum Northern Leek-orchid [64954]	Endangered	Species or species habitat likely to occur within area
Prasophyllum spicatum Dense Leek-orchid [55146]	Vulnerable	Species or species habitat known to occur within area
Prostanthera densa Villous Mintbush [12233]	Vulnerable	Species or species habitat known to occur within area
Prostanthera galbraithiae Wellington Mintbush [64959]	Vulnerable	Species or species habitat known to occur within area
Prostanthera junonis Somersby Mintbush [64960]	Endangered	Species or species habitat known to occur within area
Prostanthera marifolia Seaforth Mintbush [7555]	Critically Endangered	Species or species habitat known to occur within area
Pterostylis chlorogramma Green-striped Greenhood [56510]	Vulnerable	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Pterostylis cucullata Leafy Greenhood [15459]	Vulnerable	Species or species habitat known to occur within area
Pterostylis gibbosa Illawarra Greenhood, Rufa Greenhood, Pouched Greenhood [4562]	Endangered	Species or species habitat known to occur within area
Pterostylis saxicola Sydney Plains Greenhood [64537]	Endangered	Species or species habitat likely to occur within area
Pterostylis sp. Botany Bay (A.Bishop J221/1-13) Botany Bay Bearded Greenhood, Botany Bay Bearded Orchid [64965]	Endangered	Species or species habitat likely to occur within area
Pterostylis tenuissima Swamp Greenhood, Dainty Swamp Orchid [13139]	Vulnerable	Species or species habitat known to occur within area
Pterostylis vernalis Halbury Rustyhood [84711]	Critically Endangered	Species or species habitat may occur within area
Pterostylis ziegeleri Grassland Greenhood, Cape Portland Greenhood [64971]	Vulnerable	Species or species habitat likely to occur within area
Pultenaea aristata [18062]	Vulnerable	Species or species habitat known to occur within area
Rhizanthella slateri Eastern Underground Orchid [11768]	Endangered	Species or species habitat known to occur within area
Rhodamnia rubescens Scrub Turpentine, Brown Malletwood [15763]	Critically Endangered	Species or species habitat known to occur within area
Rhodomyrtus psidioides Native Guava [19162]	Critically Endangered	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Senecio psilocarpus Swamp Fireweed, Smooth-fruited Groundsel [64976]	Vulnerable	Species or species habitat known to occur within area
Spyridium cinereum Tiny Spyridium [13564]	Endangered	Species or species habitat known to occur within area
Stenanthemum pimeleoides Spreading Stenanthemum, Propellor Plant [15450]	Vulnerable	Species or species habitat may occur within area
Syzygium paniculatum Magenta Lilly Pilly, Magenta Cherry, Daguba, Scrub Cherry, Creek Lilly Pilly, Brush Cherry [20307]	Vulnerable	Species or species habitat known to occur within area
Thelymitra epipactoides Metallic Sun-orchid [11896]	Endangered	Species or species habitat known to occur within area
Thelymitra jonesii Sky-blue Sun-orchid [76352]	Endangered	Species or species habitat known to occur within area
Thelymitra kangaloonica Kangaloon Sun Orchid [81861]	Critically Endangered	Species or species habitat likely to occur within area
Thelymitra matthewsii Spiral Sun-orchid [4168]	Endangered	Species or species habitat likely to occur within area
Thesium australe Austral Toadflax, Toadflax [15202]	Vulnerable	Species or species habitat known to occur within area
Triplarina nowraensis Nowra Heath-myrtle [64544]	Endangered	Species or species habitat known to occur within area
Westringia davidii [19079]	Vulnerable	Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Xanthorrhoea arenaria Sand Grasstree [21603]	Vulnerable	Species or species habitat likely to occur within area
Xanthorrhoea bracteata Shiny Grasstree [7950]	Endangered	Species or species habitat known to occur within area
Xerochrysum palustre Swamp Everlasting, Swamp Paper Daisy [76215]	Vulnerable	Species or species habitat known to occur within area
Zieria granulata Hill Zieria, Hilly Zieria, Illawarra Zieria [17147]	Endangered	Species or species habitat likely to occur within area
Zieria tuberculata Warty Zieria [56736]	Vulnerable	Species or species habitat known to occur within area
REPTILE		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Hoplocephalus bungaroides Broad-headed Snake [1182]	Endangered	Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Lissolepis coventryi		
Swamp Skink, Eastern Mourning Skink [84053]	Endangered	Species or species habitat known to occur within area
Natator depressus		
Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
SHARK		
Carcharias taurus (east coast population)		
Grey Nurse Shark (east coast population) [68751]	Critically Endangered	Congregation or aggregation known to occur within area
Carcharodon carcharias		
White Shark, Great White Shark [64470]	Vulnerable	Breeding known to occur within area
Centrophorus harrissoni		
Harrisson's Dogfish, Endeavour Dogfish, Dumb Gulper Shark, Harrison's Deepsea Dogfish [68444]	Conservation Dependent	Species or species habitat likely to occur within area
Centrophorus uyato		
Little Gulper Shark [68446]	Conservation Dependent	Species or species habitat likely to occur within area
Galeorhinus galeus		
School Shark, Eastern School Shark, Snapper Shark, Tope, Soupfin Shark [68453]	Conservation Dependent	Species or species habitat likely to occur within area
Rhincodon typus		
Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Sphyrna lewini		
Scalloped Hammerhead [85267]	Conservation Dependent	Species or species habitat likely to occur within area
SNAIL		
Meridolum maryae		
Maroubra Woodland Snail, Maroubra Land Snail [89884]	Endangered	Species or species habitat known to occur within area

Listed Migratory Species [Resource Information]

Scientific Name	Threatened Category	Presence Text
Migratory Marine Birds		

Scientific Name	Threatened Category	Presence Text
Anous stolidus Common Noddy [825]		Species or species habitat likely to occur within area
Apus pacificus Fork-tailed Swift [678]		Species or species habitat likely to occur within area
Ardenna carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna grisea Sooty Shearwater [82651]	Vulnerable	Breeding known to occur within area
Ardenna pacifica Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Ardenna tenuirostris Short-tailed Shearwater [82652]		Breeding known to occur within area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Diomedea antipodensis Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
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	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Sternula albifrons Little Tern [82849]		Breeding known to occur within area
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area

Scientific Name	Threatened Category	Presence Text
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Migratory Marine Species		
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	Species or species habitat likely to occur within area

Scientific Name	Threatened Category	Presence Text
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour likely to occur within area
Carcharhinus longimanus Oceanic Whitetip Shark [84108]		Species or species habitat likely to occur within area
Carcharias taurus Grey Nurse Shark [64469]		Congregation or aggregation known to occur within area
Carcharodon carcharias White Shark, Great White Shark [64470]	Vulnerable	Breeding known to occur within area
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area
Dugong dugon Dugong [28]		Species or species habitat may occur within area
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Scientific Name	Threatened Category	Presence Text
Eubalaena australis as Balaena glacialis australis		
Southern Right Whale [40]	Endangered	Breeding known to occur within area
Isurus oxyrinchus		
Shortfin Mako, Mako Shark [79073]		Species or species habitat likely to occur within area
Isurus paucus		
Longfin Mako [82947]		Species or species habitat likely to occur within area
Lagenorhynchus obscurus		
Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lamna nasus		
Porbeagle, Mackerel Shark [83288]		Species or species habitat likely to occur within area
Megaptera novaeangliae		
Humpback Whale [38]		Foraging, feeding or related behaviour 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	Foraging, feeding or related behaviour known to occur within area
Orcinus orca		
Killer Whale, Orca [46]		Species or species habitat likely to occur within area
Physeter macrocephalus		
Sperm Whale [59]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Rhincodon typus Whale Shark [66680]	Vulnerable	Species or species habitat may occur within area
Migratory Terrestrial Species		
Cuculus optatus Oriental Cuckoo, Horsfield's Cuckoo [86651]		Species or species habitat known to occur within area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area
Migratory Wetlands Species		
Actitis hypoleucos Common Sandpiper [59309]		Species or species habitat known to occur within area
Arenaria interpres Ruddy Turnstone [872]	Vulnerable	Roosting known to occur within area
Calidris acuminata Sharp-tailed Sandpiper [874]	Vulnerable	Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	Species or species habitat known to occur within area
Calidris ferruginea Curlew Sandpiper [856]	Critically Endangered	Species or species habitat known to occur within area
Calidris melanotos Pectoral Sandpiper [858]		Species or species habitat known to occur within area
Calidris pugnax as Philomachus pugnax Ruff [91256]		Roosting known to occur within area

Scientific Name	Threatened Category	Presence Text
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area
Calidris tenuirostris Great Knot [862]	Vulnerable	Roosting known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting known to occur within area
Charadrius leschenaultii Greater Sand Plover, Large Sand Plover [877]	Vulnerable	Species or species habitat known to occur within area
Charadrius mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area
Gallinago hardwickii Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat known to occur within area
Gallinago megala Swinhoe's Snipe [864]		Roosting likely to occur within area
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat known to occur within area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Limosa limosa Black-tailed Godwit [845]	Endangered	Roosting known to occur within area
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area
Pluvialis squatarola Grey Plover [865]	Vulnerable	Roosting known to occur within area
Thalasseus bergii Greater Crested Tern [83000]		Breeding known to occur within area
Tringa brevipes Grey-tailed Tattler [851]		Roosting known to occur within area
Tringa glareola Wood Sandpiper [829]		Roosting known to occur within area
Tringa incana Wandering Tattler [831]		Roosting known to occur within area
Tringa nebularia Common Greenshank, Greenshank [832]	Endangered	Species or species habitat known to occur within area
Tringa stagnatilis Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area

Scientific Name	Threatened Category	Presence Text
Xenus cinereus Terek Sandpiper [59300]	Vulnerable	Roosting known 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
Australian Academy of Science	
Commonwealth Land - Australian Academy of Science [12031]	NSW
Australian National University	
Commonwealth Land - Australian National University [15737]	NSW
Commonwealth Land - Australian National University [13156]	NSW
Commonwealth Land - Australian National University [12023]	NSW
Commonwealth Land - Australian National University [12022]	NSW
Commonwealth Land - Australian National University [12021]	NSW
Commonwealth Land - Australian National University [12024]	NSW
Commonwealth Land - Australian National University [12019]	NSW
Commonwealth Bank of Australia	
Commonwealth Land - Commonwealth Bank of Australia [13158]	NSW
Commonwealth Land - Commonwealth Bank of Australia [14331]	NSW
Commonwealth Trading Bank of Australia	
Commonwealth Land - Commonwealth Trading Bank of Australia [12224]	NSW
Commonwealth Land - Commonwealth Trading Bank of Australia [12020]	NSW
Commonwealth Land - Commonwealth Trading Bank of Australia [12203]	NSW
Commonwealth Land - Commonwealth Trading Bank of Australia [14337]	NSW

Commonwealth Land Name	State
Commonwealth Land - Commonwealth Trading Bank of Australia [14322]	NSW
Commonwealth Land - Commonwealth Trading Bank of Australia [14323]	NSW
Commonwealth Land - Commonwealth Trading Bank of Australia [14325]	NSW
Commonwealth Land - Commonwealth Trading Bank of Australia [12202]	NSW
Commonwealth Land - Commonwealth Trading Bank of Australia [13209]	NSW
Commonwealth Land - Commonwealth Trading Bank of Australia [12017]	NSW
Communications, Information Technology and the Arts - Australian Broadcasting Corporation	
Commonwealth Land - Australian Broadcasting Corporation [15511]	NSW
Communications, Information Technology and the Arts - Australian Postal Corporation	
Commonwealth Land - Australian Postal Commission [13153]	NSW
Commonwealth Land - Australian Postal Commission [13195]	NSW
Commonwealth Land - Australian Postal Commission [11893]	NSW
Commonwealth Land - Australian Postal Commission [14280]	NSW
Commonwealth Land - Australian Postal Commission [14284]	NSW
Commonwealth Land - Australian Postal Commission [12225]	NSW
Commonwealth Land - Australian Postal Commission [13291]	NSW
Commonwealth Land - Australian Postal Commission [13290]	NSW
Commonwealth Land - Australian Postal Commission [14355]	NSW
Commonwealth Land - Australian Postal Commission [14350]	NSW
Commonwealth Land - Australian Postal Commission [14338]	NSW
Commonwealth Land - Australian Postal Commission [15538]	NSW
Commonwealth Land - Australian Postal Commission [15537]	NSW
Commonwealth Land - Australian Postal Commission [12078]	NSW
Commonwealth Land - Australian Postal Commission [13215]	NSW
Commonwealth Land - Australian Postal Commission [16431]	NSW

Commonwealth Land Name	State
Commonwealth Land - Australian Postal Commission [14366]	NSW
Commonwealth Land - Australian Postal Commission [13137]	NSW
Commonwealth Land - Australian Postal Commission [14326]	NSW
Commonwealth Land - Australian Postal Commission [14324]	NSW
Commonwealth Land - Australian Postal Commission [14329]	NSW
Commonwealth Land - Australian Postal Commission [12205]	NSW
Commonwealth Land - Australian Postal Commission [12052]	NSW
Commonwealth Land - Australian Postal Commission [14391]	NSW
Commonwealth Land - Australian Postal Commission [12016]	NSW
Commonwealth Land - Australian Postal Corporation [12227]	NSW
Commonwealth Land - Australian Postal Corporation [13152]	NSW
Commonwealth Land - Australian Postal Corporation [12226]	NSW
Commonwealth Land - Australian Postal Corporation [14342]	NSW
Commonwealth Land - Australian Postal Corporation [14343]	NSW
Commonwealth Land - Australian Postal Corporation [12072]	NSW
Commonwealth Land - Australian Postal Corporation [13214]	NSW
Commonwealth Land - Australian Postal Corporation [16009]	NSW
Commonwealth Land - Australian Postal Corporation [16021]	NSW
Commonwealth Land - Australian Postal Corporation [12207]	NSW
Commonwealth Land - Australian Postal Corporation [12073]	NSW
Communications, Information Technology and the Arts - Telstra Corporation Limited	
Commonwealth Land - Australian & Overseas Telecommunications Corporation [13155]	NSW
Commonwealth Land - Australian & Overseas Telecommunications Corporation [14359]	NSW
Commonwealth Land - Australian Telecommunications Commission [16473]	NSW
Commonwealth Land - Australian Telecommunications Commission [11887]	NSW
Commonwealth Land - Australian Telecommunications Commission [11888]	NSW

Commonwealth Land Name	State
Commonwealth Land - Australian Telecommunications Commission [11889]	NSW
Commonwealth Land - Australian Telecommunications Commission [13154]	NSW
Commonwealth Land - Australian Telecommunications Commission [13157]	NSW
Commonwealth Land - Australian Telecommunications Commission [13194]	NSW
Commonwealth Land - Australian Telecommunications Commission [11892]	NSW
Commonwealth Land - Australian Telecommunications Commission [11894]	NSW
Commonwealth Land - Australian Telecommunications Commission [12036]	NSW
Commonwealth Land - Australian Telecommunications Commission [12038]	NSW
Commonwealth Land - Australian Telecommunications Commission [14281]	NSW
Commonwealth Land - Australian Telecommunications Commission [14285]	NSW
Commonwealth Land - Australian Telecommunications Commission [12008]	NSW
Commonwealth Land - Australian Telecommunications Commission [12223]	NSW
Commonwealth Land - Australian Telecommunications Commission [15461]	NSW
Commonwealth Land - Australian Telecommunications Commission [13293]	NSW
Commonwealth Land - Australian Telecommunications Commission [12215]	NSW
Commonwealth Land - Australian Telecommunications Commission [16089]	NSW
Commonwealth Land - Australian Telecommunications Commission [15430]	NSW
Commonwealth Land - Australian Telecommunications Commission [14381]	NSW
Commonwealth Land - Australian Telecommunications Commission [14351]	NSW

Commonwealth Land Name	State
Commonwealth Land - Australian Telecommunications Commission [14356]	NSW
Commonwealth Land - Australian Telecommunications Commission [13162]	NSW
Commonwealth Land - Australian Telecommunications Commission [15535]	NSW
Commonwealth Land - Australian Telecommunications Commission [13129]	NSW
Commonwealth Land - Australian Telecommunications Commission [14279]	NSW
Commonwealth Land - Australian Telecommunications Commission [14379]	NSW
Commonwealth Land - Australian Telecommunications Commission [12025]	NSW
Commonwealth Land - Australian Telecommunications Commission [11853]	NSW
Commonwealth Land - Australian Telecommunications Commission [15611]	NSW
Commonwealth Land - Australian Telecommunications Commission [13216]	NSW
Commonwealth Land - Australian Telecommunications Commission [12040]	NSW
Commonwealth Land - Australian Telecommunications Commission [12265]	NSW
Commonwealth Land - Australian Telecommunications Commission [13136]	NSW
Commonwealth Land - Australian Telecommunications Commission [14327]	NSW
Commonwealth Land - Australian Telecommunications Commission [12050]	NSW
Commonwealth Land - Australian Telecommunications Commission [12053]	NSW
Commonwealth Land - Australian Telecommunications Commission [12058]	NSW
Commonwealth Land - Australian Telecommunications Commission [12059]	NSW
Commonwealth Land - Australian Telecommunications Commission [12010]	NSW

Commonwealth Land Name	State
Commonwealth Land - Australian Telecommunications Commission [12014]	NSW
Commonwealth Land - Australian Telecommunications Commission [12015]	NSW
Commonwealth Land - Australian Telecommunications Corporation [14286]	NSW
Commonwealth Land - Australian Telecommunications Corporation [13292]	NSW
Commonwealth Land - Telstra Corporation Limited [15888]	NSW
Commonwealth Land - Telstra Corporation Limited [14283]	NSW
Commonwealth Land - Telstra Corporation Limited [14282]	NSW
Commonwealth Land - Telstra Corporation Limited [14287]	NSW
Commonwealth Land - Telstra Corporation Limited [12039]	NSW
Commonwealth Land - Telstra Corporation Limited [14349]	NSW
Commonwealth Land - Telstra Corporation Limited [15407]	NSW
Commonwealth Land - Telstra Corporation Limited [12075]	NSW
Commonwealth Land - Telstra Corporation Limited [13213]	NSW
Commonwealth Land - Telstra Corporation Limited [14368]	NSW
Commonwealth Land - Telstra Corporation Limited [13187]	NSW
Commonwealth Land - Telstra Corporation Limited [12076]	NSW
Commonwealth Land - Telstra Corporation Limited [12204]	NSW
Commonwealth Land - Telstra Corporation Limited [12051]	NSW
Commonwealth Land - Telstra Corporation Limited [14333]	NSW
Commonwealth Land - Telstra Corporation Limited [14332]	NSW
Defence	
Commonwealth Land - Defence Service Homes Corporation [14363]	NSW
Commonwealth Land - Defence Service Homes Corporation [11895]	NSW
Commonwealth Land - Defence Service Homes Corporation [11897]	NSW
Commonwealth Land - Defence Service Homes Corporation [11896]	NSW
Commonwealth Land - Defence Service Homes Corporation [14357]	NSW

Commonwealth Land Name	State
Commonwealth Land - Defence Service Homes Corporation [14352]	NSW
Commonwealth Land - Defence Service Homes Corporation [13210]	NSW
Commonwealth Land - Defence Service Homes Corporation [14360]	NSW
Commonwealth Land - Defence Service Homes Corporation [13211]	NSW
Commonwealth Land - Defence Service Homes Corporation & Alice Isabel Patterson [14377]	NSW
Commonwealth Land - Director of Defence Service Homes [13208]	NSW
Defence - BANKSMEADOW DEPOT (Sydney Workshop Company) [11116]	NSW
Defence - BANKSMEADOW DEPOT (Sydney Workshop Company) [11117]	NSW
Defence - BEECROFT RAPIER RANGE [10051]	NSW
Defence - BEECROFT RAPIER RANGE [10050]	NSW
Defence - BEECROFT RAPIER RANGE [10049]	NSW
Defence - BEECROFT RAPIER RANGE [10048]	NSW
Defence - BEECROFT RAPIER RANGE [10052]	NSW
Defence - DEFENCE PLAZA SYDNEY [11179]	NSW
Defence - DEGAUSSING RANGE [10039]	NSW
Defence - DUTSON BOMBING RANGE [20038]	VIC
Defence - DUTSON BOMBING RANGE [20033]	VIC
Defence - DUTSON BOMBING RANGE [20035]	VIC
Defence - DUTSON BOMBING RANGE [20036]	VIC
Defence - DUTSON BOMBING RANGE [20037]	VIC
Defence - DUTSON BOMBING RANGE [20034]	VIC
Defence - DUTSON BOMBING RANGE [20061]	VIC
Defence - DUTSON BOMBING RANGE [20062]	VIC
Defence - ENDEAVOUR HOUSE - COOGEE [11172]	NSW
Defence - FLEET BASE WHARVES [10024]	NSW

Commonwealth Land Name	State
Defence - FLEET BASE WHARVES [10023]	NSW
Defence - FLEET BASE WHARVES [10021]	NSW
Defence - FLEET BASE WHARVES [10022]	NSW
Defence - GARDEN ISLAND [10014]	NSW
Defence - Graovac House [10147]	NSW
Defence - HMAS KUTTABUL (AC 30/5 Lot4 DP218946) [11074]	NSW
Defence - HMAS PENGUIN [11071]	NSW
Defence - HMAS PLATYPUS - SPDU FOR DISPOSAL [10042]	NSW
Defence - HMAS PLATYPUS - SPDU FOR DISPOSAL [10041]	NSW
Defence - HMAS PLATYPUS - SPDU FOR DISPOSAL [10040]	NSW
Defence - HMAS WATSON [10029]	NSW
Defence - HYDROGRAPHIC OFFICE [10234]	NSW
Defence - JENNER BUILDING [10034]	NSW
Defence - KENSINGTON DEPOT [11110]	NSW
Defence - KISMET/HMAS KUTTABUL-POTTS PT [11173]	NSW
Defence - LADY GOWRIE HOUSE [10045]	NSW
Defence - LADY GOWRIE HOUSE [10046]	NSW
Defence - LADY GOWRIE HOUSE [10047]	NSW
Defence - LAKE ILLAWARRA CADET FACILITY [10241]	NSW
Defence - MARITIME COMD CTRE-POTTS POINT ; BOMERAH/TARANA [10032]	NSW
Defence - MARITIME COMD CTRE-POTTS POINT ; BOMERAH/TARANA [10033]	NSW
Defence - MARITIME HEADQUARTERS [11178]	NSW
Defence - MILLER'S POINT TRAINING DEPOT [11118]	NSW
Defence - NFI CHOWDER BAY (fuel depot) [10043]	NSW
Defence - NORTH SYDNEY - HYDRO OFFICE [11161]	NSW
Defence - OXFORD ST SYDNEY [11164]	NSW

Commonwealth Land Name	State
Defence - OXFORD ST SYDNEY [11165]	NSW
Defence - OXFORD ST SYDNEY [11169]	NSW
Defence - OXFORD ST SYDNEY [11168]	NSW
Defence - OXFORD ST SYDNEY [11167]	NSW
Defence - OXFORD ST SYDNEY [11166]	NSW
Defence - PARKVIEW BUILDING - SYDNEY [11170]	NSW
Defence - RANDWICK (CARRINGTON RD) [11135]	NSW
Defence - RANDWICK (CARRINGTON RD) [11134]	NSW
Defence - RANDWICK (CARRINGTON RD) [11133]	NSW
Defence - RANDWICK (CARRINGTON RD) [11132]	NSW
Defence - RANDWICK BARRACKS [11129]	NSW
Defence - RANDWICK BARRACKS [11128]	NSW
Defence - RANDWICK BARRACKS [11131]	NSW
Defence - RANDWICK BARRACKS [11130]	NSW
Defence - RANDWICK BARRACKS [11124]	NSW
Defence - RANDWICK BARRACKS [11127]	NSW
Defence - RANDWICK BARRACKS [11125]	NSW
Defence - RANDWICK BARRACKS [11126]	NSW
Defence - RANDWICK FRENCHMANS TRG [11162]	NSW
Defence - RANDWICK FRENCHMANS TRG [11163]	NSW
Defence - ROCKDALE TRAINING DEPOT [11111]	NSW
Defence - SUSSEX INLET - DEFENCE RESERVE [11233]	NSW
Defence - THROSBY TRG DEPOT-PORT KEMBLA [10056]	NSW
Defence - TRAINING SHIP CONDAMINE [11072]	NSW
Defence - TRAINING SHIP CONDAMINE [11073]	NSW
Defence - TRESCO [10044]	NSW
Defence - TS ALBATROSS-WOLLONGONG [10148]	NSW

Commonwealth Land Name	State
Defence - VAUCLUSE TRAINING DEPOT [11137]	NSW
Defence - VICTORIA BARRACKS - PADDINGTON [11119]	NSW
Defence - VICTORIA BARRACKS - PADDINGTON [11120]	NSW
Defence - VICTORIA BARRACKS - PADDINGTON [11121]	NSW
Defence - WILLOUGHBY TRG DEP [11140]	NSW
Defence - WILLOUGHBY TRG DEP [11147]	NSW
Defence - WILLOUGHBY TRG DEP [11141]	NSW
Defence - WILLOUGHBY TRG DEP [11144]	NSW
Defence - WILLOUGHBY TRG DEP [11146]	NSW
Defence - WILLOUGHBY TRG DEP [11145]	NSW
Defence - WILLOUGHBY TRG DEP [11149]	NSW
Defence - WILLOUGHBY TRG DEP [11148]	NSW
Defence - WILLOUGHBY TRG DEP [11143]	NSW
Defence - WILLOUGHBY TRG DEP [11142]	NSW
Defence - WILLOUGHBY TRG DEP [11159]	NSW
Defence - WILLOUGHBY TRG DEP [11150]	NSW
Defence - WILLOUGHBY TRG DEP [11158]	NSW
Defence - WILLOUGHBY TRG DEP [11151]	NSW
Defence - WILLOUGHBY TRG DEP [11154]	NSW
Defence - WILLOUGHBY TRG DEP [11155]	NSW
Defence - WILLOUGHBY TRG DEP [11152]	NSW
Defence - WILLOUGHBY TRG DEP [11153]	NSW
Defence - WILLOUGHBY TRG DEP [11156]	NSW
Defence - WILLOUGHBY TRG DEP [11157]	NSW
Defence - WILLOUGHBY TRG DEP [11139]	NSW
Defence - WILLOUGHBY TRG DEP [11138]	NSW
Defence - WOLLONGONG MULTI-USER DEPOT [11209]	NSW

Commonwealth Land Name	State
Defence - WOOLLOOMOOLOO CARPARK [11176]	NSW
Defence - WOOLLOOMOOLOO CARPARK [11177]	NSW
Defence - WOOLLOOMOOLOO CARPARK [11175]	NSW
Defence - WOOLLOOMOOLOO CARPARK [11174]	NSW
Defence - ZETLAND NAVY SUPPLY CENTRE [11091]	NSW
Defence - ZETLAND NAVY SUPPLY CENTRE [11090]	NSW
Defence - ZETLAND NAVY SUPPLY CENTRE [11081]	NSW
Defence - ZETLAND NAVY SUPPLY CENTRE [11088]	NSW
Defence - ZETLAND NAVY SUPPLY CENTRE [11085]	NSW
Defence - ZETLAND NAVY SUPPLY CENTRE [11082]	NSW
Defence - ZETLAND NAVY SUPPLY CENTRE [11083]	NSW
Defence - ZETLAND NAVY SUPPLY CENTRE [11080]	NSW
Defence - ZETLAND NAVY SUPPLY CENTRE [11084]	NSW
Defence - ZETLAND NAVY SUPPLY CENTRE [11086]	NSW
Defence - ZETLAND NAVY SUPPLY CENTRE [11087]	NSW
Defence - ZETLAND NAVY SUPPLY CENTRE [11092]	NSW
Defence - ZETLAND NAVY SUPPLY CENTRE [11089]	NSW
Defence - ZETLAND NAVY SUPPLY CENTRE [11078]	NSW
Defence - ZETLAND NAVY SUPPLY CENTRE [11079]	NSW
Defence - ZETLAND NAVY SUPPLY CENTRE [11075]	NSW
Defence - ZETLAND NAVY SUPPLY CENTRE [11076]	NSW
Defence - ZETLAND NAVY SUPPLY CENTRE [11077]	NSW
Defence - Defence Housing Authority	
Commonwealth Land - Defence Housing Authority [14289]	NSW
Commonwealth Land - Defence Housing Authority [15413]	NSW
Commonwealth Land - Defence Housing Authority [14293]	NSW
Commonwealth Land - Defence Housing Authority [14291]	NSW

Commonwealth Land Name	State
Commonwealth Land - Defence Housing Authority [14290]	NSW
Commonwealth Land - Defence Housing Authority [14292]	NSW
Commonwealth Land - Defence Housing Authority [13286]	NSW
Commonwealth Land - Defence Housing Authority [13289]	NSW
Commonwealth Land - Defence Housing Authority [13288]	NSW
Commonwealth Land - Defence Housing Authority [13191]	NSW
Commonwealth Land - Defence Housing Authority [13190]	NSW
Commonwealth Land - Defence Housing Authority [15608]	NSW
Commonwealth Land - Defence Housing Authority [15886]	NSW
Commonwealth Land - Defence Housing Authority [15881]	NSW
Commonwealth Land - Defence Housing Authority [15884]	NSW
Commonwealth Land - Defence Housing Authority [12034]	NSW
Commonwealth Land - Defence Housing Authority [12035]	NSW
Commonwealth Land - Defence Housing Authority [12033]	NSW
Commonwealth Land - Defence Housing Authority [16062]	NSW
Commonwealth Land - Defence Housing Authority [14450]	NSW
Commonwealth Land - Defence Housing Authority [15918]	NSW
Commonwealth Land - Defence Housing Authority [15441]	NSW
Commonwealth Land - Defence Housing Authority [14288]	NSW
Commonwealth Land - Defence Housing Authority [16286]	NSW
Commonwealth Land - Defence Housing Authority [15885]	NSW
Commonwealth Land - Defence Housing Authority [12211]	NSW
Commonwealth Land - Defence Housing Authority [12213]	NSW
Commonwealth Land - Defence Housing Authority [13189]	NSW
Commonwealth Land - Defence Housing Authority [12216]	NSW
Commonwealth Land - Defence Housing Authority [12212]	NSW
Commonwealth Land - Defence Housing Authority [13175]	NSW

Commonwealth Land Name	State
Commonwealth Land - Defence Housing Authority [13176]	NSW
Commonwealth Land - Defence Housing Authority [13174]	NSW
Commonwealth Land - Defence Housing Authority [15756]	NSW
Commonwealth Land - Defence Housing Authority [15757]	NSW
Commonwealth Land - Defence Housing Authority [14344]	NSW
Commonwealth Land - Defence Housing Authority [14345]	NSW
Commonwealth Land - Defence Housing Authority [14347]	NSW
Commonwealth Land - Defence Housing Authority [13172]	NSW
Commonwealth Land - Defence Housing Authority [13178]	NSW
Commonwealth Land - Defence Housing Authority [13179]	NSW
Commonwealth Land - Defence Housing Authority [14346]	NSW
Commonwealth Land - Defence Housing Authority [13171]	NSW
Commonwealth Land - Defence Housing Authority [13170]	NSW
Commonwealth Land - Defence Housing Authority [13177]	NSW
Commonwealth Land - Defence Housing Authority [16457]	NSW
Commonwealth Land - Defence Housing Authority [16456]	NSW
Commonwealth Land - Defence Housing Authority [16455]	NSW
Commonwealth Land - Defence Housing Authority [16454]	NSW
Commonwealth Land - Defence Housing Authority [13166]	NSW
Commonwealth Land - Defence Housing Authority [13167]	NSW
Commonwealth Land - Defence Housing Authority [16459]	NSW
Commonwealth Land - Defence Housing Authority [16458]	NSW
Commonwealth Land - Defence Housing Authority [16453]	NSW
Commonwealth Land - Defence Housing Authority [15754]	NSW
Commonwealth Land - Defence Housing Authority [15753]	NSW
Commonwealth Land - Defence Housing Authority [15752]	NSW
Commonwealth Land - Defence Housing Authority [16189]	NSW

Commonwealth Land Name	State
Commonwealth Land - Defence Housing Authority [15751]	NSW
Commonwealth Land - Defence Housing Authority [12210]	NSW
Commonwealth Land - Defence Housing Authority [12214]	NSW
Commonwealth Land - Defence Housing Authority [13168]	NSW
Commonwealth Land - Defence Housing Authority [13169]	NSW
Commonwealth Land - Defence Housing Authority [12061]	NSW
Commonwealth Land - Defence Housing Authority [15749]	NSW
Commonwealth Land - Defence Housing Authority [13186]	NSW
Commonwealth Land - Defence Housing Authority [13188]	NSW
Commonwealth Land - Defence Housing Authority [14295]	NSW
Commonwealth Land - Defence Housing Authority [14294]	NSW
Commonwealth Land - Defence Housing Authority [14297]	NSW
Commonwealth Land - Defence Housing Authority [14296]	NSW
Commonwealth Land - Defence Housing Authority [16122]	NSW
Commonwealth Land - Defence Housing Authority [14299]	NSW
Commonwealth Land - Defence Housing Authority [14298]	NSW
Commonwealth Land - Defence Housing Authority [16175]	NSW
Commonwealth Land - Defence Housing Authority [16176]	NSW
Commonwealth Land - Defence Housing Authority [16177]	NSW
Commonwealth Land - Defence Housing Authority [16178]	NSW
Commonwealth Land - Defence Housing Authority [14314]	NSW
Commonwealth Land - Defence Housing Authority [14315]	NSW
Commonwealth Land - Defence Housing Authority [14319]	NSW
Commonwealth Land - Defence Housing Authority [14316]	NSW
Commonwealth Land - Defence Housing Authority [14318]	NSW
Commonwealth Land - Defence Housing Authority [14311]	NSW
Commonwealth Land - Defence Housing Authority [13124]	NSW

Commonwealth Land Name	State
Commonwealth Land - Defence Housing Authority [14313]	NSW
Commonwealth Land - Defence Housing Authority [16466]	NSW
Commonwealth Land - Defence Housing Authority [15948]	NSW
Commonwealth Land - Defence Housing Authority [14306]	NSW
Commonwealth Land - Defence Housing Authority [14307]	NSW
Commonwealth Land - Defence Housing Authority [14308]	NSW
Commonwealth Land - Defence Housing Authority [14309]	NSW
Commonwealth Land - Defence Housing Authority [14303]	NSW
Commonwealth Land - Defence Housing Authority [14300]	NSW
Commonwealth Land - Defence Housing Authority [14305]	NSW
Commonwealth Land - Defence Housing Authority [14302]	NSW
Commonwealth Land - Defence Housing Authority [14312]	NSW
Commonwealth Land - Defence Housing Authority [14317]	NSW
Commonwealth Land - Defence Housing Authority [13212]	NSW
Commonwealth Land - Defence Housing Authority [14380]	NSW
Commonwealth Land - Defence Housing Authority [15969]	NSW
Commonwealth Land - Defence Housing Authority [14362]	NSW
Commonwealth Land - Defence Housing Authority [12088]	NSW
Commonwealth Land - Defence Housing Authority [12063]	NSW
Commonwealth Land - Defence Housing Authority [12062]	NSW
Commonwealth Land - Defence Housing Authority [12067]	NSW
Commonwealth Land - Defence Housing Authority [12060]	NSW
Commonwealth Land - Defence Housing Authority [12085]	NSW
Commonwealth Land - Defence Housing Authority [12084]	NSW
Commonwealth Land - Defence Housing Authority [12087]	NSW
Commonwealth Land - Defence Housing Authority [12086]	NSW
Commonwealth Land - Defence Housing Authority [13180]	NSW

Commonwealth Land Name	State
Commonwealth Land - Defence Housing Authority [13181]	NSW
Commonwealth Land - Defence Housing Authority [13184]	NSW
Commonwealth Land - Defence Housing Authority [13185]	NSW
Commonwealth Land - Defence Housing Authority [13182]	NSW
Commonwealth Land - Defence Housing Authority [13183]	NSW
Commonwealth Land - Defence Housing Authority [15596]	NSW
Commonwealth Land - Defence Housing Authority [12077]	NSW
Commonwealth Land - Defence Housing Authority [13196]	NSW
Commonwealth Land - Defence Housing Authority [16028]	NSW
Commonwealth Land - Defence Housing Authority [13135]	NSW
Commonwealth Land - Defence Housing Authority [14320]	NSW
Commonwealth Land - Defence Housing Authority [14321]	NSW
Commonwealth Land - Defence Housing Authority [12209]	NSW
Commonwealth Land - Defence Housing Authority [12208]	NSW
Commonwealth Land - Defence Housing Authority [14330]	NSW
Commonwealth Land - Defence Housing Authority [14539]	NSW
Commonwealth Land - Defence Housing Authority [15959]	NSW
Commonwealth Land - Defence Housing Authority [16465]	NSW
Commonwealth Land - Defence Housing Authority [16464]	NSW
Commonwealth Land - Defence Housing Authority [16469]	NSW
Commonwealth Land - Defence Housing Authority [16468]	NSW
Commonwealth Land - Defence Housing Authority [16467]	NSW
Commonwealth Land - Defence Housing Authority [16460]	NSW
Commonwealth Land - Defence Housing Authority [16461]	NSW
Commonwealth Land - Defence Housing Authority [15755]	NSW
Commonwealth Land - Defence Housing Authority [14304]	NSW
Commonwealth Land - Defence Housing Authority [15963]	NSW

Commonwealth Land Name	State
Commonwealth Land - Defence Housing Authority [15750]	NSW
Commonwealth Land - Defence Housing Authority [15414]	NSW
Commonwealth Land - Defence Housing Authority [16462]	NSW
Commonwealth Land - Defence Housing Authority [16463]	NSW
Commonwealth Land - Defence Housing Authority [15718]	NSW
Commonwealth Land - Defence Housing Authority [16470]	NSW
Commonwealth Land - Director of War Service Homes [12032]	NSW
Commonwealth Land - Director of War Service Homes [14358]	NSW
Commonwealth Land - Director of War Service Homes [14367]	NSW
Commonwealth Land - Director of War Service Homes [14361]	NSW
Commonwealth Land - Director of War Service Homes [12068]	NSW
Commonwealth Land - Director of War Service Homes [12206]	NSW
Defence - Royal Australian Navy Central Canteens Board	
Commonwealth Land - Royal Australian Navy Central Canteens Board [12018]	NSW
Environment and Heritage	
Commonwealth Land - Booderee National Park [91005]	JBT
Commonwealth Land - Booderee National Park [91004]	JBT
Commonwealth Land - Booderee National Park [91001]	JBT
Commonwealth Land - Booderee National Park [91003]	JBT
Commonwealth Land - Booderee National Park [91002]	JBT
Transport and Regional Services - Airservices Australia	
Commonwealth Land - Airservices Australia [12057]	NSW
Treasury - Reserve Bank of Australia	
Commonwealth Land - Reserve Bank of Australia [13150]	NSW
Commonwealth Land - Reserve Bank of Australia [13151]	NSW
Commonwealth Land - Reserve Bank of Australia [13159]	NSW
Commonwealth Land - Reserve Bank of Australia [13148]	NSW
Commonwealth Land - Reserve Bank of Australia [13149]	NSW

Commonwealth Land Name	State
Commonwealth Land - Reserve Bank of Australia [13138]	NSW
Commonwealth Land - Reserve Bank of Australia [13160]	NSW
Commonwealth Land - Reserve Bank of Australia [16499]	NSW
Unknown	
Commonwealth Land - [21488]	VIC
Commonwealth Land - [60065]	TAS
Commonwealth Land - [60066]	TAS
Commonwealth Land - [13287]	NSW
Commonwealth Land - [21498]	VIC
Commonwealth Land - [21491]	VIC
Commonwealth Land - [13285]	NSW
Commonwealth Land - [13143]	NSW
Commonwealth Land - [15459]	NSW
Commonwealth Land - [21496]	VIC
Commonwealth Land - [21497]	VIC
Commonwealth Land - [15883]	NSW
Commonwealth Land - [15882]	NSW
Commonwealth Land - [13142]	NSW
Commonwealth Land - [13146]	NSW
Commonwealth Land - [13147]	NSW
Commonwealth Land - [13144]	NSW
Commonwealth Land - [13145]	NSW
Commonwealth Land - [16116]	NSW
Commonwealth Land - [16283]	NSW
Commonwealth Land - [15729]	NSW
Commonwealth Land - [15690]	NSW
Commonwealth Land - [21490]	VIC

Commonwealth Land Name	State
Commonwealth Land - [15436]	NSW
Commonwealth Land - [15503]	NSW
Commonwealth Land - [15435]	NSW
Commonwealth Land - [15434]	NSW
Commonwealth Land - [13173]	NSW
Commonwealth Land - [16452]	NSW
Commonwealth Land - [14354]	NSW
Commonwealth Land - [14353]	NSW
Commonwealth Land - [13165]	NSW
Commonwealth Land - [13163]	NSW
Commonwealth Land - [13161]	NSW
Commonwealth Land - [15406]	NSW
Commonwealth Land - [15410]	NSW
Commonwealth Land - [11160]	NSW
Commonwealth Land - [14310]	NSW
Commonwealth Land - [14301]	NSW
Commonwealth Land - [16161]	NSW
Commonwealth Land - [16160]	NSW
Commonwealth Land - [16159]	NSW
Commonwealth Land - [14378]	NSW
Commonwealth Land - [14370]	NSW
Commonwealth Land - [14376]	NSW
Commonwealth Land - [14375]	NSW
Commonwealth Land - [14374]	NSW
Commonwealth Land - [14373]	NSW
Commonwealth Land - [14372]	NSW
Commonwealth Land - [14371]	NSW

Commonwealth Land Name	State
Commonwealth Land - [15689]	NSW
Commonwealth Land - [14369]	NSW
Commonwealth Land - [13219]	NSW
Commonwealth Land - [14365]	NSW
Commonwealth Land - [14364]	NSW
Commonwealth Land - [60067]	TAS
Commonwealth Land - [60064]	TAS
Commonwealth Land - [13217]	NSW
Commonwealth Land - [13218]	NSW
Commonwealth Land - [12042]	NSW
Commonwealth Land - [12041]	NSW
Commonwealth Land - [12046]	NSW
Commonwealth Land - [12047]	NSW
Commonwealth Land - [14334]	NSW
Commonwealth Land - [14335]	NSW
Commonwealth Land - [14336]	NSW
Commonwealth Land - [12045]	NSW
Commonwealth Land - [16562]	NSW
Commonwealth Land - [13139]	NSW
Commonwealth Land - [15688]	NSW
Commonwealth Land - [60345]	TAS
Commonwealth Land - [60340]	TAS
Commonwealth Land - [60343]	TAS
Commonwealth Land - [14396]	NSW
Commonwealth Land - [60341]	TAS
Commonwealth Land - [12232]	NSW
Commonwealth Land - [12231]	NSW

Commonwealth Land Name	State
Commonwealth Land - [14399]	NSW
Commonwealth Land - [14393]	NSW
Commonwealth Land - [14394]	NSW
Commonwealth Land - [14397]	NSW
Commonwealth Land - [14392]	NSW
Commonwealth Land - [14395]	NSW
Commonwealth Land - [14400]	NSW
Commonwealth Land - [14401]	NSW
Commonwealth Land - [21487]	VIC
Commonwealth Land - [14382]	NSW
Commonwealth Land - [21489]	VIC
Commonwealth Land - [14398]	NSW

Commonwealth Heritage Places [Resource Information]

Name	State	Status
Historic		
Admiralty House and Lodge	NSW	Listed place
Admiralty House Garden and Fortifications	NSW	Listed place
Army Cottage with return verandah	NSW	Listed place
Barracks Group HMAS Watson	NSW	Listed place
Batteries A83 and C9A	NSW	Listed place
Battery B42	NSW	Listed place
Battery for Five Guns	NSW	Listed place
Bondi Beach Post Office	NSW	Listed place
Botany Post Office	NSW	Listed place
Buildings 31 and 32	NSW	Listed place
Buildings MQVB16 and VB56	NSW	Listed place
Buildings VB13, 15, 16 & 17	NSW	Listed place
Buildings VB41, 45 & 53	NSW	Listed place

Name	State	Status
Buildings VB60 and VB62	NSW	Listed place
Buildings VB69, 75 & 76 including Garden	NSW	Listed place
Buildings VB83, 84, 85, 87 & 89	NSW	Listed place
Buildings VB90, 91, 91A & 92	NSW	Listed place
Building VB1 and Parade Ground	NSW	Listed place
Building VB2 Guard House	NSW	Listed place
Cape Baily Lighthouse	NSW	Listed place
Cape St George Lighthouse Ruins & Curtilage	ACT	Listed place
Chain and Anchor Store (former)	NSW	Listed place
Chowder Bay Barracks Group	NSW	Listed place
Christians Minde Settlement	ACT	Listed place
Cliff House	NSW	Listed place
Commonwealth Avenue Defence Housing	NSW	Listed place
Cottage at Macquarie Lighthouse	NSW	Listed place
Cronulla Post Office	NSW	Listed place
Customs Marine Centre	NSW	Listed place
Defence site - Georges Heights and Middle Head	NSW	Listed place
Eddystone Lighthouse	TAS	Listed place
Factory	NSW	Listed place
Gabo Island Lighthouse	VIC	Listed place
Garden Island Precinct	NSW	Listed place
Gazebo	NSW	Listed place
General Post Office	NSW	Listed place
Golf Clubhouse (former)	NSW	Listed place
Goose Island Lighthouse	TAS	Listed place
Headquarters 8th Brigade Precinct	NSW	Listed place

Name	State	Status
Headquarters Training Command Precinct	NSW	Listed place
HMAS Penguin	NSW	Listed place
Jervis Bay Botanic Gardens	ACT	Listed place
Kiama Post Office	NSW	Listed place
Kirribilli House	NSW	Listed place
Kirribilli House Garden & Grounds	NSW	Listed place
Macquarie Lighthouse	NSW	Listed place
Macquarie Lighthouse Group	NSW	Listed place
Macquarie Lighthouse Surrounding Wall	NSW	Listed place
Marine Biological Station (former)	NSW	Listed place
Military Road Framework - Defence Land	NSW	Listed place
Montague Island Lighthouse	NSW	Listed place
Naval Store	NSW	Listed place
Navy Refuelling Depot and Caretakers House	NSW	Listed place
North Head Artillery Barracks	NSW	Listed place
North Sydney Post Office	NSW	Listed place
Office Building	NSW	Listed place
Officers Mess, HQ Training Command	NSW	Listed place
Paddington Post Office	NSW	Listed place
Point Perpendicular Lightstation	NSW	Listed place
Reserve Bank	NSW	Listed place
Residences Group	NSW	Listed place
Rigging Shed and Chapel	NSW	Listed place
Royal Australian Naval College	ACT	Listed place
School of Musketry and Officers Mess, Randwick Army Barracks	NSW	Listed place
Shark Point Battery	NSW	Listed place

Name	State	Status
Swan Island Lighthouse	TAS	Listed place
Sydney Airport Air Traffic Control Tower	NSW	Listed place
Sydney Customs House (former)	NSW	Listed place
Ten Terminal Regiment Headquarters and AusAid Training Centre	NSW	Listed place
Thirty Terminal Squadron Precinct	NSW	Listed place
Victoria Barracks Perimeter Wall and Gates	NSW	Listed place
Victoria Barracks Precinct	NSW	Listed place
Victoria Barracks Squash Courts	NSW	Listed place
Wilsons Promontory Lighthouse	VIC	Listed place
Indigenous		
Crocodile Head Area	NSW	Within listed place
Currarong Rockshelters Area	NSW	Within listed place
Jervis Bay Territory	ACT	Listed place
Natural		
Beecroft Peninsula	NSW	Listed place
Malabar Headland	NSW	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

Scientific Name	Threatened Category	Presence Text
Ardenna carneipes as Puffinus carneipes Flesh-footed Shearwater, Fleshy-footed Shearwater [82404]		Foraging, feeding or related behaviour likely to occur within area
Ardenna grisea as Puffinus griseus Sooty Shearwater [82651]	Vulnerable	Breeding known to occur within area
Ardenna pacifica as Puffinus pacificus Wedge-tailed Shearwater [84292]		Breeding known to occur within area
Ardenna tenuirostris as Puffinus tenuirostris Short-tailed Shearwater [82652]		Breeding known to occur within area
Arenaria interpres Ruddy Turnstone [872]	Vulnerable	Roosting 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]	Vulnerable	Roosting known to occur within area
Calidris alba Sanderling [875]		Roosting known to occur within area
Calidris canutus Red Knot, Knot [855]	Vulnerable	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 known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Calidris pugnax as Philomachus pugnax Ruff [91256]		Roosting known to occur within area overfly marine area
Calidris ruficollis Red-necked Stint [860]		Roosting known to occur within area overfly marine area
Calidris subminuta Long-toed Stint [861]		Roosting known to occur within area overfly marine area
Calidris tenuirostris Great Knot [862]	Vulnerable	Roosting known to occur within area overfly marine area
Calonectris leucomelas Streaked Shearwater [1077]		Species or species habitat known to occur within area
Charadrius bicinctus Double-banded Plover [895]		Roosting 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 mongolus Lesser Sand Plover, Mongolian Plover [879]	Endangered	Roosting known to occur within area
Charadrius ruficapillus Red-capped Plover [881]		Roosting known to occur within area overfly marine area
Charadrius veredus Oriental Plover, Oriental Dotterel [882]		Roosting known to occur within area overfly marine area
Chroicocephalus novaehollandiae as Larus novaehollandiae Silver Gull [82326]		Breeding known to occur within area

Scientific Name	Threatened Category	Presence Text
Diomedea antipodensis		
Antipodean Albatross [64458]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea antipodensis gibsoni as Diomedea gibsoni		
Gibson's Albatross [82270]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea epomophora		
Southern Royal Albatross [89221]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea exulans		
Wandering Albatross [89223]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Diomedea sanfordi		
Northern Royal Albatross [64456]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Eudyptula minor		
Little Penguin [1085]		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
Gallinago hardwickii		
Latham's Snipe, Japanese Snipe [863]	Vulnerable	Species or species habitat known to occur within area overfly marine area
Gallinago megala		
Swinhoe's Snipe [864]		Roosting likely to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Gallinago stenura Pin-tailed Snipe [841]		Roosting likely to occur within area overfly marine area
Haliaeetus leucogaster White-bellied Sea-Eagle [943]		Breeding known to occur within area
Halobaena caerulea Blue Petrel [1059]	Vulnerable	Species or species habitat may occur within area
Himantopus himantopus Pied Stilt, Black-winged Stilt [870]		Roosting known to occur within area overfly marine area
Hirundapus caudacutus White-throated Needletail [682]	Vulnerable	Species or species habitat known to occur within area overfly marine area
Hydroprogne caspia as Sterna caspia Caspian Tern [808]		Breeding known to occur within area
Larus dominicanus Kelp Gull [809]		Breeding known to occur within area
Larus pacificus Pacific Gull [811]		Breeding known to occur within area
Lathamus discolor Swift Parrot [744]	Critically Endangered	Breeding known to occur within area overfly marine area
Limicola falcinellus Broad-billed Sandpiper [842]		Roosting known to occur within area overfly marine area
Limnodromus semipalmatus Asian Dowitcher [843]	Vulnerable	Species or species habitat known to occur within area overfly marine area
Limosa lapponica Bar-tailed Godwit [844]		Species or species habitat known to occur within area

Scientific Name	Threatened Category	Presence Text
Limosa limosa Black-tailed Godwit [845]	Endangered	Roosting known to occur within area overfly marine area
Macronectes giganteus Southern Giant-Petrel, Southern Giant Petrel [1060]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Macronectes halli Northern Giant Petrel [1061]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Merops ornatus Rainbow Bee-eater [670]		Species or species habitat may occur within area overfly marine area
Monarcha melanopsis Black-faced Monarch [609]		Species or species habitat known to occur within area overfly marine area
Morus serrator Australasian Gannet [1020]		Breeding known to occur within area
Motacilla flava Yellow Wagtail [644]		Species or species habitat known to occur within area overfly marine area
Myiagra cyanoleuca Satin Flycatcher [612]		Breeding known to occur within area overfly marine area
Neophema chrysogaster Orange-bellied Parrot [747]	Critically Endangered	Species or species habitat known to occur within area overfly marine area
Neophema chrysostoma Blue-winged Parrot [726]	Vulnerable	Species or species habitat known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Numenius madagascariensis Eastern Curlew, Far Eastern Curlew [847]	Critically Endangered	Species or species habitat known to occur within area
Numenius minutus Little Curlew, Little Whimbrel [848]		Roosting known to occur within area overfly marine area
Numenius phaeopus Whimbrel [849]		Roosting known to occur within area
Onychoprion fuscatus as Sterna fuscata Sooty Tern [90682]		Breeding known to occur within area
Pachyptila turtur Fairy Prion [1066]		Species or species habitat known to occur within area
Pandion haliaetus Osprey [952]		Species or species habitat known to occur within area
Pelagodroma marina White-faced Storm-Petrel [1016]		Breeding known to occur within area
Pelecanoides urinatrix Common Diving-Petrel [1018]		Breeding known to occur within area
Phaethon lepturus White-tailed Tropicbird [1014]		Species or species habitat known to occur within area
Phalacrocorax fuscescens Black-faced Cormorant [59660]		Breeding known to occur within area
Phoebetria fusca Sooty Albatross [1075]	Vulnerable	Species or species habitat likely to occur within area
Pluvialis fulva Pacific Golden Plover [25545]		Roosting known to occur within area

Scientific Name	Threatened Category	Presence Text
Pluvialis squatarola Grey Plover [865]	Vulnerable	Roosting known to occur within area overfly marine area
Pterodroma cervicalis White-necked Petrel [59642]		Breeding likely to occur within area
Pterodroma mollis Soft-plumaged Petrel [1036]	Vulnerable	Species or species habitat may occur within area
Recurvirostra novaehollandiae Red-necked Avocet [871]		Roosting known to occur within area overfly marine area
Rhipidura rufifrons Rufous Fantail [592]		Species or species habitat known to occur within area overfly marine area
Rostratula australis as Rostratula benghalensis (sensu lato) Australian Painted Snipe [77037]	Endangered	Species or species habitat known to occur within area overfly marine area
Stercorarius antarcticus as Catharacta skua Brown Skua [85039]		Species or species habitat may occur within area
Sterna striata White-fronted Tern [799]		Breeding known to occur within area
Sternula albifrons as Sterna albifrons Little Tern [82849]		Breeding known to occur within area
Sternula nereis as Sterna nereis Fairy Tern [82949]		Breeding known to occur within area
Symposiachrus trivirgatus as Monarcha trivirgatus Spectacled Monarch [83946]		Species or species habitat known to occur within area overfly marine area

Scientific Name	Threatened Category	Presence Text
Thalassarche bulleri Buller's Albatross, Pacific Albatross [64460]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche bulleri platei as Thalassarche sp. nov. Northern Buller's Albatross, Pacific Albatross [82273]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche carteri Indian Yellow-nosed Albatross [64464]	Vulnerable	Species or species habitat likely to occur within area
Thalassarche cauta Shy Albatross [89224]	Endangered	Foraging, feeding or related behaviour likely to occur within area
Thalassarche chrysostoma Grey-headed Albatross [66491]	Endangered	Species or species habitat may occur within area
Thalassarche eremita Chatham Albatross [64457]	Endangered	Foraging, feeding or related behaviour may occur within area
Thalassarche impavida Campbell Albatross, Campbell Black-browed Albatross [64459]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche melanophris Black-browed Albatross [66472]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche salvini Salvin's Albatross [64463]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area
Thalassarche steadi White-capped Albatross [64462]	Vulnerable	Foraging, feeding or related behaviour known to occur within area

Scientific Name	Threatened Category	Presence Text
Thalasseus bergii as Sterna bergii		
Greater Crested Tern [83000]		Breeding known to occur within area
Thinornis cucullatus as Thinornis rubricollis		
Hooded Plover, Hooded Dotterel [87735]		Species or species habitat known to occur within area overfly marine area
Thinornis cucullatus cucullatus as Thinornis rubricollis rubricollis		
Eastern Hooded Plover, Eastern Hooded Plover [90381]	Vulnerable	Species or species habitat known to occur within area overfly marine area
Tringa brevipes as Heteroscelus brevipes		
Grey-tailed Tattler [851]		Roosting known to occur within area
Tringa glareola		
Wood Sandpiper [829]		Roosting known to occur within area overfly marine area
Tringa incana as Heteroscelus incanus		
Wandering Tattler [831]		Roosting known to occur within area
Tringa nebularia		
Common Greenshank, Greenshank [832]	Endangered	Species or species habitat known to occur within area overfly marine area
Tringa stagnatilis		
Marsh Sandpiper, Little Greenshank [833]		Roosting known to occur within area overfly marine area
Xenus cinereus		
Terek Sandpiper [59300]	Vulnerable	Roosting known to occur within area overfly marine area
Fish		
Acentronura tentaculata		
Shortpouch Pygmy Pipehorse [66187]		Species or species habitat may occur within area
Cosmocampus howensis		
Lord Howe Pipefish [66208]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Festucalex cinctus Girdled Pipefish [66214]		Species or species habitat may occur within area
Filicampus tigris Tiger Pipefish [66217]		Species or species habitat may occur within area
Heraldia nocturna Upside-down Pipefish, Eastern Upside-down Pipefish, Eastern Upside-down Pipefish [66227]		Species or species habitat may occur within area
Hippichthys penicillus Beady Pipefish, Steep-nosed Pipefish [66231]		Species or species habitat may occur within area
Hippocampus abdominalis Big-belly Seahorse, Eastern Potbelly Seahorse, New Zealand Potbelly Seahorse [66233]		Species or species habitat may occur within area
Hippocampus breviceps Short-head Seahorse, Short-snouted Seahorse [66235]		Species or species habitat may occur within area
Hippocampus minotaur Bullneck Seahorse [66705]		Species or species habitat may occur within area
Hippocampus whitei White's Seahorse, Crowned Seahorse, Sydney Seahorse [66240]	Endangered	Species or species habitat known to occur within area
Histiogamphelus briggsii Crested Pipefish, Briggs' Crested Pipefish, Briggs' Pipefish [66242]		Species or species habitat may occur within area
Histiogamphelus cristatus Rhino Pipefish, Macleay's Crested Pipefish, Ring-back Pipefish [66243]		Species or species habitat may occur within area
Hypselognathus rostratus Knifesnout Pipefish, Knife-snouted Pipefish [66245]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Kaupus costatus Deepbody Pipefish, Deep-bodied Pipefish [66246]		Species or species habitat may occur within area
Kimblaeus bassensis Trawl Pipefish, Bass Strait Pipefish [66247]		Species or species habitat may occur within area
Leptoichthys fistularius Brushtail Pipefish [66248]		Species or species habitat may occur within area
Lissocampus caudalis Australian Smooth Pipefish, Smooth Pipefish [66249]		Species or species habitat may occur within area
Lissocampus runa Javelin Pipefish [66251]		Species or species habitat may occur within area
Maroubra perserrata Sawtooth Pipefish [66252]		Species or species habitat may occur within area
Mitotichthys mollisoni Mollison's Pipefish [66260]		Species or species habitat may occur within area
Mitotichthys semistriatus Halfbanded Pipefish [66261]		Species or species habitat may occur within area
Mitotichthys tuckeri Tucker's Pipefish [66262]		Species or species habitat may occur within area
Notiocampus ruber Red Pipefish [66265]		Species or species habitat may occur within area
Phycodurus eques Leafy Seadragon [66267]		Species or species habitat may occur within area

Scientific Name	Threatened Category	Presence Text
Phyllopteryx taeniolatus Common Seadragon, Weedy Seadragon [66268]		Species or species habitat may occur within area
Pugnaso curtirostris Pugnose Pipefish, Pug-nosed Pipefish [66269]		Species or species habitat may occur within area
Solegnathus robustus Robust Pipehorse, Robust Spiny Pipehorse [66274]		Species or species habitat may occur within area
Solegnathus spinosissimus Spiny Pipehorse, Australian Spiny Pipehorse [66275]		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
Solenostomus paradoxus Ornate Ghostpipefish, Harlequin Ghost Pipefish, Ornate Ghost Pipefish [66184]		Species or species habitat may occur within area
Stigmatopora argus Spotted Pipefish, Gulf Pipefish, Peacock Pipefish [66276]		Species or species habitat may occur within area
Stigmatopora nigra Widebody Pipefish, Wide-bodied Pipefish, Black Pipefish [66277]		Species or species habitat may occur within area
Stipecampus cristatus Ringback Pipefish, Ring-backed Pipefish [66278]		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

Scientific Name	Threatened Category	Presence Text
Urocampus carinirostris Hairy Pipefish [66282]		Species or species habitat may occur within area
Vanacampus margaritifer Mother-of-pearl Pipefish [66283]		Species or species habitat may occur within area
Vanacampus phillipi Port Phillip Pipefish [66284]		Species or species habitat may occur within area
Vanacampus poecilolaemus Longsnout Pipefish, Australian Long-snout Pipefish, Long-snouted Pipefish [66285]		Species or species habitat may occur within area
Mammal		
Arctocephalus forsteri Long-nosed Fur-seal, New Zealand Fur-seal [20]		Species or species habitat may occur within area
Arctocephalus pusillus Australian Fur-seal, Australo-African Fur-seal [21]		Breeding known to occur within area
Dugong dugon Dugong [28]		Species or species habitat may occur within area
Reptile		
Caretta caretta Loggerhead Turtle [1763]	Endangered	Foraging, feeding or related behaviour known to occur within area
Chelonia mydas Green Turtle [1765]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Dermochelys coriacea Leatherback Turtle, Leathery Turtle, Luth [1768]	Endangered	Foraging, feeding or related behaviour known to occur within area

Scientific Name	Threatened Category	Presence Text
Eretmochelys imbricata Hawksbill Turtle [1766]	Vulnerable	Foraging, feeding or related behaviour known to occur within area
Hydrophis elegans Elegant Sea Snake, Bar-bellied Sea Snake [1104]		Species or species habitat may occur within area
Hydrophis platura as Pelamis platurus Yellow-bellied Sea Snake [93746]		Species or species habitat may occur within area
Natator depressus Flatback Turtle [59257]	Vulnerable	Foraging, feeding or related behaviour known to 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	Species or species habitat likely to occur within area
Balaenoptera physalus Fin Whale [37]	Vulnerable	Foraging, feeding or related behaviour likely to occur within area

Current Scientific Name	Status	Type of Presence
Berardius arnuxii Arnoux's Beaked Whale [70]		Species or species habitat may occur within area
Caperea marginata Pygmy Right Whale [39]		Foraging, feeding or related behaviour likely to occur within area
Delphinus delphis Common Dolphin, Short-beaked Common Dolphin [60]		Species or species habitat may occur within area
Eubalaena australis Southern Right Whale [40]	Endangered	Breeding known to occur within area
Feresa attenuata Pygmy Killer Whale [61]		Species or species habitat may occur within area
Globicephala macrorhynchus Short-finned Pilot Whale [62]		Species or species habitat may occur within area
Globicephala melas Long-finned Pilot Whale [59282]		Species or species habitat may occur within area
Grampus griseus Risso's Dolphin, Grampus [64]		Species or species habitat may occur within area
Hyperoodon planifrons Southern Bottlenose Whale [71]		Species or species habitat may occur within area
Kogia breviceps Pygmy Sperm Whale [57]		Species or species habitat may occur within area
Kogia sima Dwarf Sperm Whale [85043]		Species or species habitat may occur within area

Current Scientific Name	Status	Type of Presence
Lagenorhynchus obscurus Dusky Dolphin [43]		Species or species habitat likely to occur within area
Lissodelphis peronii Southern Right Whale Dolphin [44]		Species or species habitat may occur within area
Megaptera novaeangliae Humpback Whale [38]		Foraging, feeding or related behaviour known to occur within area
Mesoplodon bowdoini Andrew's Beaked Whale [73]		Species or species habitat may occur within area
Mesoplodon densirostris Blainville's Beaked Whale, Dense-beaked Whale [74]		Species or species habitat may occur within area
Mesoplodon ginkgodens Gingko-toothed Beaked Whale, Gingko-toothed Whale, Gingko Beaked Whale [59564]		Species or species habitat may occur within area
Mesoplodon grayi Gray's Beaked Whale, Scamperdown Whale [75]		Species or species habitat may occur within area
Mesoplodon hectori Hector's Beaked Whale [76]		Species or species habitat may occur within area
Mesoplodon layardii Strap-toothed Beaked Whale, Strap-toothed Whale, Layard's Beaked Whale [25556]		Species or species habitat may occur within area
Mesoplodon mirus True's Beaked Whale [54]		Species or species habitat may occur within area
Orcinus orca Killer Whale, Orca [46]		Species or species habitat likely to 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
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
Tasmacetus shepherdi Shepherd's Beaked Whale, Tasman Beaked Whale [55]		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 truncatus s. str. Bottlenose Dolphin [68417]		Species or species habitat may occur within area
Ziphius cavirostris Cuvier's Beaked Whale, Goose-beaked Whale [56]		Species or species habitat may occur within area

Commonwealth Reserves Terrestrial [Resource Information]

Name	State	Type
Booderee	JBT	National Park (Commonwealth)
Booderee	JBT	Botanic Gardens (Commonwealth)

Australian Marine Parks	[Resource Information]
Park Name	Zone & IUCN Categories
Central Eastern	Habitat Protection Zone (IUCN IV)
Hunter	Habitat Protection Zone (IUCN IV)
Jervis	Habitat Protection Zone (IUCN IV)
Flinders	Marine National Park Zone (IUCN II)
Freycinet	Marine National Park Zone (IUCN II)
Beagle	Multiple Use Zone (IUCN VI)
East Gippsland	Multiple Use Zone (IUCN VI)
Flinders	Multiple Use Zone (IUCN VI)
Freycinet	Multiple Use Zone (IUCN VI)
Freycinet	Recreational Use Zone (IUCN IV)
Jervis	Special Purpose Zone (Trawl) (IUCN VI)

Extra Information

State and Territory Reserves		[Resource Information]
Protected Area Name	Reserve Type	State
Anderson Islands	Conservation Area	TAS
Anser Island	Reference Area	VIC
Ansons Bay	Conservation Area	TAS
Arthur Bay	Conservation Area	TAS
Baawang	Reference Area	VIC
Babel Island	Indigenous Protected Area	TAS

Protected Area Name	Reserve Type	State
Badger Island	Indigenous Protected Area	TAS
Bancroft Bay - Kalimna G.L.R.	Natural Features Reserve	VIC
Barren Grounds	Nature Reserve	NSW
Bass Pyramid	Nature Reserve	TAS
Batemans	Marine Park	NSW
Battery Island	Conservation Area	TAS
Baxter Island G.L.R.	Natural Features Reserve	VIC
Bay of Fires	Conservation Area	TAS
Bell Bird Creek	Nature Reserve	NSW
Belowla Island	Nature Reserve	NSW
Bemm, Goolengook, Arte and Errinundra Rivers	Heritage River	VIC
Ben Boyd	National Park	NSW
Benedore River	Reference Area	VIC
Berkeley	Nature Reserve	NSW
Bermaguee	Nature Reserve	NSW
Bermagui	Flora Reserve	NSW
Beware Reef	Marine Sanctuary	VIC
Biamanga	National Park	NSW
Big Green Island	Nature Reserve	TAS
Big Silver	Conservation Covenant	TAS
Binalongtime	Conservation Covenant	TAS
Blond Bay G.L.R.	Natural Features Reserve	VIC
Blond Bay W.R.	Natural Features Reserve	VIC
Blyth Point	Conservation Area	TAS

Protected Area Name	Reserve Type	State
Boat Harbour	Aquatic Reserve	NSW
Boat Harbour Road Killiecrankie	Conservation Covenant	TAS
Boggy Creek	Conservation Area	TAS
Bournda	Nature Reserve	NSW
Bournda	National Park	NSW
Boxen Island	Conservation Area	TAS
Briggs Islet	Conservation Area	TAS
Brodribb River F.F.R	Nature Conservation Reserve	VIC
Bronte-Coogee	Aquatic Reserve	NSW
Brougham Sugarloaf	Conservation Area	TAS
Broulee Island	Nature Reserve	NSW
Brush Island	Nature Reserve	NSW
Bun Beetons Point	Conservation Area	TAS
Bushrangers Bay	Aquatic Reserve	NSW
Cabbage Tree Bay	Aquatic Reserve	NSW
Cabbage Tree Creek F.R	Nature Conservation Reserve	VIC
Cape Banks	Aquatic Reserve	NSW
Cape Conran Coastal Park	Conservation Park	VIC
Cape Howe	Wilderness Zone	VIC
Cape Howe	Marine National Park	VIC
Cat Island	Conservation Area	TAS
Chalky Island	Conservation Area	TAS
Chappell Islands	Nature Reserve	TAS
Chimneys Lagoon	Conservation Covenant	TAS
Clyde River	National Park	NSW
Comerong Island	Nature Reserve	NSW

Protected Area Name	Reserve Type	State
Cone Islet	Conservation Area	TAS
Conjola	National Park	NSW
Corner Inlet	Marine National Park	VIC
Corner Inlet Marine and Coastal Park	National Parks Act Schedule 4 park or reserve	VIC
Corramy	Regional Park	NSW
Craggy Island	Conservation Area	TAS
Croajingolong	National Park	VIC
Cullendulla Creek	Nature Reserve	NSW
Curtis Island	Nature Reserve	TAS
Darling Range	Conservation Area	TAS
Darriman H29 B.R	Natural Features Reserve	VIC
Devils Tower	Nature Reserve	TAS
Dharawal	Nature Reserve	NSW
Dharawal	National Park	NSW
Doctors Peak	Regional Reserve	TAS
Double Creek	Natural Catchment Area	VIC
Doughboy Island	Conservation Area	TAS
Eagles Claw	Nature Reserve	NSW
East Gippsland Coastal streams	Natural Catchment Area	VIC
East Kangaroo Island	Nature Reserve	TAS
East Moncoeur Island	Conservation Area	TAS
Eddystone Point Lighthouse	Historic Site	TAS
Egg Beach	Conservation Area	TAS
Emita	Nature Recreation Area	TAS
Entrance Point	Reference Area	VIC

Protected Area Name	Reserve Type	State
Eurobodalla	National Park	NSW
Ewing Morass W.R	Natural Features Reserve	VIC
First and Second Islands F.R.	Nature Conservation Reserve	VIC
Five Islands	Nature Reserve	NSW
Flannagan Island G.L.R.	Natural Features Reserve	VIC
Foochow	Conservation Area	TAS
Forsyth Island	Conservation Area	TAS
Fotheringate Bay	Conservation Area	TAS
Fraser Island G.L.R.	Natural Features Reserve	VIC
Fresh-water Swamp, Woodside Beach W.R	Natural Features Reserve	VIC
Freycinet	National Park	TAS
Garawarra	State Conservation Area	NSW
Gardens Road	Conservation Covenant	TAS
Garigal	National Park	NSW
George River - St Helens	Conservation Covenant	TAS
George Rocks	Nature Reserve	TAS
Giffard H31 B.R	Natural Features Reserve	VIC
Gippsland Lakes Coastal Park	Conservation Park	VIC
Goose Island	Conservation Area	TAS
Great Dog Island	Indigenous Protected Area	TAS
Great Musselroe River	Conservation Area	TAS
Gulaga	National Park	NSW
Gull Island	Conservation Area	TAS
Heathcote	National Park	NSW

Protected Area Name	Reserve Type	State
Hogan Group	Conservation Area	TAS
Holts Point	Conservation Area	TAS
Humbug Point	Nature Recreation Area	TAS
Ile des Phoques	Nature Reserve	TAS
Illawarra Escarpment	State Conservation Area	NSW
Illawong	Nature Reserve	NSW
Isabella Island	Nature Reserve	TAS
Jack Smith Lake W.R	Natural Features Reserve	VIC
Jacksons Cove	Conservation Area	TAS
Jervis Bay	National Park	NSW
Jervis Bay	Marine Park	NSW
Kamay Botany Bay	National Park	NSW
Kent Group	National Park	TAS
Killiecrankie	Nature Recreation Area	TAS
Kuhns Rd Memana	Conservation Covenant	TAS
Lackrana	Conservation Area	TAS
Lake Coleman W.R	Natural Features Reserve	VIC
Lake Corringle W.R	Natural Features Reserve	VIC
Lake Curlip W.R.	Natural Features Reserve	VIC
Lake Denison W.R	Natural Features Reserve	VIC
Lake Tyers S.P.	State Park	VIC
Lanark Farm #1	Conservation Covenant	TAS
Lanark Farm #2	Conservation Covenant	TAS
Lanark Farm #3	Conservation Covenant	TAS

Protected Area Name	Reserve Type	State
Lanark Farm #4	Conservation Covenant	TAS
Lanark Farm #5	Conservation Covenant	TAS
Lanark Farm #6	Conservation Covenant	TAS
Lands End	Conservation Covenant	TAS
Lighthouse Point	Conservation Area	TAS
Lime Pit Road	Conservation Area	TAS
Little Chalky Island	Conservation Area	TAS
Little Dog Island	Game Reserve	TAS
Little Green Island	Conservation Area	TAS
Little Island	Conservation Area	TAS
Little Silver	Conservation Covenant	TAS
Little Swan Island	Nature Reserve	TAS
Logan Lagoon	Conservation Area	TAS
Logan Lagoon	State Reserve	TAS
Logans Lagoon	Conservation Covenant	TAS
Long Island	Conservation Area	TAS
Low Islets	Nature Reserve	TAS
Low Point	Conservation Area	TAS
Lughrata	Conservation Covenant	TAS
lungatalanana	Indigenous Protected Area	TAS
Lyall Road Binalong Bay	Conservation Covenant	TAS
Malabar Headland	National Park	NSW
Mallacoota B.R.	Natural Features Reserve	VIC
Maria Island	National Park	TAS
Marriott Reef	Conservation Area	TAS
Marshall Beach	Conservation Area	TAS

Protected Area Name	Reserve Type	State
Marthvale	Conservation Covenant	TAS
McDonalds Point	Conservation Area	TAS
Medeas Cove	Conservation Area	TAS
Meroo	National Park	NSW
Metung B.R.	Natural Features Reserve	VIC
Mile Island	Conservation Area	TAS
Mimosa Rocks	National Park	NSW
Montague Island	Nature Reserve	NSW
Moriarty Rocks	Nature Reserve	TAS
Morley Swamp G.L.R.	Natural Features Reserve	VIC
Mortimers Paddock B.R.	Natural Features Reserve	VIC
Mount Chappell Island	Indigenous Protected Area	TAS
Mount Pearson	State Reserve	TAS
Mount Tanner	Nature Recreation Area	TAS
Mount Vereker Creek	Natural Catchment Area	VIC
Mount William	National Park	TAS
Mount William	Conservation Area	TAS
Mulligans Hill	Conservation Area	TAS
Mulligans Hill	Conservation Covenant	TAS
Mumbulla	Flora Reserve	NSW
Murrah	Flora Reserve	NSW
Murramarang	National Park	NSW
Musselroe Bay	Conservation Covenant	TAS
Musselroe Bay	Conservation Area	TAS
Nadgee	Nature Reserve	NSW

Protected Area Name	Reserve Type	State
Nameless Sylvan	Conservation Reserve	NSW
Narrawallee Creek	Nature Reserve	NSW
Neds Reef	Conservation Area	TAS
Night Island	Conservation Area	TAS
Ninety Mile Beach	Marine National Park	VIC
Nooramunga Marine & Coastal Park	National Parks Act Schedule 4 park or reserve	VIC
North East Islet	Nature Reserve	TAS
North East River	Game Reserve	TAS
North Head	Private Nature Reserve	NSW
North Sydney Harbour	Aquatic Reserve	NSW
Nungurner B.R.	Natural Features Reserve	VIC
Nyerimilang Park G.L.R.	Natural Features Reserve	VIC
Oyster Rocks	Conservation Area	TAS
Paddys Island	Nature Reserve	TAS
Palana Beach	Nature Recreation Area	TAS
Parnella	Conservation Area	TAS
Pasco Group	Conservation Area	TAS
Passage Island	Conservation Area	TAS
Patriarchs	Private Sanctuary	TAS
Patriarchs	Conservation Area	TAS
Point Hicks	Marine National Park	VIC
Prime Seal Island	Conservation Area	TAS
Rame Head	Remote and Natural Area - Schedule 6, National Parks Act	VIC
Ram Island	Conservation Area	TAS

Protected Area Name	Reserve Type	State
Raymond Island G.L.R.	Natural Features Reserve	VIC
Reedy Lagoon	Private Nature Reserve	TAS
Reef Island	Conservation Area	TAS
Rigby Island G.L.R.	Natural Features Reserve	VIC
Rodondo Island	Nature Reserve	TAS
Royal	National Park	NSW
Roydon Island	Conservation Area	TAS
Salt Lake - Backwater Morass G.L.R.	Natural Features Reserve	VIC
Sandpatch	Wilderness Zone	VIC
Scamander	Conservation Area	TAS
Seal Creek	Reference Area	VIC
Seal Islands W.R.	Nature Conservation Reserve	VIC
Sellars Lagoon	Game Reserve	TAS
Sentinel Island	Conservation Area	TAS
Settlement Point	Conservation Area	TAS
Seven Mile Beach	National Park	NSW
Shag Lagoon	Conservation Area	TAS
Shiprock	Aquatic Reserve	NSW
Sister Islands	Conservation Area	TAS
Snowy River	Heritage River	VIC
South East Forest	National Park	NSW
Southern Wilsons Promontory	Remote and Natural Area - Schedule 6, National Parks Act	VIC
South Pats River	Conservation Area	TAS
Spike Island	Conservation Area	TAS

Protected Area Name	Reserve Type	State
Steel Bay - Newland Backwater G.L.R.	Natural Features Reserve	VIC
St Helens	Conservation Area	TAS
St Helens 1 Marthavale	Conservation Covenant	TAS
Storehouse Island	Conservation Area	TAS
Strzelecki	National Park	TAS
Sugarloaf Rock	Conservation Area	TAS
Summer Camp	Conservation Area	TAS
Sydney Cove	Historic Site	TAS
Sydney Harbour	National Park	NSW
Tanja	Flora Reserve	NSW
Tarra Tarra B.R	Natural Features Reserve	VIC
The Dock	Conservation Covenant	TAS
The Dutchman	Conservation Area	TAS
The Lakes	National Park	VIC
Tollgate Islands	Nature Reserve	NSW
Towra Point	Nature Reserve	NSW
Towra Point	Aquatic Reserve	NSW
Trefula	Conservation Covenant	TAS
Trousers Point Beach	Conservation Area	TAS
Unnamed (Badger Corner)	Conservation Area	TAS
Unnamed P0155	Private Nature Reserve	VIC
Vansittart Island	Conservation Area	TAS
Vereker Creek	Reference Area	VIC
Waterhouse Island	Conservation Area	TAS
West Moncoeur Island	Nature Reserve	TAS
White Beach	Conservation Area	TAS

Protected Area Name	Reserve Type	State
William Hunter F.R	Nature Conservation Reserve	VIC
Wilsons Promontory	Wilderness Zone	VIC
Wilsons Promontory	National Park	VIC
Wilsons Promontory	Marine National Park	VIC
Wilsons Promontory Islands	Remote and Natural Area - Schedule 6, National Parks Act	VIC
Wilsons Promontory Marine Park	National Parks Act Schedule 4 park or reserve	VIC
Wilsons Promontory Marine Reserve	National Parks Act Schedule 4 park or reserve	VIC
Wingaroo	Nature Reserve	TAS
Wolli Creek	Regional Park	NSW
Wright Rock	Nature Reserve	TAS
Wybalenna Island	Conservation Area	TAS
Youngs Creek	Conservation Area	TAS

Regional Forest Agreements [Resource Information]

Note that all areas with completed RFAs have been included. Please see the associated resource information for specific caveats and use limitations associated with RFA boundary information.

RFA Name	State
East Gippsland RFA	Victoria
Eden RFA	New South Wales
Gippsland RFA	Victoria
Southern RFA	New South Wales
Tasmania RFA	Tasmania

Nationally Important Wetlands [Resource Information]

Wetland Name	State
Beecroft Peninsula	NSW
Benedore River	VIC

Wetland Name	State
Bondi Lake	NSW
Botany Wetlands	NSW
Clyde River Estuary	NSW
Coila Creek Delta	NSW
Coomaditchy Lagoon	NSW
Coomonderry Swamp	NSW
Cormorant Beach	NSW
Corner Inlet	VIC
Cullendulla Creek and Embayment	NSW
Durras Lake	NSW
Eve St. Marsh, Arncliffe	NSW
Ewing's Marsh (Morass)	VIC
Fergusons Lagoon	TAS
Five Islands Nature Reserve	NSW
Flyover Lagoon 1	TAS
Flyover Lagoon 2	TAS
Hogans Lagoon	TAS
Jack Smith Lake State Game Reserve	VIC
Jervis Bay	NSW
Jervis Bay Sea Cliffs	NSW
Jocks Lagoon	TAS
Killalea Lagoon	NSW
Lagoon Head	NSW
Lake Bunga	VIC
Lake Illawarra	NSW
Lake King Wetlands	VIC
Lake Tyers	VIC

Wetland Name	State
Lake Victoria Wetlands	VIC
Lake Wellington Wetlands	VIC
Little Thirsty Lagoon	TAS
Logan Lagoon	TAS
Lower Snowy River Wetlands System	VIC
Mallacoota Inlet Wetlands	VIC
Merimbula Lake	NSW
Meroo Lake Wetland Complex	NSW
Minnamurra River Estuary	NSW
Moruya River Estuary Saltmarshes	NSW
Nadgee Lake and tributary wetlands	NSW
Nargal Lake	NSW
Nelson Lagoon	NSW
O'Hares Creek Catchment	NSW
Pambula Estuarine Wetlands	NSW
Sellars Lagoon	TAS
Shoalhaven/Crookhaven Estuary	NSW
Snowy River	VIC
Stans Lagoon	TAS
St Georges Basin	NSW
Swan Lagoon	NSW
Sydenham Inlet Wetlands	VIC
Syndicate Lagoon	TAS
Tabourie Lake	NSW
Tamboon Inlet Wetlands	VIC
Tambo River (Lower Reaches) East Swamps	VIC
Termeil Lake Wetland Complex	NSW

Wetland Name	State
Thompsons Lagoon	TAS
Thurra River	VIC
Towra Point Estuarine Wetlands	NSW
Tuross River Estuary	NSW
Twofold Bay	NSW
Unnamed Wetland	TAS
Unnamed Wetland	TAS
Unnamed Wetland	TAS
Unnamed Wetland	TAS
Unnamed Wetland	TAS
Unnamed Wetland	TAS
Waldrons Swamp	NSW
Wallaga Lake	NSW
Wallagoot Lagoon (Wallagoot Lake)	NSW
Wollumboola Lake	NSW

EPBC Act Referrals

[Resource Information]

Title of referral	Reference	Referral Outcome	Assessment Status
Albion Park Quarry Extraction Area Stage 7 Extension	2020/8871		Post-Approval
Albion Park Rail Bypass, NSW	2017/7909		Post-Approval
Aurora Green Offshore Wind Farm Preliminary Surveys	2024/09968		Referral Decision
Bermagui Golf Club Proposed Subdivision (Stages 3-8)	2022/09242		Post-Approval
Blue Mackerel North Offshore Wind Farm Marine Surveys	2024/09934		Referral Decision
Blue Marlin Offshore Wind Energy Project	2023/09532		Referral Decision
Broulee Beach Estate residential development subdivision	2023/09551		Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Circular Quay Renewal	2023/09727		Assessment
Darlington Wastewater Treatment Plant, Service Infrastructure and Water Supply Upgrade	2023/09596		Referral Decision
Development of a Residential Care Facility, Middle Head, NSW	2014/7194		Post-Approval
Dunmore Hard Rock Quarry Modification 13	2022/09319		Assessment
Dunmore Lakes Sand Project Modification 2 Pond 5B extraction	2023/09552		Completed
Eastern Rise Offshore Wind Project	2023/09544		Assessment
Eastern Rise Offshore Wind Project Initial Marine Field Investigations	2023/09555		Completed
Eurobodalla Regional Hospital	2023/09506		Completed
Gippsland Offshore Wind Farm Marine Survey Investigations	2023/09682		Completed
Greater Gippsland Offshore Wind Project	2022/09379		Assessment
Greater Gippsland Offshore Wind Project Initial Marine Field Investigations	2022/09374		Completed
Greenway Wall - Macquarie Lightstation Conservation	2023/09650		Completed
Hawaiki Nui Submarine Cable - Marine Route Survey and Cable Installation	2024/09814		Completed
Hunter-Central Coast Offshore Energy Initial Marine Field Investigations	2023/09480		Completed
Hunter Central-Coast Offshore Energy Project	2023/09478		Assessment
Kamay Ferry Wharves Project	2020/8825		Post-Approval
MARA Team Testing - Release 38 - Smoke Test -05 April 2024 - To Be Deleted	2024/09849		Post-Approval
MARA Team Testing - Release 39 - 29 April 2024 - To Be Deleted	2024/09866		Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Marine Route Survey for Subsea Fibre Optic Data Cable System - Australia East	2024/09795		Completed
North East Wind - construction and operation of wind turbines and associated infrastructure	2022/09388		Assessment
PEP11 Site Survey	2009/5093		Completed
Preliminary Site Investigations for Great Eastern Offshore Wind Project	2024/09890		Referral Decision
Proposed residential subdivision	2023/09632		Completed
Residential development, 11 Jennifer Street, Little Bay, NSW	2018/8170		Completed
Residential Development, Lot 172 DP 755923 and Lot 823 DP 247285, Manyana, NSW	2020/8704		Post-Approval
Seadragon Offshore Wind, Early Marine Surveys	2023/09670		Completed
Seadragon Offshore Wind Farm	2022/9163		Completed
South East Australia Carbon Capture and Storage Project, Commonwealth waters	2023/09732		Referral Decision
South East Australia Carbon Capture and Storage Project, Onshore and State waters	2023/09731		Referral Decision
South Pacific Offshore Wind Project	2023/09605		Completed
West Culburra Residential Subdivision	2023/09524		Assessment
Controlled action			
Australian Institute of Police Management Facilities Upgrade	2006/2746	Controlled Action	Post-Approval
Construction and operation of the Westconnex New M5, Sydney, NSW	2015/7520	Controlled Action	Post-Approval
Cook Cove Southern Precinct development, Sydney, NSW	2016/7767	Controlled Action	Post-Approval
Cooks Cove Development Project	2006/2685	Controlled Action	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Develop an Offshore Tidal Energy Facility	2008/4518	Controlled Action	Completed
Expansion of Port Botany facilities	2002/543	Controlled Action	Post-Approval
Expansion of the NRE No. 1 Colliery Coal Mine in the Southern Coalfield of NSW	2013/6838	Controlled Action	Completed
Extension of Underground Mining Operations at The Bulli Seam Operations	2010/5350	Controlled Action	Post-Approval
Garden Island Hammerhead Crane Proposed Removal, NSW	2012/6430	Controlled Action	Post-Approval
Gippsland Lakes Mosquito Control Aerial /Hovercraft Spraying	2001/491	Controlled Action	Completed
Gippsland Regional Port Project	2020/8667	Controlled Action	Assessment Approach
Golden Beach Gas Project	2019/8513	Controlled Action	Post-Approval
Kurnell Sand Extraction and Backfilling Proposal	2002/631	Controlled Action	Completed
Land rehabilitation following clearing	2008/4635	Controlled Action	Post-Approval
Moriah War Memorial College expansion	2002/575	Controlled Action	Post-Approval
Musselroe Wind Farm	2002/683	Controlled Action	Post-Approval
North Manyana Subdivision, NSW	2021/8948	Controlled Action	Further Information Request
Piano Cove Golf Course and Hotel	2020/8808	Controlled Action	Further Information Request
Pilot Offshore Artificial Reefs	2008/4176	Controlled Action	Post-Approval
Relocation of Grey-Headed Flying-Fox Colony	2008/4646	Controlled Action	Post-Approval
Residential Subdivision and Town Centre Development, Vincentia	2006/2927	Controlled Action	Post-Approval
Rezoning of land and associated public works to facilitate residential development	2007/3448	Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Controlled action			
Russell Vale Colliery Revised Underground Expansion Project	2020/8702	Controlled Action	Post-Approval
Russell Vale Colliery Underground Expansion Project, NSW	2014/7268	Controlled Action	Completed
Sand Reclamation to Towra Beach	2003/1085	Controlled Action	Post-Approval
Southern section of the Bonnie Doon Golf Course, Pagewood, NSW	2015/7479	Controlled Action	Completed
Star of the South Offshore Wind Farm Project	2020/8650	Controlled Action	Guidelines Issued
Sydney Opera House Building Renewal Program, NSW	2016/7825	Controlled Action	Post-Approval
Sydney Opera House Building Renewal Program - Concert Hall and associated works	2017/7955	Controlled Action	Post-Approval
Thomson River Mercury Recovery Project	2010/5734	Controlled Action	Completed
Upgrade of Floodlighting for Night Sports Training	2009/4798	Controlled Action	Completed
Upgrade of surface facilities at NRE No.1 Colliery	2011/5891	Controlled Action	Post-Approval
Yolla Gas Field (TRL1) Development	2001/321	Controlled Action	Post-Approval
Not controlled action			
2004/2005 drilling program for exploration and production (VIC 01-06, 09-11, 16, 18 & 19 and VIC/RL	2003/1282	Not Controlled Action	Completed
2D seismic Survey in VIC/P55, VIC/RL2 and VIC/P41	2004/1876	Not Controlled Action	Completed
55m lattice tower & infrastructure	2003/1159	Not Controlled Action	Completed
Acquistion of 2D seismic data in State Waters adjacent to Ninety Mile Beach-VIC/P39(V)	2004/1889	Not Controlled Action	Completed
Admiralty House, Kirribilli, foreshore works, NSW	2014/7357	Not Controlled Action	Completed
Allmans Levee Track - Maintenance Work	2003/1053	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Angas and Galloway Exploration Wells VIC/P39(v)	2005/2330	Not Controlled Action	Completed
APX-East sub-sea telecommunications & data cable system	2014/7139	Not Controlled Action	Completed
Australia-USA Southern Cross NEXT fibre optic cable installation	2019/8405	Not Controlled Action	Completed
Basker-Manta-Gummy Oil Development	2011/6052	Not Controlled Action	Completed
Basker-Manta-Gummy Oil Field Development	2007/3402	Not Controlled Action	Completed
Basker-Manta Oil Field Development	2005/2026	Not Controlled Action	Completed
Bass Basin - Pee Jay-1 - Drilling Program	2007/3908	Not Controlled Action	Completed
Batemans Bay Marina Redevelopment	2008/4265	Not Controlled Action	Completed
Beardie-1 Field wildcat oil well	2001/505	Not Controlled Action	Completed
Biodiversity Impacts Audit	2011/6191	Not Controlled Action	Completed
Botany Bay Cable Project	2007/3552	Not Controlled Action	Completed
Botany Rail Duplication	2019/8566	Not Controlled Action	Completed
BP/Mobil Pipeline to Kingsford Smith Airport	2000/104	Not Controlled Action	Completed
Carbon Black Plant Upgrade	2006/2785	Not Controlled Action	Completed
Caswell Street - Moruya East	2020/8781	Not Controlled Action	Completed
Clearance of native vegetation to create fire breaks	2004/1534	Not Controlled Action	Completed
Communications tower extension	2003/1099	Not Controlled Action	Completed
Conservation and Adaptive Use of Quarantine Station	2002/556	Not Controlled Action	Completed
Construction of a high-capacity fibre optic submarine cable	2006/2914	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Construction of an ocean access boat ramp at Bastion Point	2004/1407	Not Controlled Action	Completed
Construction of a temporary film set, Malabar Headlands	2007/3939	Not Controlled Action	Completed
Construction Of Two New Fuel Processing Plants On Existing Site	2003/1243	Not Controlled Action	Completed
Continental slope research/mid-NSW/Commonwealth Waters	2006/3026	Not Controlled Action	Completed
Cunninghame Arm Redevelopment (Stage 3)	2002/618	Not Controlled Action	Completed
Demolition and Removal of Two Naval Cottages	2008/4373	Not Controlled Action	Completed
Demolition of Ablutions Block, Snapper Island, NSW	2018/8303	Not Controlled Action	Completed
Demolition of the existing club house and construction of a new club house	2009/4932	Not Controlled Action	Completed
Development of Kipper gas field within Vic/L3, Vic/L4 Vic/RL2	2005/2484	Not Controlled Action	Completed
Development of Turrum Oil Field and associated infrastructure	2003/1204	Not Controlled Action	Completed
DOFA weed eradication program at Goorooyaroo NSW	2003/1270	Not Controlled Action	Completed
Dredging of Tuross Lake channel and depositon of spoil in lake	2004/1554	Not Controlled Action	Completed
Drilling and side track completion at Baleen gas production well in Production Licence area VIC/L21	2004/1535	Not Controlled Action	Completed
Drilling of 'Culverin' oil exploration well, permit VIC/P56	2005/2279	Not Controlled Action	Completed
Drilling of Scallop-1 Exploration Well	2003/917	Not Controlled Action	Completed
Duke Cogeneration Plant Port Kembla	2001/179	Not Controlled Action	Completed
East Pilchard exploration well	2001/137	Not Controlled Action	Completed
Eden Wind Farm	2011/6037	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Environmental Works	2001/396	Not Controlled Action	Completed
Extension of Hale Street to Foreshore Road and Associated Works	2008/4035	Not Controlled Action	Completed
Extension to Lucas Heights production building	2003/1114	Not Controlled Action	Completed
Ferry Service Infrastructure Development	2001/269	Not Controlled Action	Completed
Fitout works, 4th Floor, Sydney Customs House, 31 Alfred Street	2004/1449	Not Controlled Action	Completed
Fuel Reduction Proposal Redfield Road, East Killara	2003/1238	Not Controlled Action	Completed
Garden Island ADI Warehouse	2000/69	Not Controlled Action	Completed
George Bass Drive Lilli Pilli Road Realignment	2021/8876	Not Controlled Action	Completed
Georges River Program 2	2003/999	Not Controlled Action	Completed
Gippsland Basin Seismic Programme	2004/1866	Not Controlled Action	Completed
Gippsland Lakes Composting Toilet Program	2000/66	Not Controlled Action	Completed
Golf Course Extension	2001/215	Not Controlled Action	Completed
Hayes Hill Ridge Wind Farm	2007/3437	Not Controlled Action	Completed
Hemingway1/Oil Exploration	2001/177	Not Controlled Action	Completed
Improving rabbit biocontrol: releasing another strain of RHDV, sthrn two thirds of Australia	2015/7522	Not Controlled Action	Completed
Increase of Road Access to 24 Hours a Day 7 Days a Week	2008/4206	Not Controlled Action	Completed
INDIGO Central Submarine Telecommunications Cable	2017/8127	Not Controlled Action	Completed
Industrial Subdivision	2004/1859	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Industrial Subdivision, 262-276 Captain Cook Drive	2004/1899	Not Controlled Action	Completed
Installation of optic fibre cable from Inverloch, Victoria to Stanley, Tasmania	2002/906	Not Controlled Action	Completed
Installation of Sydney-Guam Submarine Cable	2007/3848	Not Controlled Action	Completed
Installation of viewing platform	2005/2138	Not Controlled Action	Completed
Internal Modifications to Reserve Bank of Australia	2008/4431	Not Controlled Action	Completed
Japan-Guam-Australia Sunshine Coast Branch Marine Cable Route Survey (JGA) QLD	2018/8373	Not Controlled Action	Completed
Kipper Tuna Turrum Project Maintenance Dredging	2010/5430	Not Controlled Action	Completed
Lake Illawarra entrance works, Stage 2	2004/1696	Not Controlled Action	Completed
Little Bay Residential Subdivision	2002/873	Not Controlled Action	Completed
Longtom-3 Gas Appraisal Well, VIC/P54	2005/2494	Not Controlled Action	Completed
Longtom Gas Pipeline Development, VIC/P54	2006/3072	Not Controlled Action	Completed
Lot 2 Foreshore Drive, in-filling pit, Port Kembla, NSW	2018/8374	Not Controlled Action	Completed
Marlin-Snapper Gas Pipeline Project	2006/3197	Not Controlled Action	Completed
Melville 1 Oil Exploration Well	2001/167	Not Controlled Action	Completed
Metropolitan coal project - continutaion, upgrade and extension of underground m	2008/4519	Not Controlled Action	Completed
Milton/Ulladulla Sewerage Scheme	2001/251	Not Controlled Action	Completed
Northright-1 Exploration Well	2001/209	Not Controlled Action	Completed
Noxious weed removal, Anzac Rifle Range	2002/761	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Noxious weed removal and controlled burn	2003/1272	Not Controlled Action	Completed
Noxious Weed Removal at Anzac Rifle Range	2004/1336	Not Controlled Action	Completed
Offshore Petroleum Exploration	2001/289	Not Controlled Action	Completed
Offshore Seismic Survey	2001/498	Not Controlled Action	Completed
Princes Highway Upgrade, NSW	2013/6968	Not Controlled Action	Completed
Pump station upgrades and rising main construction, Lakes Entrance, Victoria	2016/7646	Not Controlled Action	Completed
Rabbit Control Anzac Rifle Range	2005/1940	Not Controlled Action	Completed
RBA HOWP 65 Martin Place, NSW	2020/8870	Not Controlled Action	Completed
Redevelopment 60 Martin Place, Sydney, NSW	2015/7490	Not Controlled Action	Completed
Redevelopment of the Cronulla Sharks Leagues Club	2011/5889	Not Controlled Action	Completed
Redevelopment of the former Prince Henry Hospital Site	2003/1048	Not Controlled Action	Completed
Rehabilitation works of the Coogee Sewer Diversion Submain - Maxwell Avenue, Mar	2004/1683	Not Controlled Action	Completed
Remediation of contaminated soil around the Macquarie Lighthouse	2004/1836	Not Controlled Action	Completed
Rubbish removal, Anzac Rifle Range	2002/760	Not Controlled Action	Completed
Sale of New South Head Road, Edgecliff	2001/302	Not Controlled Action	Completed
Sandon Point Residential Development	2001/458	Not Controlled Action	Completed
sewage treatmemt plant process and reliability renewals project	2005/2186	Not Controlled Action	Completed
Shellcove Boatharbour Marine, Commercial & Residential Development	2007/3935	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Shipment of Spent Nuclear Fuel to USA	2007/3672	Not Controlled Action	Completed
Ship to ship crude oil lightering	2008/4279	Not Controlled Action	Completed
Ship to Ship Crude Oil Lightering	2001/271	Not Controlled Action	Completed
Sole-2 appraisal gas well, VIC/RL3	2002/636	Not Controlled Action	Completed
Sole gas field development	2003/937	Not Controlled Action	Completed
Spikey Beach 1, West Triton Drilling Program, Bass Basin Permit T/38P	2007/3914	Not Controlled Action	Completed
Subdivision and sale of Commonwealth land in Pymble to Ku-ring-gai City Council	2004/1368	Not Controlled Action	Completed
Subdivision of 68 ha into two blocks, construction of access road and house site	2004/1531	Not Controlled Action	Completed
Subdivision of Precincts 3 and 12, St Patricks Estate	2004/1925	Not Controlled Action	Completed
Supply of a gigabit ethernet connection with associated trenching, boring and ha	2007/3637	Not Controlled Action	Completed
Sydney Desalination Plant	2005/2331	Not Controlled Action	Completed
Sydney Metro Network Stage 2	2010/5307	Not Controlled Action	Completed
Sydney Primary Loop Gas Pipeline	2006/2622	Not Controlled Action	Completed
Taleb Property Pty Ltd, Tempe Tyres Warehouse project, Captain Cook Drive, Kurnell	2017/8068	Not Controlled Action	Completed
Tallawarra Lands: Urban Development	2011/6002	Not Controlled Action	Completed
The 3000 Acres, clearing and development of native vegetation	2006/3199	Not Controlled Action	Completed
Torpedo Factory Renewal Project	2020/8847	Not Controlled Action	Completed
Translocation of DFTD-free Tasmanian Devils	2011/6216	Not Controlled Action	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action			
Turrum Phase 2 Development Project	2008/4191	Not Controlled Action	Completed
Undertake a controlled burn of the Eastern Suburbs Banksia Scrub at Byrne Cresce	2004/1728	Not Controlled Action	Completed
Undertaking of fire protection measures for the bushland regeneration of the Ranwick Environmental P	2003/959	Not Controlled Action	Completed
Upgrade of Captain Cook Drive	2012/6286	Not Controlled Action	Completed
Valentine Substation	2005/1961	Not Controlled Action	Completed
wastewater collection systems and pumping stations	2001/511	Not Controlled Action	Completed
West Triton Drilling Program - Gippsland Basin	2007/3915	Not Controlled Action	Completed
Wreck Bay Housing Development	2001/299	Not Controlled Action	Completed
Not controlled action (particular manner)			
2D & 3D seismic survey T/39P	2005/2237	Not Controlled Action (Particular Manner)	Post-Approval
2D marine seismic survey in PEP-11 permit area, NSW	2002/879	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Aquisition Survey	2008/4041	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Survey	2008/4066	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Survey	2008/4131	Not Controlled Action (Particular Manner)	Post-Approval
2D seismic survey in the Sole gas field and adjacent acreage in the Gippsland Basin (VIC RL/3 & VIC/	2002/871	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
2D seismic survey Permit Area VIC/P49	2006/2943	Not Controlled Action (Particular Manner)	Post-Approval
2D Seismic Survey Program in Bass Strait	2008/4040	Not Controlled Action (Particular Manner)	Post-Approval
3D Seismic Survey	2008/4528	Not Controlled Action (Particular Manner)	Post-Approval
Apache 3D seismic exploration survey	2006/3146	Not Controlled Action (Particular Manner)	Post-Approval
Aroo Chappell 3D seismic survey	2010/5701	Not Controlled Action (Particular Manner)	Post-Approval
Bass Basin 2D and 3D seismic surveys (T/38P & T/37P)	2007/3650	Not Controlled Action (Particular Manner)	Post-Approval
Bream 3D seismic survey	2006/2556	Not Controlled Action (Particular Manner)	Post-Approval
Bushland Path Through Malabar Headland West	2007/3790	Not Controlled Action (Particular Manner)	Post-Approval
Church and School Development	2006/3185	Not Controlled Action (Particular Manner)	Post-Approval
Construction and operation of a subsea telecommunications cable, between Sydney and New Zealand	2015/7480	Not Controlled Action (Particular Manner)	Post-Approval
Construction of wharf	2003/1050	Not Controlled Action (Particular Manner)	Post-Approval
Construction works on SE corner of the grounds of Admiralty House	2012/6278	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Dalrymple 3D Seismic Survey	2010/5680	Not Controlled Action (Particular Manner)	Post-Approval
Development of Commercial Shellfish Aquaculture Leases within Jervis Bay	2013/6768	Not Controlled Action (Particular Manner)	Post-Approval
Eden Breakwater Wharf extension, NSW	2015/7582	Not Controlled Action (Particular Manner)	Post-Approval
Eden Breakwater Wharf Extension, NSW	2016/7828	Not Controlled Action (Particular Manner)	Completed
Exploration drilling of the Craigow-1 and Tolpuddle-1 wells	2010/5725	Not Controlled Action (Particular Manner)	Post-Approval
Gas Pipeline	2000/20	Not Controlled Action (Particular Manner)	Post-Approval
Gippsland 2D Marine Seismic Survey - VIC/P-63, VIC/P-64 and T/46P	2009/5241	Not Controlled Action (Particular Manner)	Post-Approval
Golden Beach gas field development	2003/1031	Not Controlled Action (Particular Manner)	Post-Approval
Hawaiki Fibre-Optic Submarine Cable installation	2016/7765	Not Controlled Action (Particular Manner)	Post-Approval
Hyde Park Barracks Proposed New Passenger Lift	2017/7933	Not Controlled Action (Particular Manner)	Post-Approval
Illawarra coal seam gas exploration drilling and gas monitoring program	2011/5821	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
INDIGO Marine Cable Route Survey (INDIGO)	2017/7996	Not Controlled Action (Particular Manner)	Post-Approval
Inspection of project vessels for presence of invasive marine pests in Commonwealth waters off Victo	2012/6362	Not Controlled Action (Particular Manner)	Post-Approval
International fibre optic submarine cable installation, between Sydney and Honiara, Solomon Islands	2015/7502	Not Controlled Action (Particular Manner)	Post-Approval
Japan-Guam-Australia (JGA) Fibre Optic Cable project	2016/7795	Not Controlled Action (Particular Manner)	Post-Approval
Kiama Post Office alterations	2006/2940	Not Controlled Action (Particular Manner)	Post-Approval
Kingsford Defence Land Subdivision and Redevelopment	2002/852	Not Controlled Action (Particular Manner)	Post-Approval
Labatt 3D Seismic Survey T/47P Bass Strait	2007/3759	Not Controlled Action (Particular Manner)	Post-Approval
Lake Illawarra Entrance Works (stage 2)	2005/1997	Not Controlled Action (Particular Manner)	Post-Approval
Lakes Entrance Sand Management Program Trial Dredging	2007/3852	Not Controlled Action (Particular Manner)	Post-Approval
Lakes Entrance Sand Management Program Trial Dredging	2007/3694	Not Controlled Action (Particular Manner)	Completed
Longtom-5 Offshore Production Drilling (Vic/L29), VIC	2012/6498	Not Controlled Action (Particular Manner)	Post-Approval
Longtom South -1 Exploration Drilling	2011/6217	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Maintenance Dredging of Oceanic Sand	2011/5932	Not Controlled Action (Particular Manner)	Post-Approval
Moriah Primary School, Centennial Park, Sydney	2004/1676	Not Controlled Action (Particular Manner)	Post-Approval
NBN Transit Fibre Minnamurra Wetlands Section	2011/5900	Not Controlled Action (Particular Manner)	Post-Approval
Non-exclusive 3-D Marine Seismic Survey, Bass Strait	2002/775	Not Controlled Action (Particular Manner)	Post-Approval
Northern Fields 3D Seismic Survey	2001/140	Not Controlled Action (Particular Manner)	Post-Approval
Pelican 3D Marine Seismic Survey, Gippsland Basin, Vic	2017/8097	Not Controlled Action (Particular Manner)	Post-Approval
Project 2 Witchcliffe - proposed vineyard & dam	2005/2263	Not Controlled Action (Particular Manner)	Post-Approval
Residential Building	2003/935	Not Controlled Action (Particular Manner)	Post-Approval
Residential Development & Associated Works, Jerberra Estate, Tomerong, NSW	2012/6415	Not Controlled Action (Particular Manner)	Post-Approval
Seismic Exploration in Permit VIC/P41	2001/267	Not Controlled Action (Particular Manner)	Post-Approval
Seismic Survey	2001/206	Not Controlled Action (Particular Manner)	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
Seismic survey, Gippsland Basin	2001/525	Not Controlled Action (Particular Manner)	Post-Approval
Shearwater 2D and 3D marine seismic survey	2005/2180	Not Controlled Action (Particular Manner)	Post-Approval
Soil and Organic Recycling Facility	2005/2216	Not Controlled Action (Particular Manner)	Post-Approval
Southern Cross Australia-New Zealand-America marine acoustic survey of the seabed	2017/7863	Not Controlled Action (Particular Manner)	Post-Approval
Southern Flanks 2D Marine Seismic Survey	2010/5288	Not Controlled Action (Particular Manner)	Post-Approval
Southern Margins 3D Seismic Survey VIC/P55	2007/3780	Not Controlled Action (Particular Manner)	Post-Approval
supersonic missile launch facility	2000/120	Not Controlled Action (Particular Manner)	Post-Approval
Tap Oil Ltd Molson 2D Seismic Survey T47P	2008/3967	Not Controlled Action (Particular Manner)	Post-Approval
Tasman Global Access submarine cable marine route survey, Narrabeen, NSW	2015/7442	Not Controlled Action (Particular Manner)	Post-Approval
Transport of intermediate level radioactive waste to Lucas Heights, NSW	2015/7437	Not Controlled Action (Particular Manner)	Post-Approval
Transport of OPAL Spent Fuel to France in 2018 and 2025	2016/7841	Not Controlled Action (Particular Manner)	Post-Approval
Tuskfish 3D Seismic Survey, Bass Strait	2002/864	Not Controlled Action (Particular	Post-Approval

Title of referral	Reference	Referral Outcome	Assessment Status
Not controlled action (particular manner)			
		Manner)	
Walking Track connecting Middle Head Rd & Balmoral Park	2002/572	Not Controlled Action (Particular Manner)	Post-Approval
Waterfront Facility at HMAS Creswell	2002/658	Not Controlled Action (Particular Manner)	Post-Approval
West Seahorse Oil Development Project, Commonwealth waters offshore Victoria	2013/6973	Not Controlled Action (Particular Manner)	Post-Approval
Referral decision			
All actions taken in response to the current severe bushfires in Victoria.	2009/4787	Referral Decision	Completed
Alterations and Additions	2006/3081	Referral Decision	Completed
Beardie-1 Field wildcat oil well	2001/469	Referral Decision	Completed
Beecroft Weapons Range Visitors Centre	2004/1322	Referral Decision	Completed
Breeding program for Grey Nurse Sharks	2007/3245	Referral Decision	Completed
Darymple 3D Seismic Survey, Petroleum Exploration Permit T/41P	2010/5322	Referral Decision	Completed
Demolition and Removal of Five Naval Cottages	2008/4322	Referral Decision	Completed
Demolition of Naval Cottages & Revegetation as Part of SHFT's Headland Park	2005/2128	Referral Decision	Completed
Enlargement of existing farm dam to irrigate a vineyard	2004/1853	Referral Decision	Completed
Holloman 2010 Vic/P60 3D Seismic Acquisition Survey Program	2009/5251	Referral Decision	Completed
Longtom 5 Offshore Production Drilling (VIC/L29)	2012/6404	Referral Decision	Completed
Longtom-5 Offshore Production Drilling (Vic/L29)	2012/6413	Referral Decision	Completed

Title of referral	Reference	Referral Outcome	Assessment Status
Referral decision			
Mineral Exploration Ringarooma Bay	2012/6508	Referral Decision	Completed
PEP11 Drilling Program	2009/5094	Referral Decision	Completed
Relocation of Grey-Headed Flying-Fox Colony	2008/4568	Referral Decision	Completed
Renovation and Landscape Rehabilitation of the Championship Course at Royal Sydney Golf Club	2022/9167	Referral Decision	Referral Publication
Shark 3D Seismic Survey	2007/3294	Referral Decision	Completed
Stage 2 Masonry Plant, Port Kembla, NSW	2014/7247	Referral Decision	Completed
Stanton 3D Marine Seismic Survey	2013/6764	Referral Decision	Completed
Upgrade of Corringle Road	2009/4825	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
Big Horseshoe Canyon	South-east
Canyons on the eastern continental slope	Temperate east
Seamounts South and east of Tasmania	South-east
Shelf rocky reefs	Temperate east
Tasman Front and eddy field	Temperate east
Tasmantid seamount chain	Temperate east
Upwelling East of Eden	South-east

Biologically Important Areas [Resource Information]

Scientific Name	Behaviour	Presence
Dolphins		
Tursiops aduncus Indo-Pacific/Spotted Bottlenose Dolphin [68418]	Breeding	Known to occur

Scientific Name	Behaviour	Presence
Tursiops aduncus Indo-Pacific/Spotted Bottlenose Dolphin [68418]	Breeding	Likely to occur
Seabirds		
Ardenna carneipes Flesh-footed Shearwater [82404]	Foraging	Known to occur
Ardenna grisea Sooty Shearwater [82651]	Breeding	Known to occur
Ardenna grisea Sooty Shearwater [82651]	Foraging	Likely to occur
Ardenna grisea Sooty Shearwater [82651]	Foraging	Known to occur
Ardenna pacifica Wedge-tailed Shearwater [84292]	Breeding	Known to occur
Ardenna tenuirostris Short-tailed Shearwater [82652]	Breeding	Known to occur
Ardenna tenuirostris Short-tailed Shearwater [82652]	Foraging	Likely to occur
Ardenna tenuirostris Short-tailed Shearwater [82652]	Foraging	Known to occur
Ardenna tenuirostris Short-tailed Shearwater [82652]	Foraging	Likely to occur
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Foraging	Likely to occur
Diomedea exulans (sensu lato) Wandering Albatross [1073]	Foraging	Known to occur
Diomedea exulans antipodensis Antipodean Albatross [82269]	Foraging	Known to occur
Eudyptula minor Little Penguin [1085]	Breeding	Likely to occur
Eudyptula minor Little Penguin [1085]	Breeding	Known to occur

Scientific Name	Behaviour	Presence
Eudyptula minor Little Penguin [1085]	Foraging	Known to occur
Macronectes giganteus Southern Giant Petrel [1060]	Foraging	Known to occur
Macronectes halli Northern Giant Petrel [1061]	Foraging	Known to occur
Oceanites oceanites Wilsons Storm Petrel [1034]	Migration	Known to occur
Pelagodroma marina White-faced Storm-petrel [1016]	Breeding	Known to occur
Pelagodroma marina White-faced Storm-petrel [1016]	Foraging	Known to occur
Pelecanoides urinatrix Common Diving-petrel [1018]	Breeding	Known to occur
Pelecanoides urinatrix Common Diving-petrel [1018]	Foraging	Known to occur
Phalacrocorax fuscescens Black-faced Cormorant [59660]	Breeding	Known to occur
Phalacrocorax fuscescens Black-faced Cormorant [59660]	Foraging	Likely to occur
Phalacrocorax fuscescens Black-faced Cormorant [59660]	Foraging	Known to occur
Procellaria parkinsoni Black Petrel [1048]	Foraging	Likely to occur
Pterodroma macroptera Great-winged Petrel [1035]	Foraging	Likely to occur
Pterodroma mollis Soft-plumaged Petrel [1036]	Foraging	Known to occur
Sterna striata White-fronted Tern [799]	Breeding	Known to occur

Scientific Name	Behaviour	Presence
Sterna striata White-fronted Tern [799]	Foraging	Known to occur
Thalassarche bulleri Bullers Albatross [64460]	Foraging	Known to occur
Thalassarche cauta cauta Shy Albatross [82345]	Foraging likely	Likely to occur
Thalassarche cauta steadi White-capped Albatross [82344]	Foraging	Known to occur
Thalassarche chlororhynchos bassi Indian Yellow-nosed Albatross [85249]	Foraging	Known to occur
Thalassarche melanophris Black-browed Albatross [66472]	Foraging	Known to occur
Thalassarche melanophris impavida Campbell Albatross [82449]	Foraging	Likely to occur
Thalassarche melanophris impavida Campbell Albatross [82449]	Foraging	Known to occur
Thalasseus bergii Crested Tern [83000]	Breeding	Known to occur
Thalasseus bergii Crested Tern [83000]	Foraging	Likely to occur
Sharks		
Carcharias taurus Grey Nurse Shark [64469]	Foraging	Known to occur
Carcharias taurus Grey Nurse Shark [64469]	Reproduction	Known to occur
Carcharodon carcharias White Shark [64470]	Breeding (nursery area)	Known to occur
Carcharodon carcharias White Shark [64470]	Foraging	Known to occur
Whales		

Scientific Name	Behaviour	Presence
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Foraging	Likely to be present
Balaenoptera musculus brevicauda Pygmy Blue Whale [81317]	Known Foraging Area	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Migration	Known to occur
Megaptera novaeangliae Humpback Whale [38]	Migration (north and south)	Known to occur

Bioregional Assessments

[Resource Information]

SubRegion	BioRegion	Website
Gippsland	Gippsland Basin	BA website
Sydney	Sydney Basin	BA website

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 is 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 on the contents of this report.

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 point locations and environmental data layers.

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 when time permits.

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 breeding sites; and
- 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.

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-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
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-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 SPILL MODELLING REPORT

EMPEROR ENERGY VIC/P47 OIL SPILL MODELLING

Report

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TERMS AND ABBREVIATIONS

Actionable oil	Oil which is thick enough for the effective use of mitigation strategies.
AMSA	Australian Maritime Safety Authority
API	American Petroleum Institute gravity. A measure of how heavy or light a petroleum liquid is compared to water.
Bonn Agreement	An agreement for cooperation in dealing with pollution of the North Sea by oil and other harmful substances, 1983, includes: Governments of the Kingdom of Belgium, the Kingdom of Denmark, the French Republic, the Federal Republic of Germany, the Republic of Ireland, the Kingdom of the Netherlands, the Kingdom of Norway, the Kingdom of Sweden, the United Kingdom of Great Britain and Northern Ireland and the European Union.
BP	Boiling point. The temperature at which the vapor pressure of the liquid is equal to the pressure exerted on it by the surrounding atmosphere.
BTEX	Benzene, Toluene, Ethylbenzene, and Xylenes
Decay	The process where oil components are changed either chemically or biologically (biodegradation) to another compound. It includes breakdown to simpler organic carbon compounds by bacteria and other organisms, photo-oxidation by solar energy, and other chemical reactions.
Deterministic (single) Oil spill modelling	Oil spill modelling involving a computer simulation of a single hypothetical oil spill event subject to a single sequence of wind, current and other sea conditions over time. Single oil spill modelling, also referred to as “deterministic modelling” provides a simulation of one possible outcome of a given spill scenario, subject to the metocean conditions that are imposed. Single oil spill modelling is commonly used to consider the fate and effects of ‘worst-case’ oil spill scenarios that are carefully selected in consideration of the nature and scale of the offshore petroleum activity and the local environment (NOPSEMA, 2017). Because the outcomes of a single oil spill simulation can only represent the outcome of that scenario under one sequence of metocean conditions, worst-case conditions are often identified from stochastic modelling. It is impossible to calculate the likelihood of any outcome from a single oil spill simulation. Single oil spill modelling is generally used for response planning, preparedness planning and for supporting oil spill response operations in the event of an actual spill.
Dynamic viscosity	The dynamic viscosity of a fluid expresses its resistance to shearing flows, where adjacent layers move parallel to each other with different speeds.
Floating oil exposure	Contact by floating oil on the sea surface at concentrations equal to or exceeding defined threshold concentrations. The consequence will vary depending on the threshold and the receptors.
HYCOM	Hybrid Coordinate Ocean Model. A data-assimilative, three-dimensional ocean model
HYDROMAP	Advanced ocean/coastal tidal model used to predict tidal water levels, current speed and current direction.
MAHs	Monoaromatic Hydrocarbons
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
PAH	Polynuclear Aromatic Hydrocarbons
Pour Point	The pour point of a liquid is the temperature below which the liquid loses its flow characteristics.
Shoreline accumulation	Arrival of oil at or near shorelines at on-water concentrations equal to or exceeding defined threshold concentrations. Shoreline accumulation is judged for floating oil arriving within a 2 km buffer zone from any shoreline as a conservative measure.
SIMAP	Spill Impact Model Application Package. SIMAP is designed to simulate the fate and effects of spilled hydrocarbons for surface or subsea releases.
Stochastic (multiple) oil spill modelling	Stochastic oil spill modelling is created by overlaying and statistically analysing the outcomes of many single oil-spill simulations of a defined spill scenario, where each simulation was subject to a different sequence of metocean conditions, selected objectively (typically by random selection) from a long sequence of historic conditions for the study area. Analysis of this larger set of simulations provides a more accurate indication of the areas of potential exposure and indicates

	which locations are more likely to be exposed (as well as other statistics). Stochastic oil spill modelling avoids biases that affect single oil spill modelling (due to the reliance on only one possible sequence of conditions). However, when interpreting stochastic modelling, which is based on a wide range of potential conditions that might happen to occur, it is essential to understand that calculations will encompass a much larger area than could be affected in any single spill event, where a more limited set of conditions will occur. Consequently, it is misleading to imply that the region derived from stochastic modelling indicate the outcomes expected from a single spill event (NOPSEMA, 2017) Stochastic modelling is generally used for risk assessment and preparedness planning by indicating locations that could be exposed and may require response or subsequent impact assessment.
WGS 1984	World Geodetic System 1984 (WGS84); reference coordinate system

EXECUTIVE SUMMARY

Background

Emperor Energy Limited (Emperor Energy) plans to drill the Judith-2 exploration well in Permit VIC/P47 in the Gippsland Basin, approximately 200 km east of Melbourne. To support the preparation of the Environment Plan (EP) and Oil Pollution Emergency Plan (OPEP), a detailed oil spill modelling study was commissioned to assess the potential exposure for the following scenarios:

- Scenario 1 – A 280 m^3 release of Marine Diesel Oil (MDO) over 6 hours from a loss of containment following a vessel collision; and
- Scenario 2 – An uncontrolled subsea loss of well control (LOWC) releasing a total of 347,584 bbl (or 55,256 m^3) of condensate depleting over 77 days (average daily rate of 4,514 bbl/day or 717 m^3/day).

The potential exposure to the surrounding waters and shorelines were assessed for summer (October to March) and winter (April to September) seasons.

The modelling does not take into consideration any of the spill prevention, mitigation and response capabilities that would be implemented in response to the spill.

Methodology

The modelling study was carried out in stages. Firstly, a 10-year wind and current dataset (2010–2019) that includes the combined influence of large-scale ocean and tidal currents was prepared. Secondly, the currents, winds and detailed oil characteristics were used as inputs in the three-dimensional trajectory and fates model; Spill Impact Model Application Package (SIMAP). The SIMAP model calculates the transport, spreading, entrainment and evaporation of spilled hydrocarbons over time, based on the prevailing wind and current conditions and the physical and chemical properties.

Modelling was conducted using a stochastic (or probabilistic) approach, which involved running 100 spill simulations per season (and scenario), with each simulation having the same spill information (volume, duration and oil properties) but randomly selected start time to ensure a range of wind and current conditions were assessed. Once all 100 simulations were run for each season, the results were combined to determine the seasonal exposure to the surrounding waters, shorelines and sensitive receptors based on the thresholds outlined in the NOPSEMA Oil Spill Modelling Bulletin (NOPSEMA 2019).

Oil Characteristics

The MDO for this study has a density of 829.1 kg/m^3 (API gravity of 37.6) and a dynamic viscosity of 4.0 cP at 25ºC. MDO is characterised by a high percentage of volatile components (95%), which will evaporate when on the sea surface. It also contains 5% persistent hydrocarbons, which will not evaporate, though will decay over time. It is classified as a Group II light persistent oil.

Reservoir modelling had indicated that the condensate is likely to have an API of 54.6, which is equivalent to a density of 760 kg/m^3. The chosen proxy has a low viscosity of 0.875 cP and the volatile to semi-volatile components (boiling point (BP) < 265 °C) represent approximately 83% of the whole condensate which is likely to evaporate over the first few days if exposed to the atmosphere at local temperatures, leaving the low volatile portion (16%) to progressively evaporate more slowly over a longer period. Only 1% of the condensate is considered persistent and will decay over time. It is classified as a Group I non persistent oil.

When exposed to the atmosphere, approximately 64% of the condensate should evaporate within the first 12 – 24 hours (boiling point (BP) < 180 °C). A further 19% of the semi-volatiles should evaporate within the first 24-72 hours (180°C < BP < 265°C); and low volatile portion (16%) should evaporate over a longer period (265°C < BP < 380°C). Only 1% of the condensate is considered persistent and will decay over time. It is classified as a Group I non persistent oil.

It is important to note that some of the low volatile and persistent components contained the condensate and MDO will 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.

Summary of Modelling Results

Scenario 1: Vessel Collision

- Floating oil concentrations exceeding 1 g/m^2 could extend up to 167.3 km from the release location due to a small, isolated patch which had resurfaced near the New South Wales (NSW) boarder during a simulation under summer conditions. The distance reduces to 18.7 km as the threshold increases to 10 g/m^2 and down to 2.9 km as the threshold increases further to 50 g/m^2.
- There was no floating oil exposure predicted for any receptor at any threshold.
- No shoreline accumulation was predicted for the 100 g/m^2 and 1,000 g/m^2 thresholds.
- The highest probability of oil accumulation at the 10 g/m^2 threshold was during winter at 12% and the minimum time before oil had reached the shorelines was 3.6 days. The maximum volume ashore during a simulation was 9.1 m^3.
- The highest probability of oil accumulation at the 10 g/m^2 threshold was forecast for the East Gippsland shoreline (7% during summer and winter conditions). The same shoreline sector recorded the quickest time before oil accumulation at 3.25 days under summer conditions.
- Dissolved hydrocarbon concentrations exceeding 10 ppb may potentially occur 177.4 km from the release location with the distance reducing to 3.1 km as the exposure threshold increases to 50 ppb for winter conditions only. The concentrations did not exceed 400 ppb. Based on the 10 ppb threshold, during summer a 1% probability of exposure was predicted for Victorian State waters. For winter conditions, a 1% probability of exposure was forecast for New Zealand Star Bank and New South Wales State waters, which had occurred after 2.50 days and 2.63 days, respectively.
- Entrained hydrocarbon concentrations exceeding 10 ppb may potentially occur up to 610.9 km from the release location, with the distance reducing to 221.2 km as the threshold increases to 100 ppb.
- Probabilities of entrained hydrocarbon exposure to receptors for concentrations equal to or greater than 10 ppb was predicted to be greatest at the New Zealand Star Bank (26% for summer and 39% for winter conditions). The highest concentration was predicted at the Big Horseshoe Canyon Key Ecological Feature (KEF) at 496 ppb during winter.

Scenario 2: Subsea LOWC

- In the event of a LOWC, the amalgamated gas and condensate would propel rapidly upward from the seabed and rupture the sea surface, hence, condensate would be present in the surface waters (0 – 5 m depth).
- Floating oil concentrations ≥1 g/m^2 could extend up to 202.2 km from the release location. The distance reduces to 18.3 km as the threshold increases to 10 g/m^2 and 0.4 km as the threshold further increases to the 50 g/m^2, during winter conditions only.
- Probabilities of floating oil exposure to receptors at concentrations ≥1 g/m^2 were highest for Victorian State waters for summer (9%) and winter (23%). The exposure was predicted to occur after 3.42 days after the commencement of the spill. There was no predicted exposure to any of the receptors as the threshold increases to 10 g/m^2.
- The highest probability of accumulation on shorelines at the 10 g/m^2 threshold was during winter (98%) and the minimum time before shoreline accumulation of condensate was 2.92 days. The maximum volume of oil ashore was forecast for the East Gippsland shorelines at 17.1 m^3 and 28.1 m^3 during summer and winter conditions, respectively.

- Dissolved hydrocarbon concentrations exceeding 10 ppb may potentially occur 1,039.1 km from the release location with the distance reducing to 898.8 km and 186.7 km as the exposure threshold increases to 50 ppb and 400 ppb, respectively.
- The probability of dissolved hydrocarbon exposure to receptors for concentrations at or above 10 ppb was highest at the New Zealand Star Bank (100% during summer and winter conditions), while the highest concentration was predicted at Cape Howe Marine National Park (MNP) at 394 ppb during winter conditions.
- Entrained hydrocarbon concentrations exceeding 10 ppb may potentially occur 917.2 km from the release location, with the distance reducing to 578.3 km as the threshold increases to 100 ppb.
- New Zealand Star Bank and Victorian State waters recorded probabilities of 100% for entrained hydrocarbon exposure at or above 10 ppb for both summer and winter conditions. New Zealand Star Bank recorded the highest probability of exposure for concentrations exceeding 100 ppb at 78% for summer and 72% under winter conditions. The highest concentration of entrained hydrocarbons was predicted at the Big Horseshoe Canyon KEF as 518 ppb.

1 INTRODUCTION

1.1 Background

Emperor Energy Limited (Emperor Energy plans to drill the Judith-2 exploration well in Permit VIC/P47 in the Gippsland Basin, approximately 200 km east of Melbourne. To support the preparation of the Environment Plan (EP) and Oil Pollution Emergency Plan (OPEP), AGR on behalf of EMP had commissioned RPS to undertake a detailed oil spill modelling study to assess the potential exposure for the following scenarios:

- Scenario 1 – A 280 m^3 release of Marine Diesel Oil (MDO) over 6 hours from a loss of containment following a vessel collision; and
- Scenario 2 – An uncontrolled subsea loss of well control (LOWC) releasing a total of 347,584 bbl (or 55,256 m^3) of condensate depleting over 77 days (average daily rate of 4,514 bbl/day or 717 m3/day).

The potential exposure to the surrounding waters and shorelines were assessed for summer (October to March) and winter (April to September) seasons.

The coordinates of the release location are presented in Table 1.1 and is illustrated in Figure 1.1.

The spill modelling was performed using an advanced three-dimensional trajectory and fates model; Spill Impact Model Application Package (SIMAP). The SIMAP model calculates the transport, spreading, entrainment and evaporation of spilled hydrocarbons over time, based on the prevailing wind and current conditions and the physical and chemical properties. The modelling does not take into consideration any of the spill prevention, mitigation and response capabilities that would be implemented in response to the spill.

The hydrocarbon spill model, the method and analysis applied herein uses modelling algorithms which have been peer reviewed and published in international journals. Further, RPS warrants that this work meets and exceeds the American Society for Testing and Materials (ASTM) Standard F2067-13 “*Standard Practice for Development and Use of Oil Spill Models*”.

Table 1.1 Coordinates of VIC/P47 oil spill modelling release location.

Latitude*	Longitude*	Water depth (m)
38° 8' 30" S	148° 32' 21" E	70

*Datum: WGS 1984

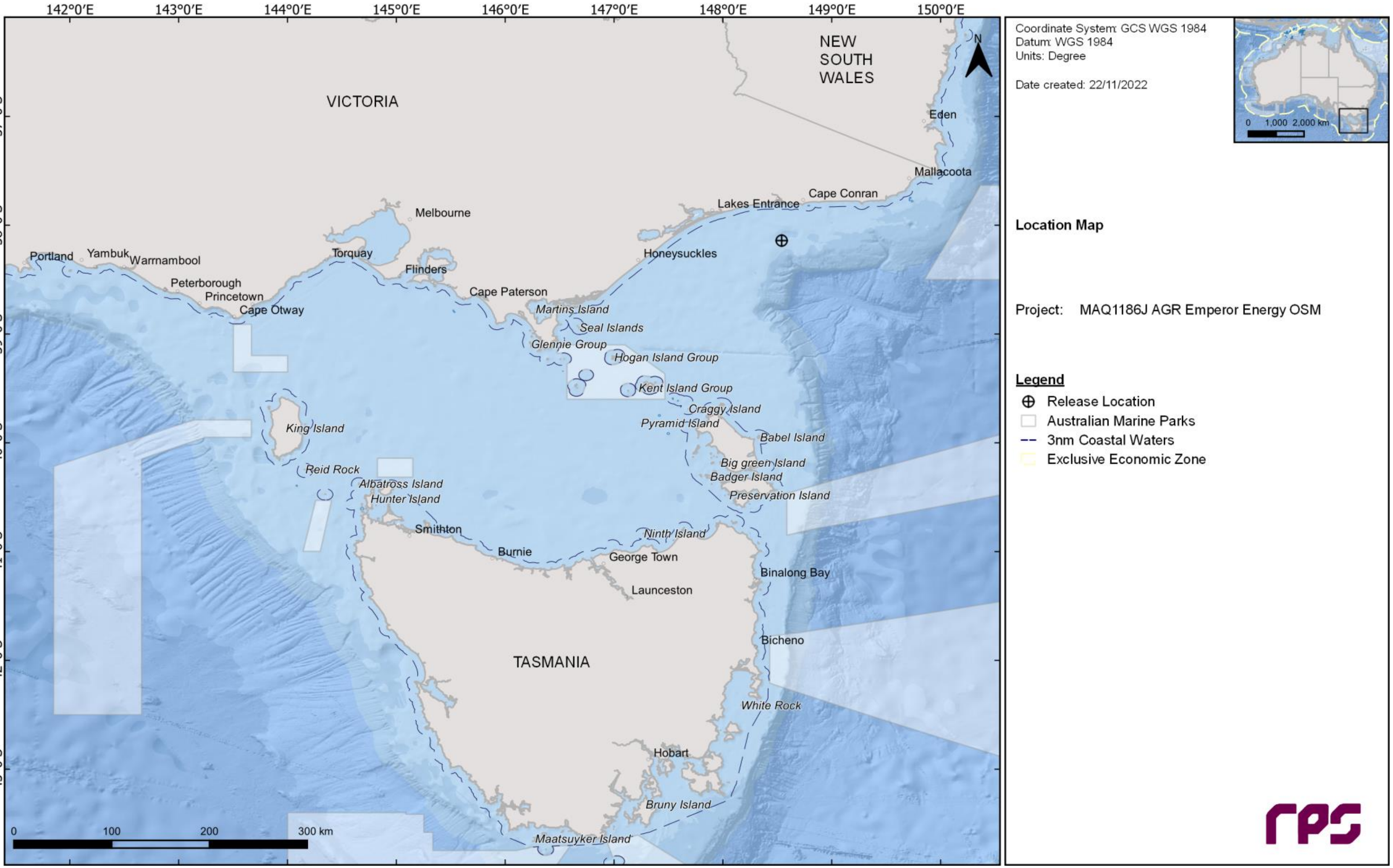

Figure 1.1 **VIC/P47 oil spill modelling release location.**

What is Oil Spill Modelling?

Oil spill modelling is a valuable tool widely used for risk assessment, emergency response and contingency planning where it can be particularly helpful to proponents and decision makers. By modelling a series of the most likely oil spill scenarios, decisions concerning suitable response measures and strategic locations for deploying equipment and materials can be made, and the locations at most risk can be identified. The two types of oil spill modelling often used are stochastic and deterministic modelling.

In this study, oil spill modelling was undertaken using a three-dimensional oil spill trajectory and weathering model, SIMAP (Spill Impact Model Application Package), which is designed to simulate the transport, spreading and weathering of specific oil types under the influence of changing meteorological and oceanographic forces. For the subsea release near-field subsurface discharge modelling was undertaken using OILMAP, which predicts the centreline velocity, buoyancy, width and trapping depth (if any) of the rising gas and oil plumes.

1.1.1 Stochastic Modelling (Multiple Spill Simulations)

Stochastic oil spill modelling is created by overlaying a great number (often hundreds) of individual, computer-simulated hypothetical spills (NOPSEMA, 2018; Figure 1.2).

Stochastic modelling is a common means of assessing the potential risks from oil spills related to new projects and facilities. Stochastic modelling typically utilises hydrodynamic data for the location in combination with historic wind data. Typically, 100 simulations are run, which sufficiently samples the historic dataset that is most relevant to the season or timing of the project.

The outcomes are often presented as a probability of exposure and is primarily used for risk assessment purposes in view to understand the range of environments that may be affected or impacted by a spill. Elements of the stochastic modelling can also be used in oil spill preparedness and planning.

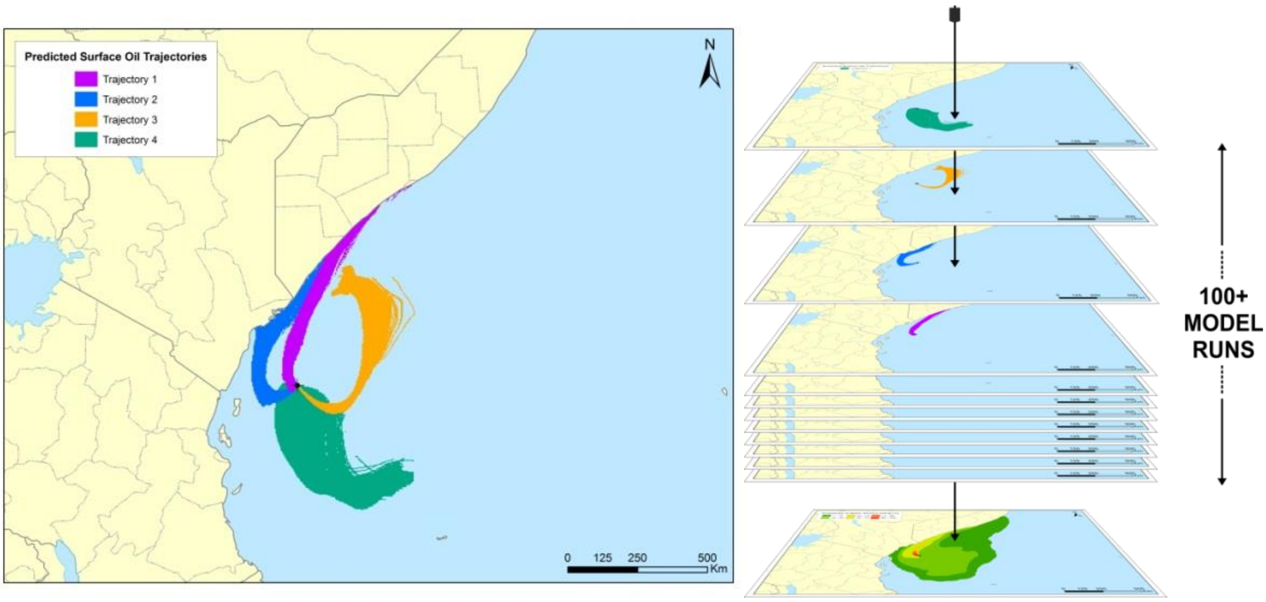

Figure 1.2 Examples of four individual spill trajectories (four replicate simulations) predicted by SIMAP for a spill scenario (left pane). The frequency of contact with given locations is used to calculate the probability of impacts during a spill. Essentially, all model runs are overlain (shown as the stacked runs on the right) and the number of times that trajectories contact a given location at a concentration is used to calculate the probability.

1.1.2 Deterministic Modelling (Single Spill Simulation)

Deterministic modelling is the predictive modelling of a single incident subject to a single sample of wind and weather conditions over time (NOPSEMA, 2018).

Deterministic modelling is often paired with stochastic modelling to place the large stochastic footprint into perspective. This deterministic analysis is generally a single run selected from the stochastic analysis and serves as the basis for developing the spill response or scientific monitoring plans.

2 SCOPE OF WORK

The scope of work included the following components:

- Generate 10 years (2010 to 2019 (inclusive)) of wind and current data. The three-dimensional current data includes the combined influence of ocean and tidal currents;
- Include the wind data, current data and oil properties into the three-dimensional oil spill model; SIMAP, to model the movement, spreading, entrainment, weathering and potential shoreline accumulation over time;
- Run 100 simulations for each season (i.e. 200 simulations total for each scenario), with each simulation having the same spill information (location, volume, duration and oil properties) but randomly varying start times. This ensured that each spill simulation was subjected to unique wind and current conditions;
- Combine the results from the 100 spill simulations (per season and scenario) to determine the potential seasonal exposure to the surrounding waters, shorelines and sensitive receptors based on the thresholds outlined in the NOPSEMA Oil Spill Modelling Bulletin (NOPSEMA 2019);
- Present the combined results from all 200 spill simulations for each scenario, to identify the low, moderate and high exposure areas; and
- From the 200 simulations modelled for each scenario, identify and present the “worst case” deterministic run resulting in the maximum volume of hydrocarbons ashore.

3 REGIONAL CURRENTS

The Gippsland Basin lies within the eastern portion of the Bass Strait, a sea strait separating Tasmania from the southern Australian mainland. The strait is a relatively shallow area of the continental shelf, connecting the southeast Indian Ocean with the Tasman Sea. This region has a reputation for high winds and strong tidal currents (Jones, 1980). Currents are primarily driven by tides, winds and density driven flows. During winter the South Australian current moves dense, salty water eastward from the Great Australian Bight into the western margin of the Bass Strait (Sandery & Kämpf, 2007). In winter and spring, waters within the strait are well mixed with no obvious stratification, while during summer the central regions of the strait become stratified (Baines & Fandry, 1983; Middleton & Black, 1994).

Figure 3.1 displays seasonal current trends within the Gippsland Basin-Bass Strait region. During winter there is a strong eastward water flow due to the strengthening of the South Australian Current (fed by the Leeuwin Current in the Northwest Shelf), which bifurcates with one extension moving though the Bass Strait, and another forming the Zeehan Current off western Tasmania (Sandery & Kämpf, 2007). During summer, water flow reverses off Tasmania, King Island and the Otway Basin travelling eastward, as the coastal current develops due to south-easterly winds.

Therefore, to accurately account for the movement of an oil spill, which can move between the offshore and near shore region, ocean and tidal currents were combined as part of the study. The following sections provide a summary of the regional current data set.

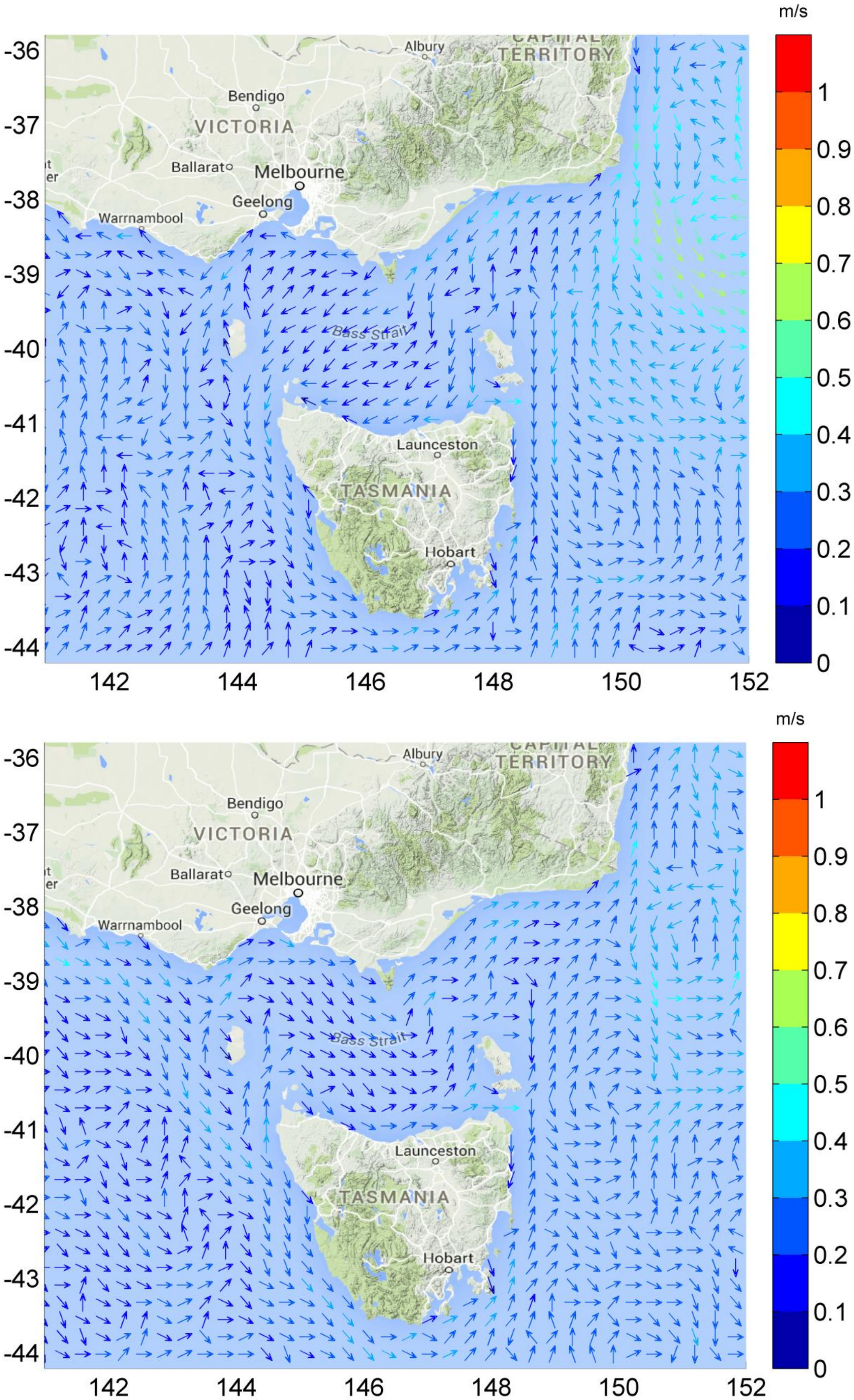

Figure 3.1 HYCOM averaged seasonal surface drift currents during summer (upper image) and winter (lower image).

3.1 Tidal currents

Tidal current data was generated using RPS's advanced ocean/coastal model, HYDROMAP. The HYDROMAP model has been thoroughly tested and verified through field measurements throughout the world for more than 30 years (Isaji & Spaulding, 1984; Isaji, et al., 2001; Zigic, et al., 2003). HYDROMAP tidal current data has been used as input to forecast (in the future) and hindcast (in the past) pollutant spills in Australian waters and forms part of the Australian National Oil Spill Emergency Response System operated by AMSA (Australian Maritime Safety Authority).

HYDROMAP employs a sophisticated sub-gridding strategy, which supports up to six levels of spatial resolution, halving the grid cell size as each level of resolution is employed. The sub-gridding allows for higher resolution of currents within areas of greater bathymetric and coastline complexity, and/or of interest to a study.

The numerical solution methodology follows that of Davies (1977a 1977b) with further developments for model efficiency by Owen (1980) and Gordon (1982). A more detailed presentation of the model can be found in Isaji & Spaulding (1984) and Isaji et al. (2001).

3.1.1 Grid Setup

The tidal model domain has been sub-gridded down to a resolution of 500 m for shallow and coastal regions, starting from an offshore (or deep water) resolution of 8 km. The finer grids were allocated in a step-wise fashion to resolve flows more accurately along the coastline, around islands and over regions with more complex bathymetry. Figure 3.2 shows the tidal model grid covering the study domain.

A combination of datasets was used and merged to describe the shape of the seabed within the grid domain (Figure 3.3). These included spot depths and contours which were digitised from nautical charts released by the hydrographic offices as well as Geoscience Australia database and depths extracted from the Shuttle Radar Topography Mission (SRTM30_PLUS) Plus dataset (see Becker et al., 2009).

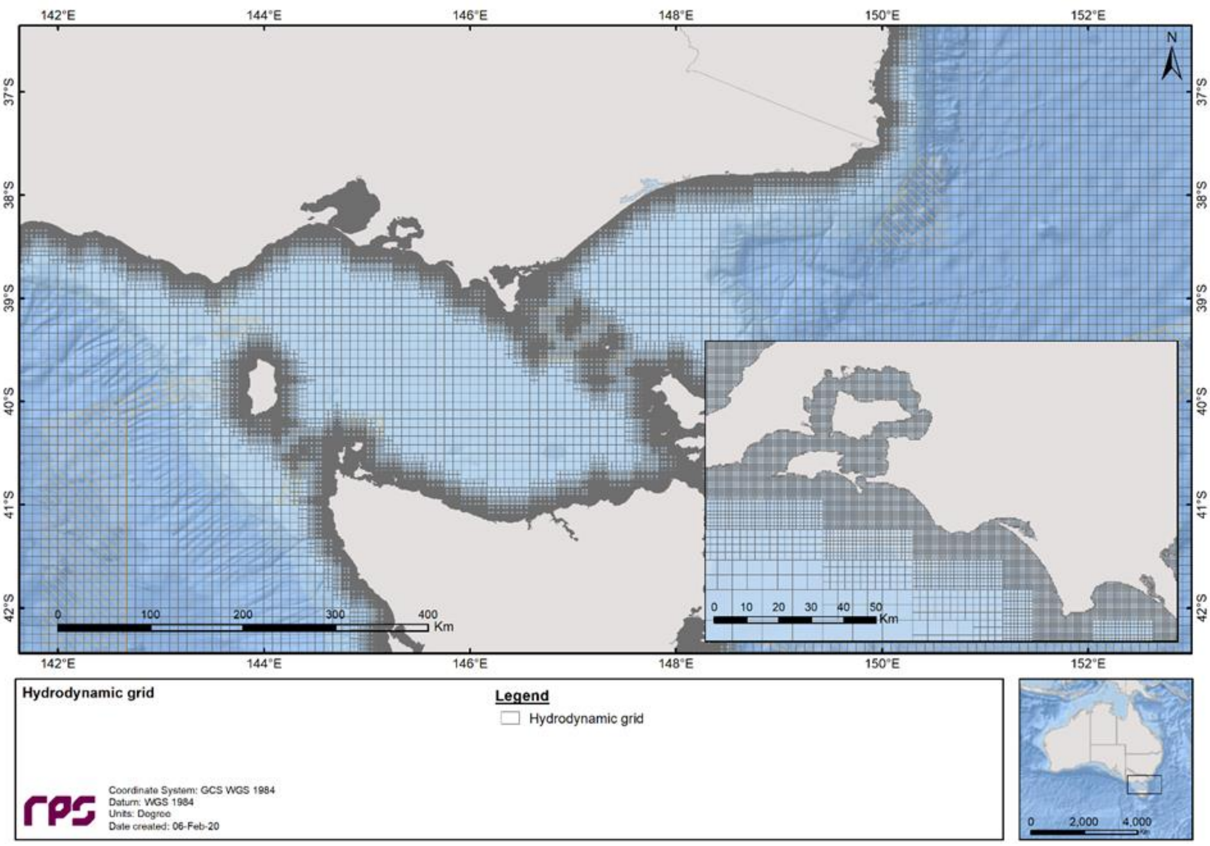

Figure 3.2 **Sample of the model grid used to generate the tidal currents for the study region. Higher resolution areas are shown by the denser mesh.**

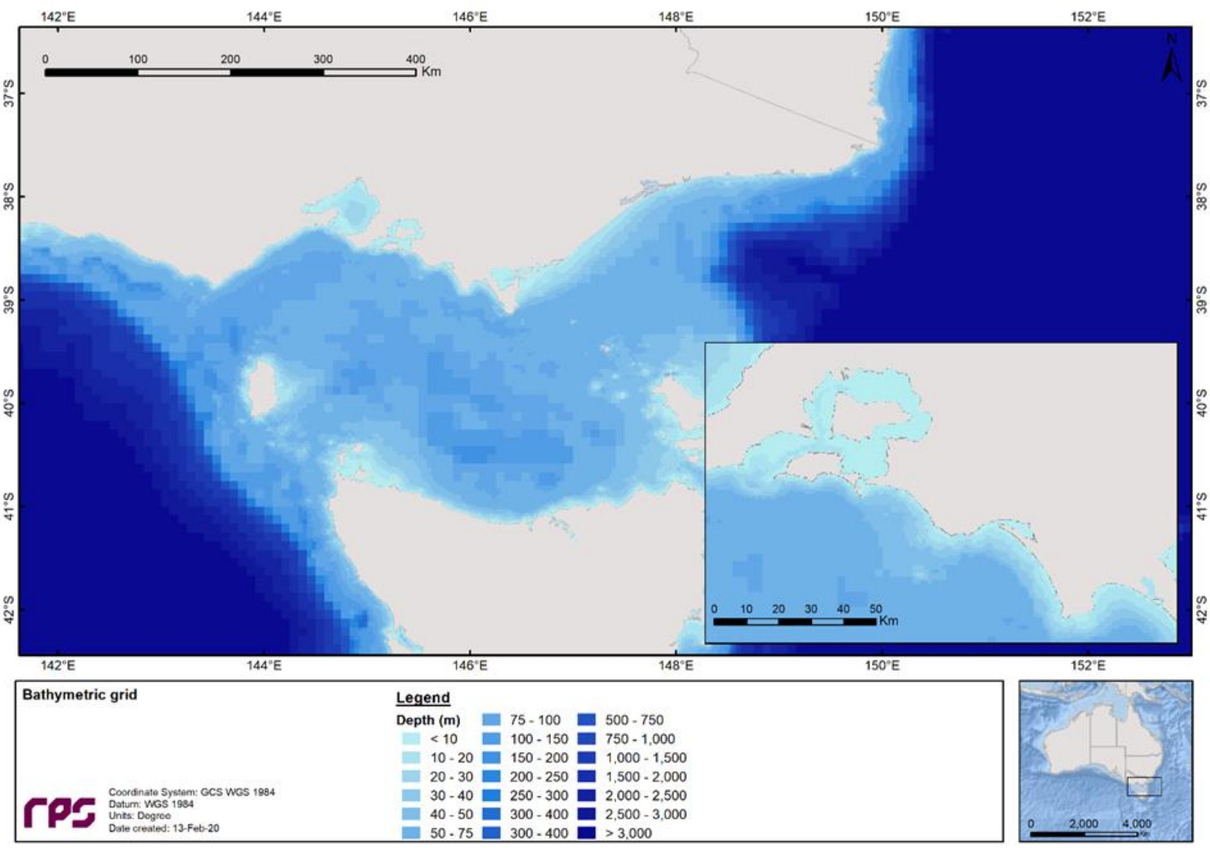

Figure 3.3 **Bathymetry defined throughout the tidal model domain.**

3.1.2 Tidal Conditions

The ocean boundary data for the regional model was obtained from satellite measured altimetry data (TOPEX/Poseidon 8.0) which provided estimates of the eight dominant tidal constituents at a horizontal scale of approximately 0.25 degrees. The eight major tidal constituents used were K_2, S_2, M_2, N_2, K_1, P_1, O_1 and Q_1. Using the tidal data, time series surface heights were calculated along the open boundaries for the simulation period.

The Topex/Poseidon satellite data has a resolution of 0.25 degrees globally, with higher resolution in coastal regions, and is produced and quality controlled by NASA (National Aeronautics and Space Administration). The data capturing satellites, equipped with two altimeters capable of taking sea level measurements accurate to less than ± 5 cm, measured oceanic surface elevations (and the resultant tides) for the period 1992–2005. In total these satellites carried out 62,000 orbits of the planet. The Topex/Poseidon tidal data has been widely used amongst the oceanographic community, being referenced in more than 2,100 research publications (e.g., Andersen, 1995; Ludicone et al., 1998; Matsumoto et al., 2000; Kostianoy et al., 2003; Yaremchuk & Tangdong, 2004; Qiu & Chen, 2010). The Topex/Poseidon tidal data is considered suitably accurate for this study.

3.2 Ocean Currents

Data describing the flow of ocean currents was obtained from HYCOM (Hybrid Coordinate Ocean Model, (Chassignet et al., 2007), which is operated by the HYCOM Consortium, sponsored by the Global Ocean Data Assimilation Experiment (GODAE). HYCOM is a data-assimilative, three-dimensional ocean model that is run as a hindcast (for a past period), assimilating time-varying observations of sea surface height, sea surface temperature and in-situ temperature and salinity measurements (Chassignet et al., 2009). The HYCOM predictions for drift currents are produced at a horizontal spatial resolution of approximately 8.25 km (1/12th of a degree) over the region, at a frequency of three-times per day. HYCOM uses isopycnal layers in the open, stratified ocean, but uses the layered continuity equation to make a dynamically smooth transition to a terrain-following coordinate in shallow coastal regions, and to z-level coordinates in the mixed layer and/or unstratified seas.

For this study, the HYCOM hindcast ocean currents were obtained for the years 2010 to 2019 (inclusive).

3.3 Surface Currents

The monthly average surface current speeds in the vicinity of the release location ranged between 0.23 m/s (April) and 0.38 m/s (July). Additionally, the monthly maximums ranged between 1.07 m/s (February) and 1.92 m/s (July). The general current directions were predominantly towards the southwest and northeast. Figure 3.4 and Figure 3.5 present the monthly and total current rose distributions, respectively.

Note the convention for defining current direction throughout this report is the direction the current flows towards. Each branch of the current rose distribution represents the currents flowing to that direction, with north to the top of the diagram. The branches are divided into segments of different colour, which represent the current speed ranges for each direction. Speed intervals of 0.1 m/s are typically used in these current roses. The length of each coloured segment within a branch is proportional to the frequency of currents flowing within the corresponding speed and direction.

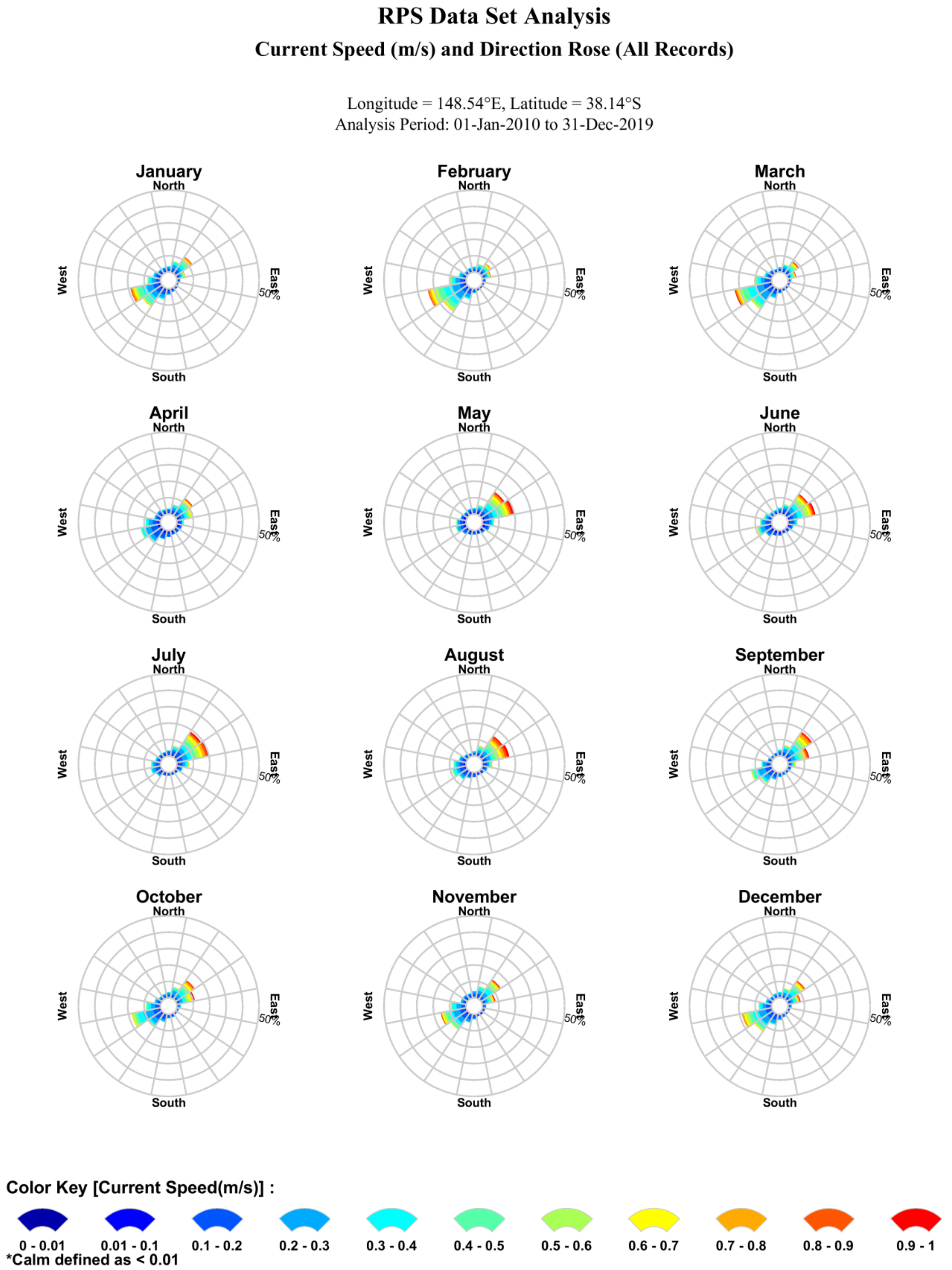

Figure 3.4 Monthly surface current rose distributions at the release location, derived from the 2010 to 2019 modelled dataset.

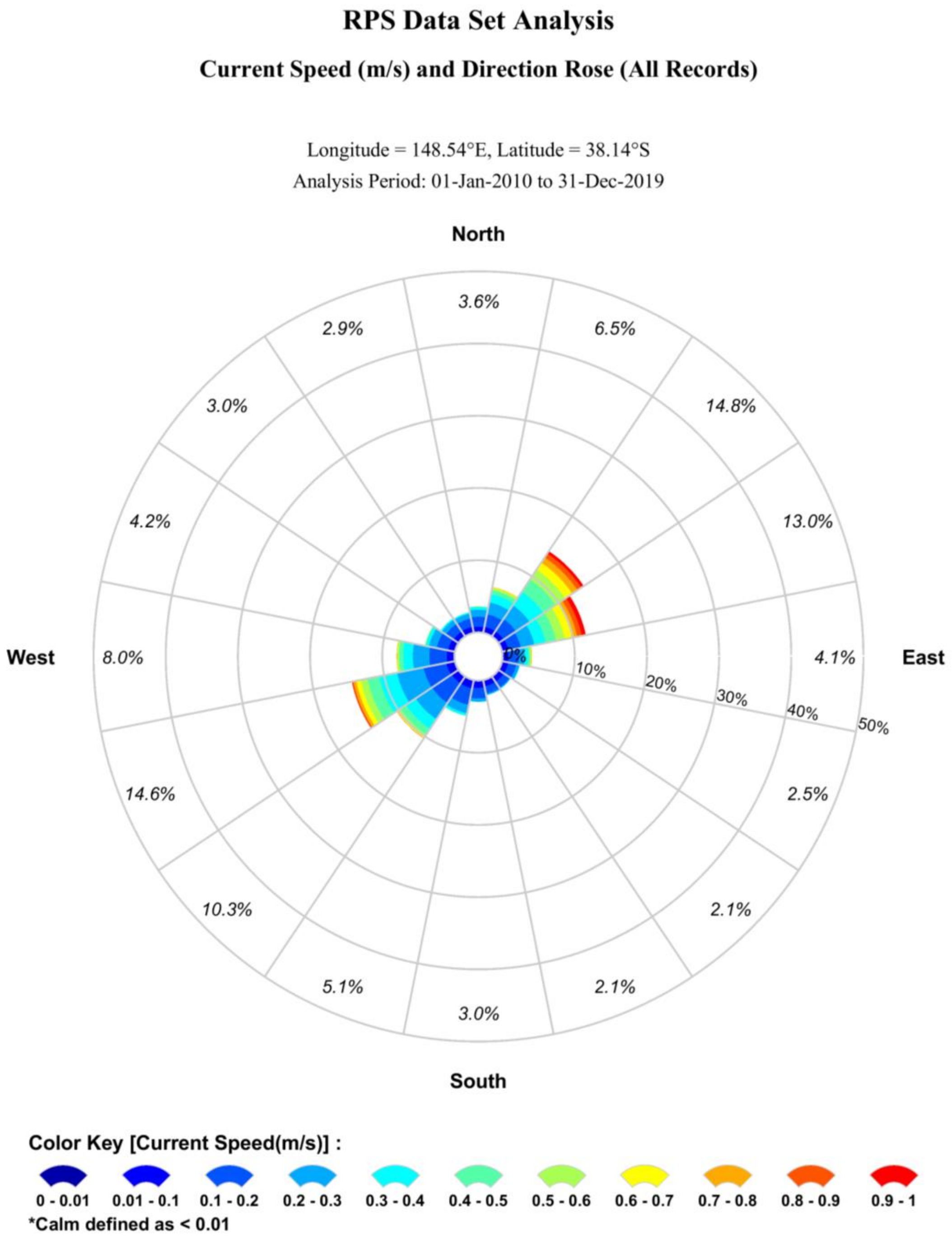

Figure 3.5 Total surface current rose plot at the release location, derived from the 2010 to 2019 modelled dataset.

4 WIND DATA

To account for the influence of the wind, data from 2010 to 2019 (inclusive) was sourced from the National Centre for Environmental Prediction (NCEP) Climate Forecast System Reanalysis (CFSR; see Saha et al., 2010). The CFSR wind model includes observations from many data sources; surface observations, upper-atmosphere air balloon observations, aircraft observations and satellite observations. The model is capable of accurately representing the interaction between the earth's oceans, land and atmosphere. The gridded wind data output is available at ¼ of a degree resolution (~33 km) and 1-hourly time intervals. Figure 4.1 shows the spatial resolution of the wind field used as input into the oil spill model.

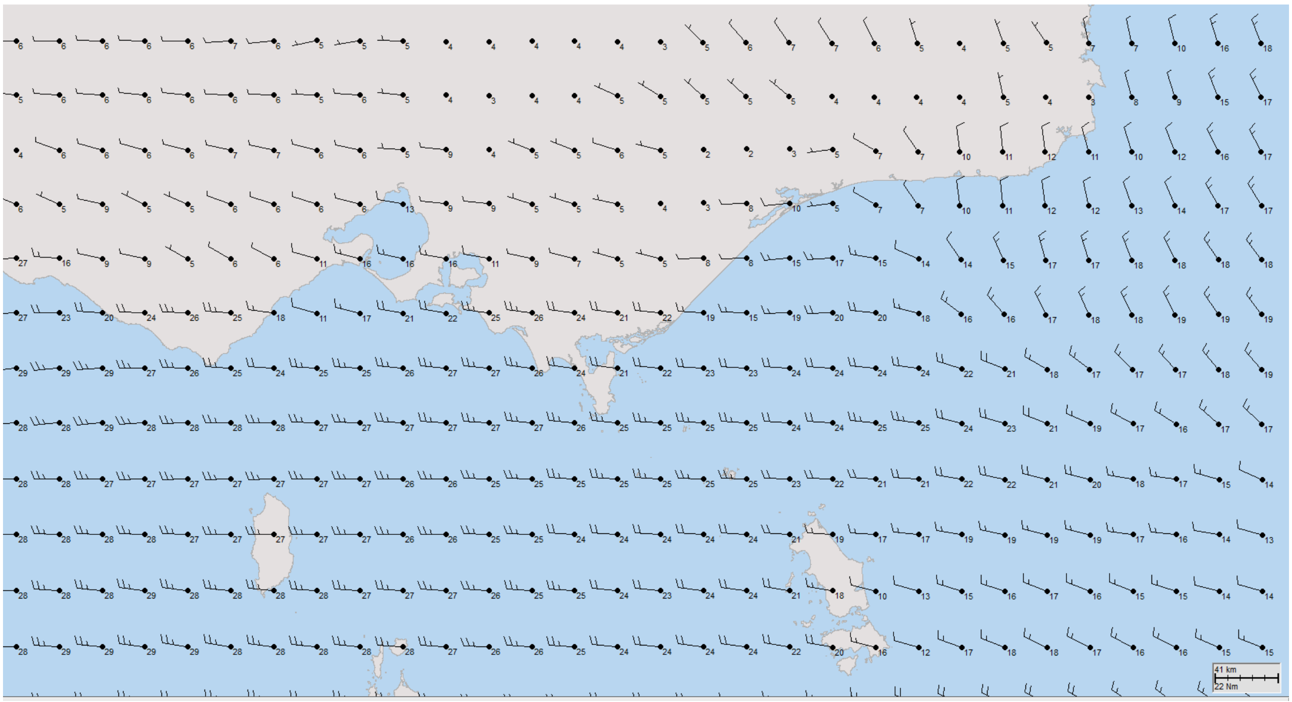

Figure 4.1 Spatial resolution of the CFSR modelled wind data used as input into the oil spill model. Note, for ease viewing only every second wind vector is displayed on the map.

Figure 4.2 and Figure 4.3 illustrates the monthly and total wind rose distributions nearby the release location, respectively.

Note that the atmospheric convention for defining wind direction, that is, the direction the wind blows from, is used to reference wind direction throughout this report. Each branch of the rose represents wind coming from that direction, with north to the top of the diagram. Sixteen directions are used. The branches are divided into segments of different colour, which represent wind speed ranges from that direction. Speed ranges of 5 knot intervals are typically used in these wind roses. The length of each segment within a branch is proportional to the frequency of winds blowing within the corresponding range of speeds from that direction.

The model wind data demonstrated that this region typically experiences moderate winds all year round and with monthly average wind speeds ranging between 13.3 knots (April) to 16.6 knots (July). The maximum monthly wind speeds ranged between 39.5 knots (January) and 49.9 knots (November). Winds typically blow from the southwest during the summer months, while winds are typically westerly during the winter months.

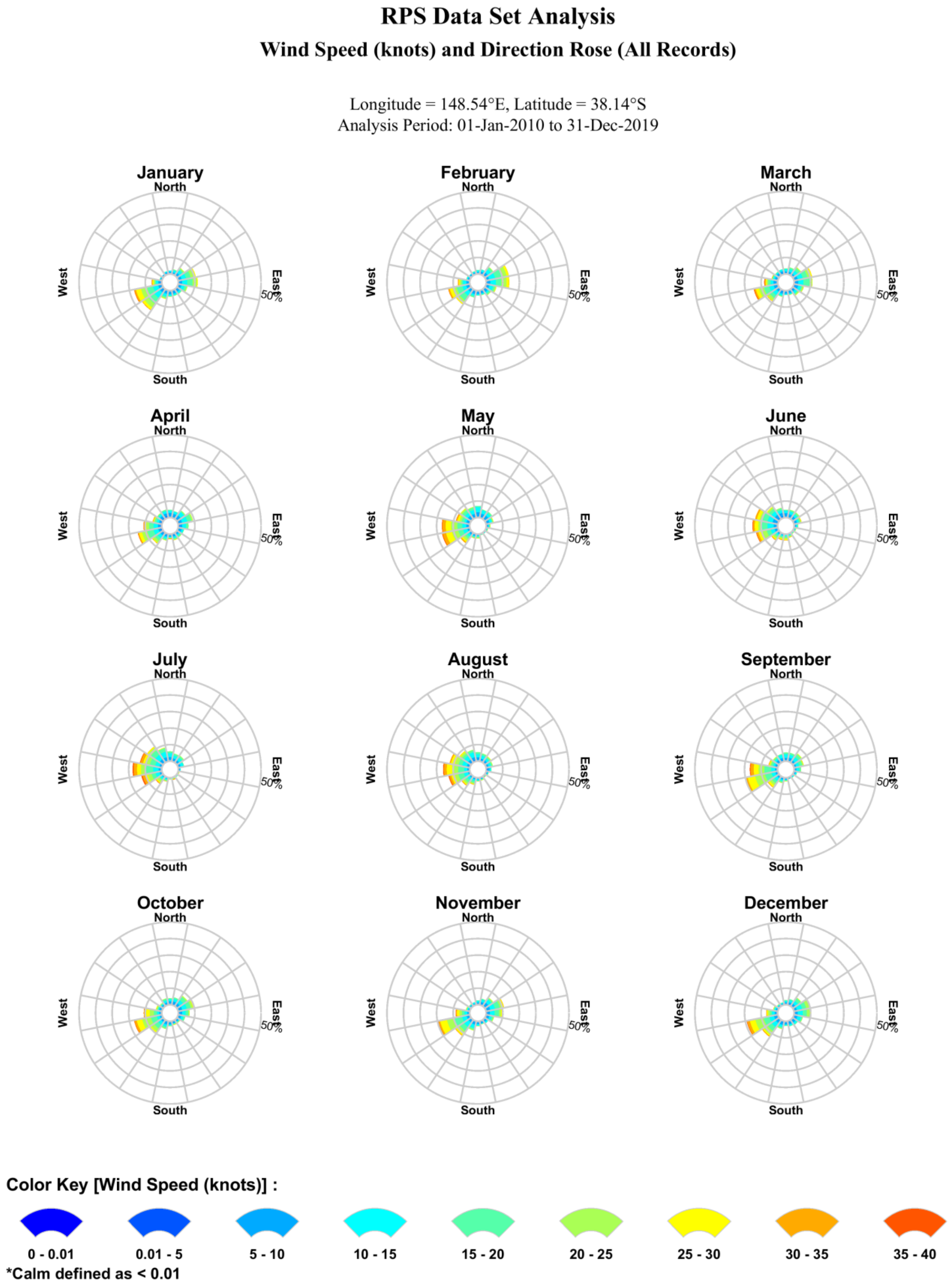

Figure 4.2 **Monthly wind rose distributions adjacent to the release location, derived from the 2010 to 2019 modelled dataset.**

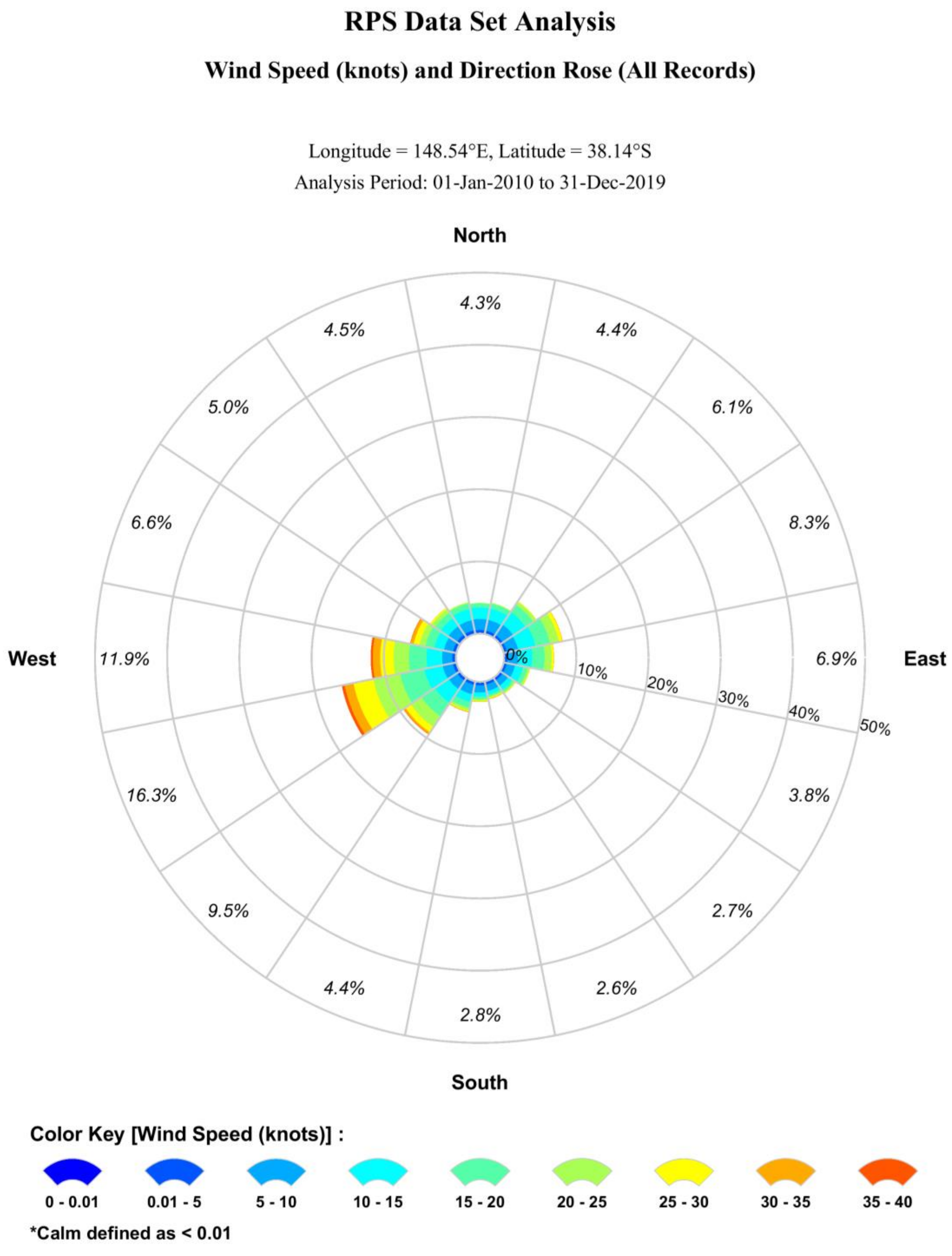

Figure 4.3 Total wind rose distributions adjacent to the release location, derived from the 2010 to 2019 modelled dataset.

5 WATER TEMPERATURE AND SALINITY

The monthly depth-varying water temperature and salinity profiles for the closest point to the release location was obtained from the World Ocean Atlas 2013 database produced by the National Oceanographic Data Centre (National Oceanic and Atmospheric Administration) and its co-located World Data Center for Oceanography (Levitus et al., 2013). The data is used to inform the weathering, movement and evaporative loss of hydrocarbon spills in the surface and subsurface layers.

Table 5.1 shows that the monthly average sea surface temperatures, which ranged from 14.0°C (July) to 20.3°C (March), whilst salinity remained relatively consistent throughout the year, ranging between 35.4 psu to 35.7 psu.

Figure 5.1 shows the vertical profile of water temperature and salinity for each month.

Table 5.1 Monthly average sea surface temperature and salinity near the release location in the 0-5 m depth layer.

Month	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sept	Oct	Nov	Dec
Temperature (°C)	18.7	19.6	20.3	19.1	17.4	16.5	14.0	14.4	14.1	15.2	16.5	17.5
Salinity (psu)	35.5	35.4	35.7	35.6	35.4	35.5	35.4	35.5	35.4	35.5	35.4	35.4

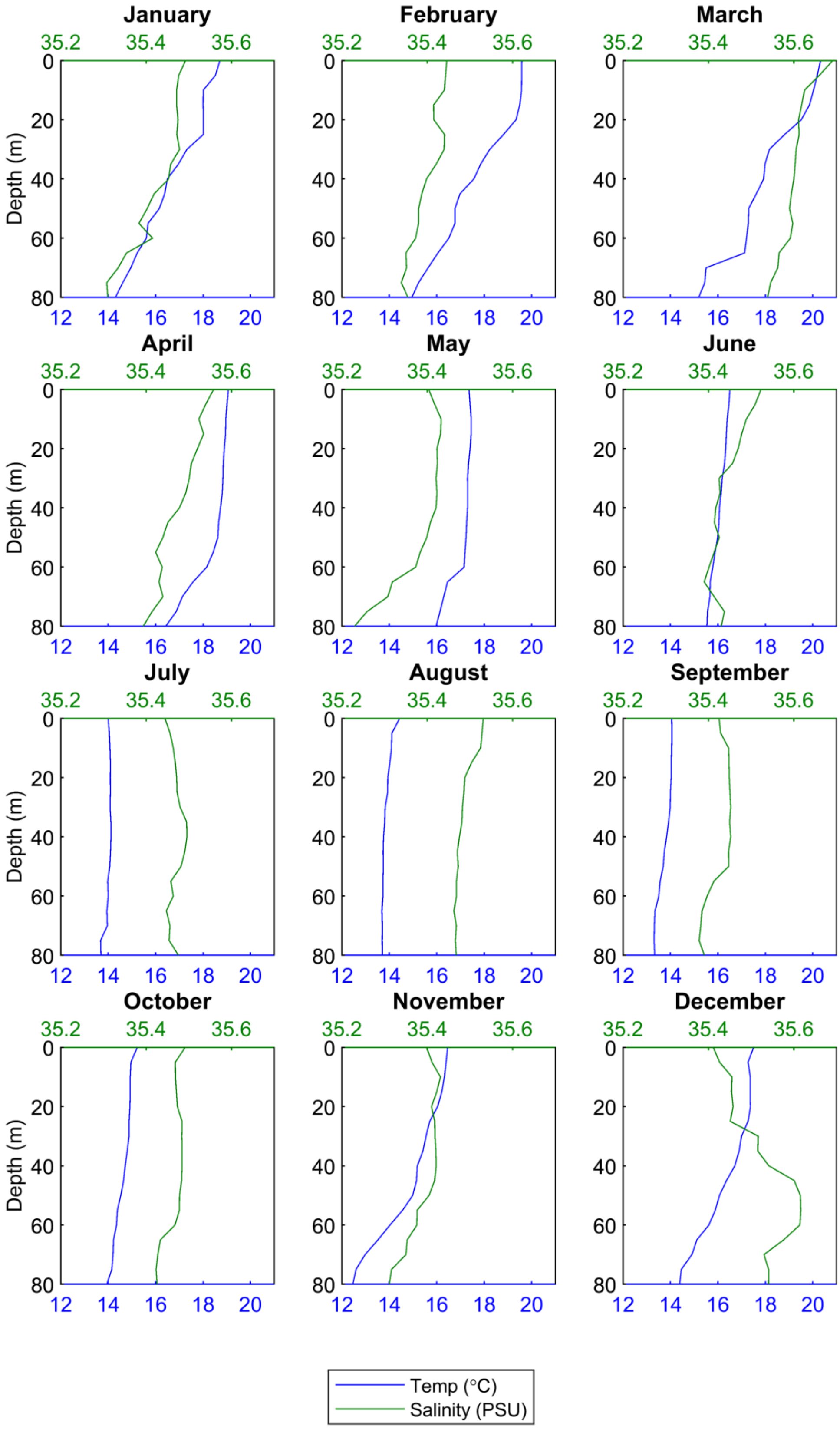

Figure 5.1 **Monthly temperature and salinity profiles throughout the water column near the release location.**

6 SUBSEA PLUME MODEL – OILMAP DEEP

In the event of an uncontrolled subsea LOWC, the gas and condensate will initially behave like a jet, which dissipates in the water column over a short distance (<10 m). The escaping condensate shears into small droplets due to turbulence generated by passing through the exit hole and subsequent turbulence generated in the plume jet. The size-distribution of the droplets will vary with the exit velocity and viscosity of the condensate. Following this phase, the density and buoyancy difference of the gas and condensate mixture relative to the surrounding waters, forces the plume upward. As the plume rises, the volume of gas will increase due to reduction of water pressure, with gas bubbles dividing into an increasing number of bubbles due to the shearing effect exerted by the water column.

In shallow water (<200 m) the rising plume of gas and condensate will tend to reach the sea surface before deflecting away from the centre of the plume (Spaulding et al., 2000). Figure 6.1 conceptually illustrates the various stages of a subsea release of oil and gas.

OILMAP Deep model (Spaulding et al. 2015) was used to simulate the near-field behaviour of the gas-condensate subsea release in two phases – the initial jet phase and the buoyant plume phase. The initial jet phase is predominately driven by the exit velocity. During this phase, the condensate droplet-size-distributions are calculated for a range of classes or bins. Next, the plume model predicts the rise dynamics of the condensate and gas plumes to calculate at which point gas lift will be lost (i.e. the trapping height).

Outputs which include the plume trapping height, plume diameter and droplet size distribution are used as input to the SIMAP model to simulate the rise and dispersion of the condensate droplets from this point onwards.

More details on the OILMAP-DEEP model, can be found in Spaulding et al. (2015). The model has been validated against observations from Deepwater Horizon as well as small and large-scale laboratory studies on subsurface oil releases (Brandvik et al 2013, 2014; Belore 2014; Spaulding et al. 2015; Li et al. 2017).

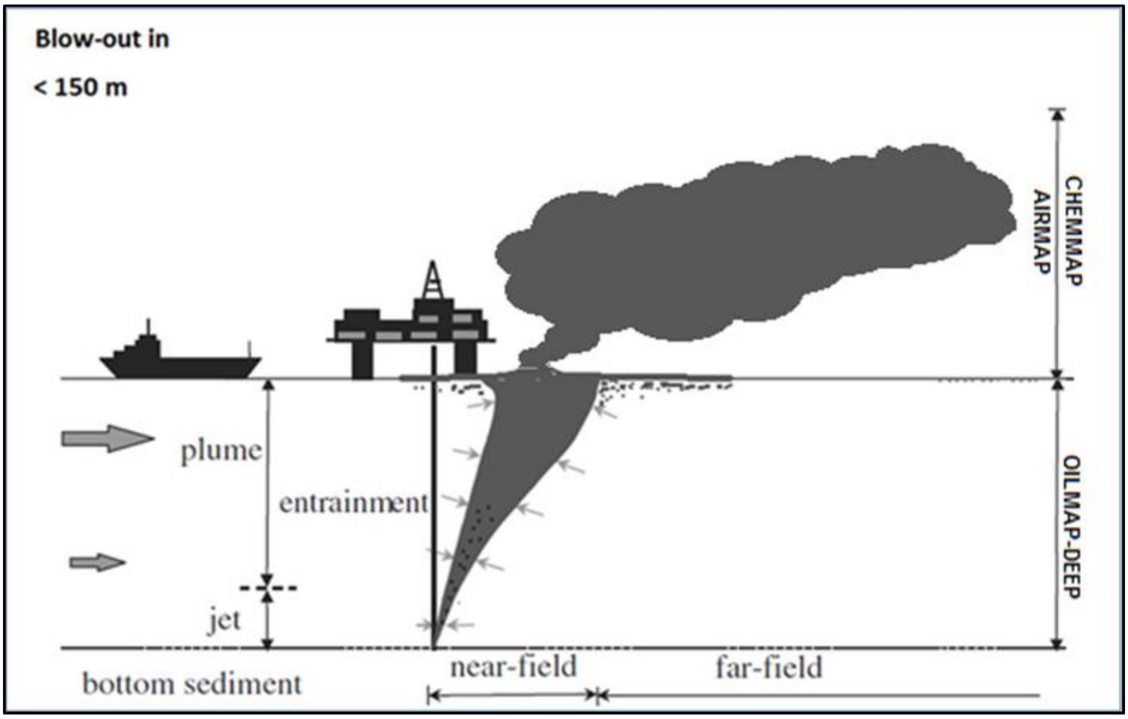

Figure 6.1 Example of a subsea plume and the various stages of the plume in the water column (Source: ASA, 2011).

Table 6.1 presents the input parameters and key results for the subsea plume modelling. Note a depleting release rate was assessed.

The subsea modelling showed that in the event of a LOWC, the amalgamated gas and condensate would propel rapidly upward from the seabed and rupture the sea surface. Droplet sizes would range from 524 µm to 2,263 µm during week 1 and 877 µm to 3,788 µm by week 11 due to the depleting release rate. There were 10 oil droplet-size classes defined, which were evenly distributed (10%), to simulate the rise and dispersion of the condensate droplets more accurately.

Table 6.1 Input data and key results for the subsea plume modelling.

Input Variable	Value
Scenario	Loss of Well Control
Water depth (m)	70
Tubing diameter (inch)	12.25
Condensate discharge rate (stb/day)	5,870 (week 1) depleting to 3,000 (week 11)
Gas rate (MMscf/day)	274.3 (week 1) depleting to 147.4 (week 11)
Formation water flow rate (stb/day)	0
Key results	
Plume execution depth (m BMSL)	0 (Breach the sea surface)
Droplet sizes (µm)	524 to 2,263 (week 1) to 877 to 3,788 (week 11)

7 OIL SPILL MODEL SIMAP

The spill modelling was carried out using a purpose-developed oil spill trajectory and fates model, SIMAP. This model is designed to simulate the transport and weathering processes that affect the outcomes of hydrocarbon spills to the sea, accounting for the specific oil type, spill scenario, and prevailing wind and current circulation patterns.

SIMAP is the evolution of the United States Environmental Protection Agency (US EPA) Natural Resource Damage Assessment model (French et al., 1999) and is designed to simulate the fate and effects of spilled oils and fuels for both the surface slick and the three-dimensional plume that is generated in the water column. SIMAP includes algorithms to account for both physical transport and weathering processes. The latter are important for accounting for the partitioning of the spilled mass over time between the water surface (surface slick), water column (entrained oil and dissolved compounds), atmosphere (evaporated compounds) and land (stranded oil). The model also accounts for the interaction between weathering and transport processes.

The physical algorithms calculate transport and spreading by physical forces, including surface tension, gravity and wind and current forces for both surface slicks and oil within the water column. The fates algorithms calculate all the weathering processes known to be important for oil spilled to marine waters. These include droplet and slick formation, entrainment by wave action, emulsification, dissolution of soluble components, sedimentation, evaporation, bacterial and photo-chemical decay and shoreline interactions. These algorithms account for the specific oil type being considered.

Entrainment is the physical process where globules of oil are transported from the sea surface into the water column by wind and wave-induced turbulence or be generated subsea by a pressurised discharge at depth. It has been observed that entrained oil is broken into droplets of varying sizes. Small droplets spread and diffuse into the water column, while larger ones rise rapidly back to the surface (Delvigne & Sweeney, 1988; Delvigne, 1991).

Dissolution is the process by which soluble hydrocarbons enter the water from a surface slick or from entrained droplets. The lower molecular weight hydrocarbons tend to be both more volatile and more soluble than those of higher molecular weight.

The formation of water-in-oil emulsions, or mousse, which is termed ‘emulsification’, depends on oil composition and sea state. Emulsified oil can contain as much as 80% water in the form of micrometre-sized droplets dispersed within a continuous phase of oil (Daling & Brandvik, 1991; Bobra, 1991; Daling et al., 1997; Fingas, 1995, 1997).

Entrainment, dissolution and emulsification rates are correlated to wave energy, which is accounted for by estimating wave heights from the sustained wind speed, direction and fetch (i.e. distance downwind from land barriers) at different locations in the domain. Dissolution rates are dependent upon the proportion of soluble, short-chained hydrocarbon compounds, and the surface area at the oil/water interface of slicks. Dissolution rates are also strongly affected by the level of turbulence. For example, dissolution rates will be relatively high at the site of the release for a deep-sea discharge at high pressure.

Evaporation can result in the transfer of large proportions of spilled oil from the sea surface to the atmosphere, depending on the type of oil. Evaporation rates vary over space and time dependent on the prevailing sea temperatures, wind and current speeds, the surface area of the slick and entrained droplets that are exposed to the atmosphere as well as the state of weathering of the oil. Evaporation rates will decrease over time, depending on the calculated rate of loss of the more volatile compounds. By this process, the model can differentiate between the fates of different oil types.

Decay (degradation) of hydrocarbons may occur as the result of photolysis, which is a chemical process energised by ultraviolet light from the sun, and by biological breakdown, termed biodegradation. Many types of marine organisms ingest, metabolise and utilise oil as a carbon source, producing carbon dioxide and water as by-products.

The SIMAP weathering algorithms include terms to represent these dynamic processes. Technical descriptions of the algorithms used in SIMAP and validations against real spill events are provided in French et al., (1999) and French-McCay (2004).

Input specifications for oil types include density, viscosity, pour-point, distillation curve (volume of oil distilled off versus temperature) and the aromatic/aliphatic component ratios within given boiling point ranges. The model calculates a distribution of the oil by mass into the following components:

a. Surface-bound or floating oil;

b. Entrained oil (non-dissolved oil droplets that are physically entrained by wave action);

c. Dissolved hydrocarbons (principally the aromatic and short-chained aliphatic compounds);

d. Evaporated hydrocarbons;

e. Sedimented hydrocarbons; and

f. Decayed hydrocarbons.

8 HYDROCARBON PROPERTIES

Table 8.1 and Table 8.2 summarise the physical properties and boiling point ranges for the MDO and condensate, respectively.

The MDO used in this study has a density of 829.1 kg/m^3 (API of 37.6) and a low pour point of -14°C. The low viscosity (4 cP) indicates that this oil will spread quickly when released and will form a thin to low thickness film on the sea surface, increasing the rate of evaporation.

Generally, about 6.0% of the MDO mass should evaporate within the first 12 hours (Boiling point (BP) < 180°C); a further 34.6% should evaporate within the first 24 hours (180°C < BP < 265°C); and an additional 54.4% should evaporate over several days (265°C < BP < 380°C). Approximately 5% (by mass) of MDO will not evaporate, though will decay slowly over time. The oil is categorised as a group II light-persistent oil according to the International Tankers Owners Pollution Federation (ITOPF, 2014) and US EPA/USCG classifications. The classification is based on the specific gravity of hydrocarbons in combination with relevant boiling point ranges.

Based on the reservoir modelling, Emperor Energy had indicated that the condensate is likely to have an API of 54.6, which is equivalent to a density of 760 kg/m^3. A proxy was carefully selected, which had a low viscosity of 0.875 cP and when exposed to the atmosphere, approximately 64% should evaporate within the first 12 – 24 hours (boiling point (BP) < 180 °C). A further 19% of the semi-volatiles should evaporate within the first 24 - 72 hours (180°C < BP < 265°C); and the low volatile portion (16%) should evaporate over a longer period (265°C < BP < 380°C). Only 1% of the condensate is considered persistent and will decay over time. It is classified as a Group I non persistent oil.

It is important to note that the low volatile and residual components for the condensate and MDO will 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.

Table 8.1 Physical properties for the condensate and MDO.

Characteristic	Marine Diesel Oil (MDO)	Condensate
Density (kg/m^3)	829.1 (at 25 °C)	760 (at 15˚C)
API	37.6	54.6
Dynamic viscosity (cP)	4.0 (at 25 °C)	0.875 (at 20°C)
Hydrocarbon property category	Group II	Group I
Hydrocarbon property classification	Light persistent oil	Non-persistent oil

Table 8.2 Boiling point ranges for the condensate and MDO.

Characteristics	Non-Persistent			Persistent
	Volatile (%)	*Semi-volatile (%)*	*Low-volatility (%)*	*Residual (%)*
Boiling point (°C)	*<180*	*180-265*	*265-380*	*>380*
Marine diesel oil (MDO)	6.0	34.6	54.4	5.0
Condensate	64.0	19.0	16.0	1.0

9 THRESHOLDS

The SIMAP model will track oil concentrations to very low levels. Hence, it is useful to define meaningful threshold concentrations for the recording of contact by oil components and determining the probability of exposure at a location (calculated from the number of replicate simulations in which this contact occurred).

The judgement of meaningful levels is complicated and will depend upon the mode of action, sensitivity of the biota contacted, the duration of the contact and the toxicity of the compounds that are represented in the oil. The latter factor is further complicated by the change in the composition of an oil type over time due to weathering processes. Without specific testing of the oil types, at different states of weathering against a wide range of the potential local receptors, such considerations are beyond the scope of this investigation.

It is important to note that the thresholds herein are based on the thresholds outlined in the NOPSEMA Oil Spill Modelling Bulletin (NOPSEMA 2019), which are summarised in Table 9.1. Their relationship to exposure for the sea surface, shoreline, and water column (entrained and dissolved hydrocarbons) are presented in Sections 9.1 to 9.3. Supporting justifications of the adopted thresholds applied during the study and additional context relating to the area of exposure are also provided.

Table 9.1 Summary of the thresholds applied in this study.

Floating Oil Concentration (g/m^2)	Shoreline Oil Accumulation (g/m^2)	Entrained Hydrocarbons Concentration (ppb)	Instantaneous Dissolved Hydrocarbons (ppb)
1 10 50	10 100 1,000	10 100	10 50 400

9.1 Floating Oil

Floating oil concentrations are relevant to describing the risks of oil coating emergent reefs, vegetation in the littoral zone and shoreline habitats, as well as the risk to wildlife found on the water surface, such as marine mammals, reptiles, and birds. Floating oil is also visible at relatively low concentrations (> ~0.05 g/m^2). Hence, the area exposed to visible oil, which might trigger social or economic impacts, will be larger than the area where biological impacts might be expected.

The low threshold for floating oil exposure was set to 1 g/m^2, which equates approximately to an average thickness of 1 µm. It represents the practical limit of observing hydrocarbon sheens in the marine environment. This threshold is considered below levels which would cause environmental harm and is more indicative of the areas perceived to be affected due to its visibility on the sea-surface and potential to trigger temporary closures of areas (i.e., fishing grounds) as a precautionary measure.

Oil of this thickness is described as rainbow sheen in appearance, according to the Bonn Agreement Oil Appearance Code (Bonn Agreement, 2009; AMSA, 2014) (see Table 9.2). Figure 9.1 shows photographs highlighting the difference in appearance between a silvery sheen, rainbow sheen and metallic sheen.

Ecological impact has been estimated to occur at 10 g/m^2 (a film thickness of approximately 10 µm or 0.01 mm) (French et al.,1996 and French-McCay, 2009) as this level of fresh oiling has been observed to mortally impact some birds through adhesion of oil to their feathers, exposing them to secondary effects such as hypothermia. The appearance of oil at this average thickness has been described as a metallic sheen (Bonn Agreement, 2009). Concentrations above 10 g/m^2 is also considered the lower actionable threshold, where oil may be thick enough for containment and recovery as well as dispersant treatment (AMSA, 2015).

Oil concentrations on the sea surface of 25 g/m^2 (or greater) would be harmful for all birds that have landed in an oil film due to potential contamination of their feathers, with secondary effects such as loss of temperature regulation and ingestion of oil through preening (Scholten et al., 1996; Koops et al., 2004). The appearance of oil at this thickness is also described as metallic sheen (Bonn Agreement, 2009). For this study the high exposure threshold was set to 50 g/m^2 and above based on NOPSEMA (2019). This threshold can also be used to inform response planning. Table 9.3 is a summary of each threshold.

Table 9.2 The Bonn Agreement Oil Appearance Code.

Code	Description Appearance	Layer Thickness Interval (g/m^2 or µm)	Litres per km^2
1	Sheen (silvery/grey)	0.04 – 0.30	40 – 300
2	Rainbow	0.30 – 5.0	300 – 5,000
3	Metallic	5.0 – 50	5,000 – 50,000
4	Discontinuous True Oil Colour	50 – 200	50,000 – 200,000
5	Continuous True Oil Colour	≥ 200	≥ 200,000

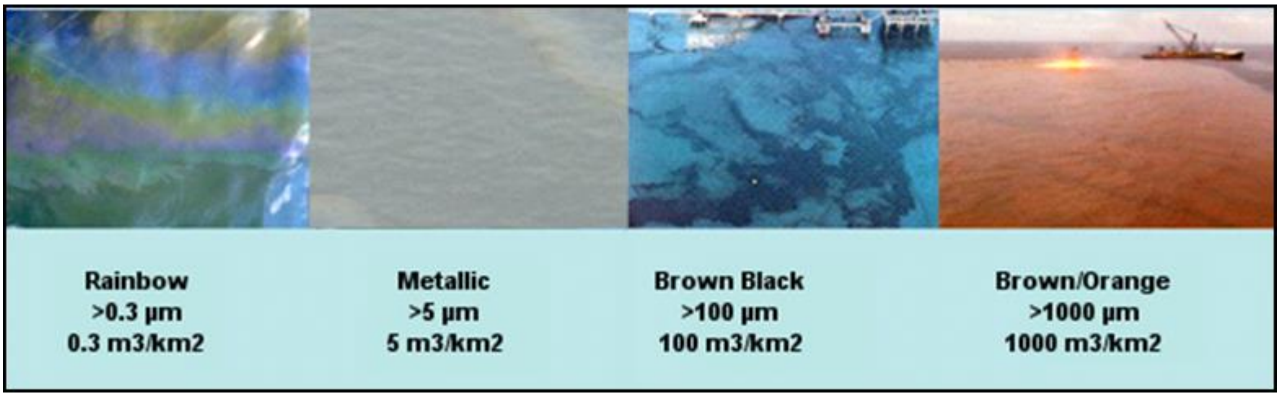

Figure 9.1 Photographs showing the difference between oil colour and thickness on the sea surface (source: adapted from Oil Spill Solutions, 2015).

Table 9.3 Floating oil exposure thresholds used in the oil spill modelling study (in alignment with NOPSEMA, 2019).

Threshold level	Floating oil (g/m^2)	Description
Low	1	Approximates range of socio-economic effects and establishes planning area for scientific monitoring
Moderate	10	Approximates lower limit for harmful exposures to birds and marine mammals
High	50*	Approximates surface oil slick and informs response planning

* 50 g/m^2 also used to define the threshold for actionable floating oil.

9.2 Shoreline Oil Accumulation

There are many different types of shorelines, ranging from cliffs, rocky beaches, sandy beaches, mud flats and mangroves, and each of these influences the volume of oil that can remain stranded ashore and its thickness before the shoreline saturation point occurs. For instance, a sandy beach may allow oil to percolate through the sand, thus increasing its ability to hold more oil ashore over tidal cycles and various wave actions than an equivalent area of water; hence oil can increase in thickness onshore over time. A sandy beach shoreline was assumed as the default shoreline type for the modelling in this study, as it allows for the highest carrying capacity of oil (of the available open/exposed shoreline types).

Previous risk assessment studies, a threshold of 10 g/m^2 was used to assess the potential for shoreline accumulation (French-McCay et al.,2005a; 2005b). This is a conservative threshold used to define regions of socio-economic impact, such as triggering temporary closures of adjoining fisheries or the need for shore clean-up on beaches or man-made features/amenities (breakwaters, jetties, marinas, etc.). It would equate to approximately 2 teaspoons of hydrocarbon per square meter of shoreline accumulation. The appearance is described as a stain/film. On that basis, the 10 g/m^2 has been selected to define the low threshold.

French et al. (1996) and French-McCay (2009) define a shoreline oil accumulation threshold of 100 g/m^2, or above, would potentially harm shorebirds and wildlife (fur-bearing aquatic mammals and marine reptiles on or along the shore) based on studies for sub-lethal and lethal impacts. This threshold has been used in previous environmental risk assessment studies (see French-McCay, 2003; French-McCay et al., 2004, French-McCay et al., 2011; 2012; NOAA, 2013). Additionally, this threshold is also recommended in AMSA's foreshore assessment guide as the acceptable minimum thickness that does not inhibit the potential for recovery and is best remediated by natural coastal processes alone (AMSA, 2015). This threshold equates to approximately ½ a cup of oil per square meter of shoreline accumulation and is described as a thin oil coat. The 100 g/m^2 has been selected to define the moderate threshold.

Observations by Lin & Mendelssohn (1996) demonstrated that loadings of more than 1,000 g/m^2 of hydrocarbon during the growing season would be required to impact marsh plants significantly. Similar thresholds have been found in studies assessing hydrocarbon impacts on mangroves (Grant et al., 1993; Suprayogi & Murray, 1999). This loading equates to approximately 1 litre of hydrocarbon per square meter of shoreline accumulation and the appearance is described as a hydrocarbon cover. A loading of 1,000 g/m^2 has been selected to define high threshold.

Table 9.4 is a summary of each threshold.

Table 9.4 Shoreline accumulation thresholds used in oil spill modelling study (in alignment with NOPSEMA, 2019).

Threshold level	Shoreline loading(g/m^2)	Description
Low	10	Predicts potential for some socio-economic impact
Moderate	100*	Loading predicts area likely to require clean-up effort
High	1,000	Loading predicts area likely to require intensive clean-up effort

* 100 g/m^2 also used to define the threshold for actionable shoreline oil.

9.3 In-water

Oil is a mixture of thousands of hydrocarbons of varying physical, chemical, and toxicological characteristics, and therefore, demonstrate varying fates and impacts on organisms. As such, for in-water exposure, the SIMAP model provides separate outputs for dissolved and entrained hydrocarbons from oil droplets. The consequences of exposure to dissolved and entrained components will differ because they have different modes and magnitudes of effect.

Entrained hydrocarbon concentrations were calculated based on oil droplets that are suspended in the water column, though not dissolved. The composition of this oil would vary with the state of weathering (oil age) and may contain soluble hydrocarbons when the oil is fresh. Calculations for dissolved hydrocarbons specifically calculates oil components which are dissolved in water, which are known to be the primary source of toxicity exerted by oil.

A complicating factor that should be considered when assessing the consequence of dissolved and entrained oil distributions is that there will be some areas where both physically entrained oil droplets and dissolved hydrocarbons co-exist. Higher concentrations of each will tend to occur close to the source where sea conditions can force mixing of relatively unweathered oil into the water column, resulting in more rapid dissolution of soluble compounds.

9.3.1 Dissolved Hydrocarbons

Laboratory studies have shown that dissolved hydrocarbons exert most of the toxic effects of oil on aquatic biota (Carls et al., 2008; Nordtug et al., 2011; Redman, 2015). The mode of action is a narcotic effect, which is positively related to the concentration of soluble hydrocarbons in the body tissues of organisms (French-McCay, 2002). Dissolved hydrocarbons are taken up by organisms directly from the water column by absorption through external surfaces and gills, as well as through the digestive tract. Thus, soluble hydrocarbons are termed “bioavailable”.

Hydrocarbon compounds vary in water-solubility and the toxicity exerted by individual compounds is inversely related to solubility, however bioavailability will be modified by the volatility of individual compounds (Nirmalakhandan & Speece, 1988; Blum & Speece, 1990; McCarty, 1986; McCarty et al., 1992a, 1992b; McCarty & Mackay, 1993; Verhaar et al., 1992, 1999; Swartz et al., 1995; French-McCay, 2002; McGrath & Di Toro, 2009). Of the soluble compounds, the greatest contributor to toxicity for water-column and benthic organisms are the lower-molecular-weight aromatic compounds, which are both volatile and soluble in water. Although they are not the most water-soluble hydrocarbons within most oil types, the polynuclear aromatic hydrocarbons (PAHs) containing 2 – 3 aromatic ring structures typically exert the largest narcotic effects because they are semi-soluble and not highly volatile, so they persist in the environment long enough for significant accumulation to occur (Anderson et al., 1974, 1987; Neff & Anderson, 1981; Malins & Hodgins, 1981; McAuliffe, 1987; NRC, 2003). The monoaromatic hydrocarbons (MAHs), including the BTEX compounds (benzene, toluene, ethylbenzene, and xylenes), and the soluble alkanes (straight chain hydrocarbons) also contribute to toxicity, but these compounds are highly volatile, so that their contribution will be low when oil is exposed to evaporation and higher when oil is discharged at depth where volatilisation does not occur (French-McCay, 2002).

French-McCay (2002) reviewed available toxicity data, where marine biota was exposed to dissolved hydrocarbons prepared from oil mixtures, finding that 95% of species and life stages exhibited 50% population mortality (LC_{50}) between 6 and 400 ppb (with an average of 50 ppb) total PAH concentration after 96 hrs exposure. Therefore, concentrations lower than 6 ppb total PAH value should be protective of 97.5% of species and life stages even with exposure periods of days (at least 96 hours). Early life-history stages of fish appear to be more sensitive than older fish stages and invertebrates.

Exceedances of 10, 50 or 400 ppb over a 1-hour timestep (see Table 9.5) were applied in this study to indicate the increasing potential for sub-lethal to lethal toxic effects (or low to high), based on NOPSEMA (2019).

9.3.2 Entrained Hydrocarbons

Entrained hydrocarbons consist of oil droplets that are suspended in the water column and insoluble. Insoluble compounds in oil cannot be absorbed from the water column by aquatic organisms, therefore they are not bioavailable through absorption of compounds from the water. Exposure to these compounds would require routes of uptake other than absorption of soluble compounds. The route of exposure of organisms to whole oil alone include direct contact with tissues of organisms and uptake of oil by direct consumption, with potential for biomagnification through the food chain (NRC, 2003).

Thresholds of 10 ppb and 100 ppb were applied over a 1-hour time exposure (Table 9.5) as per NOPSEMA (2019).

The 10-ppb threshold exposure zone is not considered to be of significant biological impact and represents the area contacted by the spill.

Table 9.5 Dissolved and entrained hydrocarbon exposure thresholds assessed over a 1-hour time step used in the oil spill modelling study (in alignment NOPSEMA 2019).

	Exposure level	In-water threshold (ppb)	Description
Dissolved hydrocarbons	Low	10	Establishes planning area for scientific monitoring based on potential for exceedance of water quality triggers
	Moderate	50	Approximates potential toxic effects, particularly sublethal effects to sensitive species
	High	400	Approximates toxic effects including lethal effects to sensitive species
Entrained hydrocarbons	Low	10	Establishes planning area for scientific monitoring based on potential for exceedance of water quality triggers
	High	100	As appropriate given oil characteristics for informing risk evaluation

9.4 Dispersion

A horizontal dispersion coefficient of 10 m^2/s was used to account for dispersive processes acting at the surface that are below the scale of resolution of the input current field, based on typical values for open waters (Okubo, 1971). Dispersion rates within the water column (applicable for entrained and dissolved plumes of hydrocarbons) were specified at 1 m^2/s, based on empirical data for the dispersion of hydrocarbon plumes over the North West Shelf (King & McAllister, 1998).

10 RECEPTORS

A range of environmental receptors and shorelines were assessed for floating oil exposure, shoreline contact and water column exposure (entrained and dissolved hydrocarbons) as part of the study (see Figure 10.1 to Figure 10.18). Receptor categories are shown in Table 10.1 which includes coastal and offshore islands grouped as shorelines. All other sensitive receptors other than submerged reefs, shoals and banks (RSB) were sourced from Australian Government Department of Agriculture, Water and the Environment (http://www.environment.gov.au/). Results were separately calculated for each receptor and have been tabulated, except for the two receptors that the release location resides within (Twofold Shelf IMCRA and Upwelling East of Eden KEF).

Table 10.1 Summary of receptors assessed for potential oil exposure.

Receptor Category	Acronym	Hydrocarbon Exposure and Accumulation Assessment			Figure reference
		Floating oil	Water Column	Shoreline	
Australian Marine Park	AMP	✓	✓	×	Figure 10.1
Aquatic Reserve	AQR	✓	✓	×	Figure 10.2
Conservation Area	CA	✓	✓	×	Figure 10.3
Conservation Park	CP	✓	✓	×	Figure 10.4
Integrated marine and coastal regionalisation areas - Meso-scale Bioregions	IMCRA	✓	✓	×	Figure 10.5
Marine National Parks	MNP	✓	✓	×	Figure 10.6
Marine Park	MP	✓	✓	×	Figure 10.7
Marine Sanctuary	MS				Figure 10.8
National Park	NP	✓	✓	×	Figure 10.9
National Parks Act Schedule 4 park or reserve	NPS4	✓	✓	×	Figure 10.10
Nature Reserve	NR	✓	✓	×	Figure 10.11
Ramsar Sites	Ramsar	✓	✓	×	Figure 10.12
Reefs, Shoals and Banks	RSB	✓	✓	×	Figure 10.13
Key Ecological Feature	KEF	✓	✓	×	Figure 10.14
State Waters	State Waters	✓	✓	×	
Shorelines	Shore	✓ (Reported as: Nearshore Waters)	✓ (Reported as: Nearshore Waters)	✓	Figure 10.15 to Figure 10.18

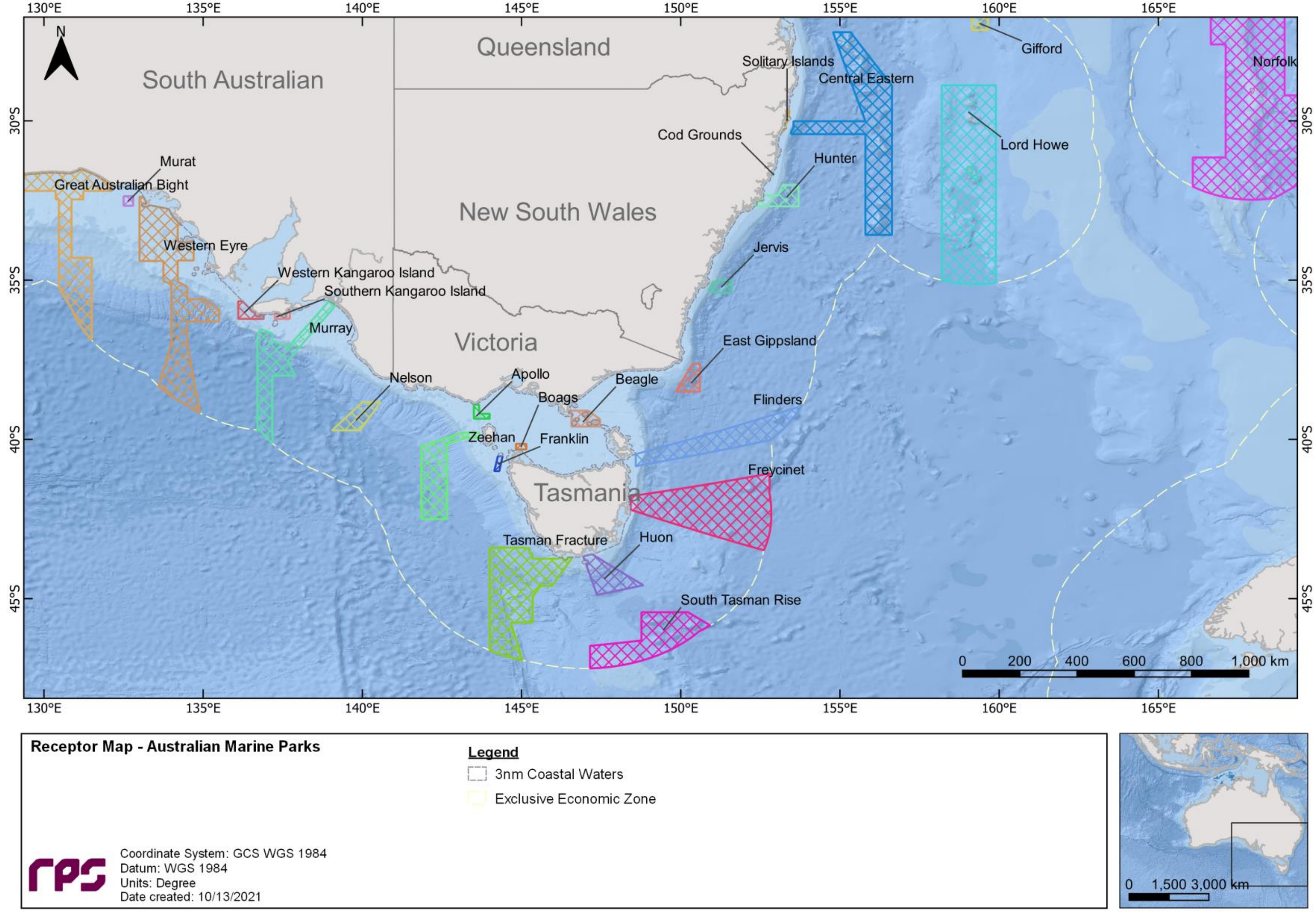

Figure 10.1 Receptor map for Australian Marine Parks (AMP).

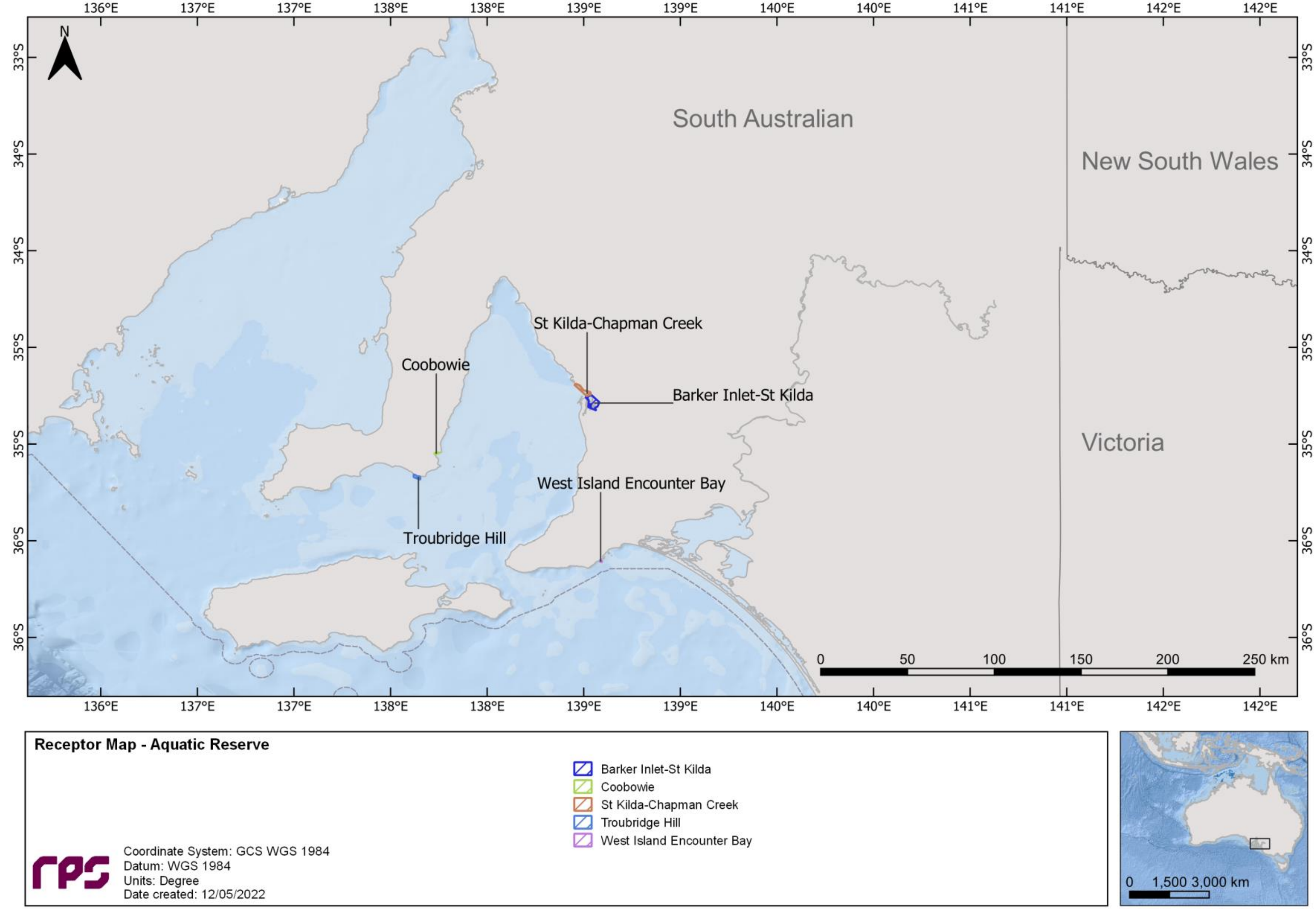

Figure 10.2 Receptor map for Aquatic Reserves (AQR).

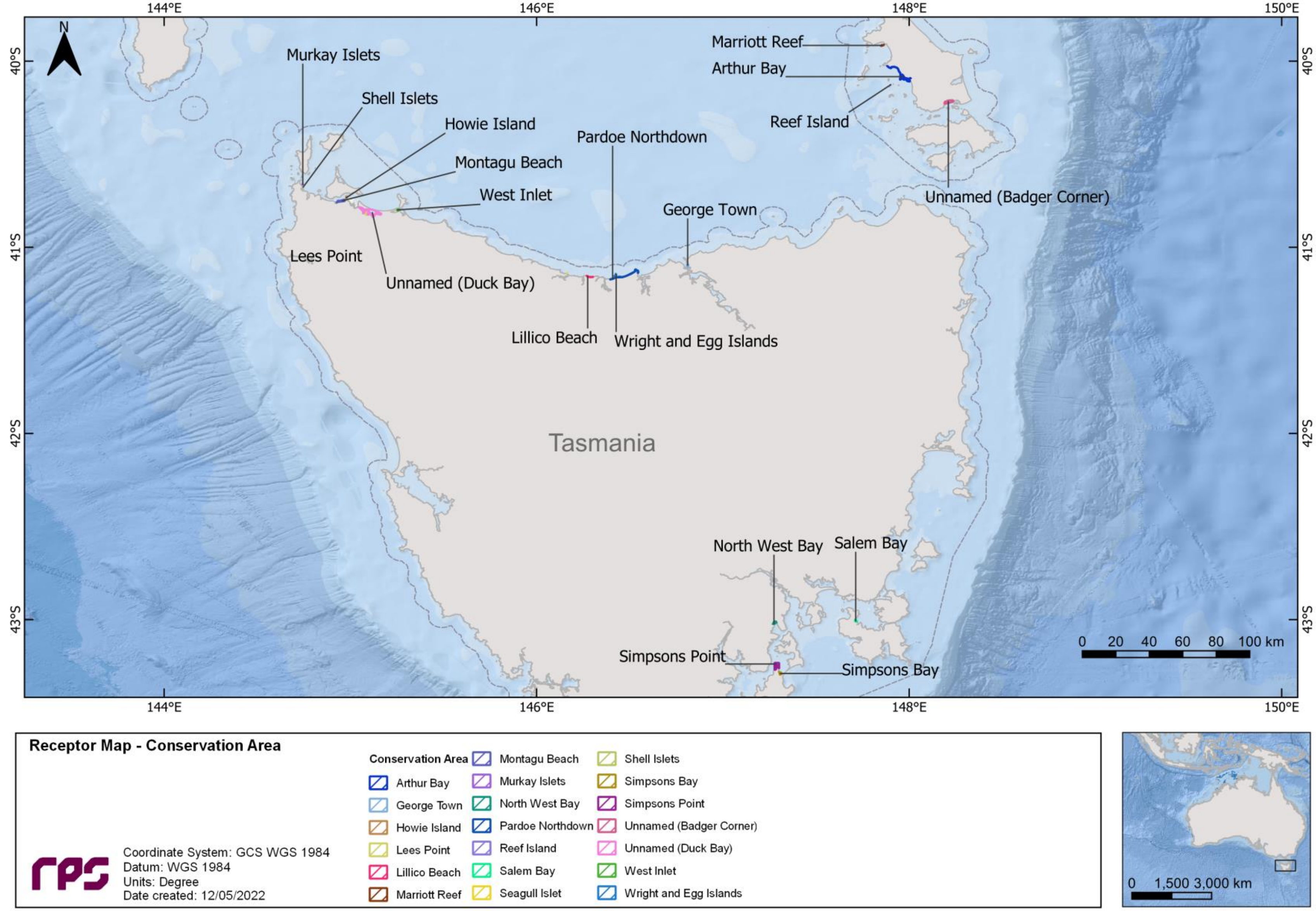

Figure 10.3 Receptor map for Conservation Area (CA).

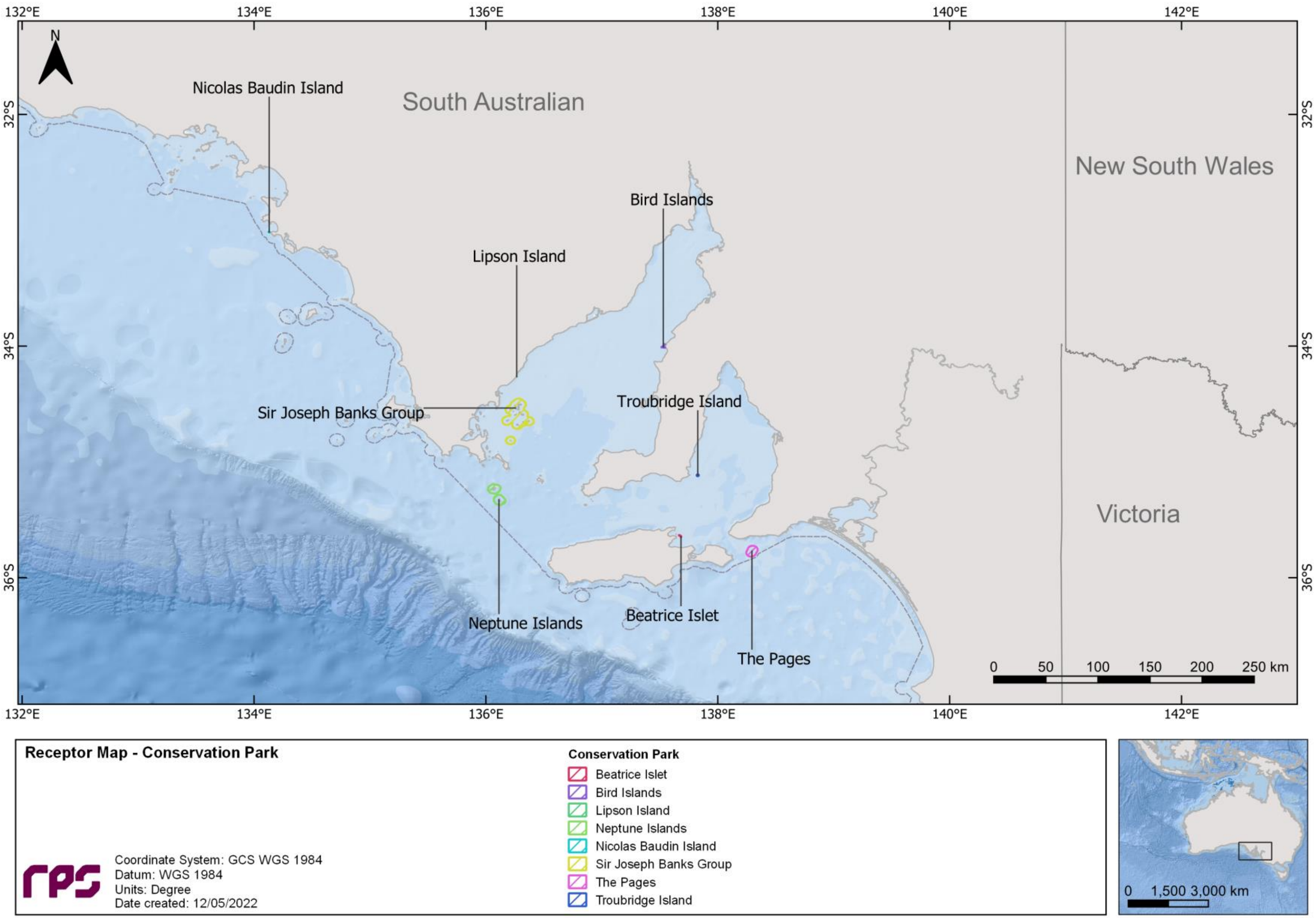

Figure 10.4 Receptor map for Conservation Park (CP).

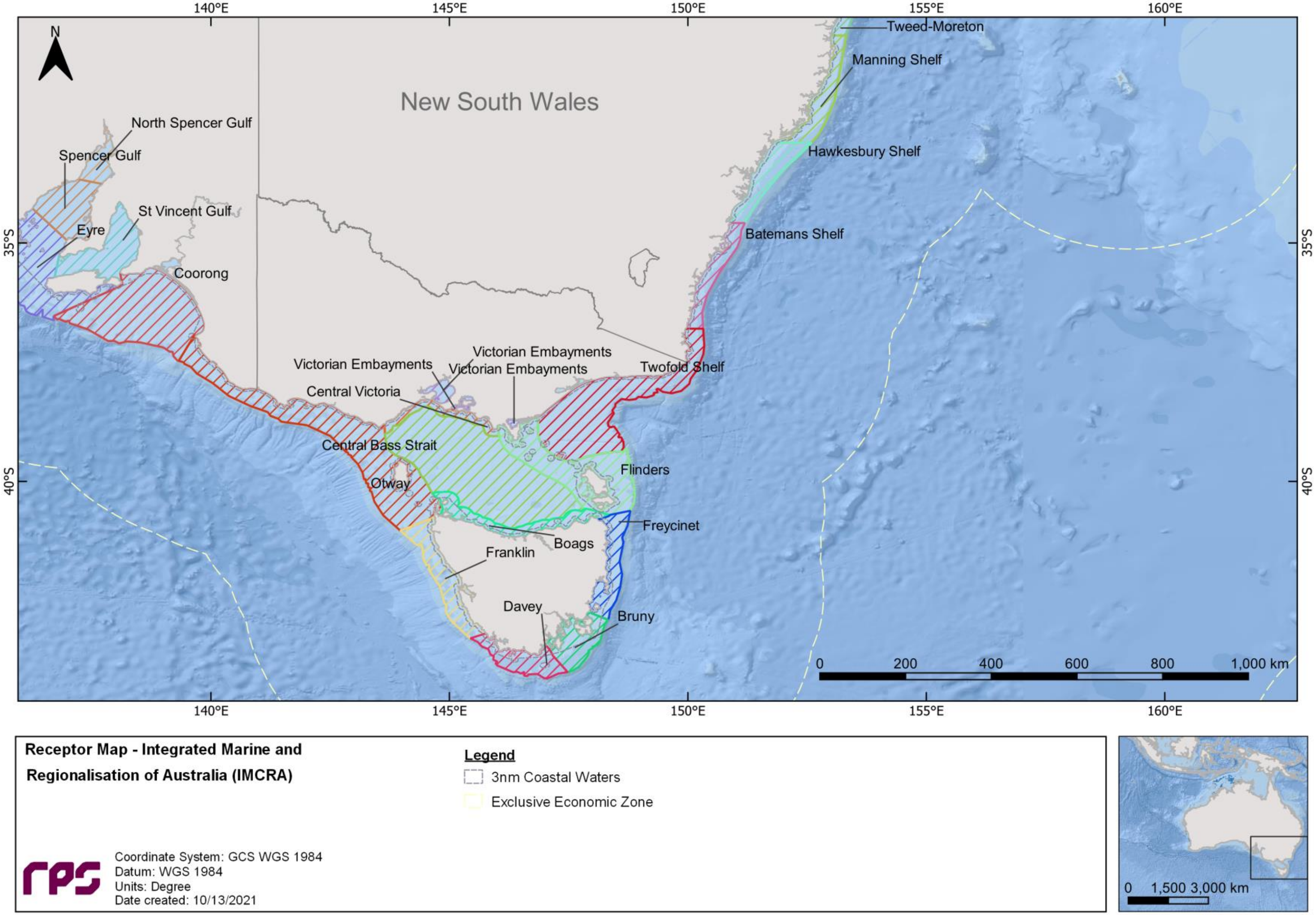

Figure 10.5 Receptor map for integrated marine and coastal regionalisation (IMCRA) areas.

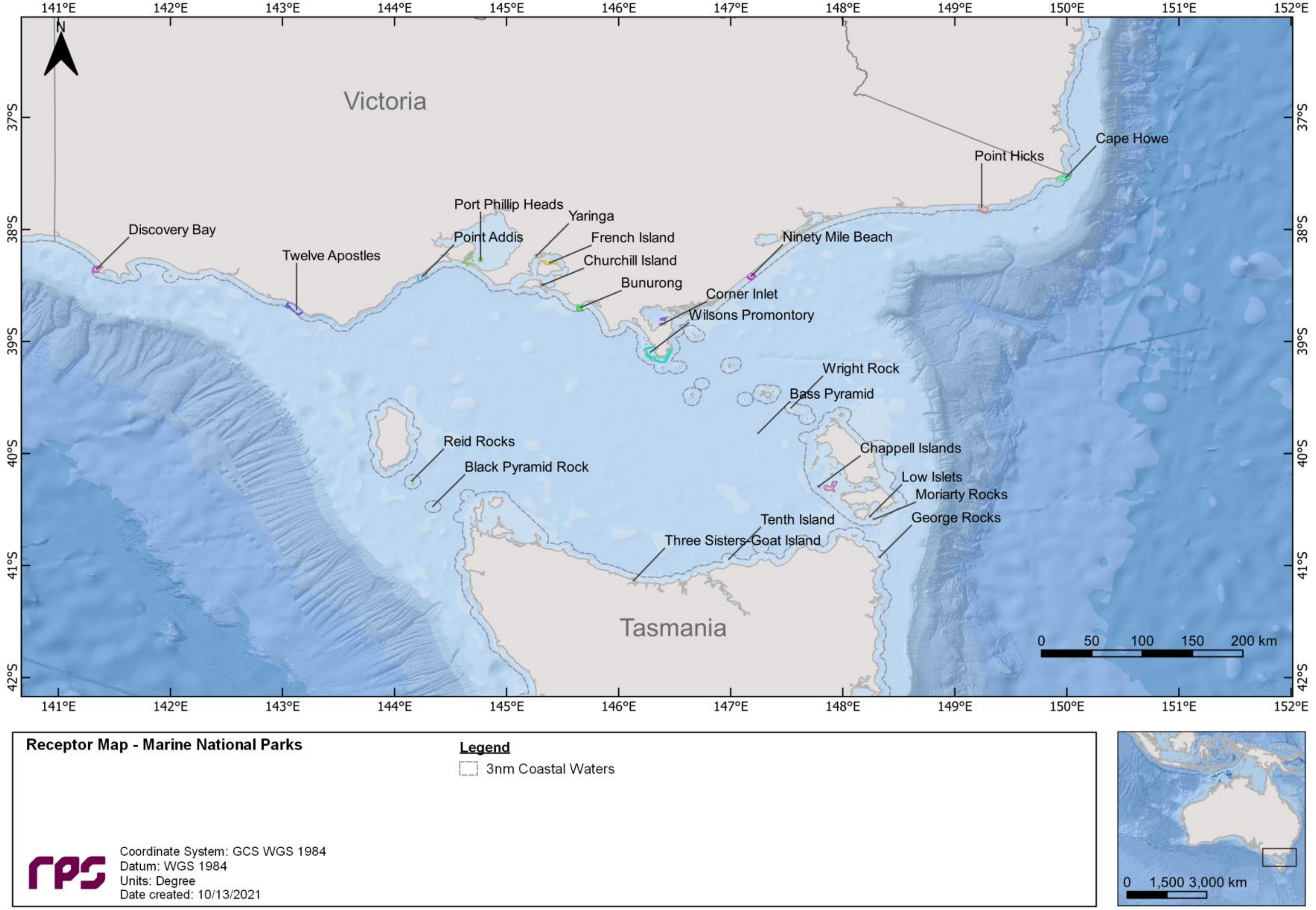

Figure 10.6 Receptor map for Marine National Parks (MNP).

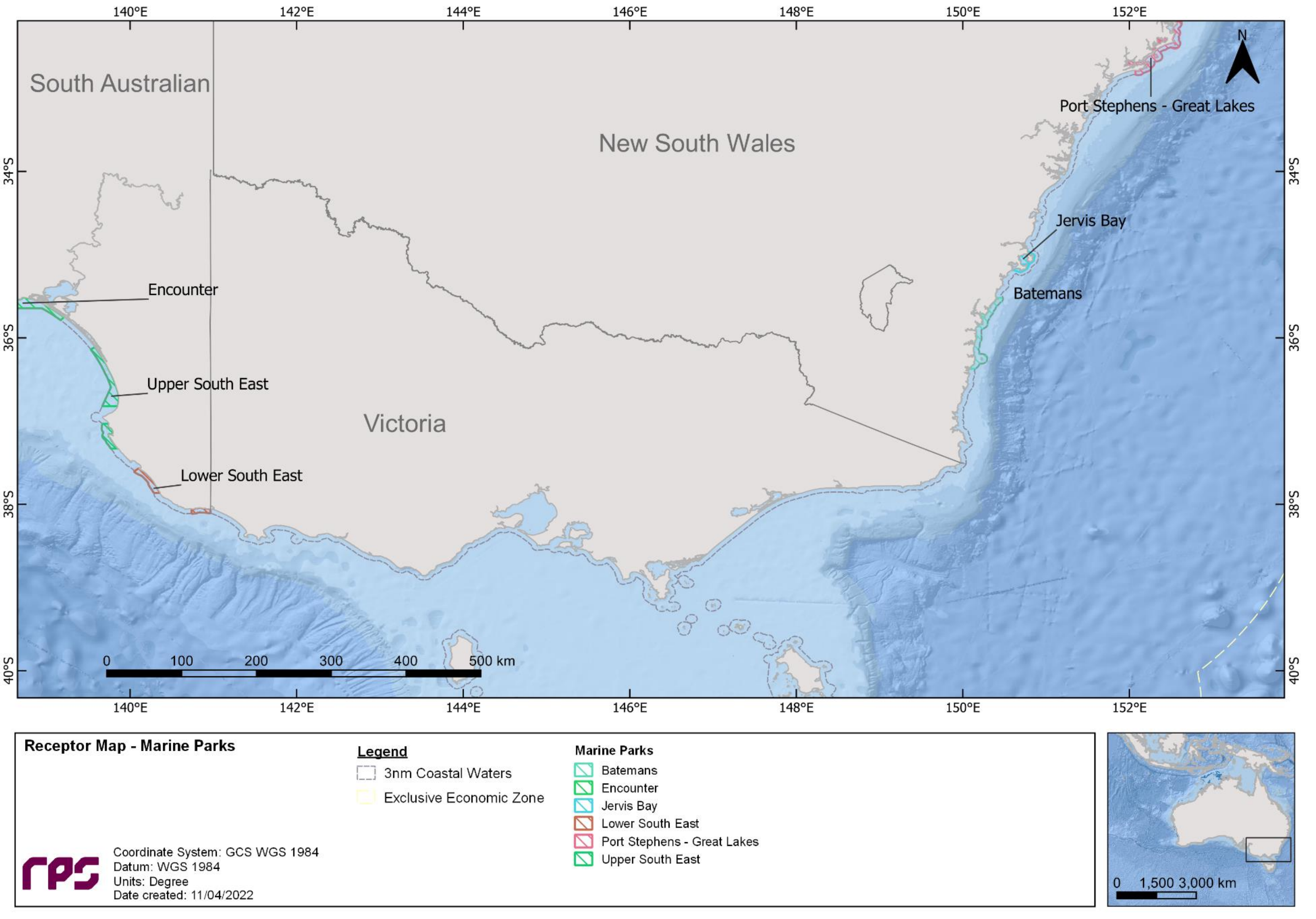

Figure 10.7 Receptor map for Marine Parks (MP).

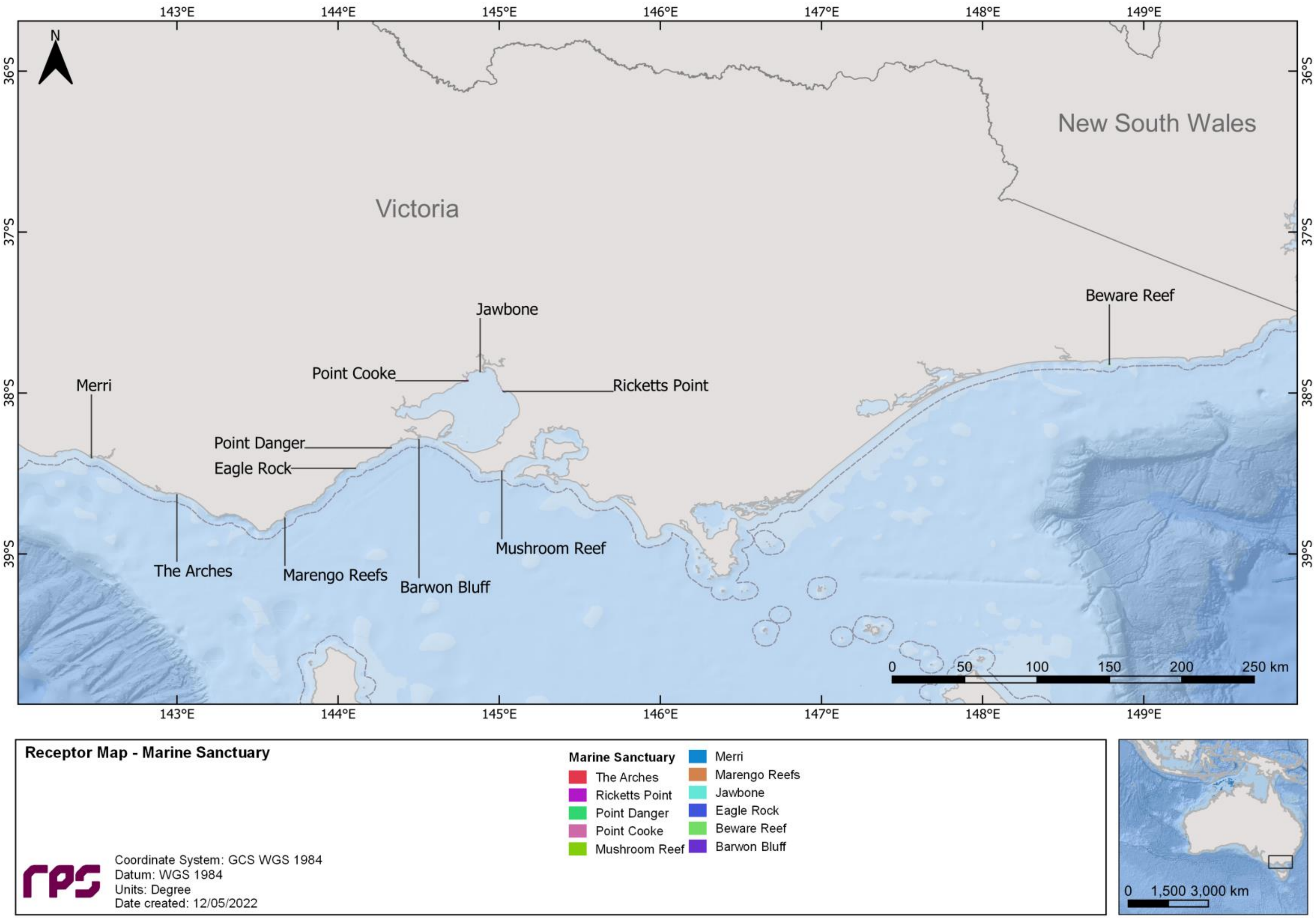

Figure 10.8 Receptor map for Marine Sanctuary.

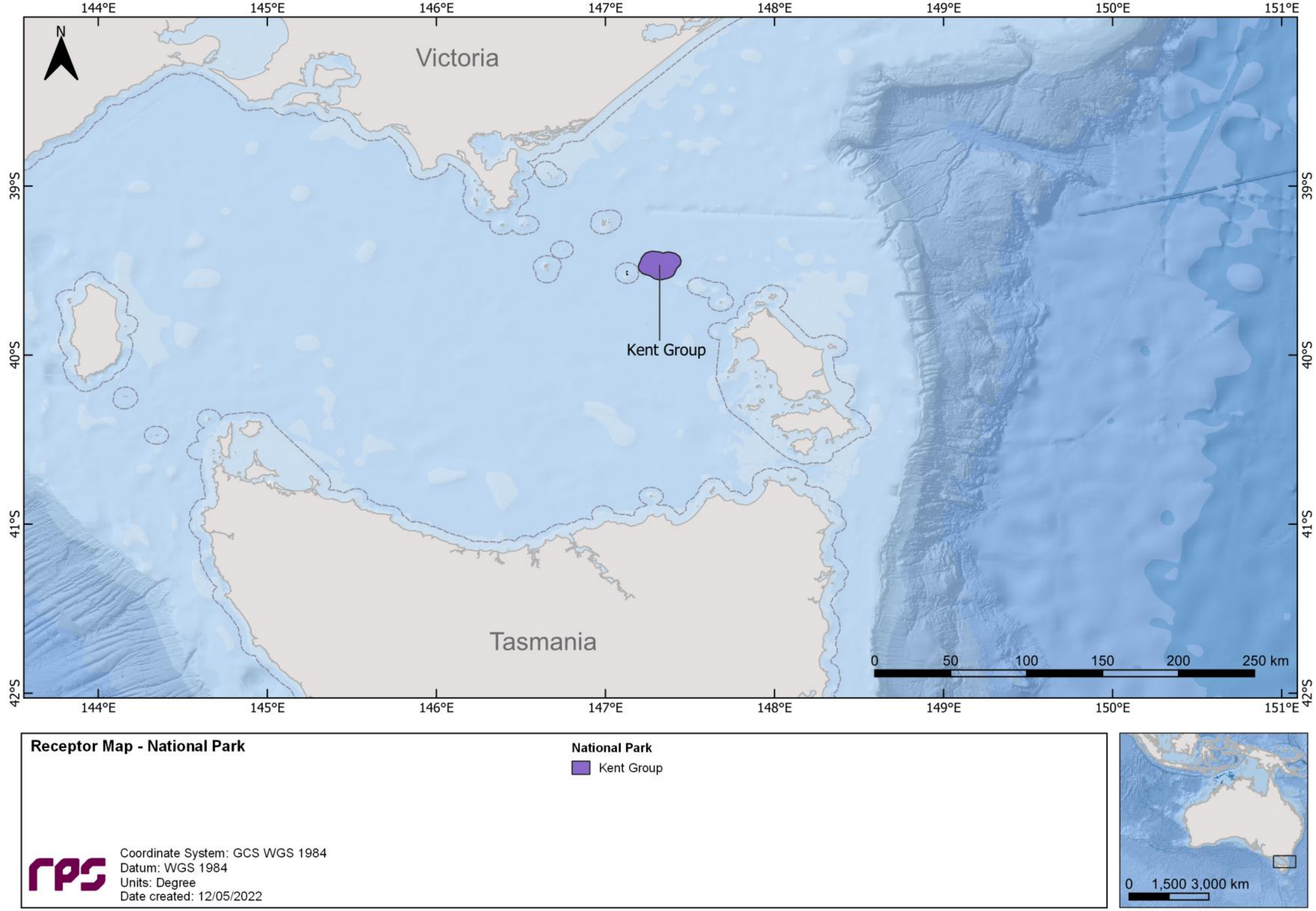

Figure 10.9 Receptor map for National Park (NP).

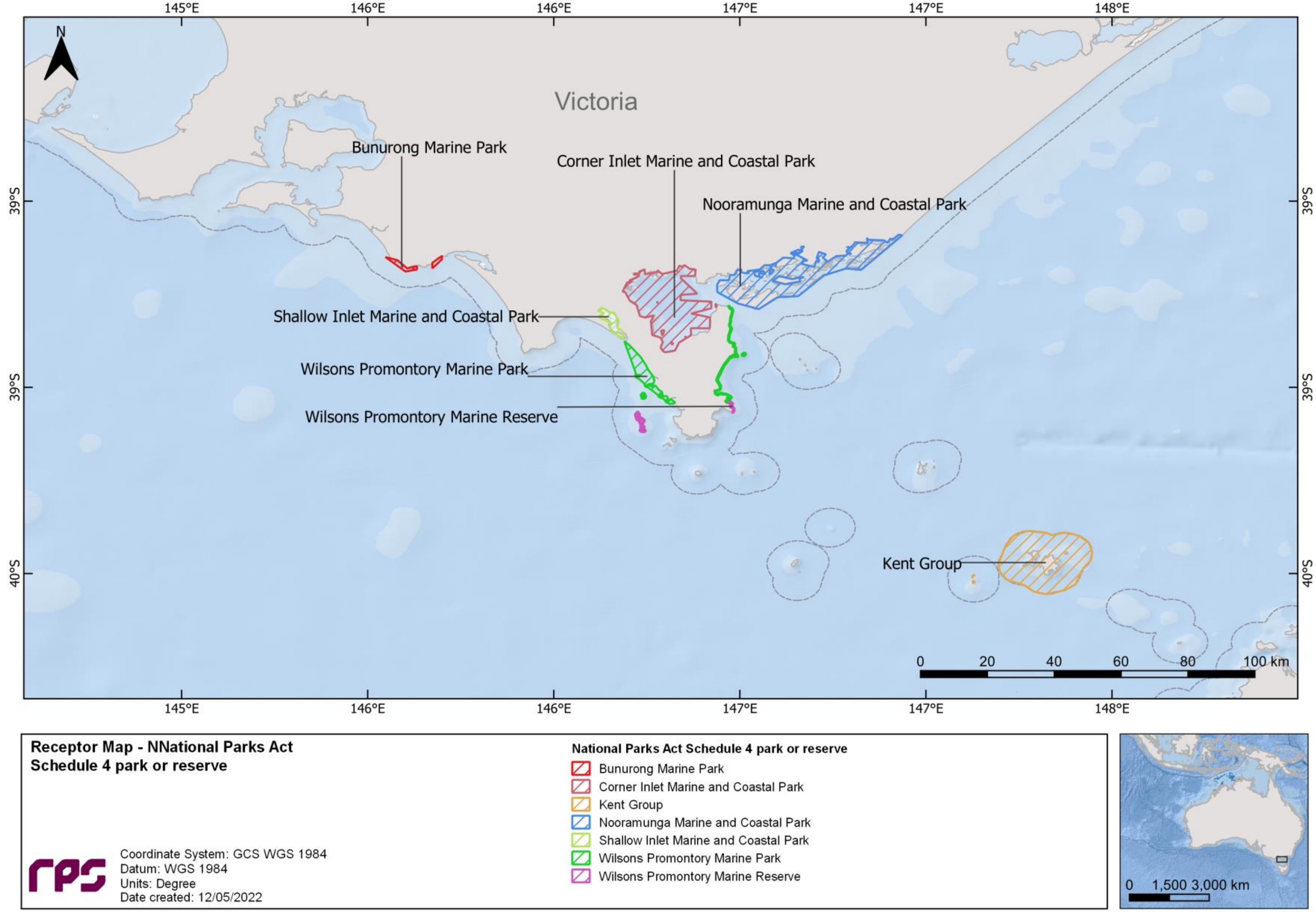

Figure 10.10 Receptor map for National Parks Act Schedule 4 park or reserve (NSP4).

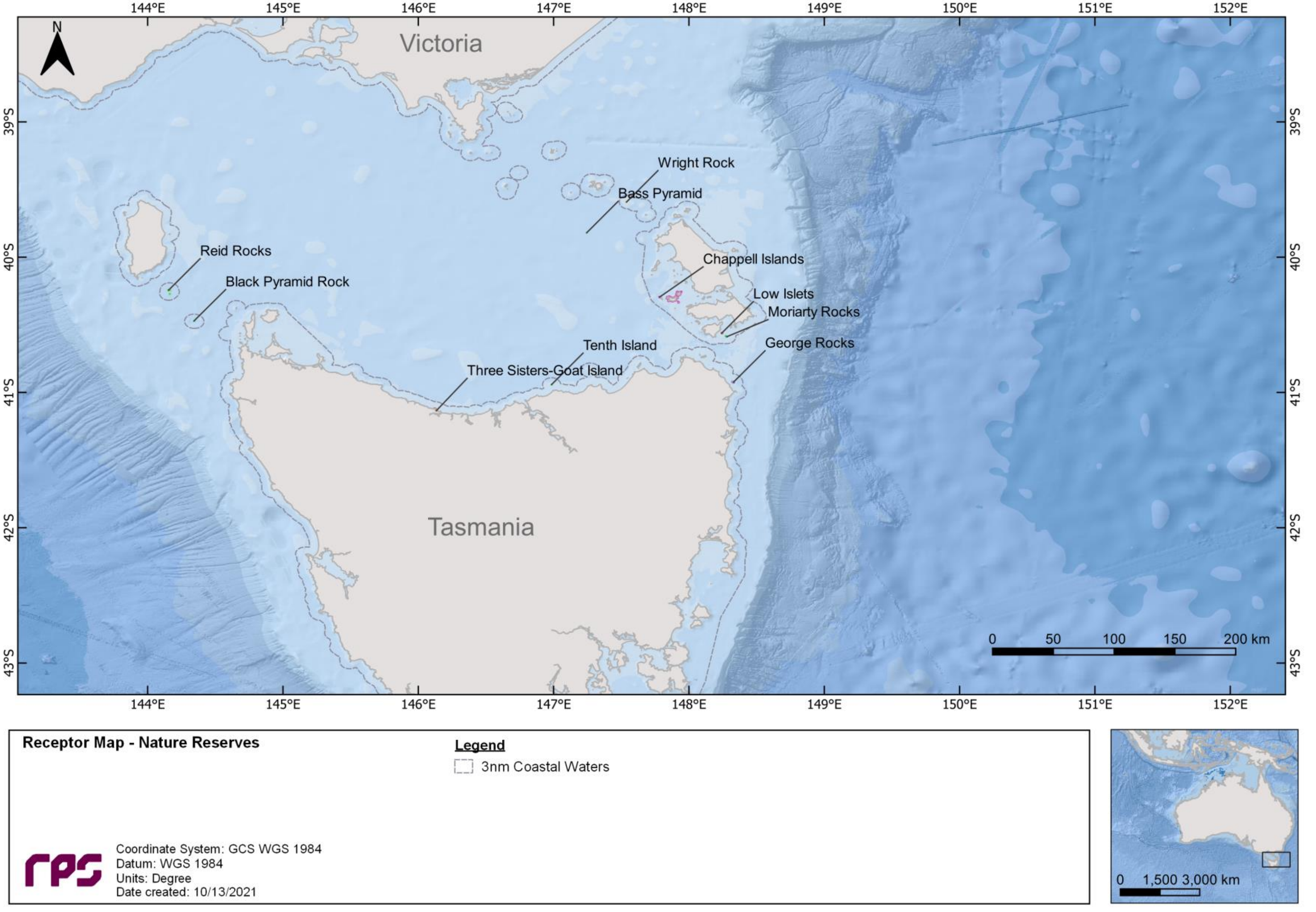

Figure 10.11 Receptor map for Nature Reserves (NR).

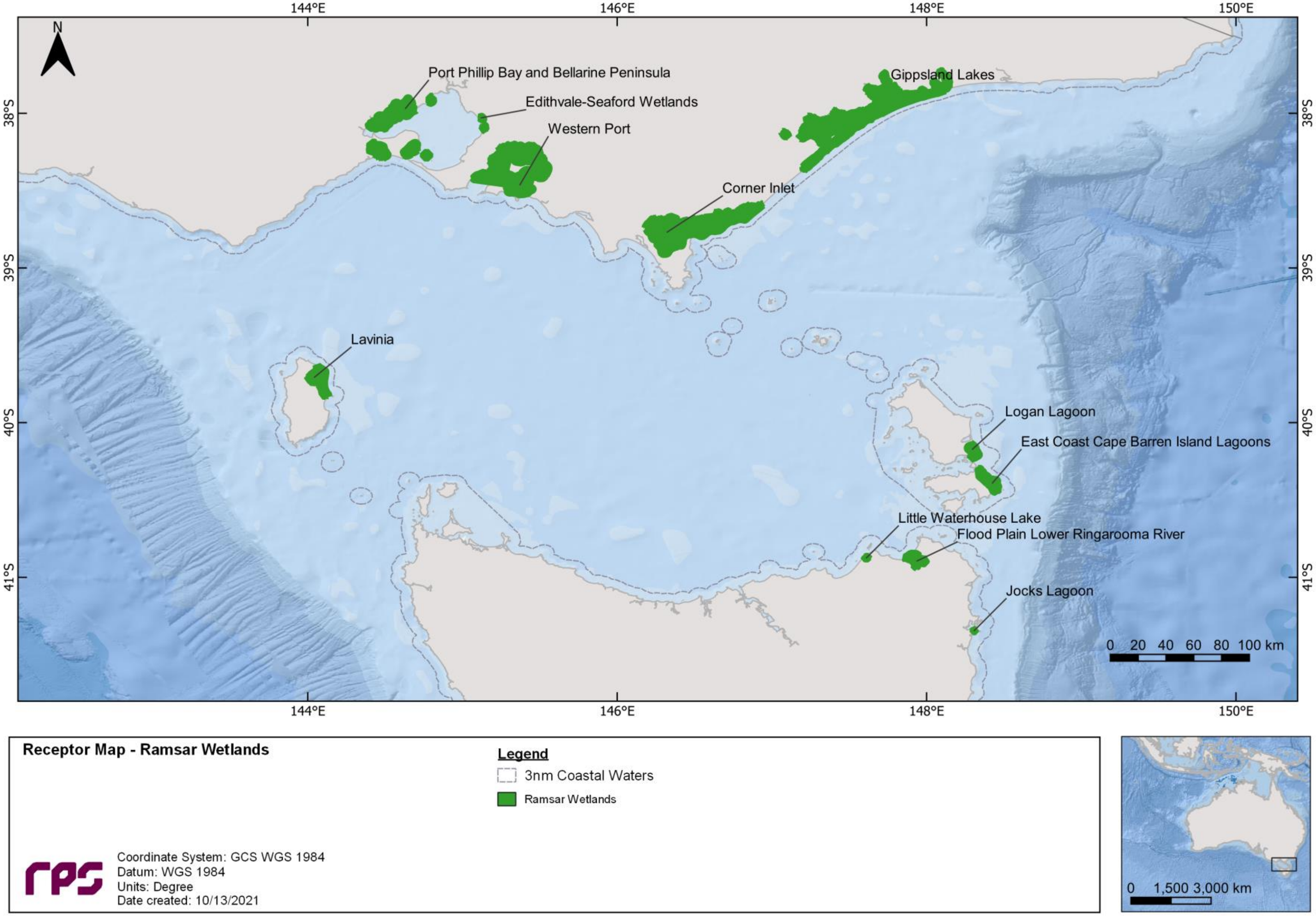

Figure 10.12 Receptor map for Ramsar Sites (Ramsar).

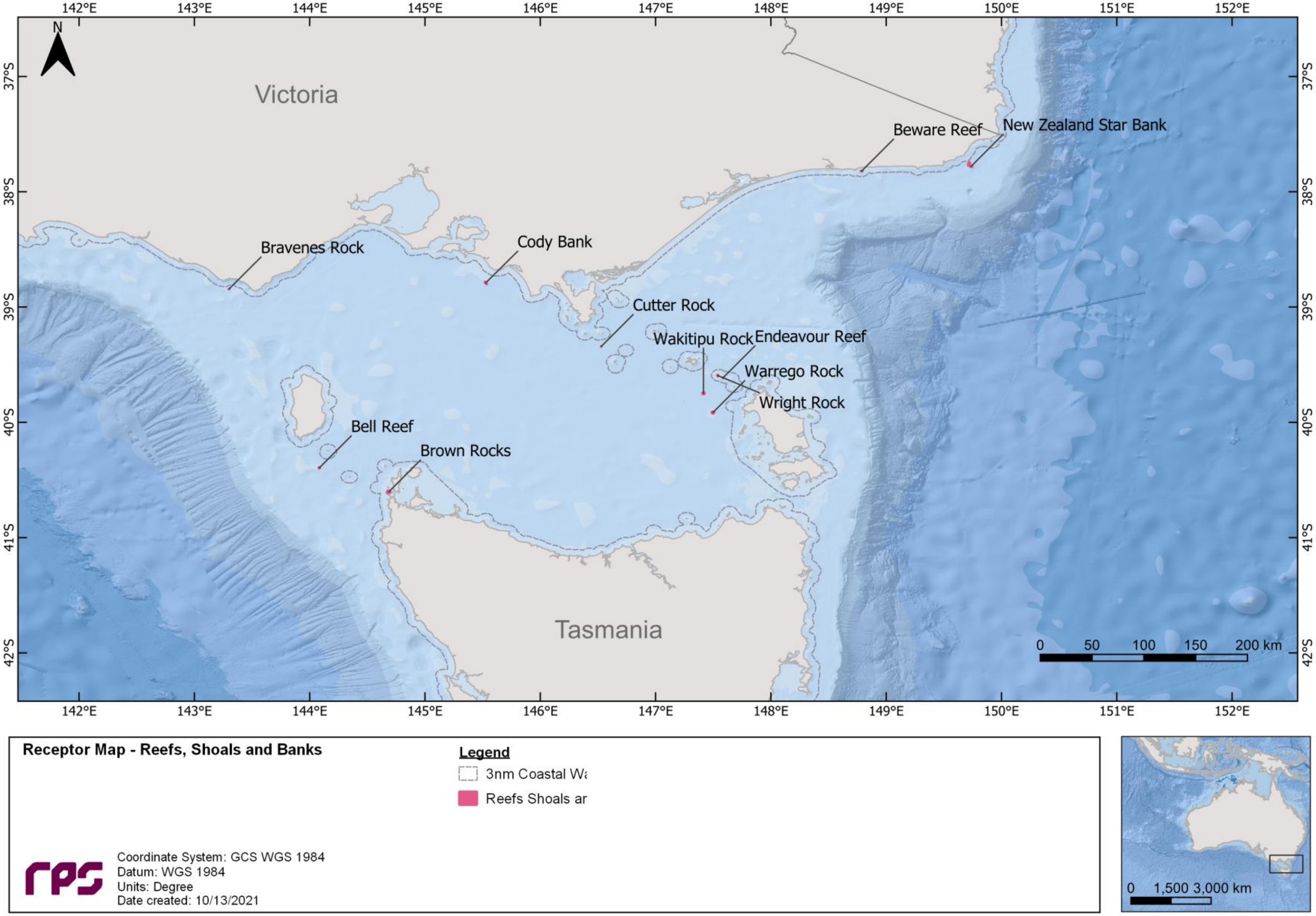

Figure 10.13 Receptor map for Reefs, Shoals and Banks (RSB).

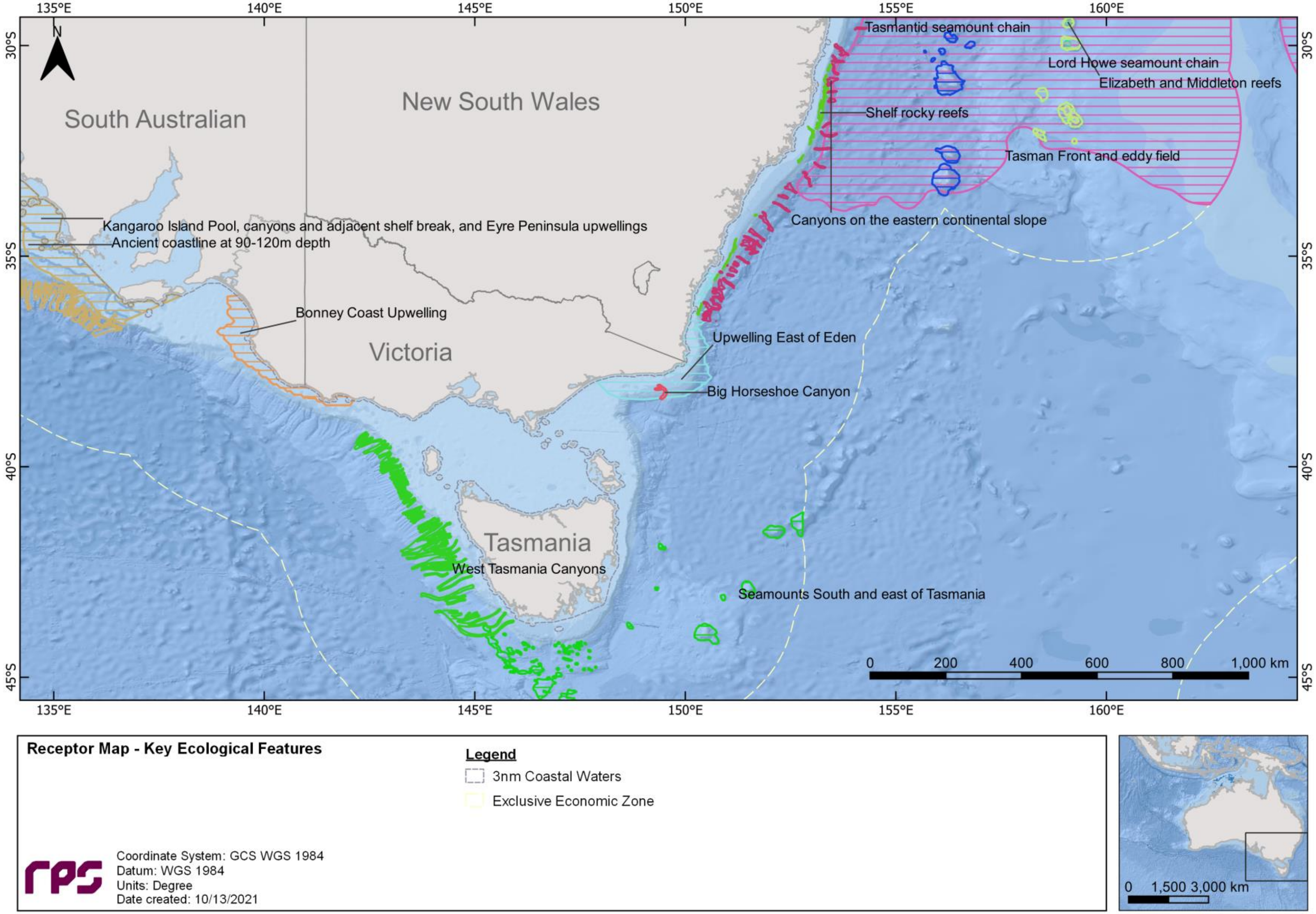

Figure 10.14 Receptor map for Key Ecological Features (KEF).

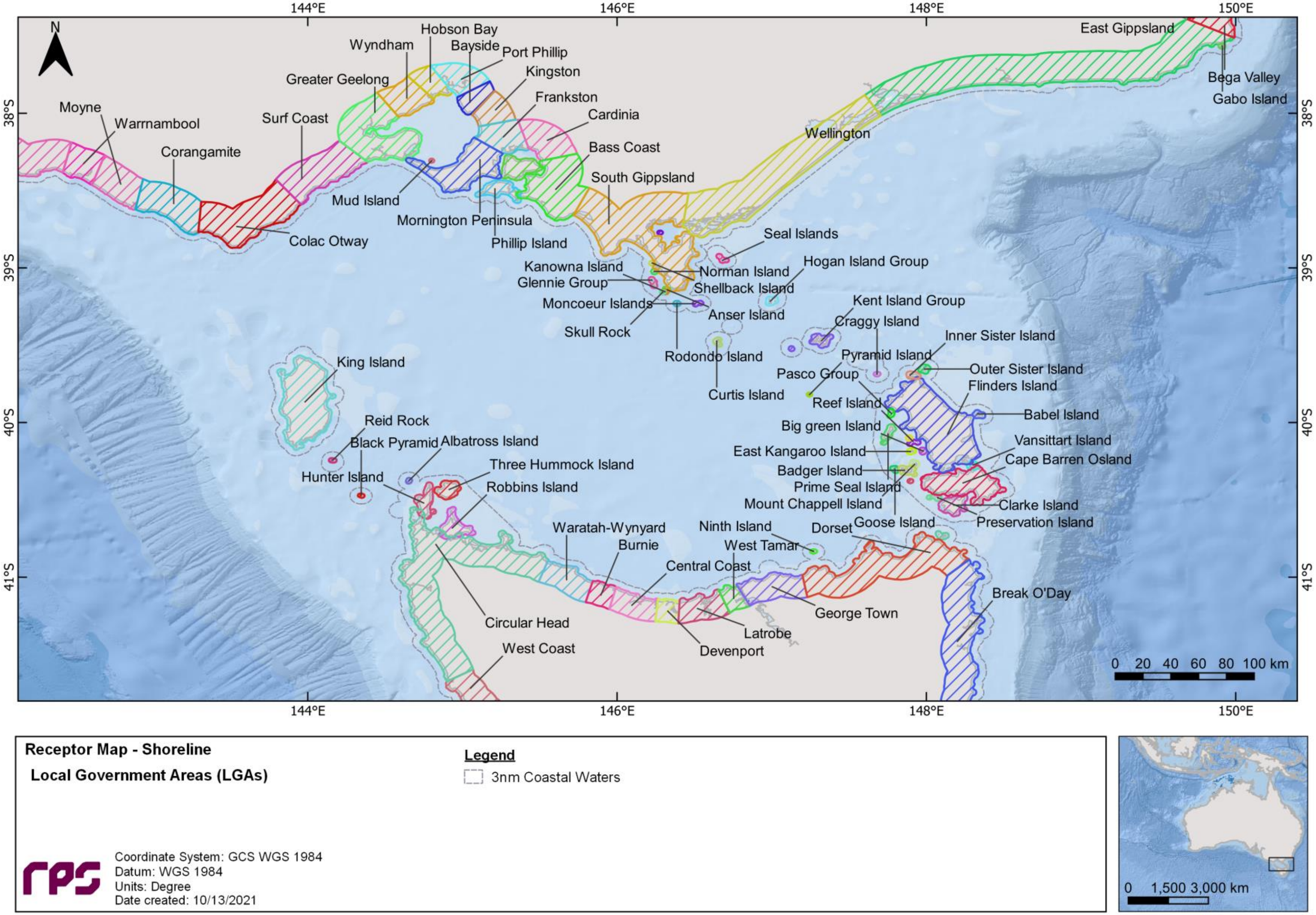

Figure 10.15 Receptor map for shorelines (1 of 4).

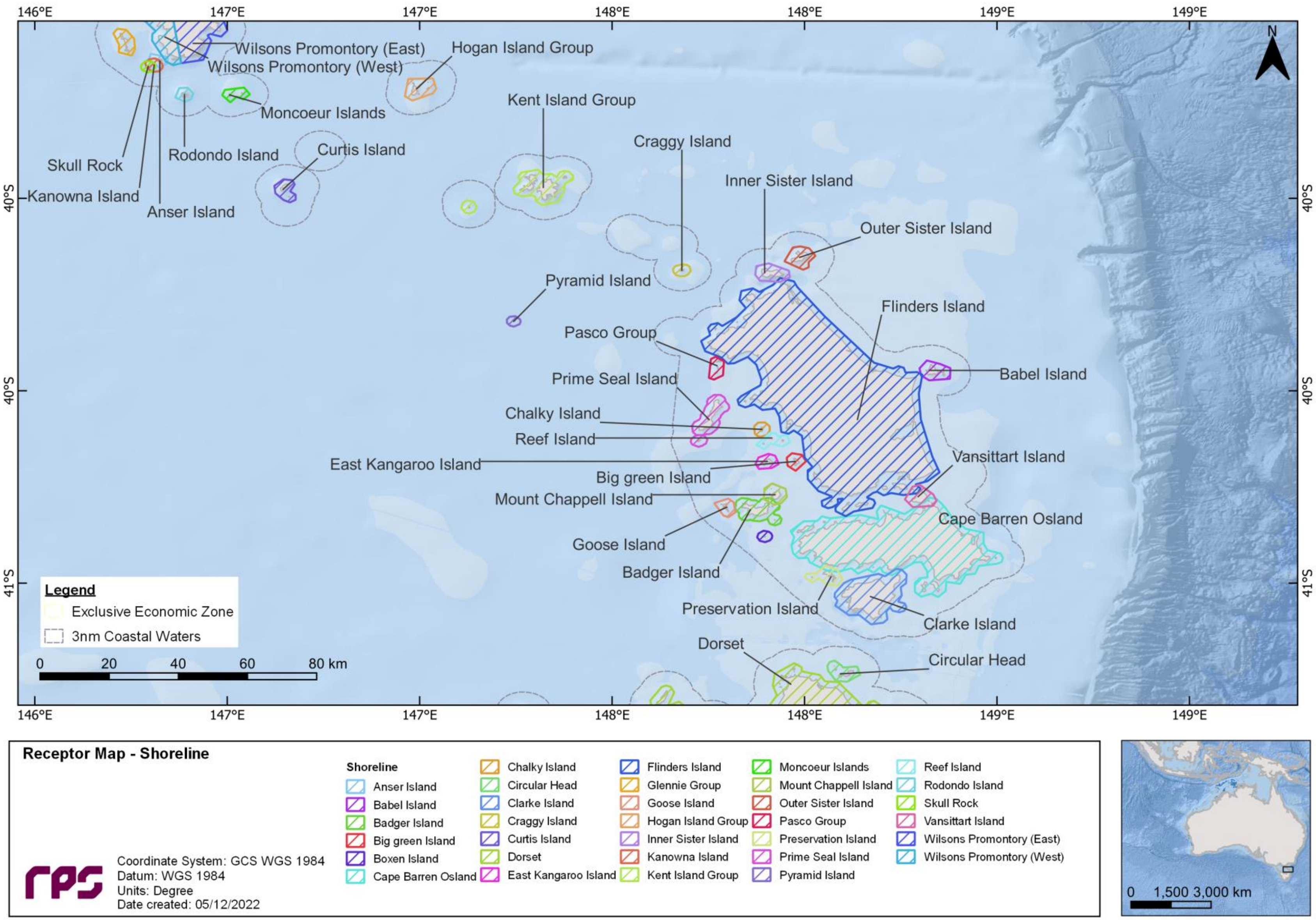

Figure 10.16 Receptor map for shorelines (2 of 4).

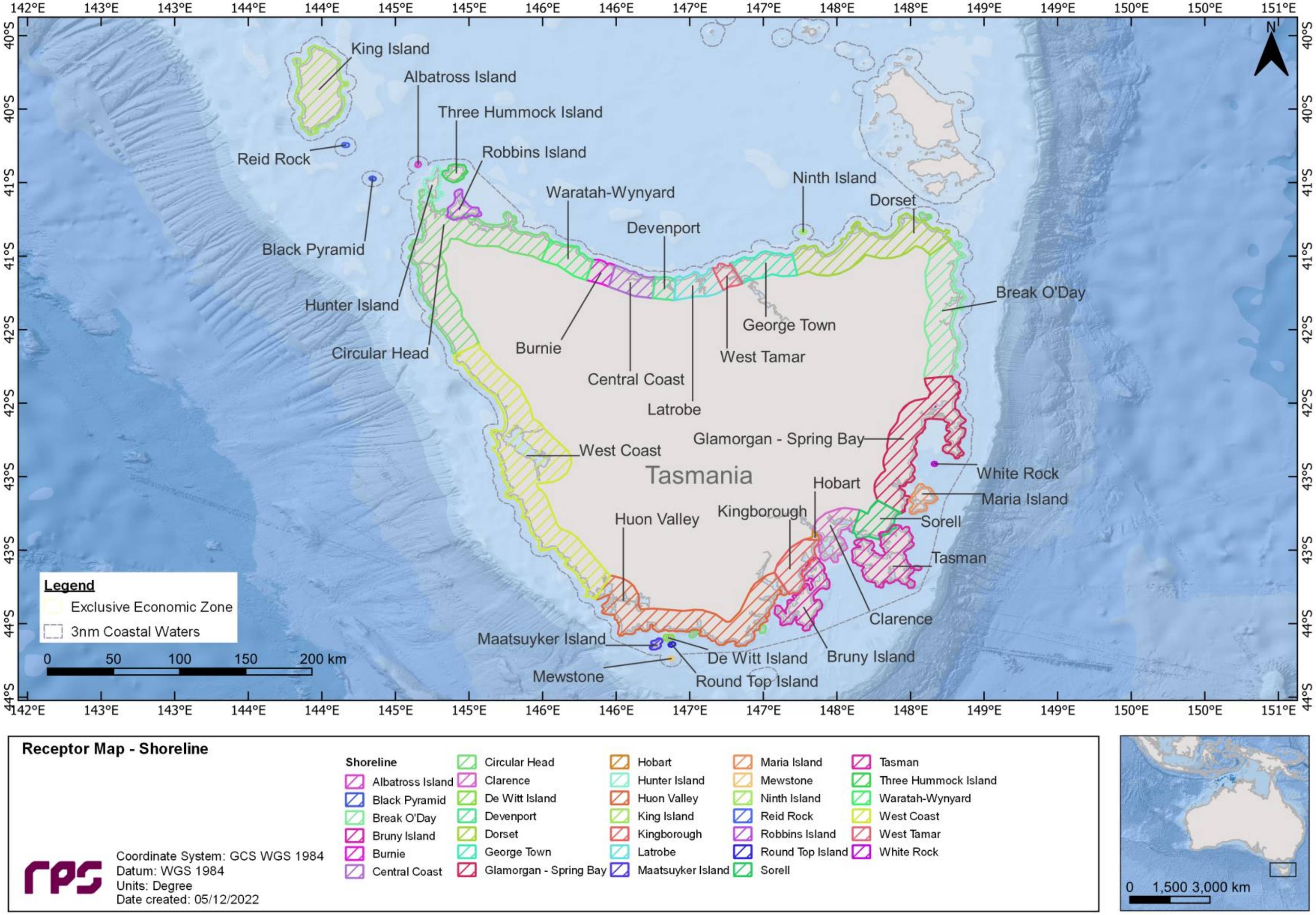

Figure 10.17 Receptor map for shorelines (3 of 4).

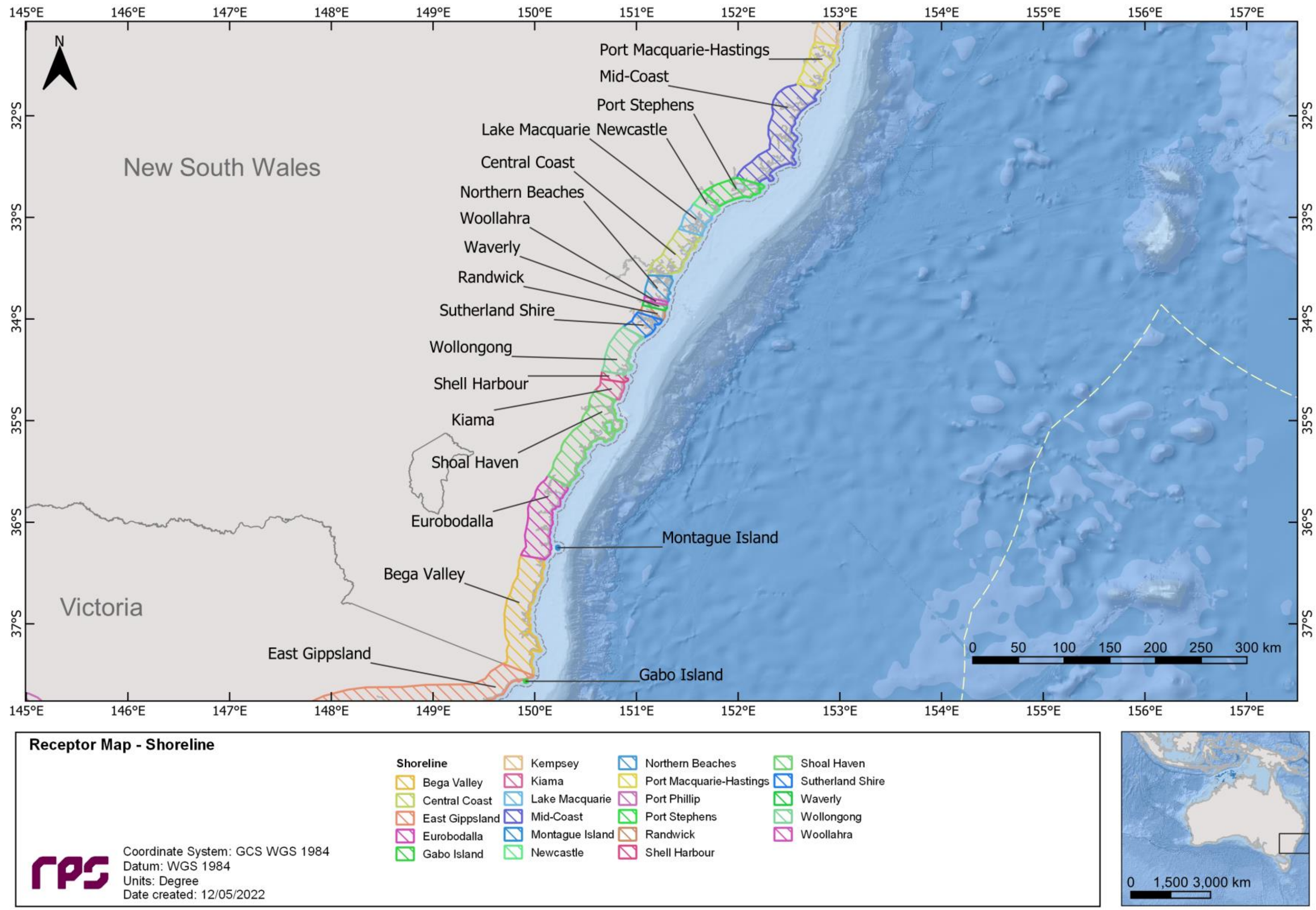

Figure 10.18 Receptor map for shorelines (4 of 4).

11 MODEL SETTINGS

Table 11.1 provides a summary of the spill modelling inputs and thresholds.

The potential risk of exposure to the surrounding waters and contact to shorelines was assessed for summer (October to March) and winter conditions (April to September).

The simulation length was carefully selected based on extensive sensitivity testing. During the sensitivity testing process, sample spill simulations were run for longer than intended durations. Upon completion of the spill simulations, the results were carefully assessed to examine the persistence of the hydrocarbon (i.e. whether the maximum evaporative loss has been achieved for the period modelled; and whether a substantial volume of hydrocarbons remain in the water column (if any)) in conjunction with the extent of floating oil exposure based on reporting thresholds. Once there was agreement between the two factors (i.e. the final fate of hydrocarbon is accounted for, and the full exposure area is identified) the simulation length was deemed appropriate.

Table 11.1 Summary of the of the oil spill modelling inputs and thresholds.

Parameter	Scenario 1 – Vessel collision	Scenario 2 – Subsea LOWC
Number of randomly selected spill start times and per season	100	
Model period	Summer (October to March) and winter conditions (April to September)	
Oil type	MDO	Condensate
Spill release rate	N/A	4,514 bbl/day (717 m^3/day)
Total Spill volume	280 m^3	347,584 bbl (55,256 m^3)
Release type	Surface	Subsea
Release duration	6 hours	77 days
Simulation length	30 days	107 days
Floating oil exposure thresholds (g/m^2)	1 (low exposure) 10 (moderate exposure) 50 (high exposure)	
Shoreline accumulation thresholds (g/m^2)	10 (low exposure) 100 (moderate exposure) 1,000 (high exposure)	
Dissolved hydrocarbon exposure thresholds (ppb)	10 (10 ppb x 1 hr, low exposure) 50 (50 ppb x 1 hr, moderate exposure) 400 (400 ppb x 1 hr, potential high exposure)	
Entrained hydrocarbon exposure thresholds (ppb)	10 (10 ppb x 1 hr, low exposure) 100 (100 ppb x 1 hr, high exposure)	

12 PRESENTATION AND INTERPRETATION OF MODEL RESULTS

The results from the modelling study are presented in a number of tables and figures, which aim to provide an understanding of the predicted sea-surface and water column (subsurface) exposure and shoreline accumulation (if predicted).

12.1 Stochastic Modelling

If readers are not fully familiar with how to interpret stochastic modelling outputs, please refer to the relevant NOPSEMA factsheet (NOPSEMA, 2018) before reading this report section.

Predictions for the probability of contact and time to contact by oil concentrations equalling or exceeding defined thresholds for floating and shoreline oil, entrained oil and dissolved hydrocarbons are provided in the following sections to summarise the stochastic results, which are calculated and presented as follows:

a. ***Areas of Exposure*** - encompasses the entire area that could be exposed and was derived from the seasonal stochastic modelling results (i.e., results from all replicate simulations across all seasons) based on the following thresholds:

Low Threshold Exposure Area

i. Floating oil – 1 g/m^2.

ii. Shoreline oil accumulation – 10 g/m^2.

iii. Dissolved aromatic hydrocarbon – 10 pb; and

iv. Entrained hydrocarbons –10 ppb.

Moderate Threshold Exposure Area

i. Floating oil – 10 g/m^2.

ii. Shoreline oil accumulation – 100 g/m^2.

iii. Dissolved aromatic hydrocarbon – 50 pb; and

High Threshold Exposure Area

iv. Floating oil – 50 g/m^2.

v. Shoreline oil accumulation – 1,000 g/m^2.

vi. Dissolved aromatic hydrocarbon – 400 pb; and

vii. Entrained hydrocarbons –100 ppb.

b. ***Seasonal Cross-sections of entrained and dissolved hydrocarbon concentrations*** - The predicted maximum entrained and dissolved hydrocarbon concentrations within the water column, along east-west and north-south transects in the vicinity of the release locations.

c. ***Predicted exposure*** zones – maps of floating oil exposure, shoreline oil accumulation, entrained oil and dissolved hydrocarbons exposure were generated based on the following thresholds:

i. Floating oil – 1-10 g/m^2 (Low), 10-50 g/m^2 (Moderate) and ≥50 g/m^2 (High).

ii. Shoreline oil accumulation – 10-100 g/m^2 (Low), 100-1,000 g/m^2 (Moderate) and ≥1,000 g/m^2 (High).

iii. Entrained hydrocarbons – 10-100 ppb (Low) and ≥100 ppb (High).

iv. Dissolved hydrocarbon – 10-50 ppb (Low), 50-400 ppb (Moderate) and ≥400 ppb (High).

d. ***The probability of oil exposure on the sea surface, in-water or shorelines*** – is calculated by dividing the number of spill simulations passing over a given grid cell at a given threshold, divided by the total number of simulations.

e. ***The minimum time before oil exposure on the sea surface, in-water or shorelines*** – is determined by ranking the elapsed time before sea surface exposure, entrained oil exposure or shoreline accumulation (at a given threshold) to a given location/grid cell for each of the spill simulations.

f. ***The maximum local accumulated concentration averaged over all replicate spills*** - the greatest concentration calculated for any point on the shoreline after averaging over all replicate simulations.

g. ***The maximum local accumulated concentration in the worst replicate spill*** - the greatest accumulation predicted for any point on the shoreline during any replicate simulation, and thus represents an extreme estimate.

h. ***The average volume of oil ashore*** – is determined by averaging the volume of oil ashore across all simulations predicted to make shoreline contact.

i. ***The maximum volume of oil ashore in the worst replicate spill*** – the greatest volume of oil predicted for any point on the shoreline during any replicate simulation, and thus represents an extreme estimate.

The mean and maximum shoreline concentrations indicate the concentrations forecast to potentially accumulate over time on any discrete part of a shoreline; calculated for individual portions of 1 km in length. Accumulated concentrations are calculated by summing the mass of oil that arrives at any concentration (including < threshold) over time at a model cell and subtracting any mass lost through evaporation and washing off, where relevant.

Note that it is possible that oil films arriving at concentrations that are less than the threshold may accumulate over the course of a spill event to result in concentrations that apparently exceed the threshold. Hence, the mean expected, and maximum concentrations of accumulated oil can exceed the threshold applied to the probability calculations for the arrival of floating oil even where no instantaneous exceedances above threshold are predicted. It is important to understand that the two parameters (floating concentration and shoreline concentration) are quite distinct, calculated in different ways and representative of alternative outcomes. The floating probability estimates, and the shoreline accumulative estimates should therefore be treated as independent estimators of different exposure outcomes, and not directly compared.

Readers should note that the contour maps presented in the stochastic modelling results, do not represent the predicted coverage of any one hydrocarbon spill or a depiction of a slick or plume at any instant in time. Rather, the contours are a composite of many theoretical slick paths, integrated over the full duration of the simulations relevant to each scenario. The stochastic modelling contour maps should be treated as indications of the probability of exposure at defined concentrations, for individual locations, at some point in time after the defined spill commences, given the trends and variations in metocean conditions that occur around the study area.

Locations with higher probability ratings were exposed during a greater number of spill simulations, indicating that the combination of the prevailing wind and current conditions are more likely to result in contact to these locations if the spill scenario were to occur in the future. The areas outside of the lowest-percentage contour indicate that contact will be less likely under the range of prevailing conditions for this region than areas falling within higher probability contours. It is important to note that the probabilities are derived from the samples of data used in the modelling. Therefore, locations that are not calculated to receive exposure at threshold concentrations or greater in any of the replicate simulations might possibly be contacted if very unusual conditions were to occur. Hence, we do not attribute a probability of nil to areas beyond the lowest probability contour.

12.2 Deterministic Modelling

While the stochastic modelling results provide an objective indication of all locations that may be exposed or contacted by oil above the reporting thresholds, the approach describes a larger potential area of influence than can be expected from any one single spill event. To understand the potential area that might be affected during an isolated (single) spill event, it is helpful to analyse the outcomes of individual deterministic cases in more detail for each scenario.

A series of maps have been presented for the deterministic simulations selected:

Maps of the predicted zones of floating oil exposure, in-water exposure (entrained and dissolved) and shoreline accumulation over the entire simulation; and

Weathering and fates graphs.

Additionally, a summary of the volumes for each oil phase and the volumes at the conclusion of the simulation.

13 MODELLING RESULTS: VESSEL COLLISION

The scenario investigated the potential exposure from a 280 m^3 surface release of MDO following a vessel collision. The oil was tracked for 30 days following the release to allow concentrations to decrease below the thresholds. The modelling assumed no mitigation efforts are undertaken to collect or otherwise affect the natural transport and weathering.

Section 13.1.1 presents the areas of exposure, Section 13.2 shows the seasonal (or stochastic) results, while Section 13.3 presents the results for the deterministic simulation.

For the stochastic results, the potential exposure and risk were separately calculated for each receptor and have been tabulated, except for the two receptors that the release location resides within (Twofold Shelf IMCRA and Upwelling East of Eden KEF).

13.1 Stochastic Analysis

13.1.1 Areas of Exposure

Figure 13.1 presents the areas of exposure based on the ‘low’, ‘moderate’ and ‘high’ thresholds derived from all 200 spill simulations.

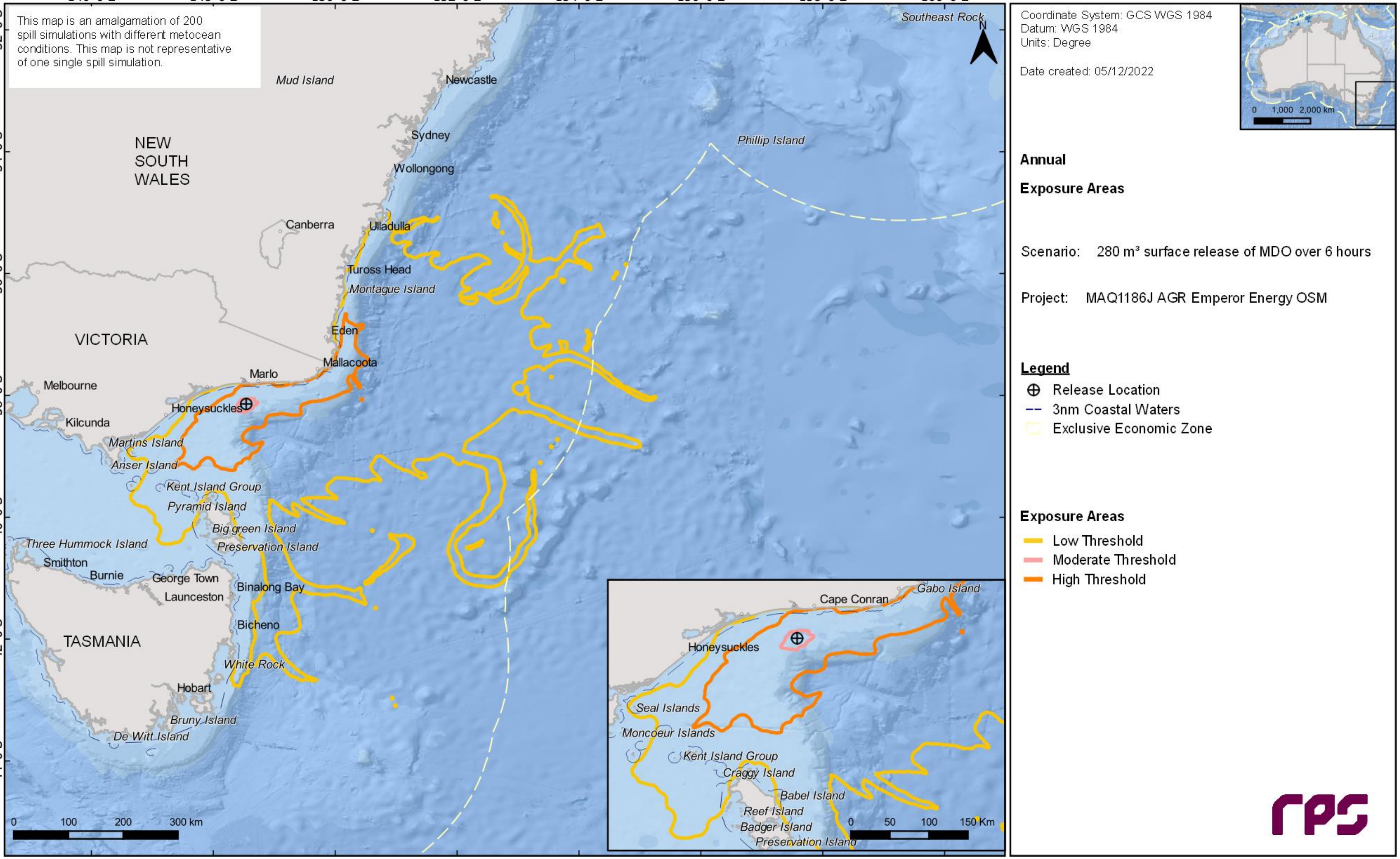

Figure 13.1 Predicted areas of exposure following a vessel collision, derived from all 200 spill simulations.

13.2 Stochastic Analysis

13.2.1 Floating Oil Exposure

Table 13.1 summarises the maximum distances from the release location to floating oil exposure thresholds. Floating oil concentrations exceeding 1 g/m^2 could extend up to 167.3 km from the release location due to a small, isolated patch which had resurfaced near the NSW boarder during a simulation under summer conditions. The distance reduces to 18.7 km as the threshold increases to 10 g/m^2 and 2.9 km as the threshold further increases to the 50 g/m^2.

There was no floating oil exposure predicted for any receptor at any threshold.

Figure 13.2 to Figure 13.3 illustrate the extent of floating oil exposure zones for each season.

Table 13.1 Maximum distances from the release location to floating oil exposure thresholds from a vessel collision for each season. Results were calculated from 100 spill simulations per season.

Season	Distance and direction travelled	Floating oil exposure thresholds		
		1 g/m^2	10 g/m^2	50 g/m^2
Summer	Maximum distance (km) from release location	167.3	18.7	-
	Maximum distance (km) from release location (99th percentile)	62.4	16.9	-
	Direction	ENE	WSW	-
Winter	Maximum distance (km) from release location	28	15.8	2.9
	Maximum distance (km) from release location (99th percentile)	26.3	15	2.9
	Direction	SSW	SW	NW

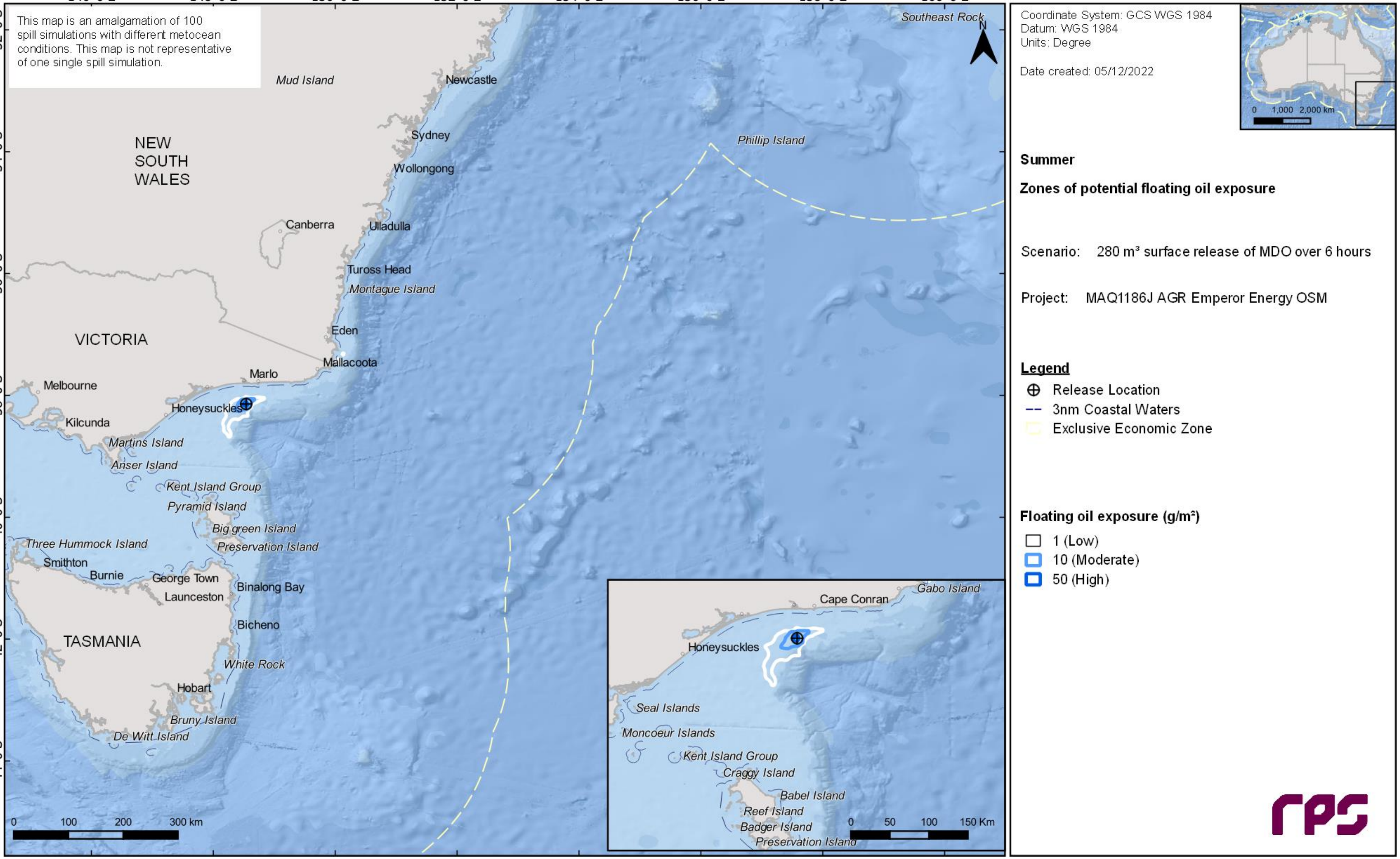

Figure 13.2 Zones of potential floating oil exposure from a vessel collision during summer conditions. The results were calculated from 100 spill simulations.

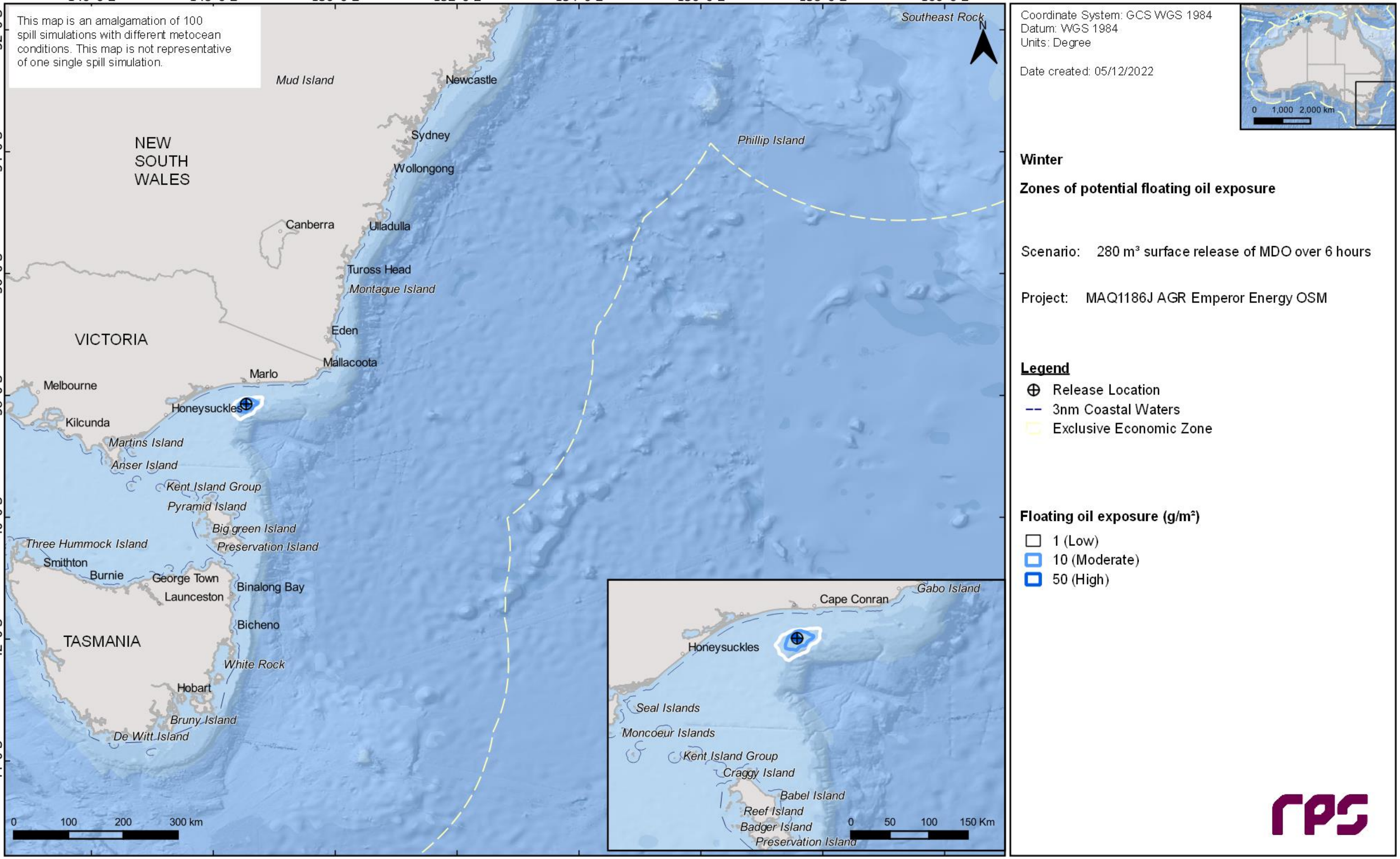

Figure 13.3 Zones of potential floating oil exposure from a vessel collision during winter conditions. The results were calculated from 100 spill simulations.

13.2.2 Shoreline Accumulation

Table 13.2 summarises the predicted oil accumulation on any shoreline during each season. The highest probability of oil accumulation at the 10 g/m^2 threshold was during winter at 12%. The maximum volume ashore was 9.1 m^3.

There was no accumulation predicted for the 1,000 g/m^2 threshold for summer and winter conditions.

Table 13.3 and Table 13.4 summarise the oil accumulation for shoreline sectors presented in Section 10 during each season. The highest probability of oil accumulation at the 10 g/m^2 threshold was forecast for the East Gippsland shoreline (7% during summer and winter conditions). The maximum volume of oil ashore was 9.1 m^3 along the East Gippsland shoreline.

The quickest time before oil had accumulated on shorelines at the 10 g/m^2 threshold was 3.25 days predicted for the East Gippsland coastline under summer conditions.

The maximum potential shoreline loading for each season are presented in Figure 13.4 and Figure 13.5.

Table 13.2 Summary of oil accumulation on any shoreline from a vessel collision during each season. Results were calculated from 100 spill simulations per season.

Shoreline Statistics	Summer	Winter
Probability of accumulation on any shoreline (%) at or above the 10 g/m^2 threshold	11	12
Absolute minimum time before oil ashore (days) at or above the 10 g/m^2 threshold	3.3	3.6
Maximum volume of hydrocarbons ashore (m^3)	1.8	9.1
Average volume of hydrocarbons ashore (m^3)	0.7	2.1
Maximum length of the shoreline at **10 g/m^2** (km)	4	23
Average shoreline length (km) at **10 g/m^2** (km)	1.9	5.7
Maximum length of the shoreline at **100 g/m^2** (km)	-	1
Average shoreline length (km) at **100 g/m^2** (km)	-	1
Maximum length of the shoreline at **1,000 g/m^2** (km)	-	-
Average shoreline length (km) at **1,000 g/m^2** (km)	-	-

Table 13.3 Summary of oil accumulation for shoreline sectors from a vessel collision during summer conditions. Results were calculated from 100 spill simulations per season.

Shoreline sector	Maximum probability of shoreline accumulation (%) at			Minimum time before shoreline accumulation (days) at			Load on shoreline (g/m²)		Volume on shoreline (m³)		Mean length of shoreline accumulation (km) at			Maximum length of shoreline accumulation (km) at		
	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	Mean	Peak	Mean	Peak	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²
Babel Island	1	-	-	14.08	-	-	13	13	0.2	0.2	0.9	-	-	0.9	-	-
Bega Valley	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
East Gippsland	7	-	-	3.25	-	-	< 1	45	0.5	1.8	1.8	-	-	3.6	-	-
Gabo Island	1	-	-	4.04	-	-	18	18	0.3	0.3	0.9	-	-	0.9	-	-
Kent Island Group	2	-	-	9.46	-	-	< 1	17	0.1	0.9	2.2	-	-	3.6	-	-
Shoal Haven	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 13.4 Summary of oil accumulation for shoreline sectors from a vessel collision during winter conditions. Results were calculated from 100 spill simulations per season.

Shoreline sector	Maximum probability of shoreline accumulation (%) at			Minimum time before shoreline accumulation (days) at			Load on shoreline (g/m²)		Volume on shoreline (m³)		Mean length of shoreline accumulation (km) at			Maximum length of shoreline accumulation (km) at		
	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	Mean	Peak	Mean	Peak	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²
Babel Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Bega Valley	2	-	-	3.75	-	-	< 1	46	0.2	1.2	2.2	-	-	3.6	-	-
East Gippsland	7	1	-	3.58	5.17	-	3	351	1.7	9.1	6.7	0.9	-	20.7	0.9	-
Gabo Island	4	-	-	3.83	-	-	3	19	0.1	0.4	1.1	-	-	1.8	-	-
Kent Island Group	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Shoal Haven	1	-	-	7.13	-	-	38	38	1.8	1.8	5.4	-	-	5.4	-	-

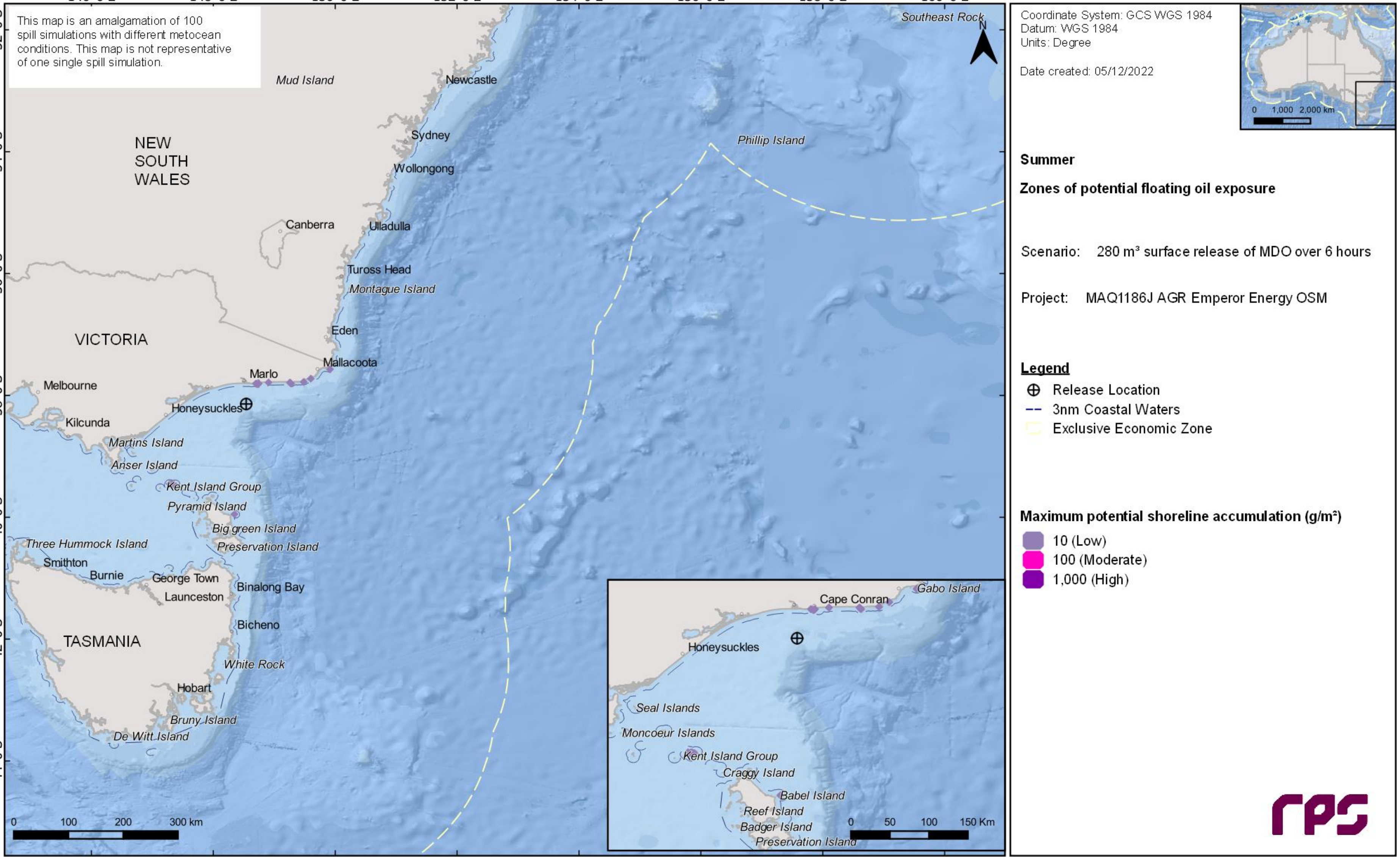

Figure 13.4 Maximum potential shoreline loading from a vessel collision during summer conditions. The results were calculated from 100 spill simulations.

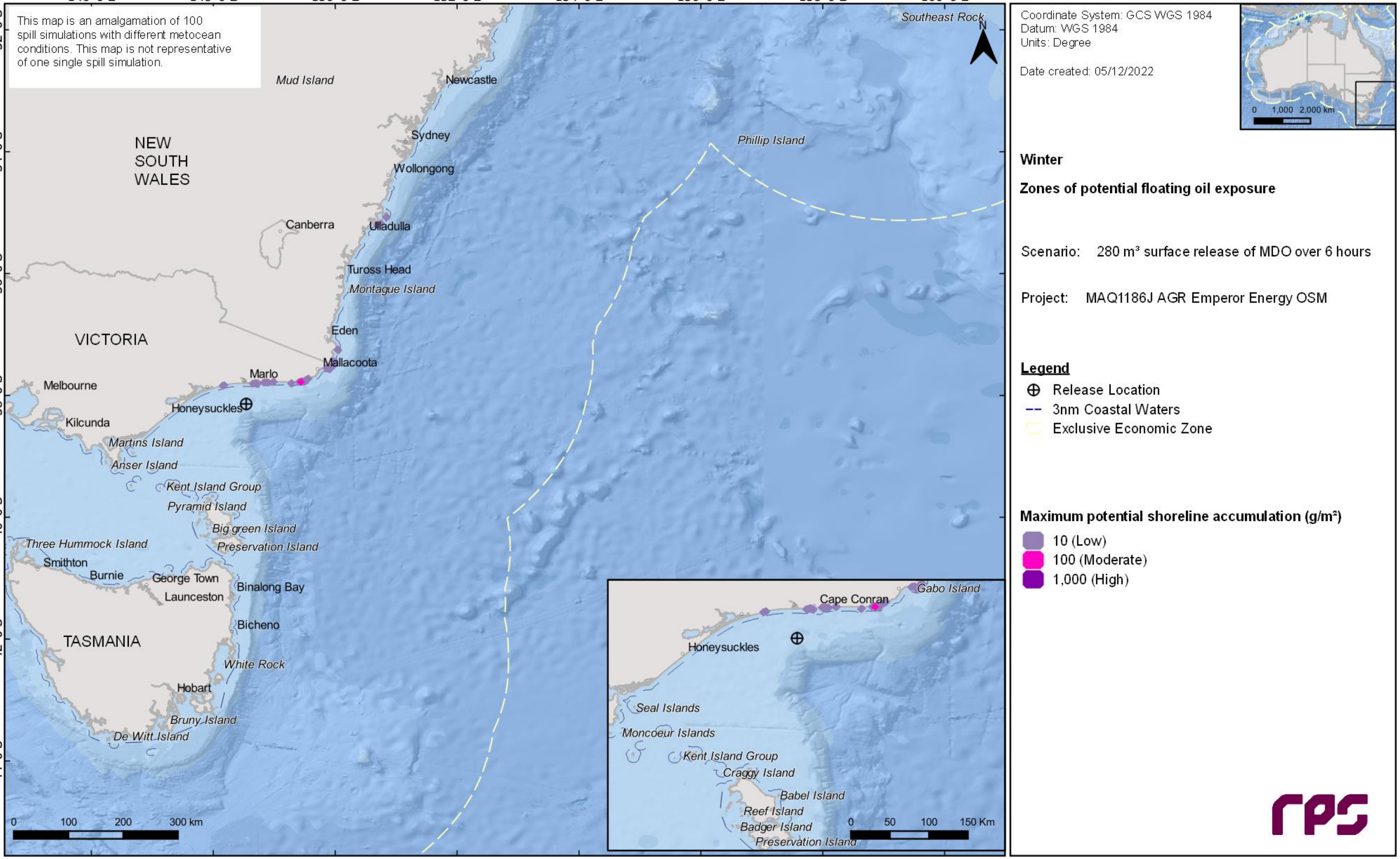

Figure 13.5 Maximum potential shoreline loading from a vessel collision during winter conditions. The results were calculated from 100 spill simulations.

13.2.3 In-water exposure

13.2.3.1 Dissolved Hydrocarbons

Table 13.5 summarises the maximum distances from the release location to dissolved hydrocarbons exposure thresholds in the 0 – 10 m depth layer. Concentrations exceeding 10 ppb may potentially occur 177.4 km from the release location with the distance reducing to 3.1 km as the exposure threshold increases to 50 ppb for winter conditions only. There was no dissolved hydrocarbon concentrations exceeding 400 ppb during summer and winter conditions.

Table 13.6 summarises the predicted exposure to receptors for each season. During summer months, exposure based on the 10 ppb threshold was only predicted for Victorian State waters (1% probability), occurring after 3.13 days. For winter conditions, a 1% probability of exposure was forecast for the New Zealand Star Bank and NSW State waters, after 2.50 days and 2.63 days, respectively.

The highest concentration was predicted at New Zealand Star Bank at 13 ppb. Hence, there was no exposure predicted for any receptor at the 50 ppb and 400 ppb thresholds.

Figure 13.6 and Figure 13.7 present the dissolved hydrocarbon exposure zones during summer and winter, respectively.

Cross-sectional transects (north-south and east-west) of the maximum dissolved hydrocarbons in the vicinity of the release site are presented in Figure 13.8 to Figure 13.11. The dissolved hydrocarbons above 10 ppb were shown to occur to a depth of 25 m.

Table 13.5 Maximum distances from the release location to dissolved hydrocarbon exposure thresholds from a vessel collision during each season. Results were calculated from 100 spill simulations per season.

Season	Distance and direction travelled	Dissolved hydrocarbon exposure thresholds		
		10 ppb	50 ppb	400 ppb
Summer	Maximum distance (km) from release location	151.8	-	-
	Maximum distance (km) from release location (99th percentile)	118.4	-	-
	Direction	ENE	N	-
Winter	Maximum distance (km) from release location	177.4	3.1	-
	Maximum distance (km) from release location (99th percentile)	126.4	3.1	-
	Direction	ENE	ENE	-

Table 13.6 Summary of the dissolved hydrocarbon exposure to receptors from a vessel collision during each season. Results were calculated from 100 spill simulations per season.

Receptors		Summer							Winter						
		Highest dissolved concentration (ppb)	Probability (%) dissolved hydrocarbon exposure at			Minimum time (days) before dissolved hydrocarbon exposure at			Highest dissolved concentration (ppb)	Probability (%) dissolved hydrocarbon exposure at			Minimum time (days) before dissolved hydrocarbon exposure at		
Type	Name		≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb		≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb
RSB	New Zealand Star Bank	4	-	-	-	-	-	-	13	1	-	-	2.50	-	-
State Waters	New South Wales	6	-	-	-	3.58	-	-	12	1	-	-	2.63	-	-
	Victoria	11	1	-	-	3.13	-	-	-	-	-	-	-	-	-

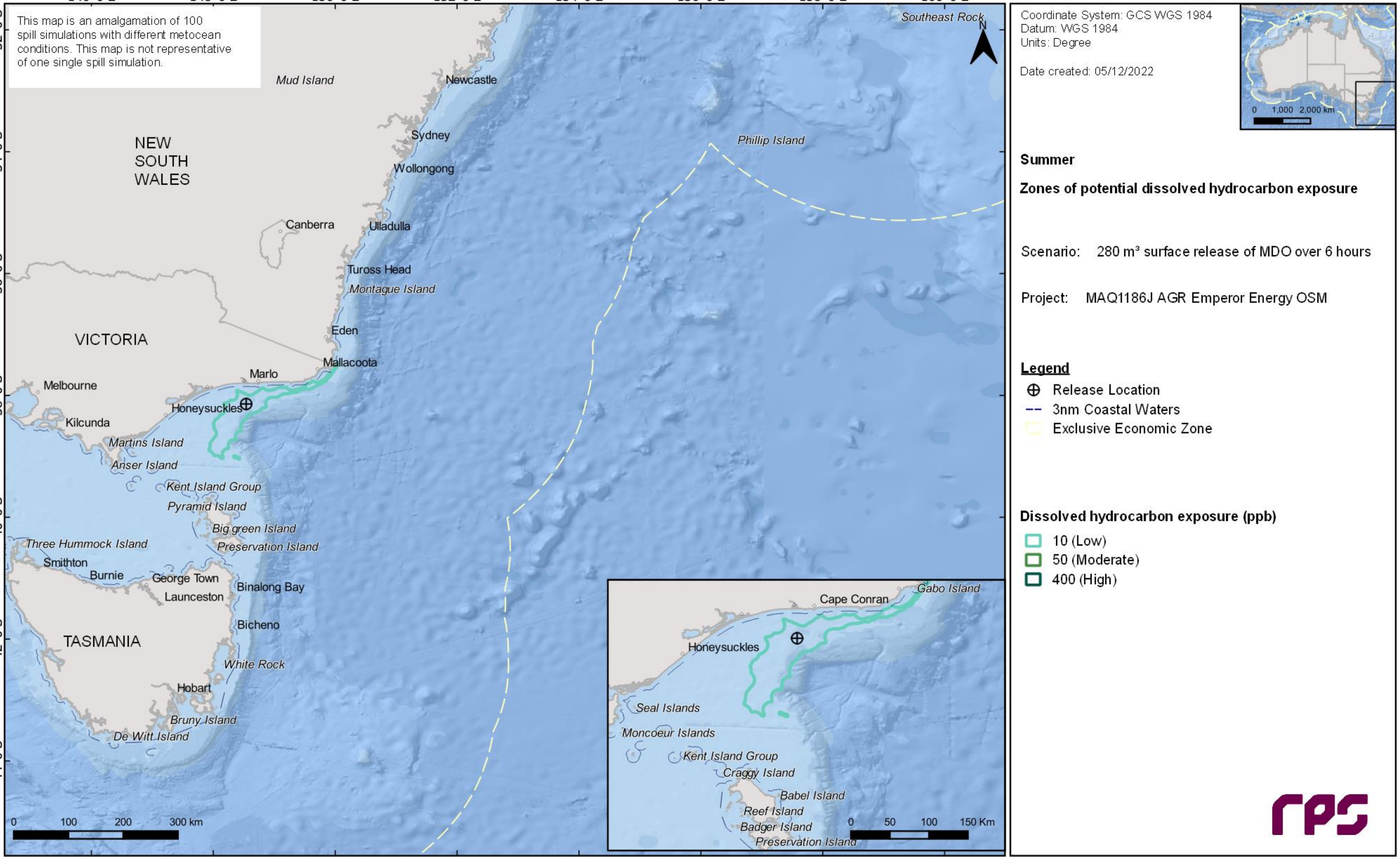

Figure 13.6 Predicted zones of dissolved hydrocarbon exposure from a vessel collision during summer conditions. The results were calculated from 100 spill simulations.

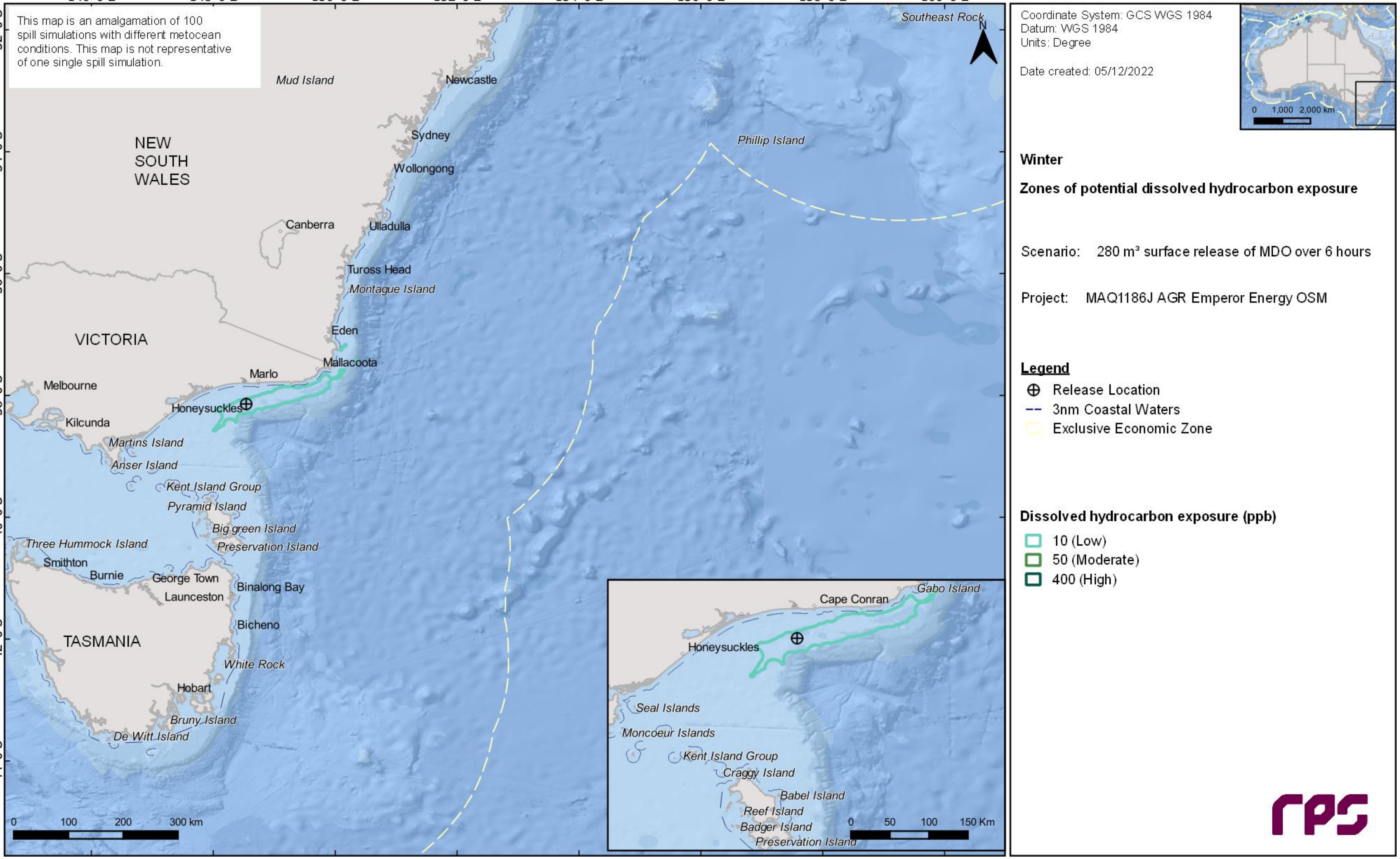

Figure 13.7 Predicted zones of dissolved hydrocarbon exposure from a vessel collision during winter conditions. The results were calculated from 100 spill simulations.

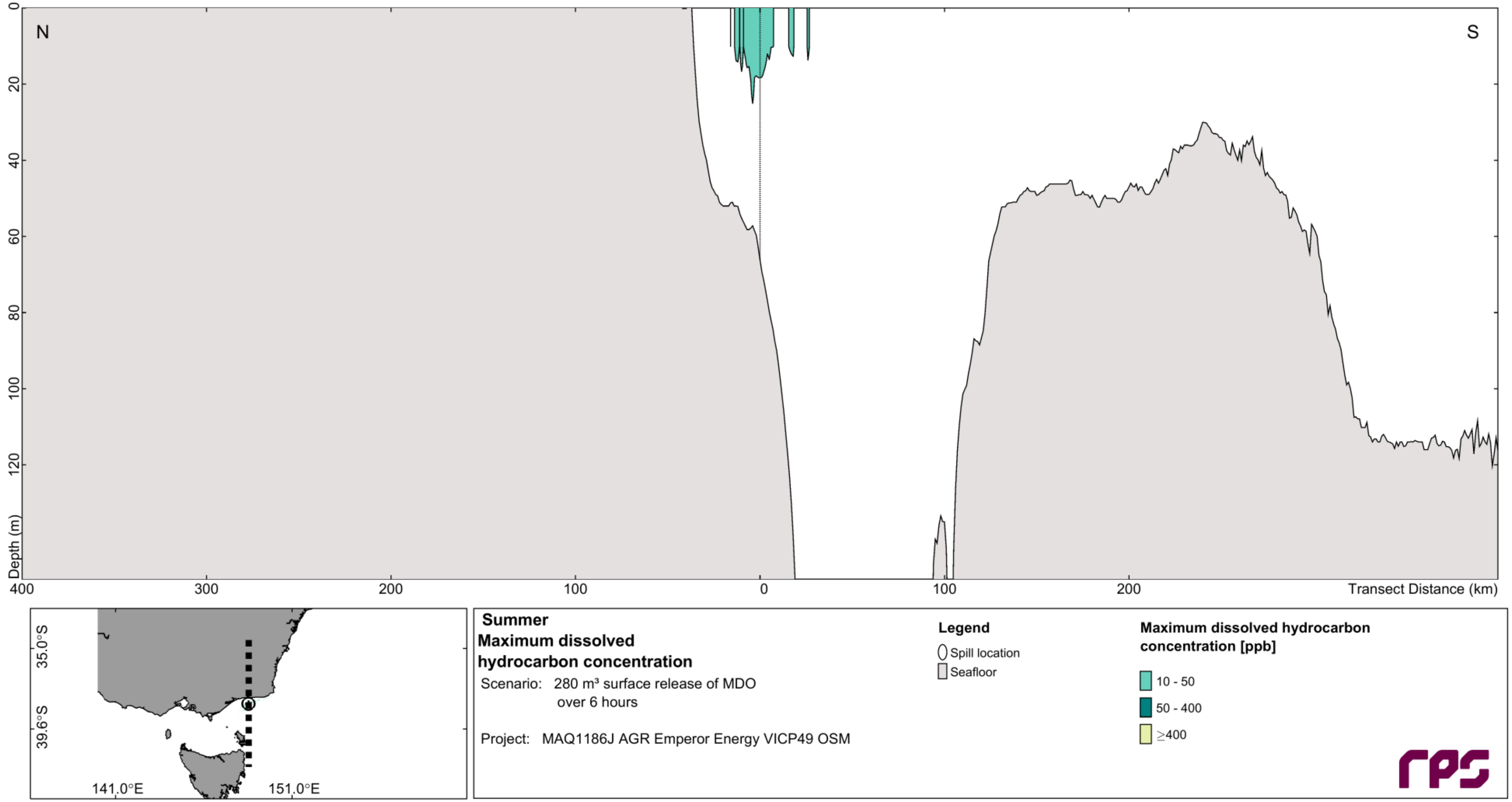

Figure 13.8 North-south cross-section transect of dissolved hydrocarbon concentrations from a vessel collision during summer conditions. The results were calculated from 100 spill simulations.

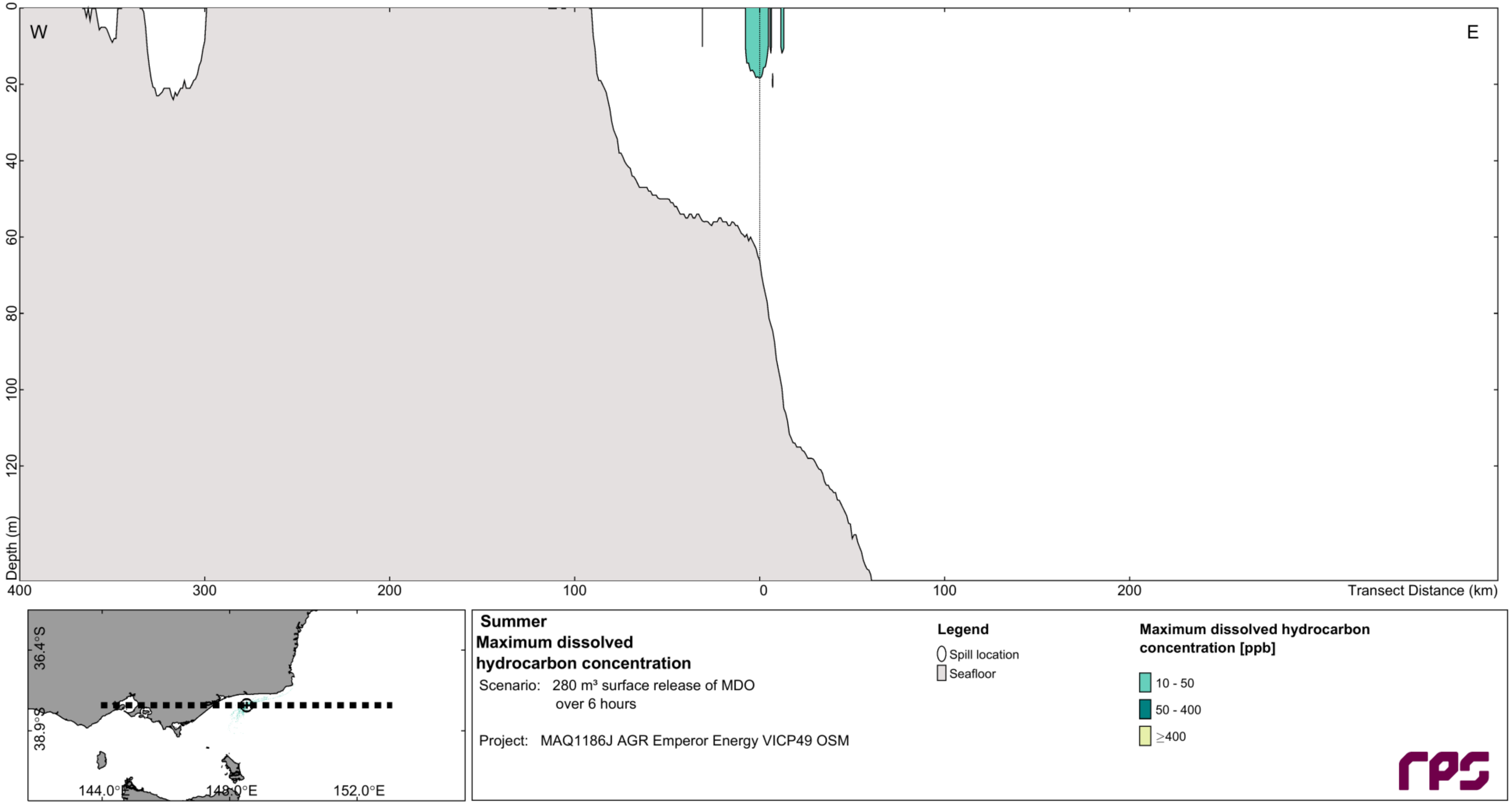

Figure 13.9 East-west cross-section transect of dissolved hydrocarbon concentrations from a vessel collision during summer conditions. The results were calculated from 100 spill simulations.

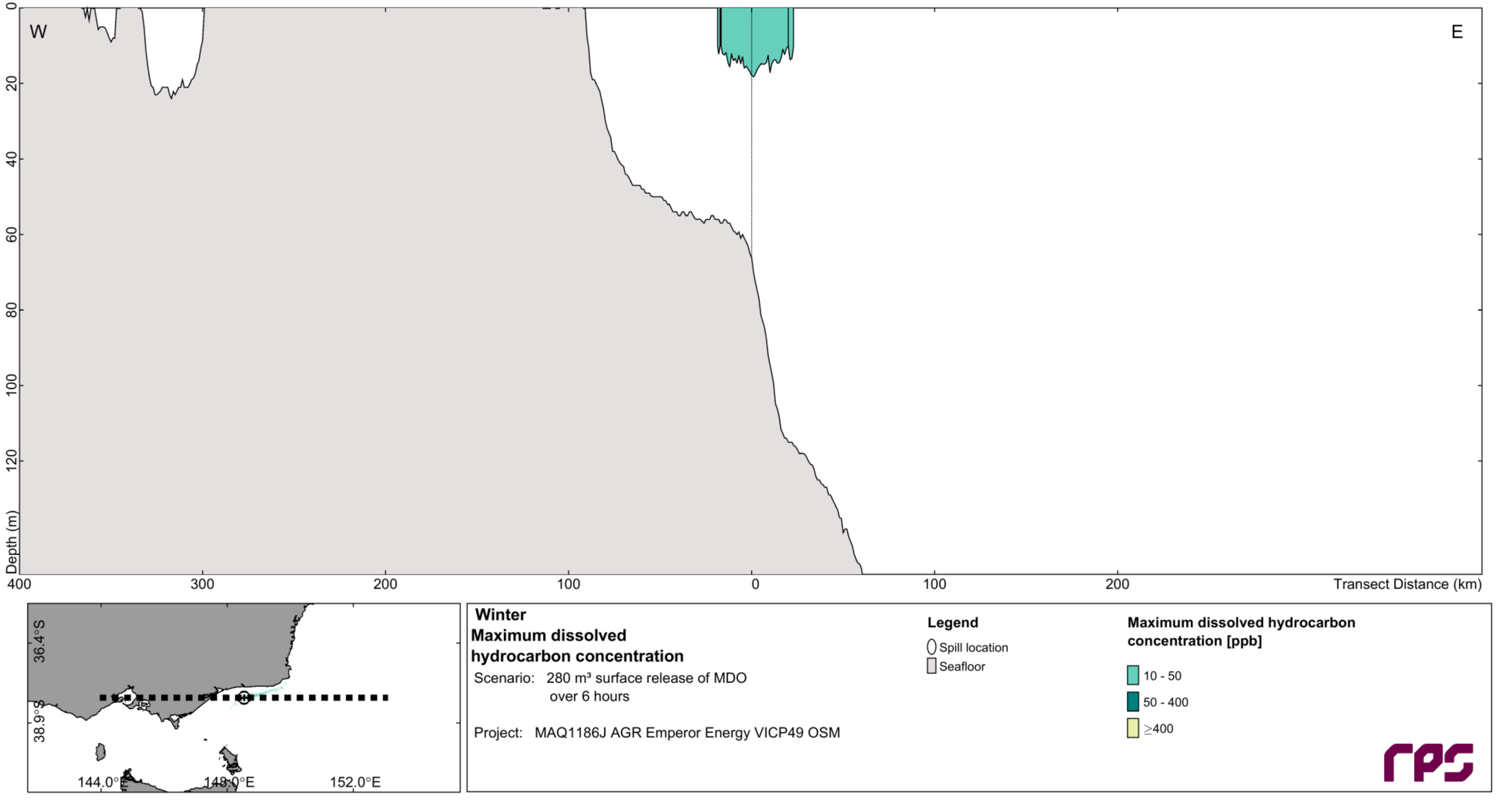

Figure 13.10 North-south cross-section transect of dissolved hydrocarbon concentrations from a vessel collision during winter conditions. The results were calculated from 100 spill simulations.

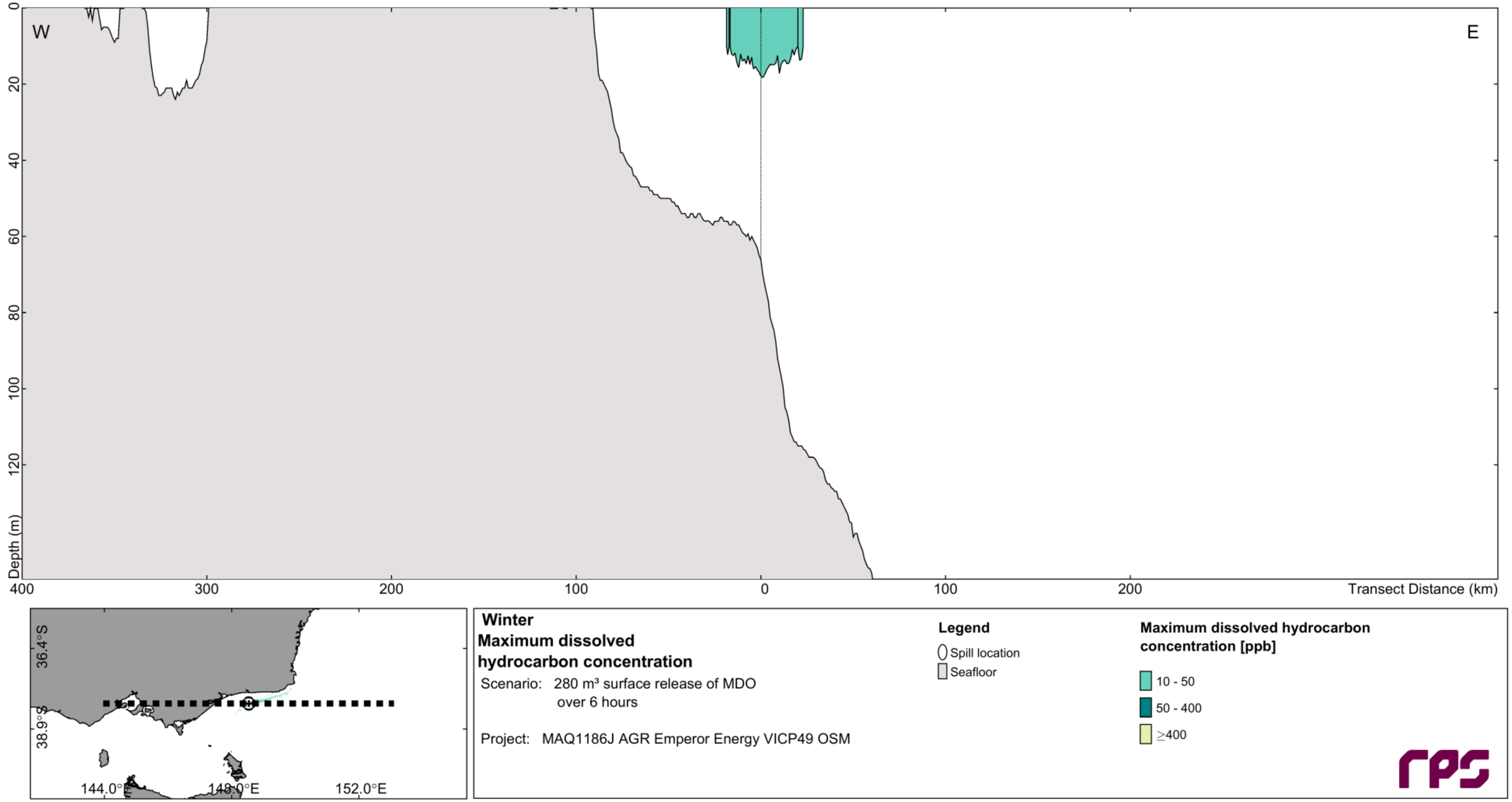

Figure 13.11 East-west cross-section transect of dissolved hydrocarbon concentrations from a vessel collision during winter conditions. The results were calculated from 100 spill simulations.

13.2.3.2 Entrained Hydrocarbons

Table 13.7 summarises the maximum distances from the release location to entrained hydrocarbon thresholds within the 0-10 m depth layer, for each season. Concentrations exceeding 10 ppb may potentially occur 610.9 km from the release location, with the distance reducing to 221.2 km as the threshold increases to 100 ppb.

Table 13.8 summarises the predicted exposure to receptors for each season. The probability of exposure was greatest at the New Zealand Star Bank (26% for summer and 39% for winter conditions) for concentrations equal to or greater than 10 ppb. The same receptor recorded the greatest probability of exposure for concentrations exceeding 100 ppb, 9% for summer and winter conditions. The quickest time before exposure at or above 10 ppb was 1.21 days and 0.88 days for the New Zealand Star Bank during summer and winter conditions, respectively.

The highest concentration of entrained hydrocarbons was predicted at the Big Horseshoe Canyon KEF at 496 ppb during winter.

Figure 13.12 and Figure 13.13 present the entrained hydrocarbon exposure zones during summer and winter, respectively.

Cross-sectional transects (north-south and east-west) of the maximum entrained hydrocarbons in the vicinity of the release site for each season, are presented in Figure 13.14 to Figure 13.17. The entrained hydrocarbons above 10 ppb were shown to occur to a depth of 25 m.

Table 13.7 Maximum distances from the release location to entrained hydrocarbon exposure thresholds in the 0-10 m depth layer from a vessel collision during each season. Results were calculated from 100 spill simulations per season.

Season	Distance and direction travelled	Entrained hydrocarbon exposure thresholds	
		10 ppb	100 ppb
Summer	Maximum distance (km) from release location	588.5	191.2
	Maximum distance (km) from release location (99th percentile)	490.2	171.4
	Direction	E	ENE
Winter	Maximum distance (km) from release location	610.9	221.2
	Maximum distance (km) from release location (99th percentile)	542.8	205.5
	Direction	ENE	NE

Table 13.8 Summary of the entrained hydrocarbon exposure to receptors from a vessel collision during each season. Results were calculated from 100 spill simulations per season.

Receptors		Summer					Winter				
		Highest entrained concentration (ppb)	Probability (%) entrained hydrocarbon exposure at		Minimum time (days) before entrained hydrocarbon exposure at		Highest entrained concentration (ppb)	Probability (%) entrained hydrocarbon exposure at		Minimum time (days) before entrained hydrocarbon exposure at	
Type	Name		≥ 10 ppb	≥ 100 ppb	≥ 10 ppb	≥ 100 ppb		≥ 10 ppb	≥ 100 ppb	≥ 10 ppb	≥ 100 ppb
AMP	Beagle	95	12	-	5.42	-	2	-	-	-	-
	East Gippsland	106	7	1	3.13	3.25	126	11	1	2.96	3.17
	Flinders	37	4	-	8.83	-	10	-	-	-	-
	Freycinet	24	3	-	13.54	-	6	-	-	-	-
	Jervis	1	-	-	-	-	13	1	-	11.92	-
IMCRA	Batemans Shelf	47	2	-	7.25	-	104	16	1	3.00	3.08
	Central Bass Strait	29	5	-	10.71	-	-	-	-	-	-
	Flinders	88	8	-	6.29	-	27	3	-	-	-
	Freycinet	13	1	-	20.92	-	1	-	-	-	-
KEF	Big Horseshoe Canyon	122	13	2	3.25	3.88	496	22	3	1.33	1.50
	Canyons on the eastern continental slope	56	3	-	7.21	-	59	3	-	4.63	-
	Seamounts South and east of Tasmania	11	1	-	14.21	-	2	-	-	-	-
	Shelf rocky reefs	2	-	-	-	-	47	4	-	3.92	-
MNP	Cape Howe	219	14	1	1.75	2.17	201	25	2	1.92	2.63
	Point Hicks	317	21	5	1.54	1.58	188	19	2	2.00	2.54

Receptors		Summer					Winter				
		Highest entrained concentration (ppb)	Probability (%) entrained hydrocarbon exposure at		Minimum time (days) before entrained hydrocarbon exposure at		Highest entrained concentration (ppb)	Probability (%) entrained hydrocarbon exposure at		Minimum time (days) before entrained hydrocarbon exposure at	
Type	Name		≥ 10 ppb	≥ 100 ppb	≥ 10 ppb	≥ 100 ppb		≥ 10 ppb	≥ 100 ppb	≥ 10 ppb	≥ 100 ppb
MP	Batemans	2	-	-	-	-	75	4	-	3.96	-
	Jervis Bay	-	-	-	-	-	26	1	-	6.42	-
MS	Beware Reef	173	4	1	3.42	3.54	61	3	-	2.63	-
NP	Kent Group	68	11	-	6.08	-	2	-	-	-	-
RSB	Beware Reef	175	5	1	3.42	3.54	61	3	-	2.63	-
	Endeavour Reef	16	3	-	10.38	-	1	0	-	-	-
	New Zealand Star Bank	339	26	9	1.21	1.33	324	39	9	0.88	1.71
	Wakitipu Rock	30	6	-	9.38	-	1	-	-	-	-
	Warrego Rock	15	3	-	12.00	-	-	-	-	-	-
	Wright Rock	17	5	-	10.38	-	1	-	-	-	-
Nearshore waters	Babel Island	21	1	-	10.67	-	1	-	-	-	-
	Bega Valley	73	6	-	2.33	-	131	11	2	2.29	2.75
	Cape Barren Osland	14	1	-	16.50	-	-	-	-	-	-
	Craggy Island	10	1	-	16.46	-	-	-	-	-	-
	East Gippsland	138	13	1	2.25	3.42	206	12	2	2.46	2.75
	Eurobodalla	1	-	-	-	-	14	1	-	1-	-
	Flinders Island	11	1	-	20.96	-	-	-	-	-	-

Receptors		Summer					Winter				
		Highest entrained concentration (ppb)	Probability (%) entrained hydrocarbon exposure at		Minimum time (days) before entrained hydrocarbon exposure at		Highest entrained concentration (ppb)	Probability (%) entrained hydrocarbon exposure at		Minimum time (days) before entrained hydrocarbon exposure at	
Type	Name		≥ 10 ppb	≥ 100 ppb	≥ 10 ppb	≥ 100 ppb		≥ 10 ppb	≥ 100 ppb	≥ 10 ppb	≥ 100 ppb
	Gabo Island	183	9	1	3.71	3.83	111	14	1	2.54	2.63
	Hogan Island Group	22	2	-	10.71	-	1	-	-	-	-
	Inner Sister Island	10	1	-	21.17	-	-	-	-	-	-
	Kent Island Group	79	9	-	6.29	-	2	-	-	-	-
	Montague Island	2	-	-	-	-	47	2	-	4.17	-
	Pyramid Island	37	7	-	8.38	-	1	-	-	-	-
	Seal Islands	14	1	-	16.88	-	-	-	-	-	-
	Shoal Haven	-	0	-	-	-	26	1	-	6.46	-
	Wellington	10	1	-	13.71	-	2	-	-	-	-
State waters	New South Wales	217	11	1	2.21	2.25	194	21	1	1.96	2.29
	Tasmania	84	11	-	5.83	-	3	-	-	-	-
	Victoria	429	23	6	1.50	1.54	244	25	4	1.75	2.08

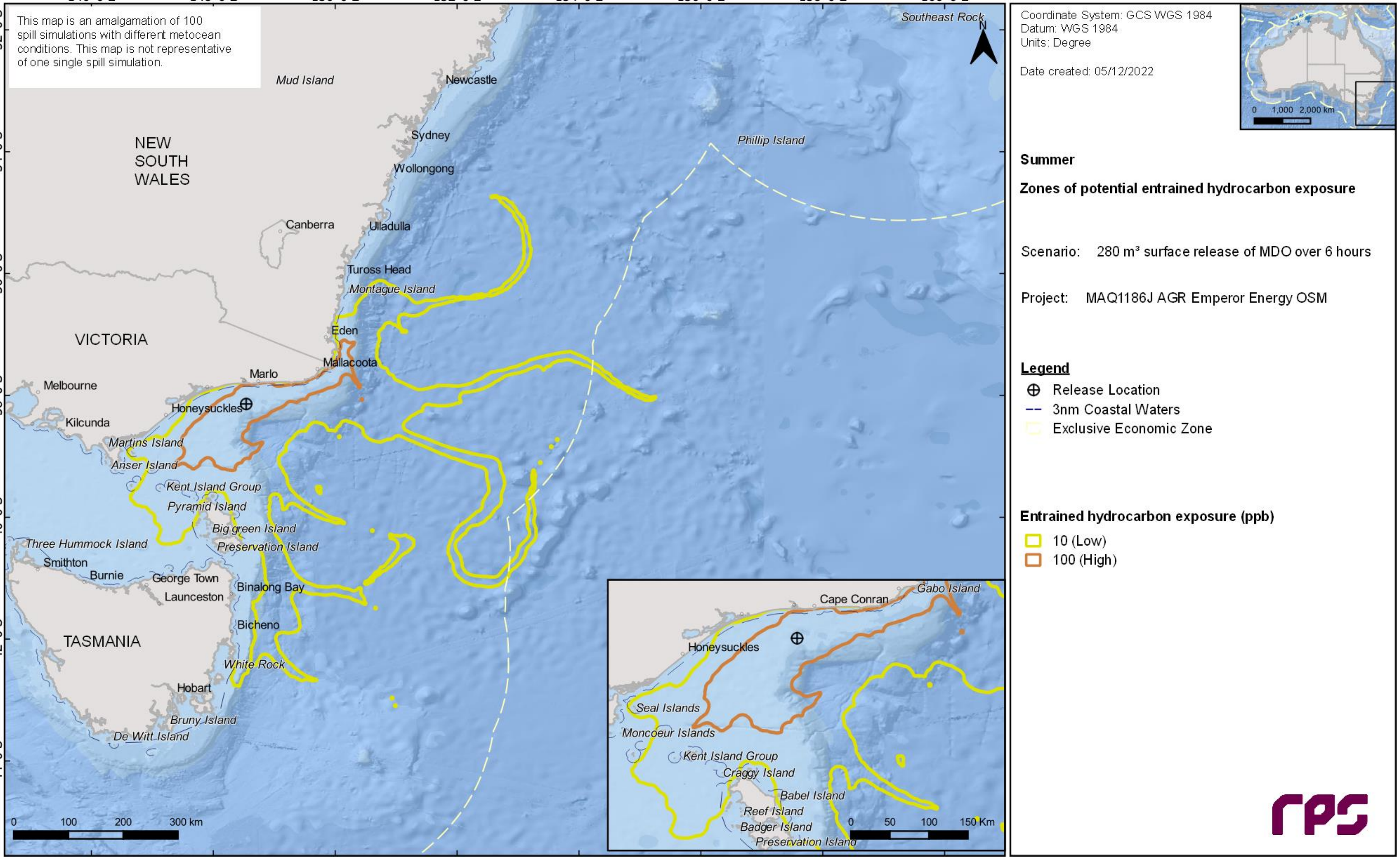

Figure 13.12 Predicted zones of entrained hydrocarbon exposure from a vessel collision during summer conditions. The results were calculated from 100 spill simulations.

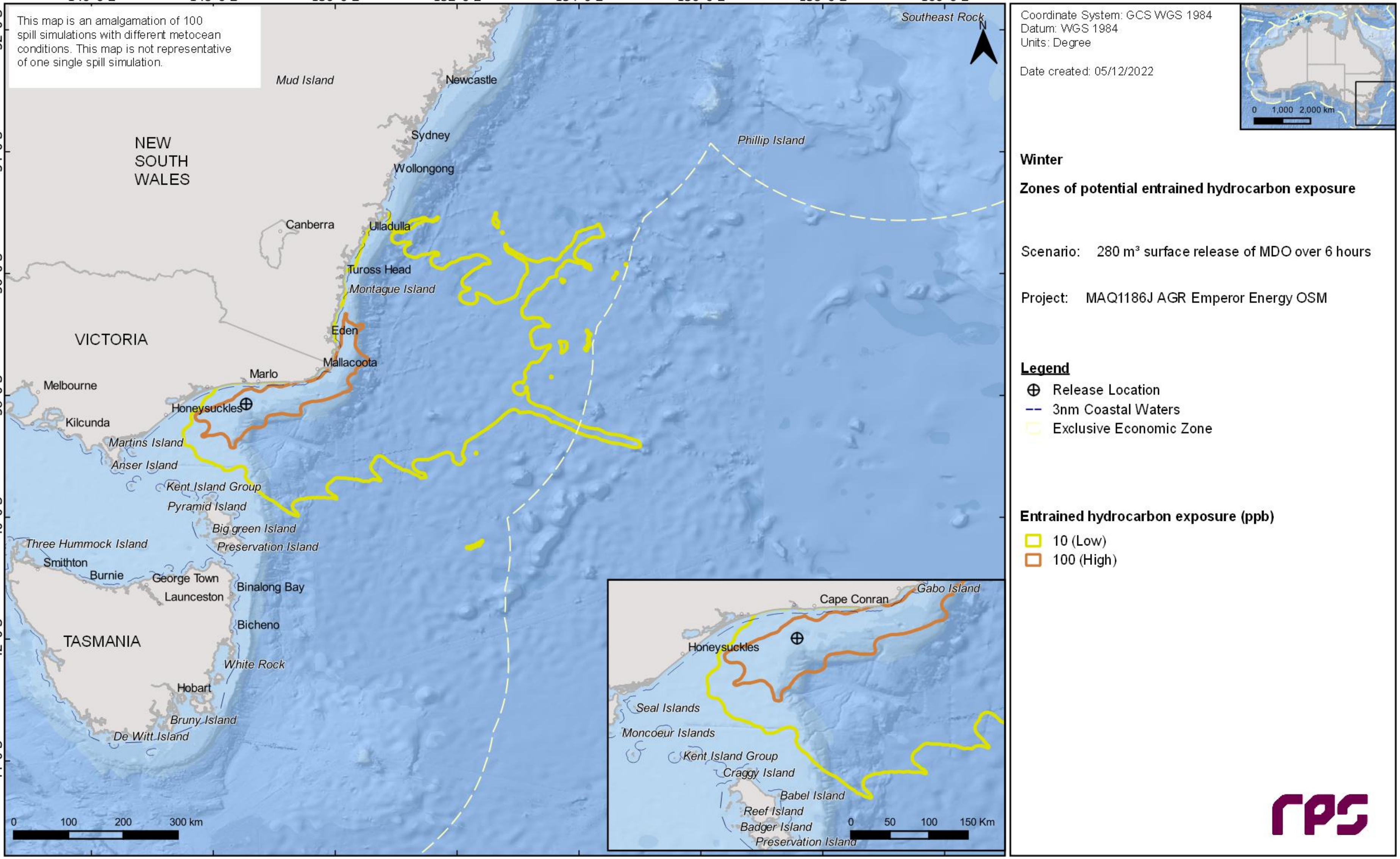

Figure 13.13 Predicted zones of entrained hydrocarbon exposure from a vessel collision during winter conditions. The results were calculated from 100 spill simulations.

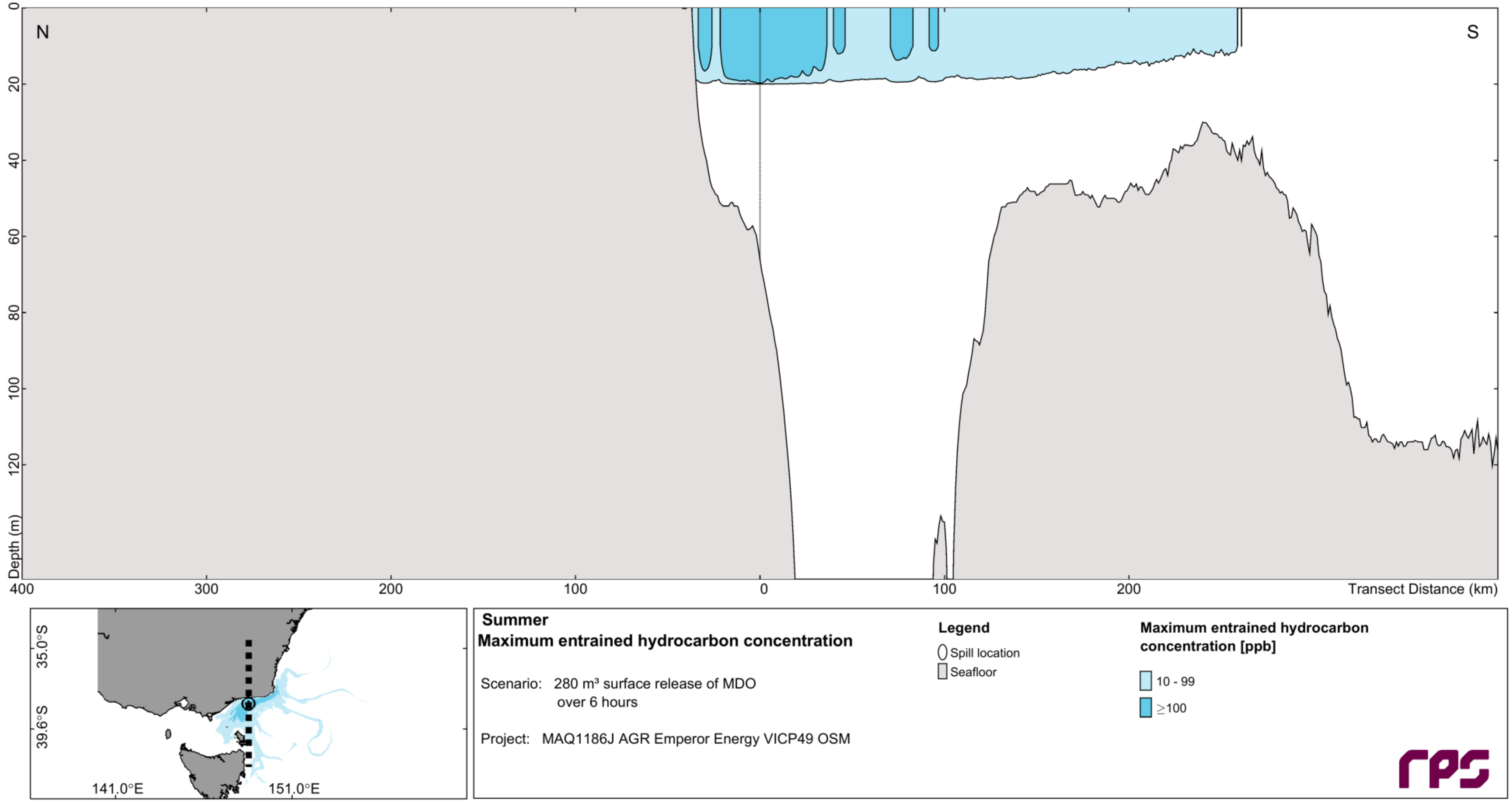

Figure 13.14 North-south cross-section transect of entrained hydrocarbon concentrations from a vessel collision during summer conditions. The results were calculated from 100 spill simulations.

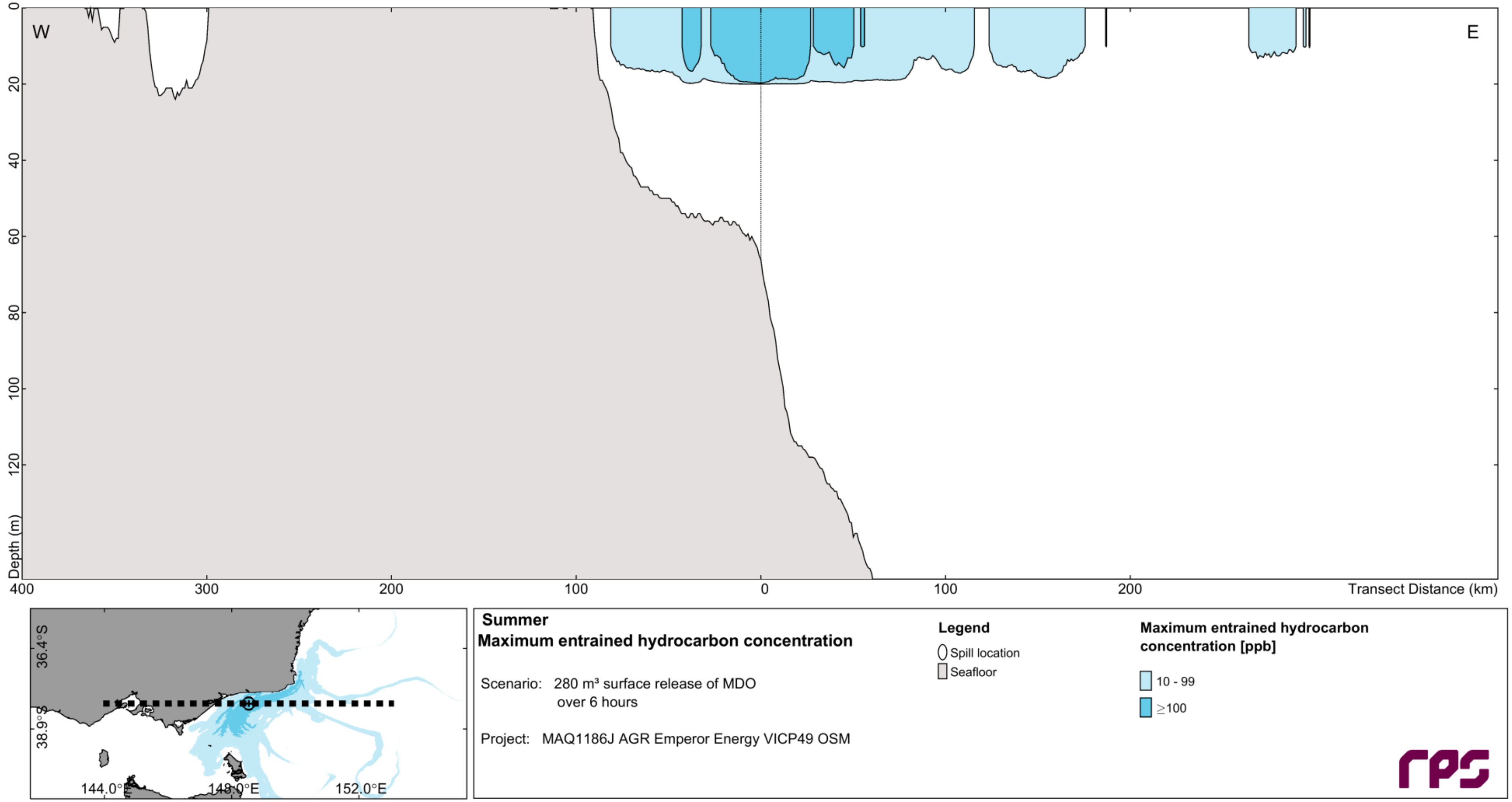

Figure 13.15 East-west cross-section transect of entrained hydrocarbon concentrations from a vessel collision during summer conditions. The results were calculated from 100 spill simulations.

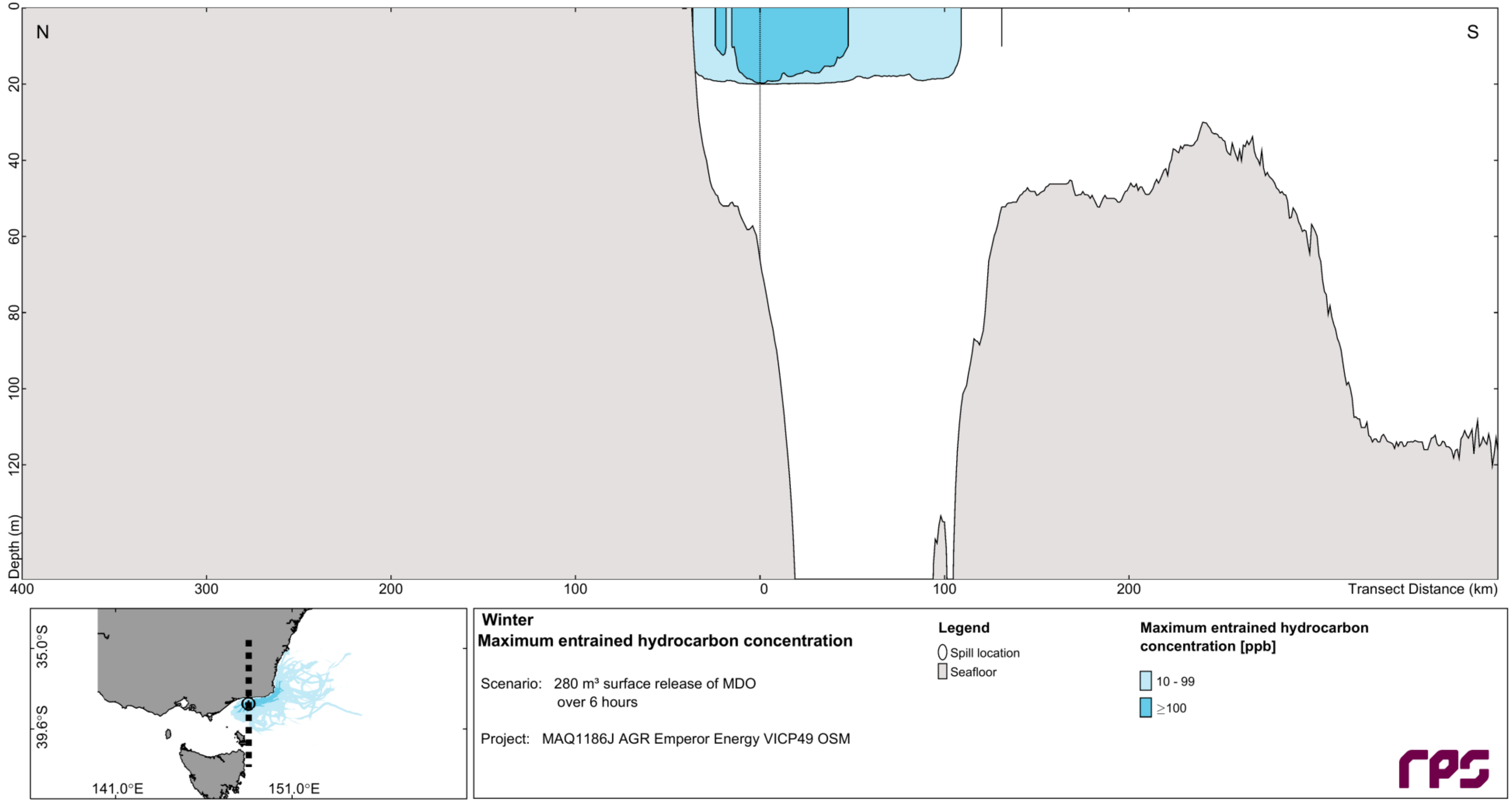

Figure 13.16 North-south cross-section transect of entrained hydrocarbon concentrations from a vessel collision during winter conditions. The results were calculated from 100 spill simulations.

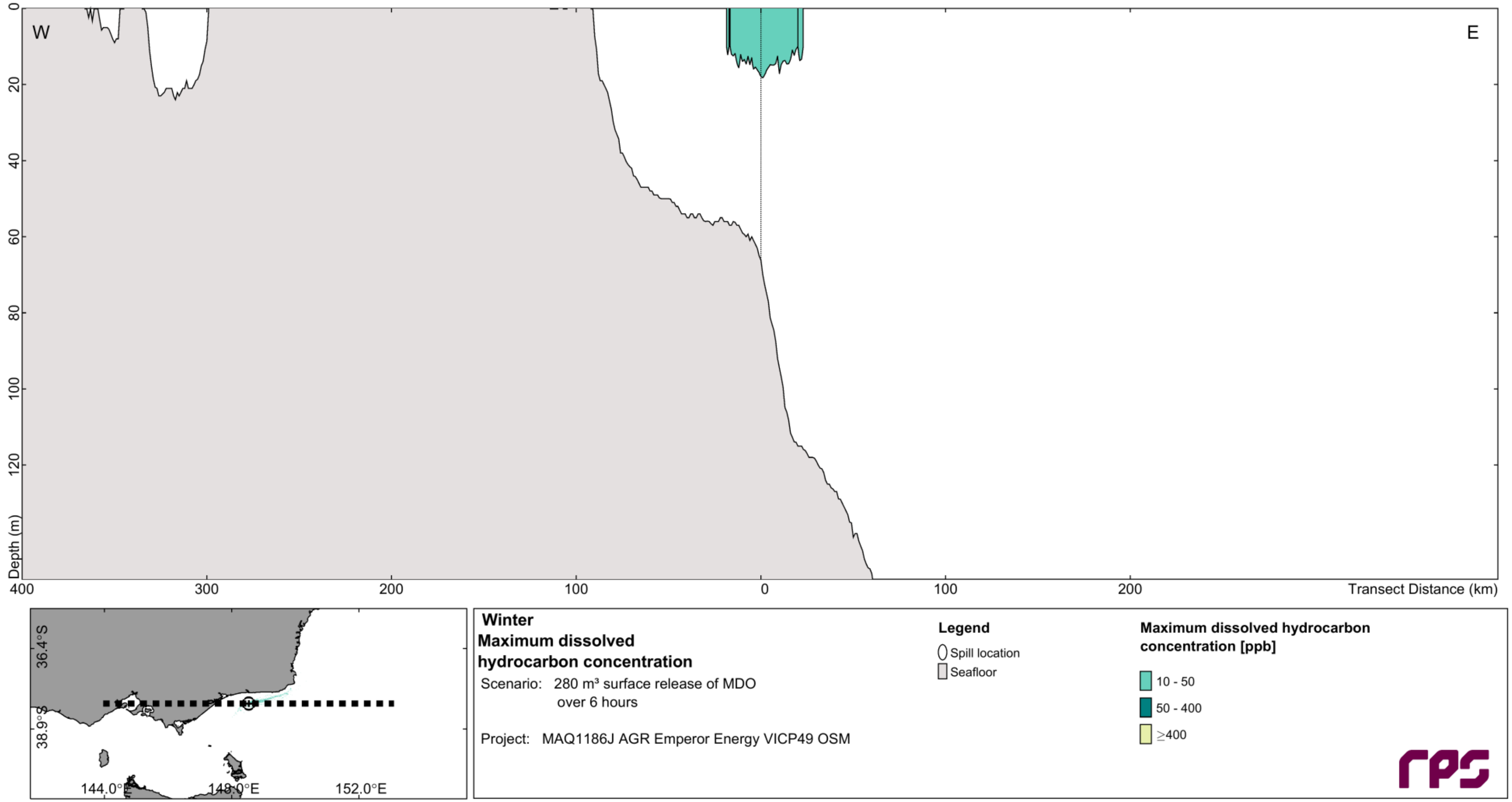

Figure 13.17 East-west cross-section transect of entrained hydrocarbon concentrations from a vessel collision during winter conditions. The results were calculated from 100 spill simulations.

13.3 Deterministic Analysis

The simulation that resulted in the largest volume of hydrocarbons ashore of 9.1 m^3 was identified as run number 35 and commenced during winter conditions, 5 pm 8th May 2018.

Figure 13.18 presents the extent of the predicted floating oil exposure zones on the sea surface (swept area) and the shoreline loading over the entire simulation (30 days). Initial shoreline accumulation occurred on day 8.

The extent of the predicted entrained hydrocarbon exposure zones in the 0–10 m depth layer over the entire 30 day simulation is presented in Figure 13.19. There was no dissolved hydrocarbon concentrations above 10 ppb.

Figure 13.20 presents the fates and weathering for the corresponding simulation. At the conclusion of the simulation (day-30), approximately 142.7 m^3 (~51%) was lost to the atmosphere through evaporation. Approximately, 75.9 m^3 (~27%) of the released volume decayed, while approximately 56.8 m^3 (~20%) was predicted to remain within the water column and approximately 4.2 m^3 (~1%) was present on the shorelines.

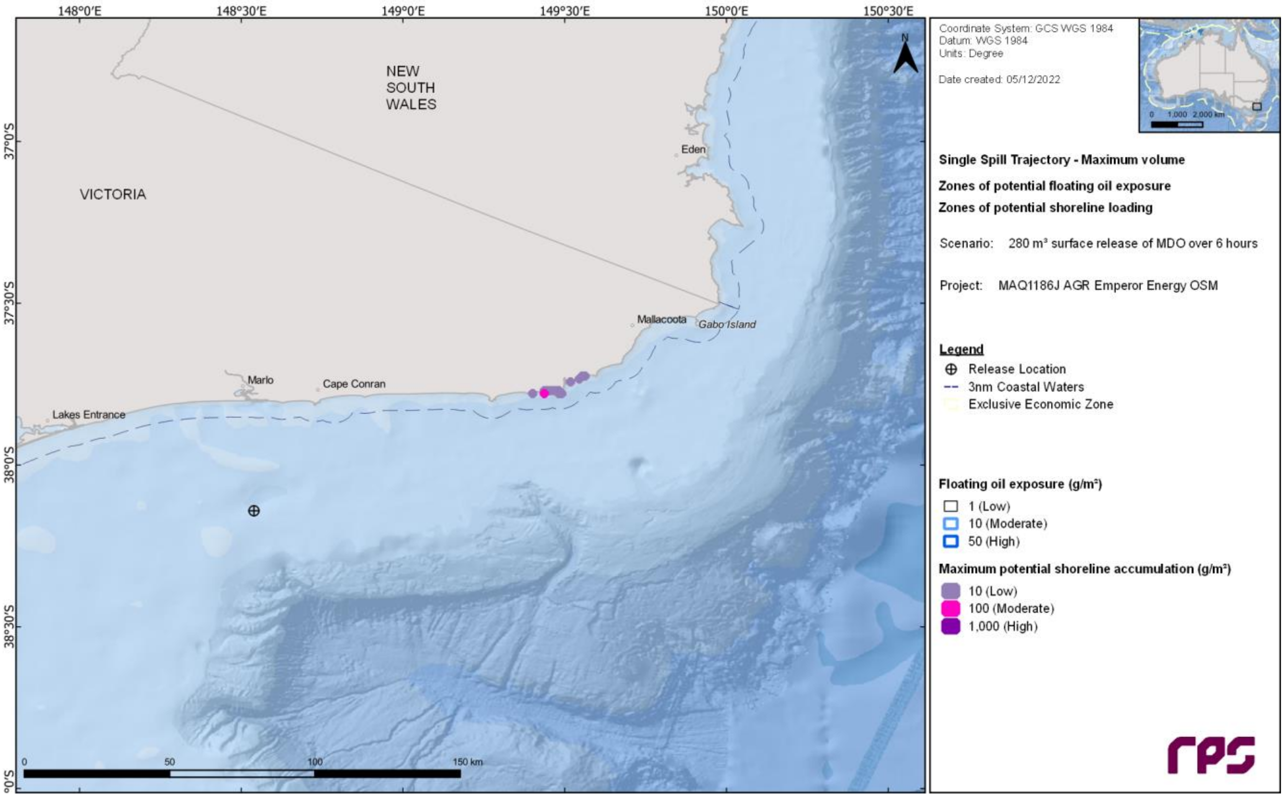

Figure 13.18 Predicted extent of the floating oil exposure and shoreline loading over the entire 30 days for the simulation that led to the largest volume of oil ashore from a vessel collision.

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Figure 13.19 Predicted extent of the entrained hydrocarbons exposure over the entire 30 days for the simulation that led to the largest volume of oil ashore from a vessel collision.

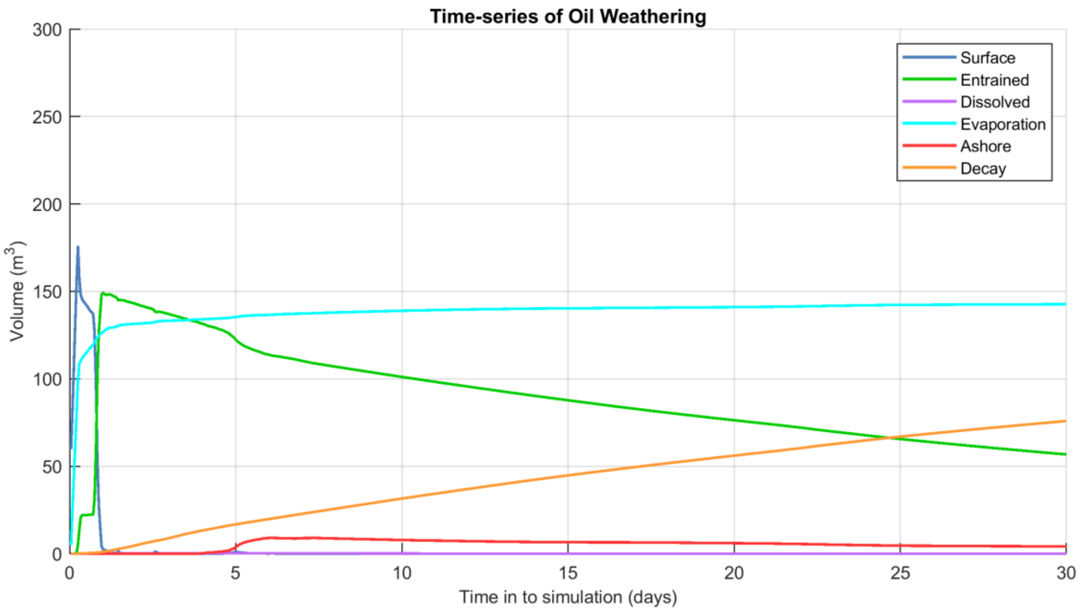


Figure 13.20 Predicted weathering and fates for the simulation that led to the largest volume of oil ashore from a vessel collision.

14 MODELLING RESULTS: SUBSEA LOWC

The scenario investigated the potential exposure from a 347,584 bbl (or 55,256 m^3) subsea release of condensate over 77 days (4,51 bbl/day or 717 m^3/day) following a LOWC. The condensate was tracked for an additional 30 days following the release to allow concentrations to decrease below the thresholds. The modelling assumed no mitigation efforts are undertaken to collect or otherwise affect the natural transport and weathering.

Section 14.1.1 presents the predicted areas of exposure, Section 14.2 shows the seasonal (or stochastic) results, while Section 14.3 presents the results for the deterministic simulation.

For the stochastic results, the potential exposure and risk were separately calculated for each receptor and have been tabulated, except for the two receptors that the release location resides within (Twofold Shelf IMCRA and Upwelling East of Eden KEF).

14.1 Stochastic Analysis

14.1.1 Areas of Exposure

Figure 14.1 presents the areas of exposure based on the ‘low’, ‘moderate’ and ‘high’ thresholds are derived from all 200 spill simulations.

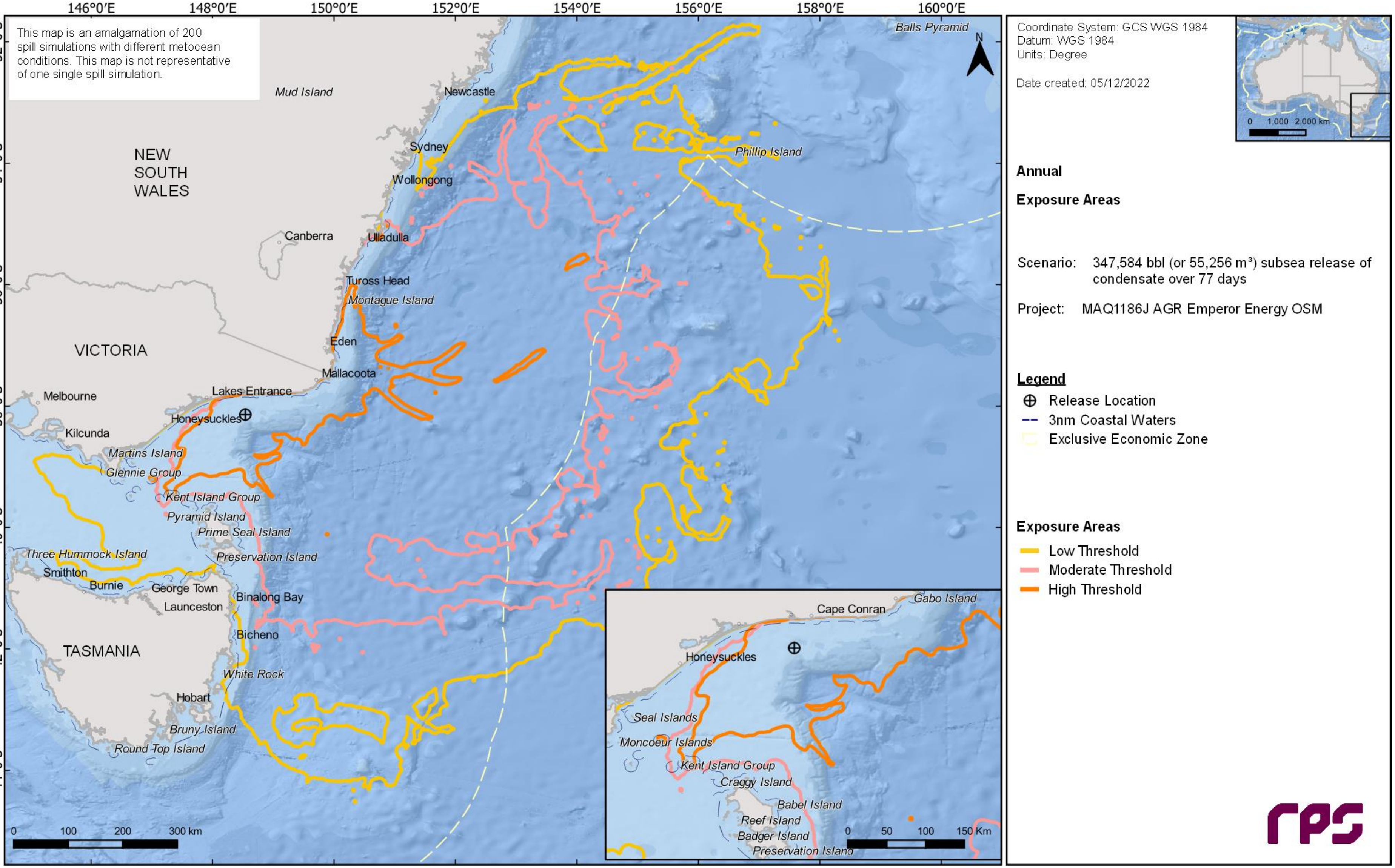


Figure 14.1 Predicted areas of exposure following a subsea LOWC, derived from all 200 spill simulations.

14.2 Stochastic Analysis

14.2.1 Floating Oil Exposure

Table 14.1 summarises the maximum distances from the release location to floating oil exposure thresholds. Floating oil concentrations exceeding 1 g/m^2 could extend up to 202.2 km from the release location. The distance reduces to 18.3 km as the threshold increases to 10 g/m^2 and 0.4 km as the threshold further increases to the 50 g/m^2.

Table 14.2 presents the predicted floating oil exposure to receptors for each season. The highest probabilities of exposure at concentrations ≥1 g/m^2 was forecast for Victorian State waters for summer (9%) and winter (23%). There was no exposure predicted to any of the receptors as the threshold increases to 10 g/m^2.

The quickest time for exposure at the 1 g/m^2 threshold was predicted at Victorian State waters during summer conditions 3.42 days after the commencement of the spill.

Figure 14.2 to Figure 14.3 illustrate the extent of floating oil exposure zones for each season.

Table 14.1 Maximum distances from the release location to floating oil exposure thresholds from a subsea LOWC for each season. Results were calculated from 100 spill simulations per season.

Season	Distance and direction travelled	Floating oil exposure thresholds		
		1 g/m^2	10 g/m^2	50 g/m^2
Summer	Maximum distance (km) from release location	176.1	18.3	-
	Maximum distance (km) from release location (99th percentile)	90.7	17.2	-
	Direction	ENE	WSW	-
Winter	Maximum distance (km) from release location	202.2	15.1	0.4
	Maximum distance (km) from release location (99th percentile)	89.5	14.3	0.4
	Direction	NE	SW	WNW

Table 14.2 Summary of the floating oil exposure to receptors from a subsea LOWC during each season. Results were calculated from 100 spill simulations per season.

Receptors		Summer						Winter					
		Probability (%) floating oil exposure at			Minimum time (days) before floating oil exposure at			Probability (%) floating oil exposure at			Minimum time (days) before floating oil exposure at		
Type	Name	1 g/m^2	10 g/m^2	50 g/m^2	1 g/m^2	10 g/m^2	50 g/m^2	1 g/m^2	10 g/m^2	50 g/m^2	1 g/m^2	10 g/m^2	50 g/m^2
MNP	Cape Howe	-	-	-	-	-	-	6	-	-	20.96	-	-
	Point Hicks	1	-	-	58.83	-	-	1	-	-	5.83	-	-
Nearshore waters	East Gippsland	9	-	-	3.42	-	-	18	-	-	5.83	-	-
	Gabo Island	-	-	-	-	-	-	3	-	-	20.42	-	-
State Waters	New South Wales	-	-	-	-	-	-	1	-	-	63.58	-	-
	Victoria	9	-	-	3.42	-	-	23	-	-	5.83	-	-

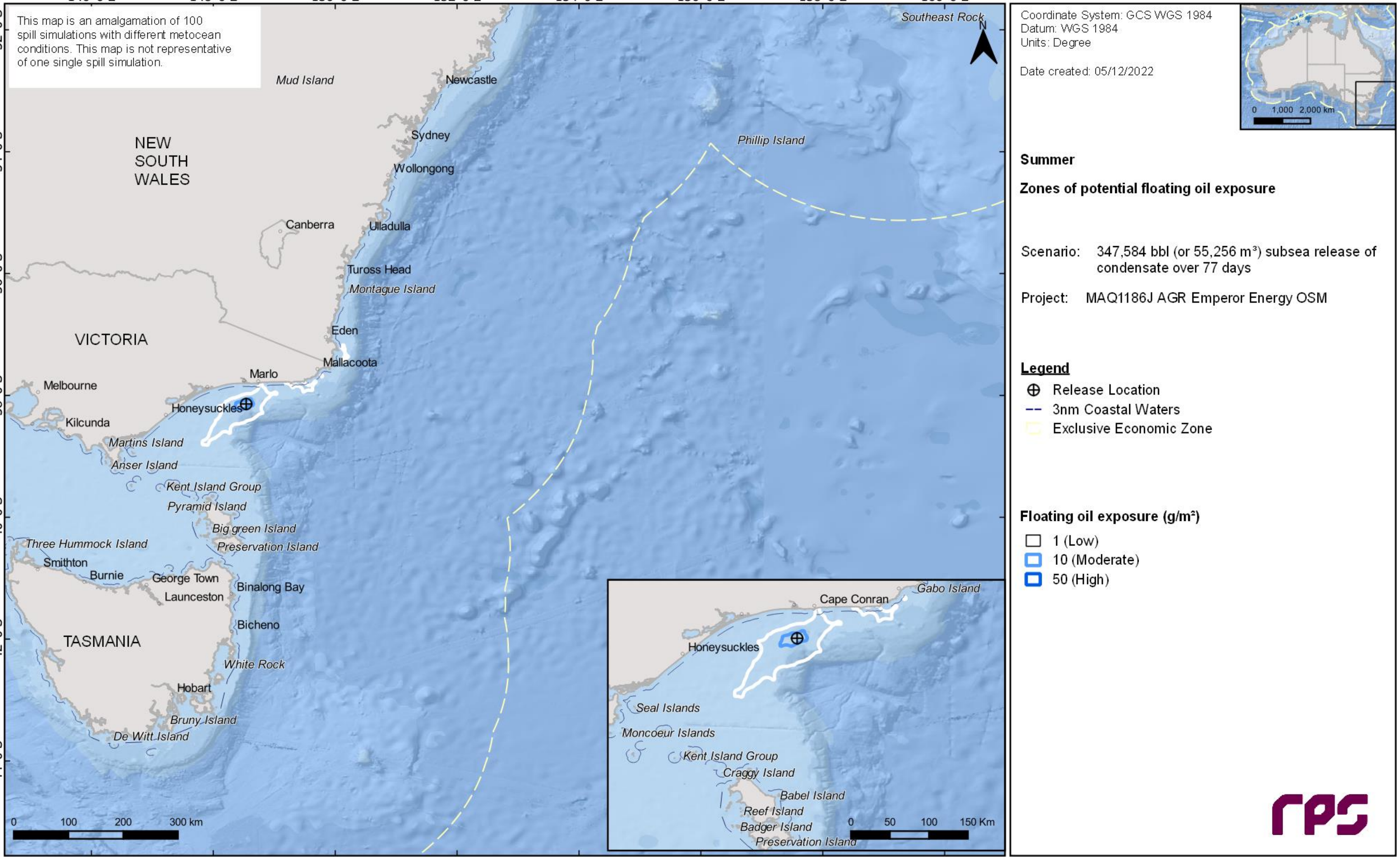


Figure 14.2 Zones of potential floating oil exposure from a subsea LOWC during summer conditions. The results were calculated from 100 spill simulations.

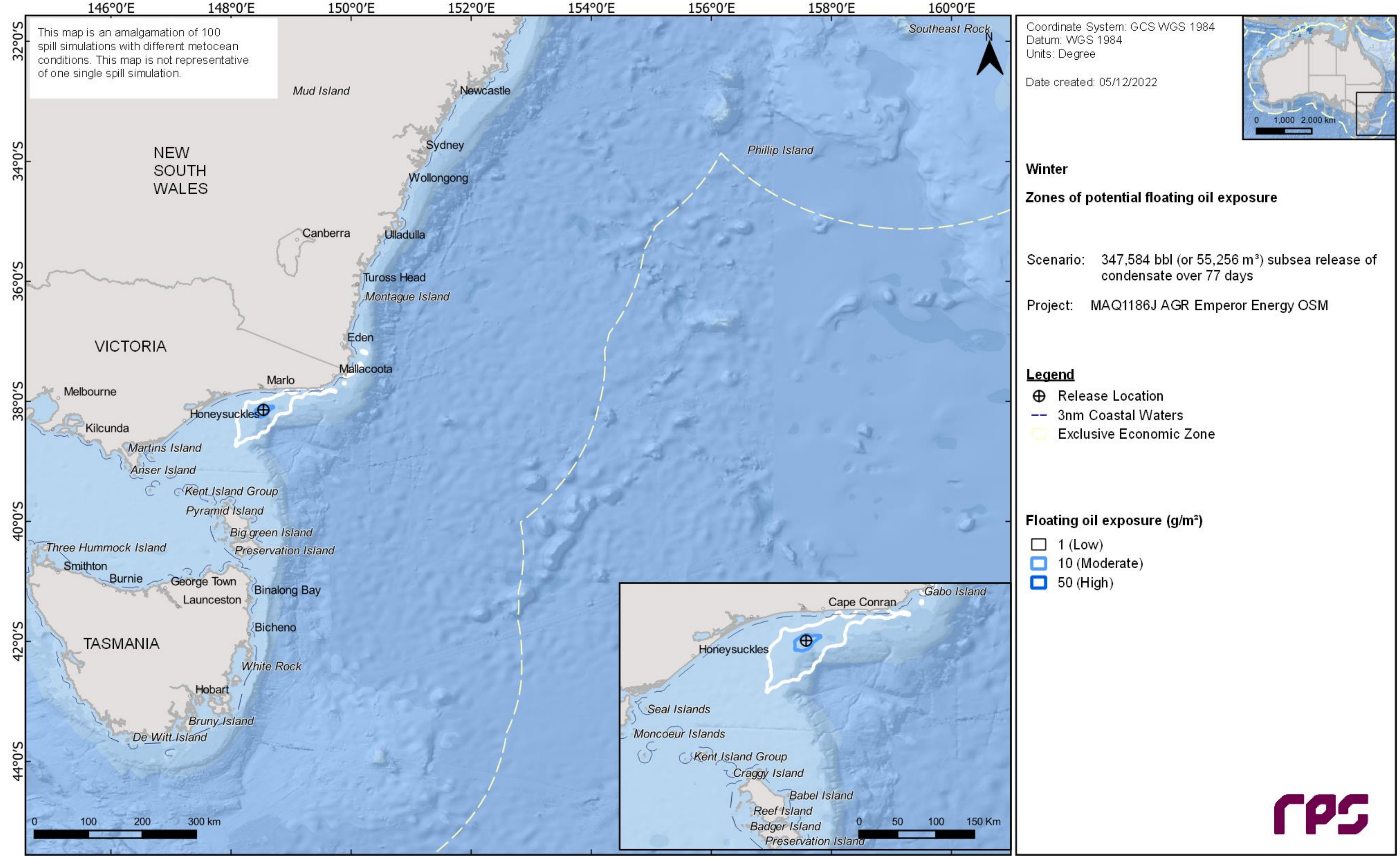


Figure 14.3 Zones of potential floating oil exposure from a subsea LOWC during winter conditions. The results were calculated from 100 spill simulations.

14.2.2 Shoreline Accumulation

Table 14.3 summarises the predicted oil accumulation on any shoreline during each season. The highest probability of accumulation at the 10 g/m^2 threshold was during winter at 98% and the minimum time before the condensate had reached the shorelines at or above the 10 g/m^2 threshold was 2.92 days. The maximum volume ashore was 28.1 m^3.

Table 14.4 and Table 14.5 summarise the accumulation on shoreline sectors during each season. The highest probability of accumulation at the 10 g/m^2 threshold was forecast for the East Gippsland coastline (75% during summer and 90% for winter conditions). The maximum volume of condensate ashore was also forecast for the East Gippsland shoreline at 17 m^3 and 28 m^3 during summer and winter conditions, respectively.

The quickest time before condensate had accumulated at the 10 g/m^2 threshold was 2.9 days during winter conditions at the Bega Valley shoreline.

The maximum potential shoreline loading for each season are presented in Figure 14.4 and Figure 14.5.

Table 14.3 Summary of accumulation on any shoreline from a subsea LOWC during each season. Results were calculated from 100 spill simulations per season.

Shoreline Statistics	Summer	Winter
Probability of accumulation on any shoreline (%) at or above the 10 g/m^2 threshold	89	98
Absolute minimum time before oil ashore (days) at or above the 10 g/m^2 threshold	3.13	2.92
Maximum volume of hydrocarbons ashore (m^3)	17.1	28.1
Average volume of hydrocarbons ashore (m^3)	2.9	5.2
Maximum length of the shoreline at **10 g/m^2** (km)	48	79
Average shoreline length (km) at **10 g/m^2** (km)	9.1	15.9
Maximum length of the shoreline at **100 g/m^2** (km)	4	7
Average shoreline length (km) at **100 g/m^2** (km)	2.3	2.5
Maximum length of the shoreline at **1,000 g/m^2** (km)	-	-
Average shoreline length (km) at **1,000 g/m^2** (km)	-	-

Table 14.4 Summary of accumulation for shoreline sectors from a subsea LOWC during summer conditions. Results were calculated from 100 spill simulations per season.

Shoreline sector	Maximum probability of shoreline accumulation (%) at			Minimum time before shoreline accumulation (days) at			Load on shoreline (g/m²)		Volume on shoreline (m³)		Mean length of shoreline accumulation (km) at			Maximum length of shoreline accumulation (km) at		
	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	Mean	Peak	Mean	Peak	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²
Babel Island	2	-	-	31.17	-	-	1	41	< 0.1	0.6	0.9	-	-	0.9	-	-
Bega Valley	38	-	-	5.63	-	-	2	64	0.6	3.2	3.7	-	-	9.9	-	-
Curtis Island	1	-	-	13.17	-	-	10	10	0.2	0.2	0.9	-	-	0.9	-	-
East Gippsland	75	12	-	3.13	30	-	3	391	2.2	17	6	2.1	-	40.4	3.6	-
Eurobodalla	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Flinders Island	2	-	-	30.29	-	-	< 1	26	< 0.1	3.4	13	-	-	14.4	-	-
Gabo Island	32	-	-	6.88	-	-	5	47	0.2	1	1.7	-	-	2.7	-	-
Hogan Island Group	1	-	-	34.75	-	-	12	12	0.4	0.4	1.8	-	-	1.8	-	-
Kent Island Group	22	-	-	9.96	-	-	2	35	0.2	1.4	1.9	-	-	4.5	-	-
Montague Island	3	-	-	22.25	-	-	2	32	< 0.1	1	4.2	-	-	4.5	-	-
Shoal Haven	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-

Table 14.5 Summary of oil accumulation for shoreline sectors from a subsea LOWC during winter conditions. Results were calculated from 100 spill simulations per season.

Shoreline sector	Maximum probability of shoreline accumulation (%) at			Minimum time before shoreline accumulation (days) at			Load on shoreline (g/m²)		Volume on shoreline (m³)		Mean length of shoreline accumulation (km) at			Maximum length of shoreline accumulation (km) at		
	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	Mean	Peak	Mean	Peak	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²	≥ 10 g/m²	≥ 100 g/m²	≥ 1,000 g/m²
Babel Island	3	-	-	53.88	-	-	3	37	< 0.1	0.8	1.2	-	-	1.8	-	-
Bega Valley	69	5	-	2.92	3.42	-	4	153	0.9	3.8	3.4	1.3	-	13.5	1.8	-
Curtis Island	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
East Gippsland	89	18	-	3	6.25	-	6	444	3.9	28	10.9	1.9	-	68.3	3.6	-
Eurobodalla	3	-	-	31.83	-	-	< 1	20	< 0.1	1	0.9	-	-	0.9	-	-
Flinders Island	3	-	-	53.96	-	-	2	32	0.1	3.4	11.7	-	-	13.5	-	-
Gabo Island	55	3	-	4	20.42	-	13	335	0.6	6.9	2.1	1.8	-	5.4	1.8	-
Hogan Island Group	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Kent Island Group	7	-	-	50.29	-	-	2	25	< 0.1	0.9	1.8	-	-	2.7	-	-
Montague Island	9	1	-	26	52	-	4	103	0.1	1.7	1.8	0.9	-	2.7	0.9	-
Shoal Haven	3	-	-	13.75	-	-	< 1	25	< 0.1	2.5	3.9	-	-	7.2	-	-

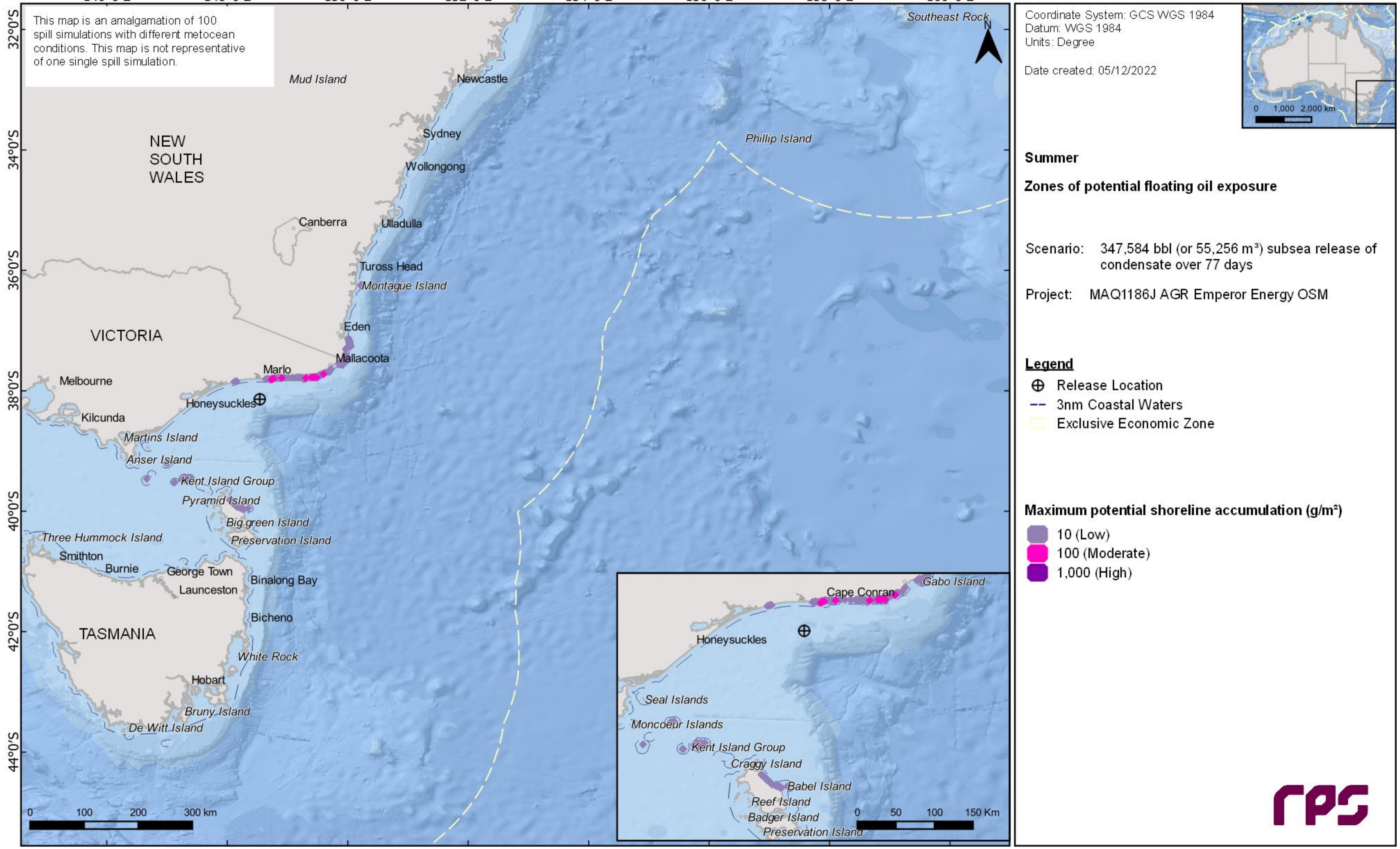


Figure 14.4 Maximum potential shoreline loading from a subsea LOWC during summer conditions. The results were calculated from 100 spill simulations.

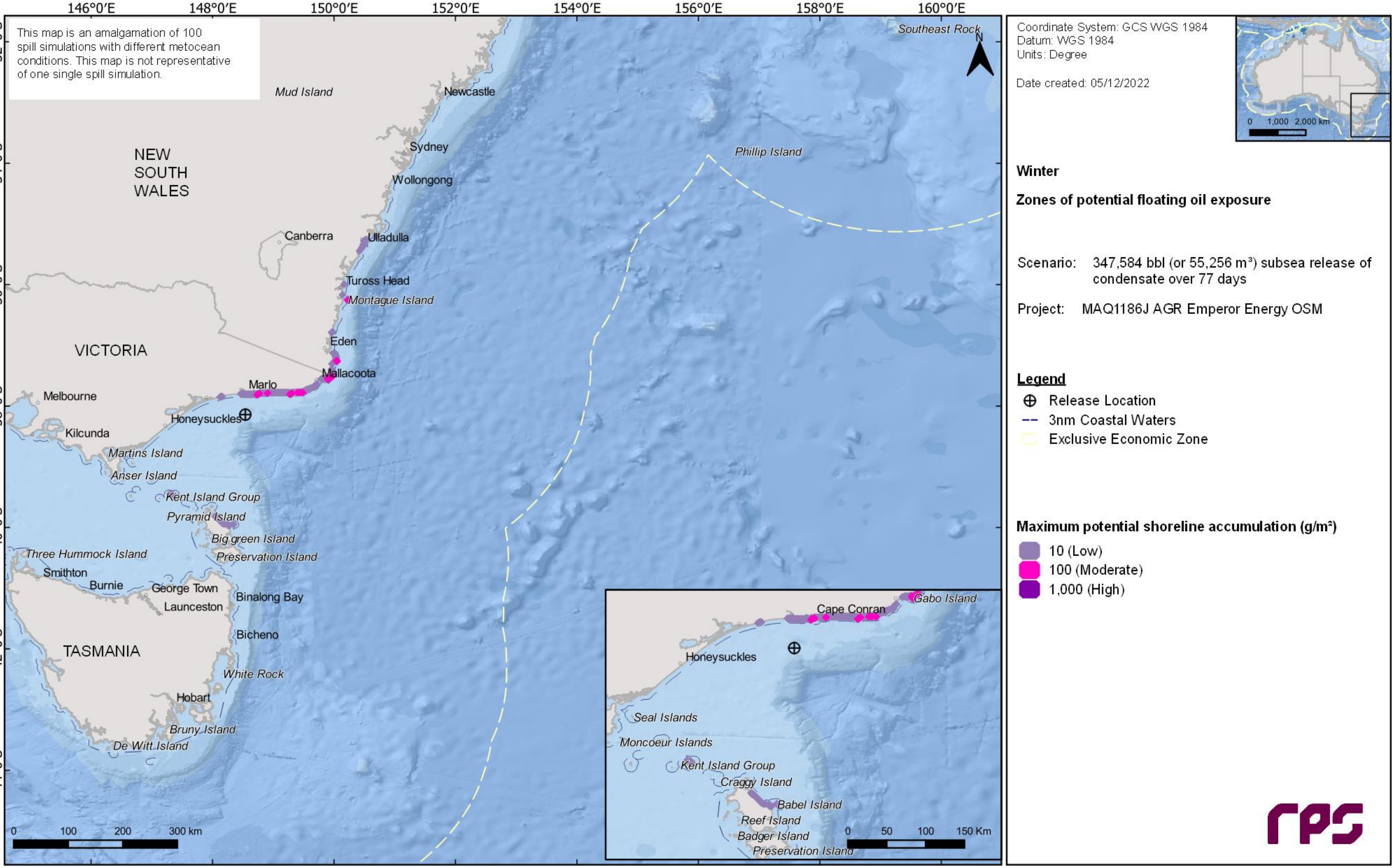


Figure 14.5 Maximum potential shoreline loading from a subsea LOWC during winter conditions. The results were calculated from 100 spill simulations.

14.2.3 In-water exposure

14.2.3.1 Dissolved Hydrocarbons

Table 14.6 summarises the maximum distances from the release location to dissolved hydrocarbons exposure thresholds in the 0 – 10 m depth layer. Concentrations exceeding 10 ppb may potentially occur 1,039.1 km from the release location with the distance reducing to 898.8 km and 186.7 km as the exposure threshold increases to 50 ppb and 400 ppb, respectively.

Table 14.7 summarises the predicted exposure to receptors for each season.

The probability of exposure for concentrations at or above 10 ppb was highest at the New Zealand Star Bank (100% during summer and winter conditions). The highest concentration was predicted at Cape Howe MNP at 394 ppb during winter conditions.

There was no exposure predicted for any receptor at concentrations above 400 ppb.

Figure 14.6 and Figure 14.7 present the dissolved hydrocarbon exposure zones during summer and winter, respectively.

Cross-sectional transects (north-south and east-west) of the maximum dissolved hydrocarbons in the vicinity of the release site are presented in Figure 14.8 to Figure 14.11. The dissolved hydrocarbons above 10 ppb were shown to occur to a depth of 75 m.

Table 14.6 Maximum distances from the release location to dissolved hydrocarbon exposure thresholds from a subsea LOWC during each season. Results were calculated from 100 spill simulations per season.

Season	Distance and direction travelled	Dissolved hydrocarbon exposure thresholds		
		10 ppb	50 ppb	400 ppb
Summer	Maximum distance (km) from release location	992.3	765.6	186.7
	Maximum distance (km) from release location (99th percentile)	746.7	584.9	186.7
	Direction	NE	ENE	ENE
Winter	Maximum distance (km) from release location	1,039.1	898.8	177.9
	Maximum distance (km) from release location (99th percentile)	718.6	555.5	177.9
	Direction	NE	NE	ENE

Table 14.7 Summary of the dissolved hydrocarbon exposure to receptors from a subsea LOWC during each season. Results were calculated from 100 spill simulations per season.

Receptors		Summer							Winter						
		Highest dissolved concentration (ppb)	Probability (%) of dissolved hydrocarbon exposure at			Minimum time (days) before dissolved hydrocarbon exposure at			Highest dissolved concentration (ppb)	Probability (%) of dissolved hydrocarbon exposure at			Minimum time (days) before dissolved hydrocarbon exposure at		
Type	Name		≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb		≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb
AMP	Beagle	163	52	4	-	5.83	6.96	-	57	9	1	-	11.67	11.79	-
	Central Eastern	14	1	-	-	86.00	-	-	37	1	-	-	26.42	-	-
	East Gippsland	330	29	5	-	6.63	7.21	-	324	61	10	-	4.50	8.58	-
	Flinders	187	9	2	-	9.17	11.38	-	159	13	2	-	7.71	7.83	-
	Freycinet	166	5	1	-	20.71	34.63	-	166	3	1	-	17.38	28.08	-
	Hunter	19	1	-	-	82.54	-	-	3	-	-	-	-	-	-
	Jervis	36	2	-	-	37.96	40.88	-	77	6	1	-	10.63	18.50	-
CA	Marriott Reef	12	1	-	-	87.88	-	-	1	-	-	-	-	-	-
	Unnamed (Badger Corner)	23	1	-	-	23.92	-	-	-	-	-	-	-	-	-
IMCRA	Batemans Shelf	390	46	13	-	7.33	8.63	33.50	387	84	21	-	2.71	3.50	-
	Boags	38	2	-	-	22.29	-	-	1	-	-	-	-	-	-
	Central Bass Strait	59	9	1	-	13.42	25.63	-	11	1	-	-	83.17	-	-
	Flinders	205	31	3	-	6.33	7.54	-	180	29	5	-	14.04	76.42	-
	Freycinet	77	5	1	-	14.21	47.42	-	23	2	-	-	36.46	-	-
	Hawkesbury Shelf	14	1	0	-	64.54	-	-	42	1	-	-	19.67	-	-
KEF	Big Horseshoe Canyon	292	77	19	-	5.17	7.96	-	323	91	40	-	1.42	1.46	-

Receptors		Summer							Winter						
		Highest dissolved concentration (ppb)	Probability (%) of dissolved hydrocarbon exposure at			Minimum time (days) before dissolved hydrocarbon exposure at			Highest dissolved concentration (ppb)	Probability (%) of dissolved hydrocarbon exposure at			Minimum time (days) before dissolved hydrocarbon exposure at		
Type	Name		≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb		≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb
	Canyons on the eastern continental slope	338	19	5	-	23.54	26.33	-	149	32	3	-	7.92	8.00	-
	Seamounts South and east of Tasmania	73	4	1	-	25.71	40.29	-	70	2	1	-	18.42	63.79	-
	Shelf rocky reefs	108	16	2	-	24.21	24.79	-	241	46	7	-	8.04	8.33	-
	Tasman Front and eddy field	40	1	-	-	56.13	83.79	-	80	2	1	-	12.96	20.96	-
	Tasmantid seamount chain	14	1	-	-	93.04	-	-	5	-	-	-	102.38	-	-
MNP	Cape Howe	347	93	46	-	3.71	4.38	-	394	100	60	-	1.71	2.46	-
	Point Hicks	220	94	47	-	1.79	2.54	-	204	97	48	-	1.92	3.71	-
	Wilsons Promontory	21	2	-	-	13.50	-	-	-	-	-	-	-	-	-
MP	Batemans	126	14	3	-	15.58	20.88	-	295	49	8	-	5.42	10.63	-
	Jervis Bay	10	1	-	-	94.46	-	-	89	4	1	-	25.33	75.04	-
MS	Beware Reef	90	28	8	-	5.67	27.67	-	78	26	5	-	4.38	21.75	-
NP	Kent Group	152	43	6	-	6.33	8.58	-	52	5	1	-	14.75	76.42	-
NPC	Booderee	2	-	-	-	-	-	-	16	1	-	-	75.42	-	-
RSB	Beware Reef	90	29	8	-	5.67	27.67	-	78	26	5	-	4.38	21.75	-
	Cutter Rock	18	4	-	-	12.42	-	-	-	-	-	-	-	-	-
	Endeavour Reef	42	17	-	-	12.17	42.50	-	9	-	-	-	-	-	-

Receptors		Summer							Winter						
		Highest dissolved concentration (ppb)	Probability (%) of dissolved hydrocarbon exposure at			Minimum time (days) before dissolved hydrocarbon exposure at			Highest dissolved concentration (ppb)	Probability (%) of dissolved hydrocarbon exposure at			Minimum time (days) before dissolved hydrocarbon exposure at		
Type	Name		≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb		≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb
	New Zealand Star Bank	284	100	70	-	1.92	1.96	-	330	100	76	-	1.21	1.29	-
	Wakitipu Rock	35	11	-	-	9.96	-	-	23	2	-	-	63.04	-	-
	Warrego Rock	26	6	-	-	19.63	-	-	5	-	-	-	-	-	-
	Wright Rock	71	21	1	-	11.75	40.63	-	15	1	-	-	63.79	-	-
Nearshore Waters	Babel Island	19	2	-	-	43.67	-	-	2	-	-	-	-	-	-
	Bega Valley	243	80	27	-	4.71	6.54	-	226	93	34	-	2.00	5.42	-
	Break O'Day	77	2	1	-	49.92	51.29	-	-	-	-	-	-	-	-
	Cape Barren Osland	115	2	1	-	22.42	70.33	-	13	1	-	-	71.25	-	-
	Circular Head	12	2	-	-	57.67	-	-	-	-	-	-	-	-	-
	Clarke Island	177	1	1	-	70.33	70.33	-	-	-	-	-	-	-	-
	Craggy Island	44	14	-	-	12.50	-	-	21	1	-	-	82.67	-	-
	Curtis Island	38	7	-	-	7.54	58.46	-	7	-	-	-	-	-	-
	Dorset	17	2	-	-	51.96	-	-	-	-	-	-	-	-	-
	East Gippsland	287	81	28	-	2.42	4.58	-	260	96	37	-	2.08	3.50	-
	Eurobodalla	70	5	1	-	15.71	53.42	-	112	28	4	-	8.46	11.21	-
	Flinders Island	39	4	-	-	22.38	82.79	-	3	-	-	-	-	-	-
	Gabo Island	175	85	31	-	4.54	5.08	-	195	92	27	-	2.04	8.04	-
	Hogan Island Group	153	20	3	-	7.13	7.54	-	7	-	-	-	14.04	-	-
	Inner Sister Island	37	5	-	-	22.42	-	-	4	-	-	-	-	-	-

Receptors		Summer							Winter						
		Highest dissolved concentration (ppb)	Probability (%) of dissolved hydrocarbon exposure at			Minimum time (days) before dissolved hydrocarbon exposure at			Highest dissolved concentration (ppb)	Probability (%) of dissolved hydrocarbon exposure at			Minimum time (days) before dissolved hydrocarbon exposure at		
Type	Name		≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb		≥ 10 ppb	≥ 50 ppb	≥ 400 ppb	≥ 10 ppb	≥ 50 ppb	≥ 400 ppb
	Kent Island Group	175	40	6	-	6.33	8.33	-	52	4	1	-	16.96	76.42	-
	Kiama	2	-	-	-	-	-	-	11	1	-	-	29.58	-	-
	Moncoeur Islands	36	2	-	-	13.50	-	-	1	-	-	-	-	-	-
	Montague Island	98	8	2	-	16.92	21.29	-	138	41	7	-	5.42	15.92	-
	Outer Sister Island	33	7	-	-	17.17	-	-	8	-	-	-	-	-	-
	Pasco Group	13	1	-	-	23.29	-	-	3	-	-	-	-	-	-
	Prime Seal Island	20	1	-	-	33.25	-	-	2	-	-	-	-	-	-
	Pyramid Island	33	15	-	-	14.00	-	-	36	2	-	-	62.33	-	-
	Rodondo Island	37	1	-	-	49.04	-	-	-	-	-	-	-	-	-
	Seal Islands	34	2	-	-	27.54	-	-	1	-	-	-	-	-	-
	Shell Harbour	3	-	-	-	-	-	-	14	1	-	-	29.71	-	-
	Shoal Haven	31	1	-	-	85.75	-	-	174	4	2	-	19.71	29.92	-
	South Gippsland	14	2	-	-	26.13	-	-	-	-	-	-	-	-	-
	Vansittart Island	18	1	-	-	23.79	-	-	1	-	-	-	-	-	-
State Waters	New South Wales	374	90	46	-	3.54	4.54	-	333	100	51	-	1.88	2.42	-
	Tasmania	177	43	6	-	6.33	7.50	-	56	5	1	-	12.79	61.04	-
	Victoria	381	97	60	-	1.71	2.17	-	394	100	65	-	1.58	2.46	-

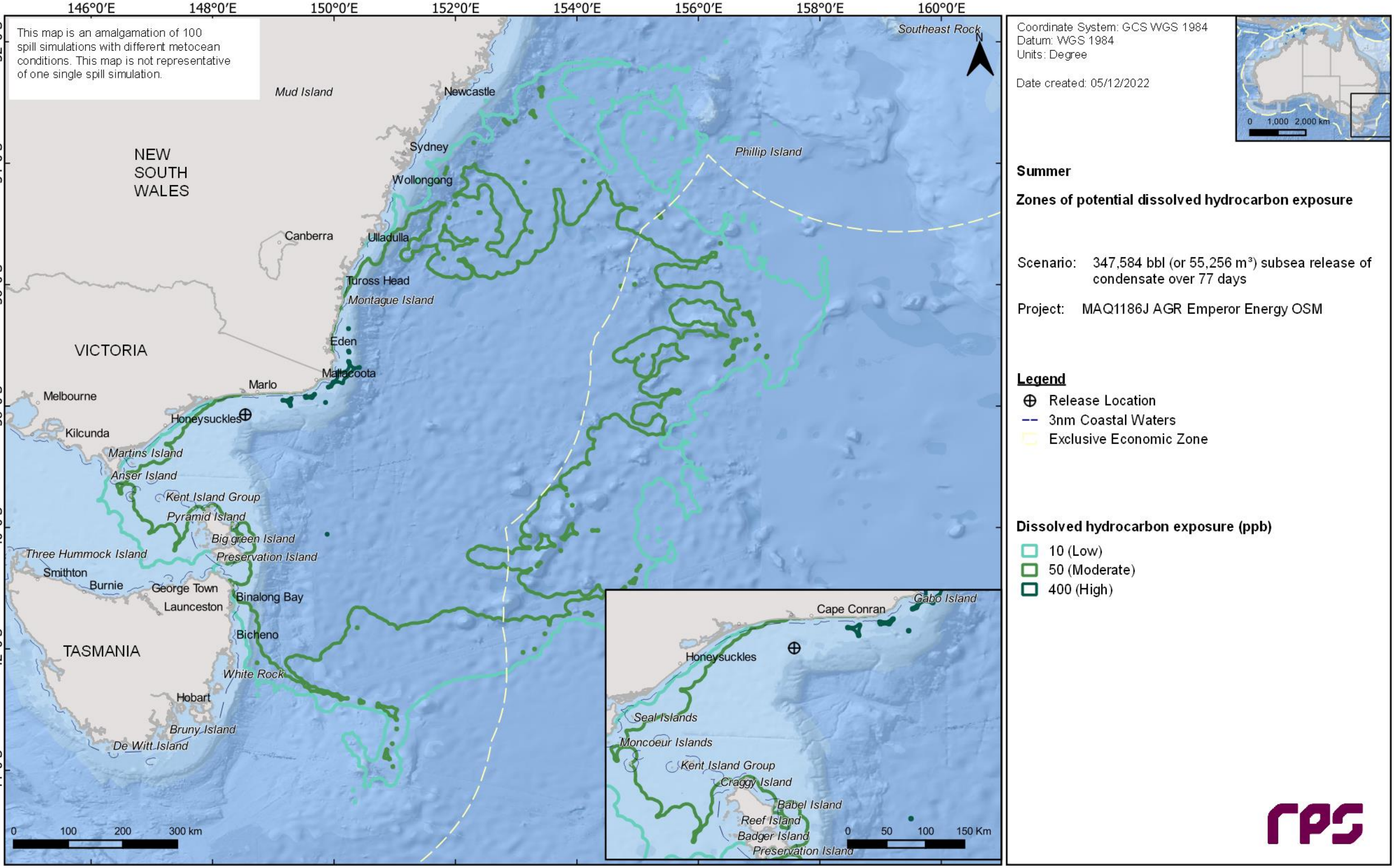


Figure 14.6 Predicted zones of dissolved hydrocarbon exposure from a subsea LOWC during summer conditions. The results were calculated from 100 spill simulations.

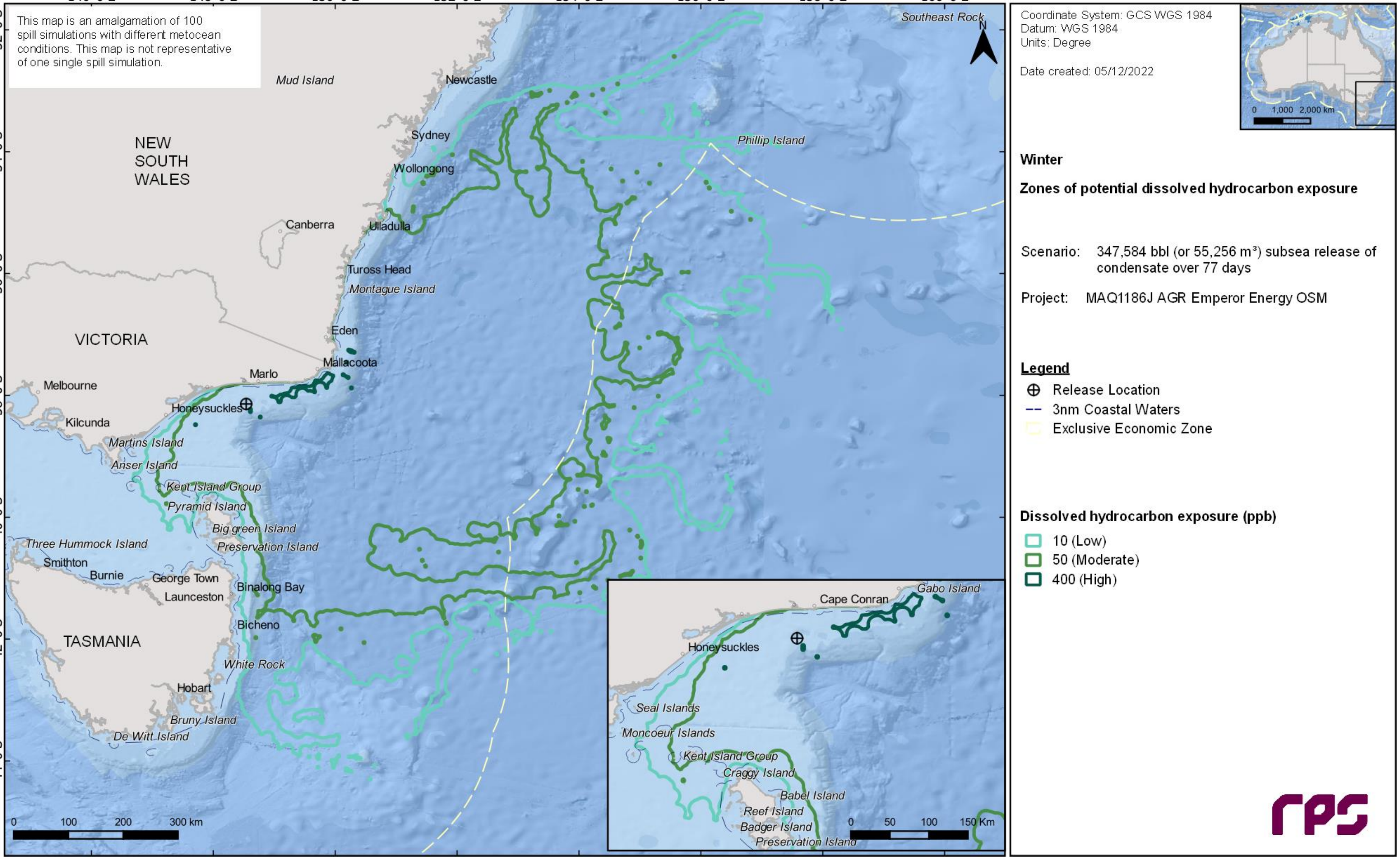


Figure 14.7 Predicted zones of dissolved hydrocarbon exposure from a subsea LOWC during winter conditions. The results were calculated from 100 spill simulations.

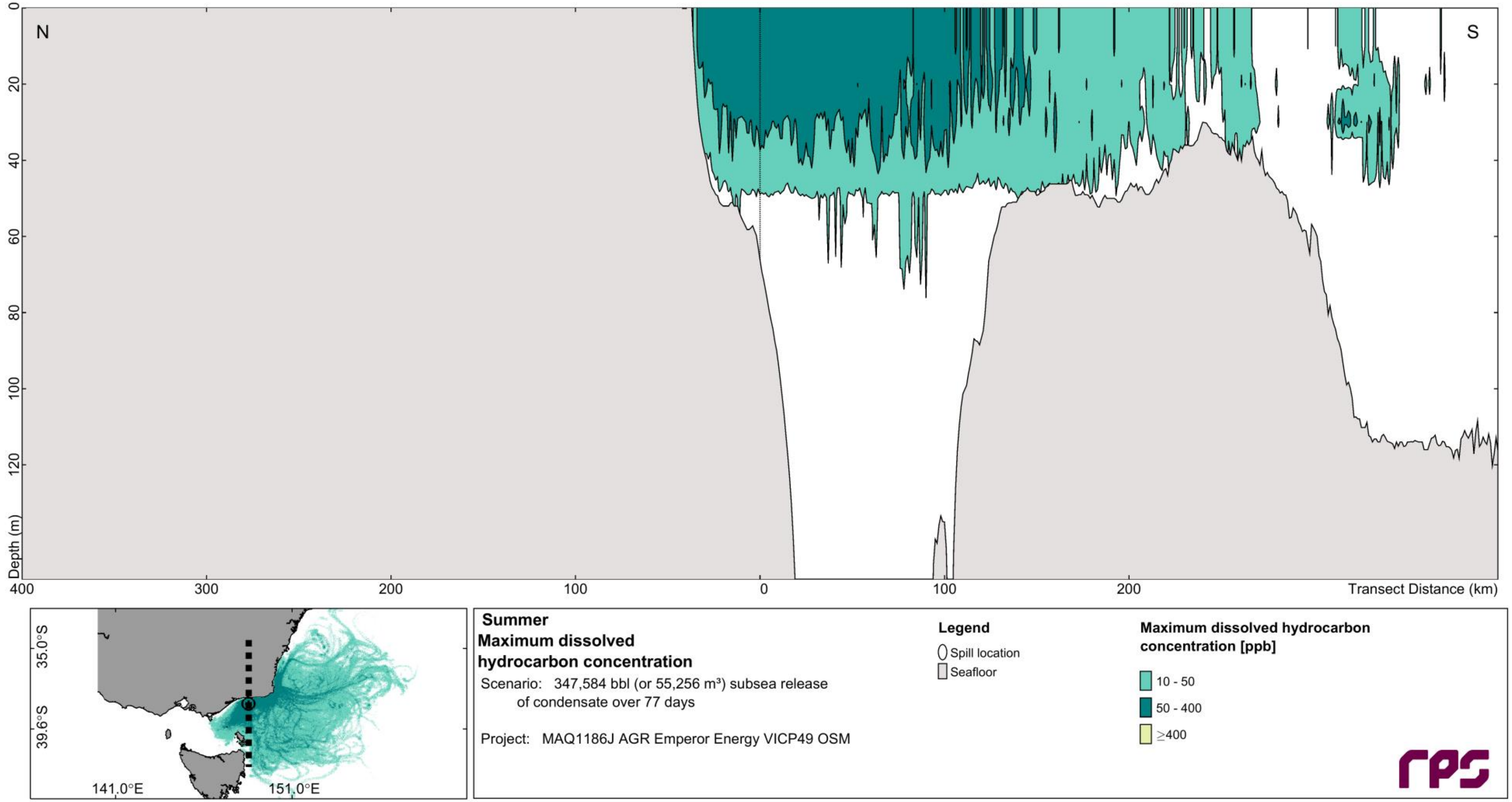


Figure 14.8 North-south cross-section transect of dissolved hydrocarbon concentrations from a subsea LOWC during summer conditions. The results were calculated from 100 spill simulations.

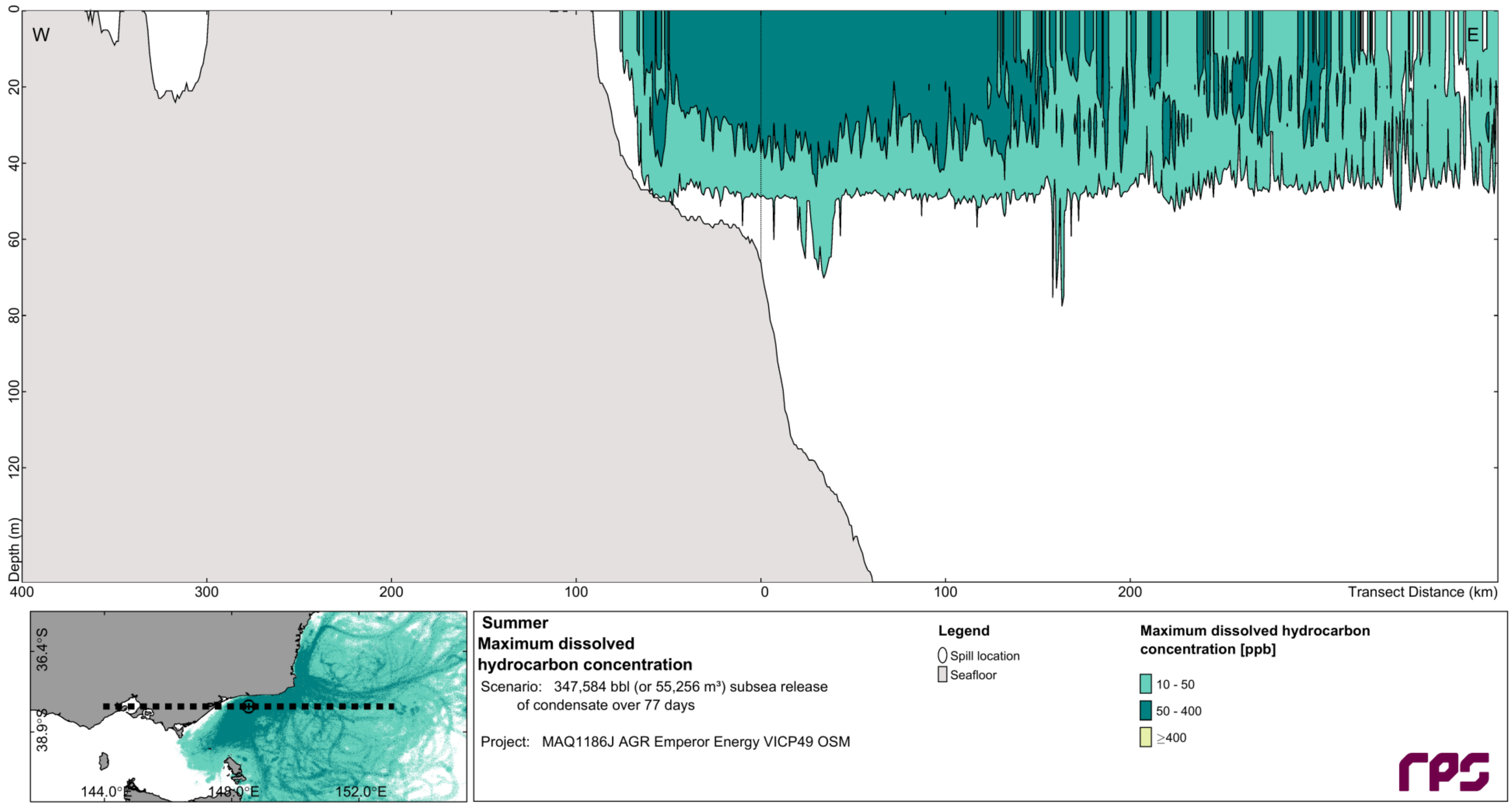


Figure 14.9 **East-west cross-section transect of dissolved hydrocarbon concentrations from a subsea LOWC during summer conditions. The results were calculated from 100 spill simulations.**

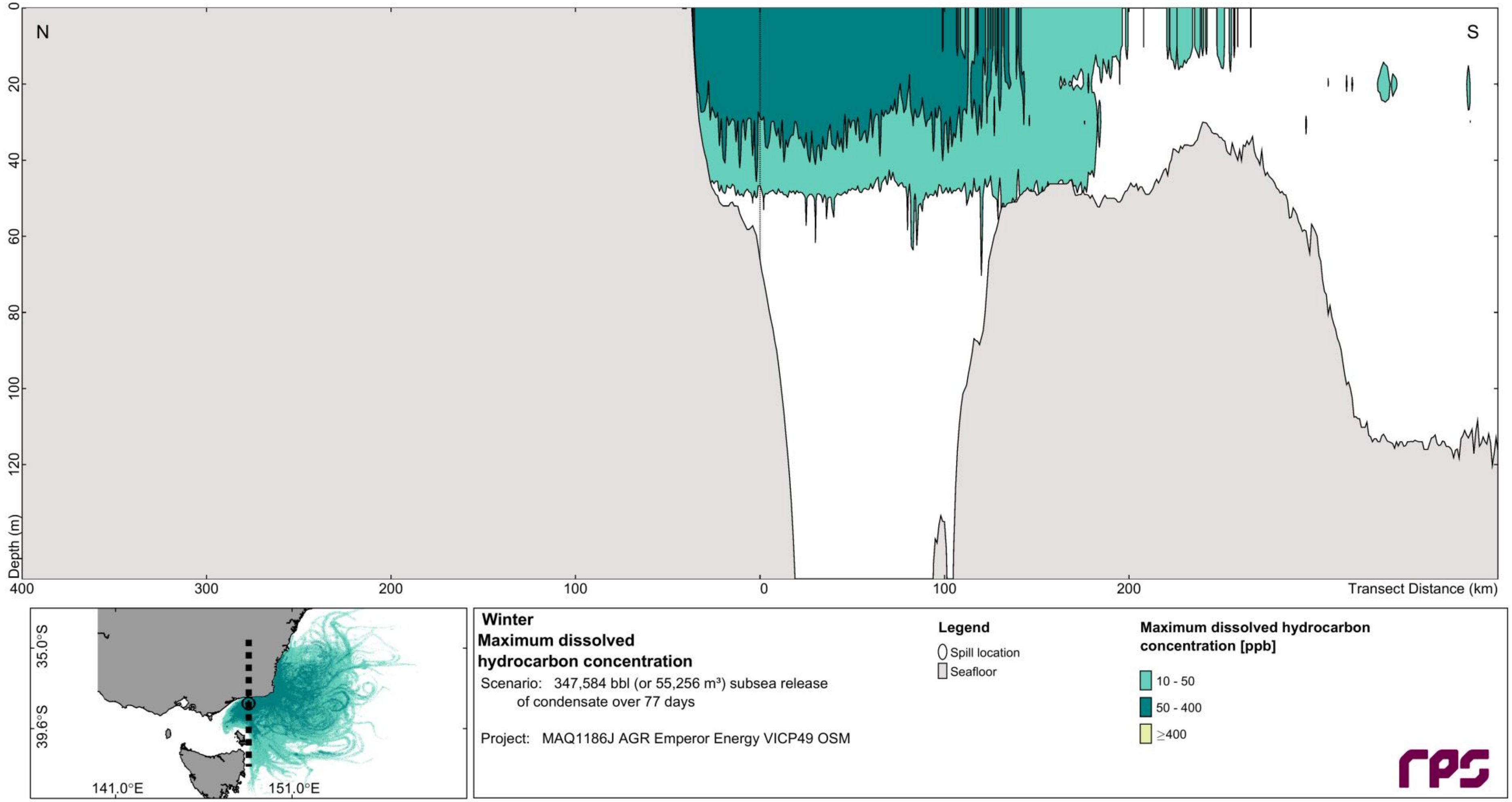


Figure 14.10 North-south cross-section transect of dissolved hydrocarbon concentrations from a subsea LOWC during winter conditions. The results were calculated from 100 spill simulations.

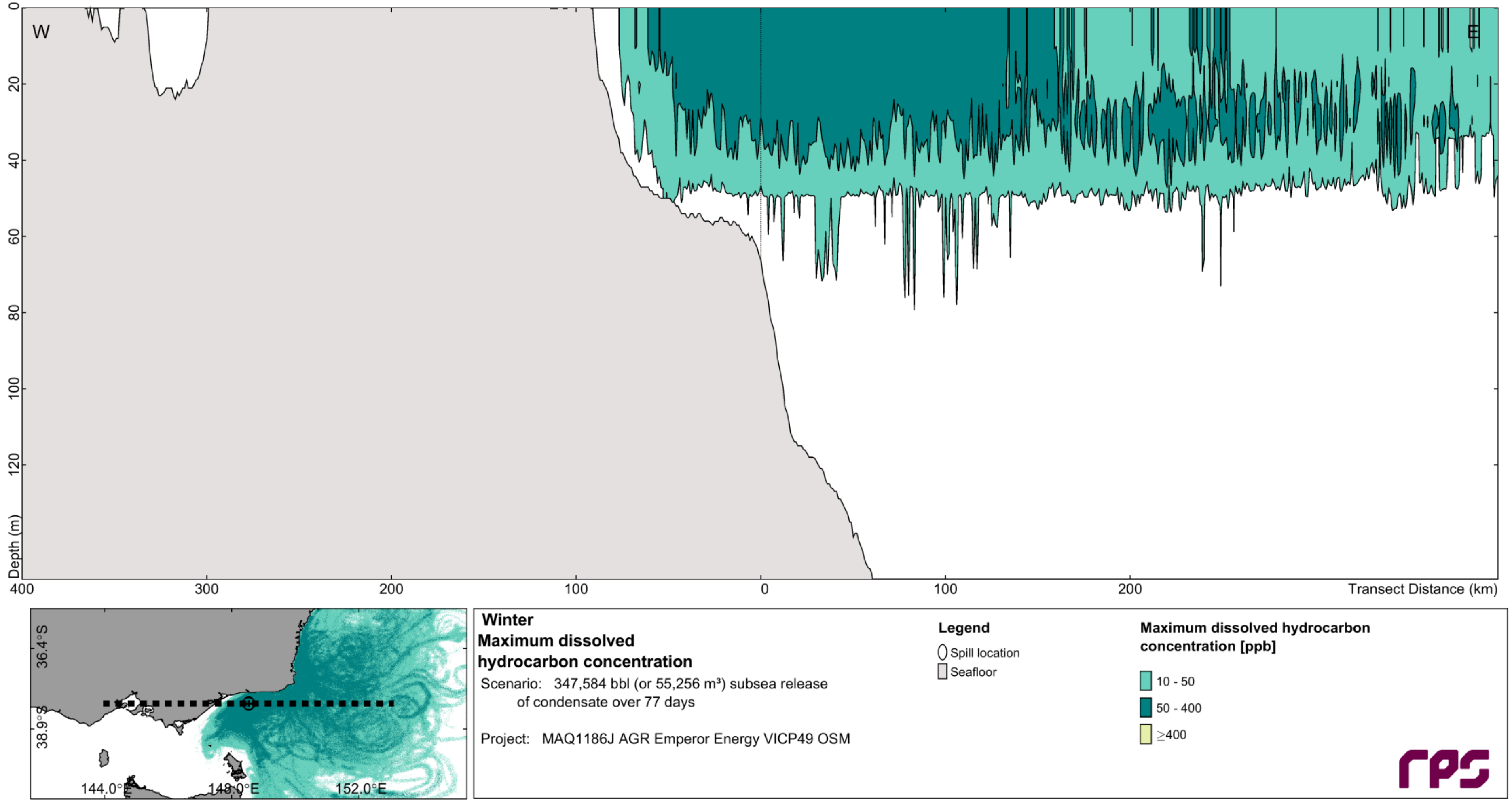


Figure 14.11 East-west cross-section transect of dissolved hydrocarbon concentrations from a subsea LOWC during winter conditions. The results were calculated from 100 spill simulations.

14.2.3.2 Entrained Hydrocarbons

Table 14.8 summarises the maximum distances from the release location to entrained hydrocarbon thresholds within the 0-10 m depth layer, for each season. Concentrations exceeding 10 ppb may potentially occur 917.2 km from the release location, with the distance reducing to 578.3 km as the threshold increases to 100 ppb.

Table 14.9 summarises the predicted exposure to receptors for each season. New Zealand Star Bank and Victorian State waters recorded probabilities of 100% for entrained hydrocarbon exposure at or above 10 ppb for both summer and winter conditions. New Zealand Star Bank recorded the highest probability for concentrations exceeding 100 ppb at 78% for summer and 72% under winter conditions. The quickest time for exposure at or above 10 ppb to any receptor was 0.79 days and 1.63 days for the New Zealand Star Bank during summer and winter conditions, respectively.

The highest concentration of entrained hydrocarbons was predicted at the Big Horseshoe Canyon KEF as 518 ppb.

Figure 14.12 and Figure 14.13 present the entrained hydrocarbon exposure zones during summer and winter, respectively.

Cross-sectional transects (north-south and east-west) of the maximum entrained hydrocarbons in the vicinity of the release site for each season, are presented in Figure 14.14 to Figure 14.17. The entrained hydrocarbons above 10 ppb were shown to occur to a depth of 25 m.

Table 14.8 Maximum distances from the release location to entrained hydrocarbon exposure thresholds in the 0-10 m depth layer from a subsea LOWC during each season. Results were calculated from 100 spill simulations per season.

Season	Distance and direction travelled	Entrained hydrocarbon exposure thresholds	
		10 ppb	100 ppb
Summer	Maximum distance (km) from release location	917.2	448.7
	Maximum distance (km) from release location (99th percentile)	757.6	314.6
	Direction	NE	ENE
Winter	Maximum distance (km) from release location	870.4	578.3
	Maximum distance (km) from release location (99th percentile)	745.8	446.4
	Direction	ENE	ENE

Table 14.9 Summary of the entrained hydrocarbon exposure to receptors from a subsea LOWC during each season. Results were calculated from 100 spill simulations per season.

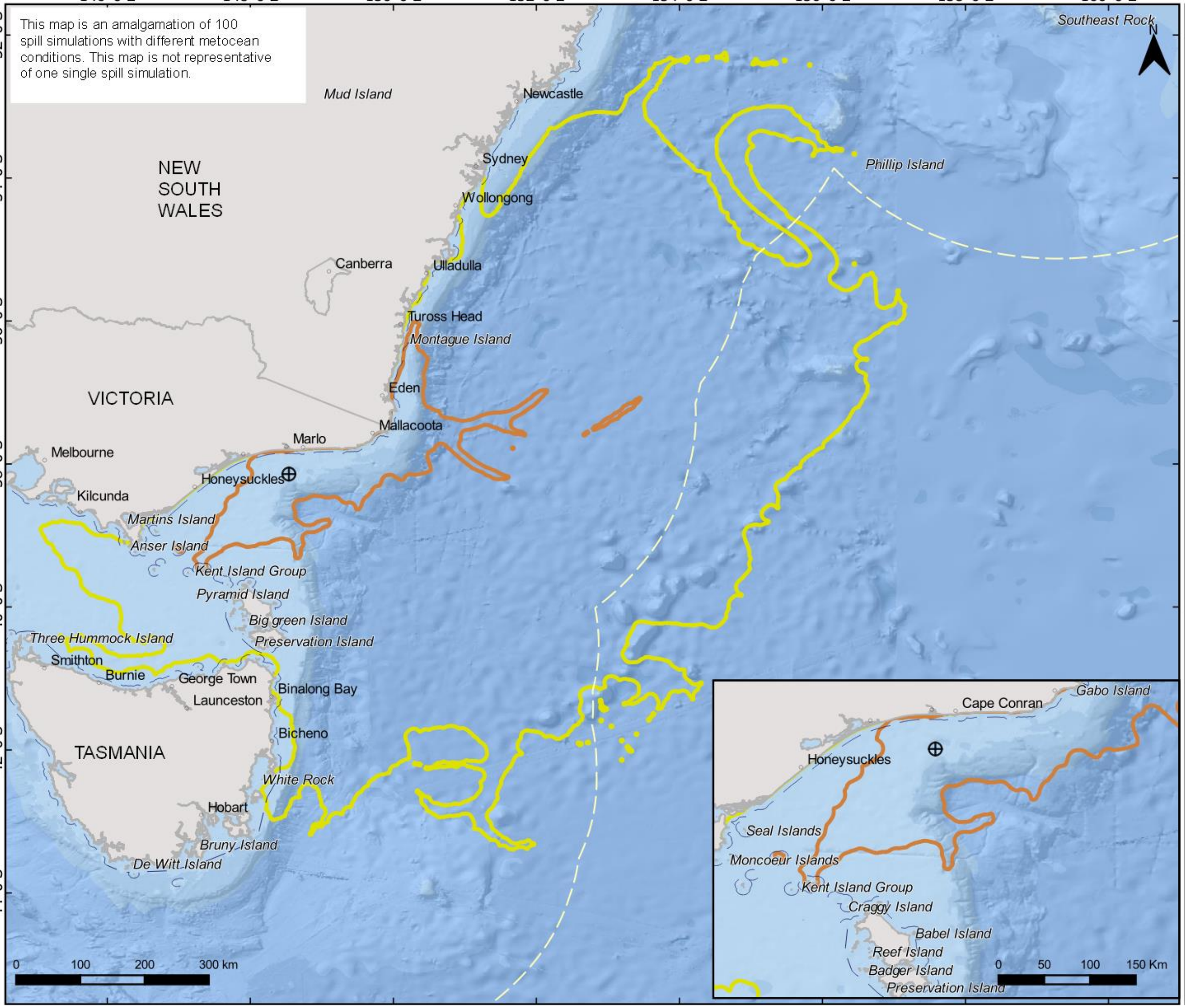
Receptors		Summer					Winter				
		Highest entrained concentration (ppb)	Probability (%) entrained hydrocarbon exposure at		Minimum time (days) before entrained hydrocarbon exposure at		Highest entrained concentration (ppb)	Probability (%) entrained hydrocarbon exposure at		Minimum time (days) before entrained hydrocarbon exposure at	
Type	Name		≥ 10 ppb	≥ 100 ppb	≥ 10 ppb	≥ 100 ppb		≥ 10 ppb	≥ 100 ppb	≥ 10 ppb	≥ 100 ppb
AMP	Beagle	127	78	4	5.21	25.79	67	23	-	12.04	-
	Central Eastern	13	2	-	66.21	-	10	1	-	21.42	-
	East Gippsland	163	76	6	6.38	7.13	130	98	8	4.17	11.75
	Flinders	85	26	-	10.54	-	80	39	-	7.42	-
	Freycinet	42	9	-	20.75	-	33	8	-	22.79	-
	Hunter	13	1	-	82.58	-	5	-	-	-	-
	Jervis	18	7	-	44.46	-	62	7	-	9.67	-
AQR	Towra Point	9	-	-	-	-	22	3	-	30.29	-
CA	Arthur Bay	16	5	-	38.88	-	8	-	-	-	-
	Marriott Reef	23	6	-	33.50	-	6	-	-	-	-
IMCRA	Batemans Shelf	200	63	19	6.88	8.58	140	89	11	2.88	22.04
	Boags	14	4	-	33.83	-	11	1	-	69.83	-
	Bruny	11	1	-	43.42	-	2	-	-	-	-
	Central Bass Strait	44	49	-	12.29	-	35	6	-	51.71	-
	Central Victoria	14	5	-	29.08	-	-	-	-	-	-
	Flinders	91	65	-	6.42	20.58	89	55	-	14.25	-
	Freycinet	31	16	-	13.83	-	23	10	-	26.00	-
	Hawkesbury Shelf	18	2	-	78.33	-	32	5	-	26.63	-
	Victorian Embayments	13	7	-	-	-	5	-	-	-	-

Receptors		Summer					Winter				
		Highest entrained concentration (ppb)	Probability (%) entrained hydrocarbon exposure at		Minimum time (days) before entrained hydrocarbon exposure at		Highest entrained concentration (ppb)	Probability (%) entrained hydrocarbon exposure at		Minimum time (days) before entrained hydrocarbon exposure at	
Type	Name		≥ 10 ppb	≥ 100 ppb	≥ 10 ppb	≥ 100 ppb		≥ 10 ppb	≥ 100 ppb	≥ 10 ppb	≥ 100 ppb
KEF	Big Horseshoe Canyon	518	95	27	5.00	17.92	298	98	64	1.42	1.42
	Canyons on the eastern continental slope	103	37	1	15.21	67.83	102	61	1	7.58	49.25
	Seamounts South and east of Tasmania	17	6	-	26.54	-	19	6	-	47.92	-
	Shelf rocky reefs	141	34	7	15.46	18.17	88	60	-	8.04	-
MNP	Ninety Mile Beach	21	7	-	41.71	-	10	1	-	75.25	-
	Point Hicks	332	95	74	1.63	2.08	366	100	43	1.63	3.58
	Wilsons Promontory	45	8	-	11.88	-	2	-	-	61.33	-
MP	Batemans	137	40	10	15.67	18.46	81	50	-	8.17	-
	Jervis Bay	15	2	-	88.04	-	101	7	1	13.17	62.46
MS	Beware Reef	221	58	11	5.25	27.42	129	53	7	2.25	22.13
NP	Kent Group	134	74	9	6.17	20.58	48	21	-	17.75	-
NPC	Booderee	6	-	-	-	-	21	4	-	24.25	-
NPS4	Nooramunga Marine and Coastal Park	13	7	-	47.54	-	5	-	-	-	-
Ramsar	Corner Inlet	13	7	-	-	-	5	-	-	-	-
RSB	Beware Reef	239	60	11	5.25	27.42	136	53	7	2.25	22.13
	Cutter Rock	30	17	-	11.92	-	10	1	-	76.67	-
	Endeavour Reef	46	59	-	11.33	-	31	14	-	46.83	-

Receptors		Summer					Winter				
		Highest entrained concentration (ppb)	Probability (%) entrained hydrocarbon exposure at		Minimum time (days) before entrained hydrocarbon exposure at		Highest entrained concentrati on (ppb)	Probability (%) entrained hydrocarbon exposure at		Minimum time (days) before entrained hydrocarbon exposure at	
Type	Name		≥ 10 ppb	≥ 100 ppb	≥ 10 ppb	≥ 100 ppb		≥ 10 ppb	≥ 100 ppb	≥ 10 ppb	≥ 100 ppb
	New Zealand Star Bank	328	100	78	1.63	1.92	433	100	72	0.79	2.17
	Wakitipu Rock	44	58	-	9.67	-	35	12	-	47.71	-
	Warrego Rock	41	52	-	16.83	-	21	12	-	48.29	-
	Wright Rock	46	60	-	1-	-	31	14	-	46.63	-
Nearshore Waters	Anser Island	12	5	-	26.21	-	-	-	-	-	-
	Babel Island	50	23	-	17.00	-	52	10	-	49.21	-
	Badger Island	16	11	-	40.04	-	15	2	-	69.63	-
	Bega Valley	171	98	28	4.50	6.96	168	98	18	1.88	13.63
	Big green Island	21	10	-	37.13	-	11	2	-	71.38	-
	Boxen Island	14	8	-	44.04	-	15	2	-	69.79	-
	Break O'Day	13	3	-	65.71	-	5	-	-	-	-
	Cape Barren Osland	39	12	-	15.54	-	17	6	-	49.13	-
	Chalky Island	24	7	-	32.33	-	11	1	-	71.38	-
	Clarke Island	22	4	-	16.08	-	10	1	-	8-	-
	Craggy Island	41	50	-	11.96	-	26	13	-	47.58	-
	Curtis Island	78	32	-	7.38	-	12	3	-	61.42	-
	East Gippsland	286	98	33	1.83	4.38	276	99	33	1.83	4.58
	East Kangaroo Island	21	9	-	32.96	-	12	2	-	70.42	-
	Eurobodalla	57	32	-	16.67	-	39	37	-	15.46	-
	Flinders Island	56	30	-	17.04	-	59	9	-	48.88	-
	Gabo Island	238	98	37	2.79	10.42	238	99	21	1.67	12.63

Receptors		Summer					Winter				
		Highest entrained concentration (ppb)	Probability (%) entrained hydrocarbon exposure at		Minimum time (days) before entrained hydrocarbon exposure at		Highest entrained concentration (ppb)	Probability (%) entrained hydrocarbon exposure at		Minimum time (days) before entrained hydrocarbon exposure at	
Type	Name		≥ 10 ppb	≥ 100 ppb	≥ 10 ppb	≥ 100 ppb		≥ 10 ppb	≥ 100 ppb	≥ 10 ppb	≥ 100 ppb
	Glamorgan - Spring Bay	13	5	-	39.58	-	1	-	-	-	-
	Glennie Group	11	1	-	72.67	-	-	-	-	-	-
	Goose Island	16	10	-	30.71	-	12	2	-	69.29	-
	Hogan Island Group	132	53	6	6.67	20.67	36	7	-	14.25	-
	Inner Sister Island	49	43	-	17.33	-	53	11	-	48.63	-
	Kanowna Island	16	7	-	27.67	-	-	-	-	-	-
	Kent Island Group	134	74	9	6.42	20.58	44	21	-	45.67	-
	Kiama	7	-	-	-	-	21	3	-	29.96	-
	Moncoeur Islands	47	15	-	11.88	-	12	2	-	61.33	-
	Montague Island	121	37	5	16.17	21.58	61	45	-	9.63	-
	Mount Chappell Island	17	11	-	38.00	-	13	2	-	70.96	-
	Northern Beaches	4	0	-	-	-	12	3	-	30.96	-
	Outer Sister Island	45	37	-	17.00	-	46	9	-	47.75	-
	Pasco Group	32	22	-	23.83	-	10	-	-	-	-
	Preservation Island	12	3	-	45.79	-	12	2	-	70.08	-
	Prime Seal Island	33	20	-	23.75	-	11	2	-	70.13	-
	Pyramid Island	51	56	-	9.25	-	39	5	-	48.79	-

Receptors		Summer					Winter				
		Highest entrained concentration (ppb)	Probability (%) entrained hydrocarbon exposure at		Minimum time (days) before entrained hydrocarbon exposure at		Highest entrained concentration (ppb)	Probability (%) entrained hydrocarbon exposure at		Minimum time (days) before entrained hydrocarbon exposure at	
Type	Name		≥ 10 ppb	≥ 100 ppb	≥ 10 ppb	≥ 100 ppb		≥ 10 ppb	≥ 100 ppb	≥ 10 ppb	≥ 100 ppb
	Randwick	11	1	-	81.29	-	29	3	-	30.13	-
	Reef Island	21	8	-	32.50	-	11	2	-	70.79	-
	Rodondo Island	47	9	-	12.21	-	3	-	-	-	-
	Seal Islands	37	15	-	13.79	-	11	1	-	76.08	-
	Shell Harbour	8	-	-	-	-	23	3	-	30.25	-
	Shoal Haven	15	2	-	80.54	-	98	10	-	12.63	-
	Skull Rock	14	7	-	27.75	-	-	-	-	-	-
	South Gippsland	36	8	-	12.50	-	3	-	-	-	-
	Sutherland Shire	17	1	-	79.29	-	31	5	-	27.04	-
	Vansittart Island	17	7	-	35.46	-	13	3	-	59.79	-
	Waverly	3	-	-	-	-	23	3	-	30.46	-
	Wellington	16	9	-	18.33	-	14	5	-	53.63	-
	Wollongong	13	1	-	83.88	-	16	5	-	3-	-
	Woollahra	3	-	-	-	-	16	3	-	30.67	-
State Waters	New South Wales	318	98	43	3.42	6.46	295	100	39	1.75	5.50
	Tasmania	134	74	9	6.17	20.58	59	21	-	13.25	-
	Victoria	419	100	78	1.58	2.04	431	100	53	1.13	2.04



Coordinate System: GCS WGS 1984
Datum: WGS 1984
Units: Degree

Date created: 05/12/2022

Summer

Zones of potential entrained hydrocarbon exposure

Scenario: 347,584 bbl (or 55,256 m³) subsea release of condensate over 77 days

Project: MAQ1186J AGR Emperor Energy OSM

Legend

⊕ Release Location
-- 3nm Coastal Waters
Exclusive Economic Zone

Entrained hydrocarbon exposure (ppb)

10 (Low)
100 (High)

Figure 14.12 Predicted zones of entrained hydrocarbon exposure from a subsea LOWC during summer conditions. The results were calculated from 100 spill simulations.

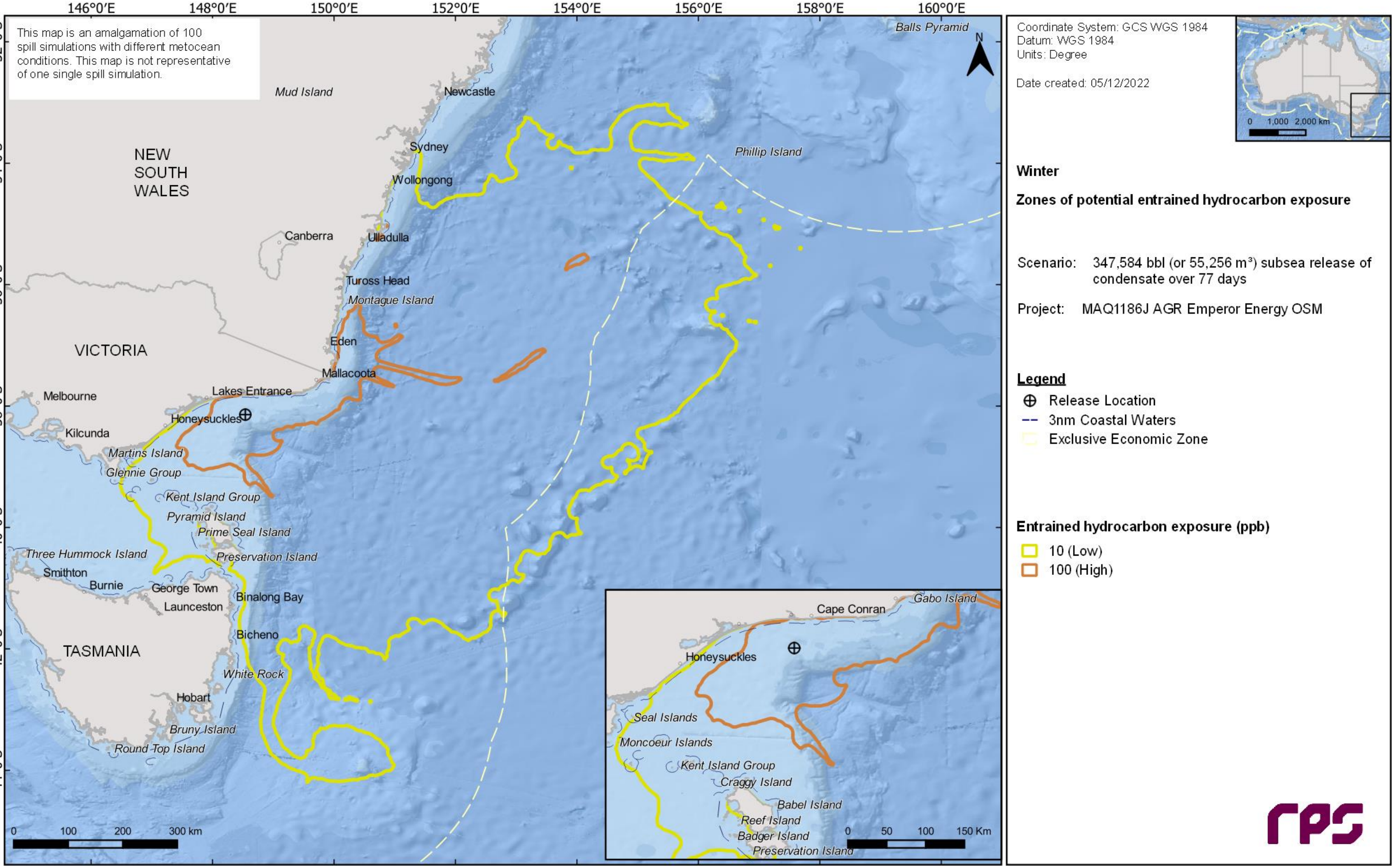


Figure 14.13 Predicted zones of entrained hydrocarbon exposure from a subsea LOWC during winter conditions. The results were calculated from 100 spill simulations.

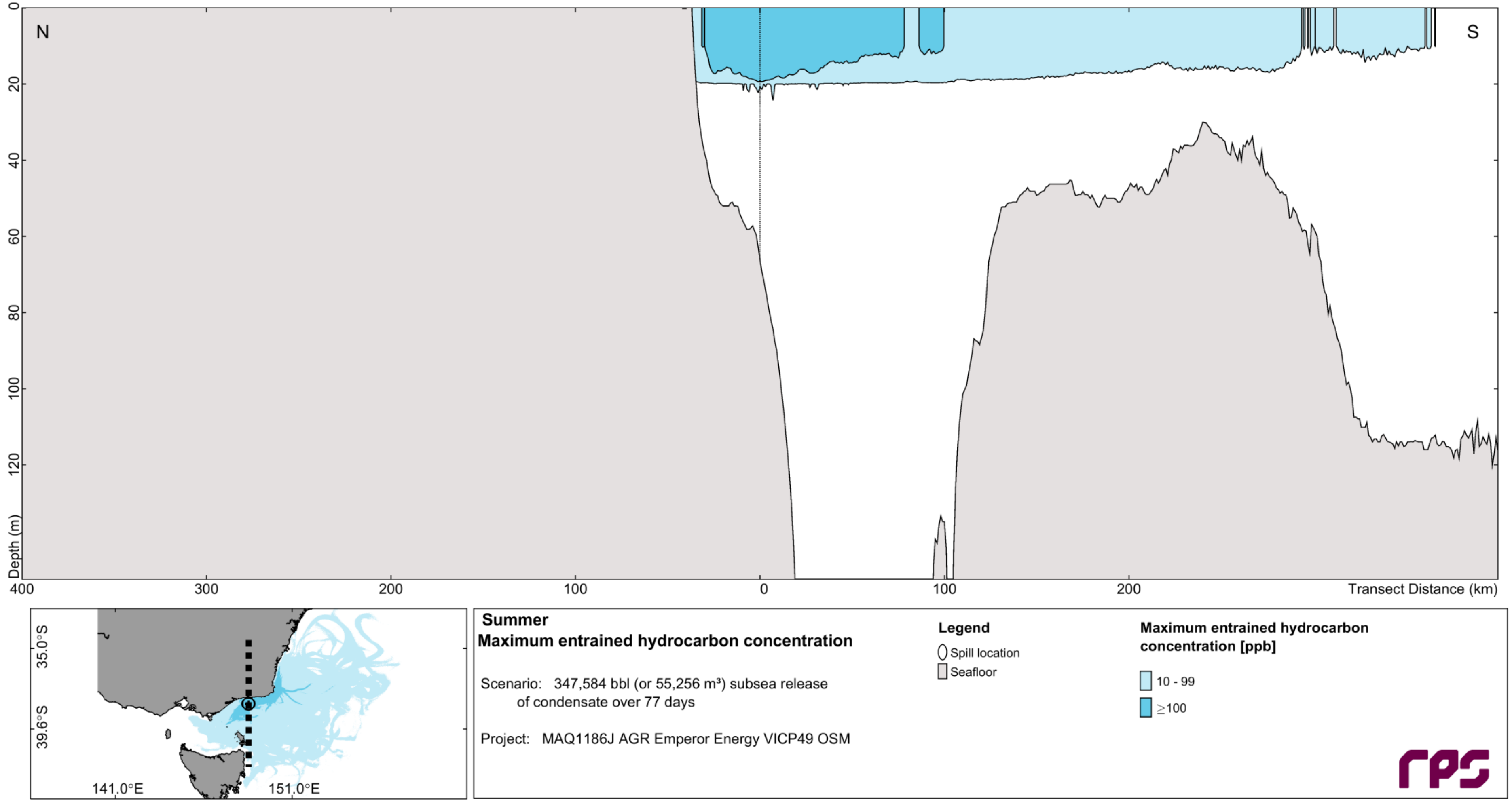


Figure 14.14 North-south cross-section transect of entrained hydrocarbon concentrations from a subsea LOWC during summer conditions. The results were calculated from 100 spill simulations.

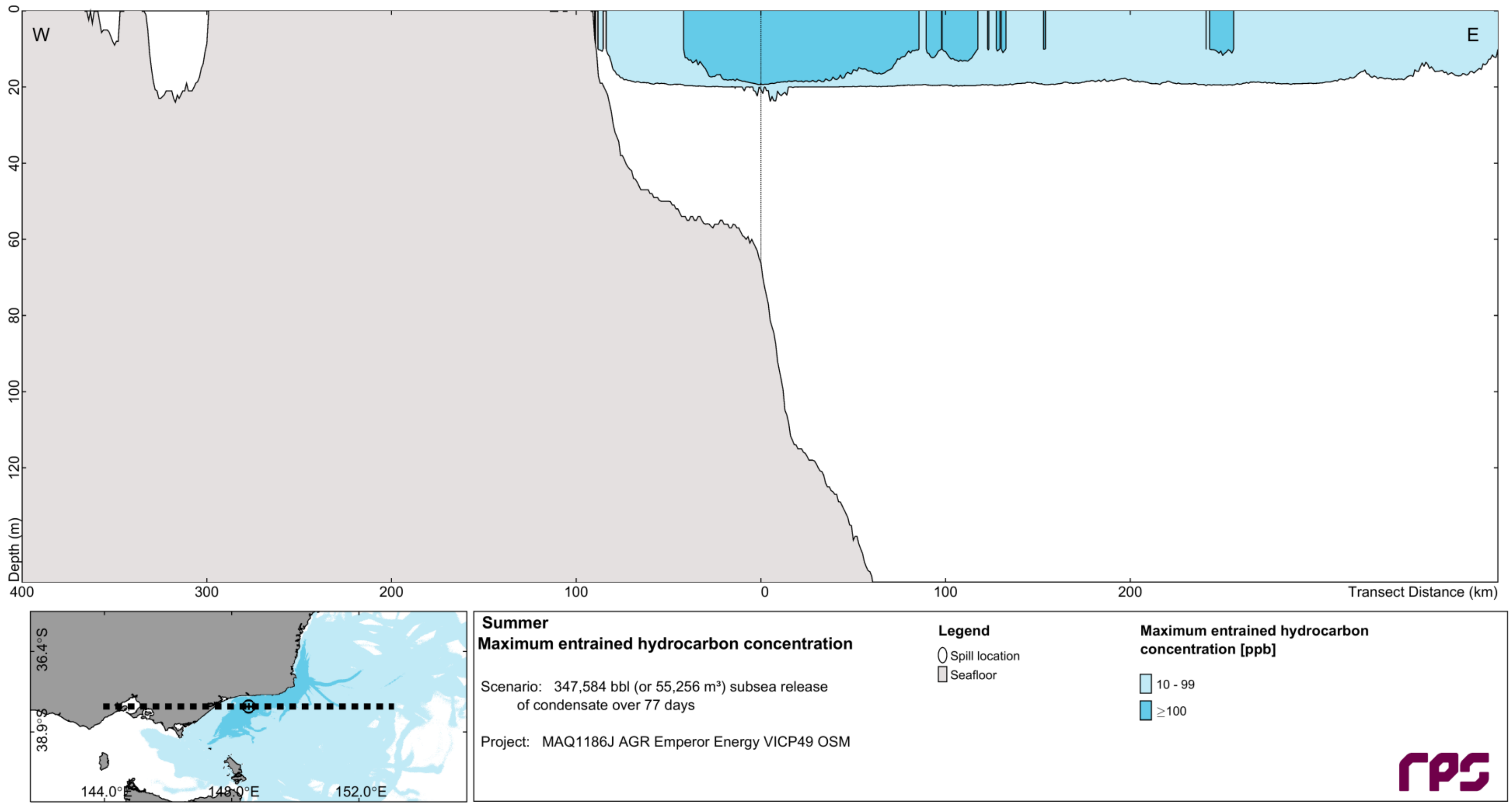


Figure 14.15 East-west cross-section transect of entrained hydrocarbon concentrations from a subsea LOWC during summer conditions. The results were calculated from 100 spill simulations.

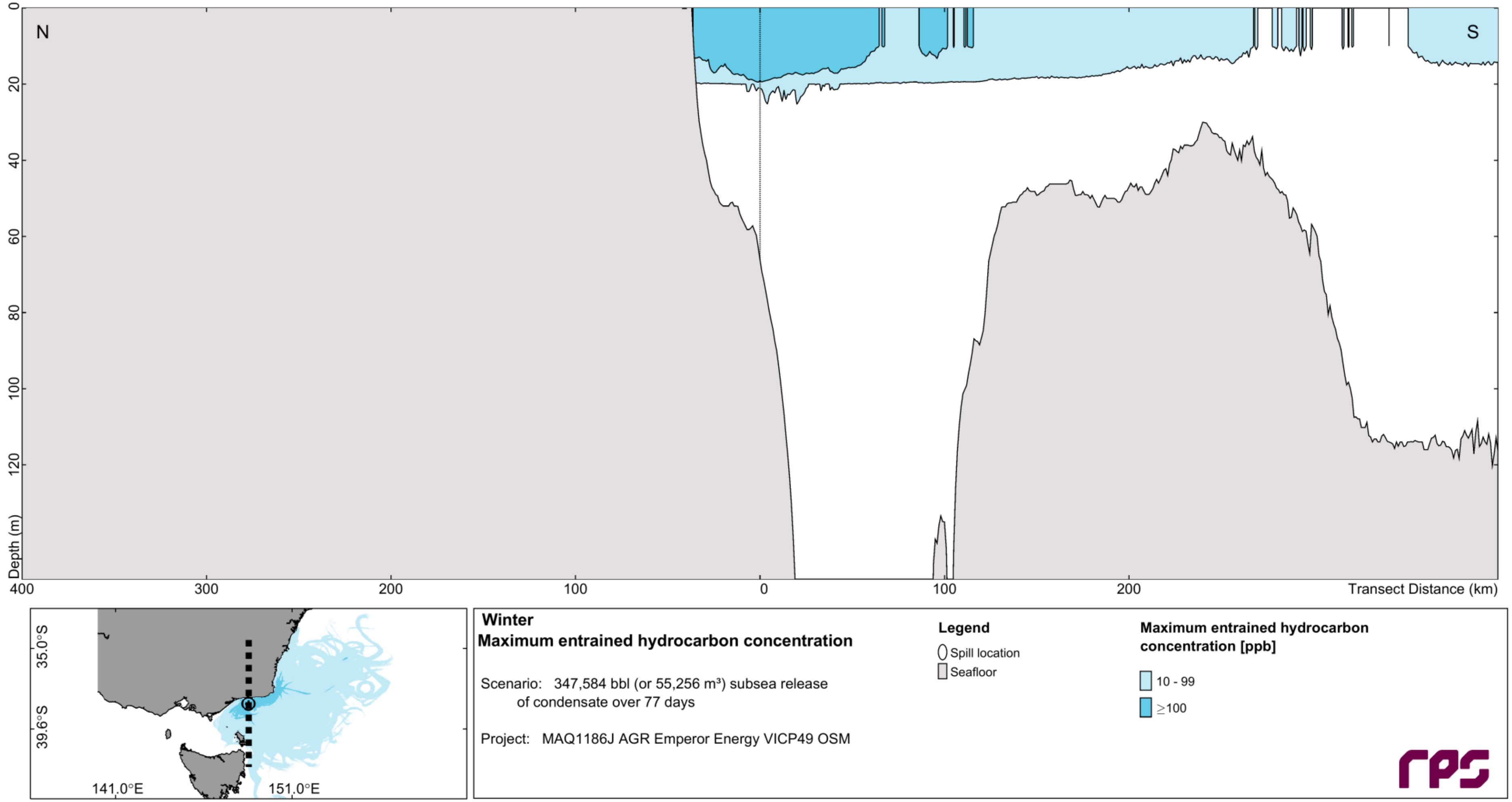


Figure 14.16 North-south cross-section transect of entrained hydrocarbon concentrations from a subsea LOWC during winter conditions. The results were calculated from 100 spill simulations.

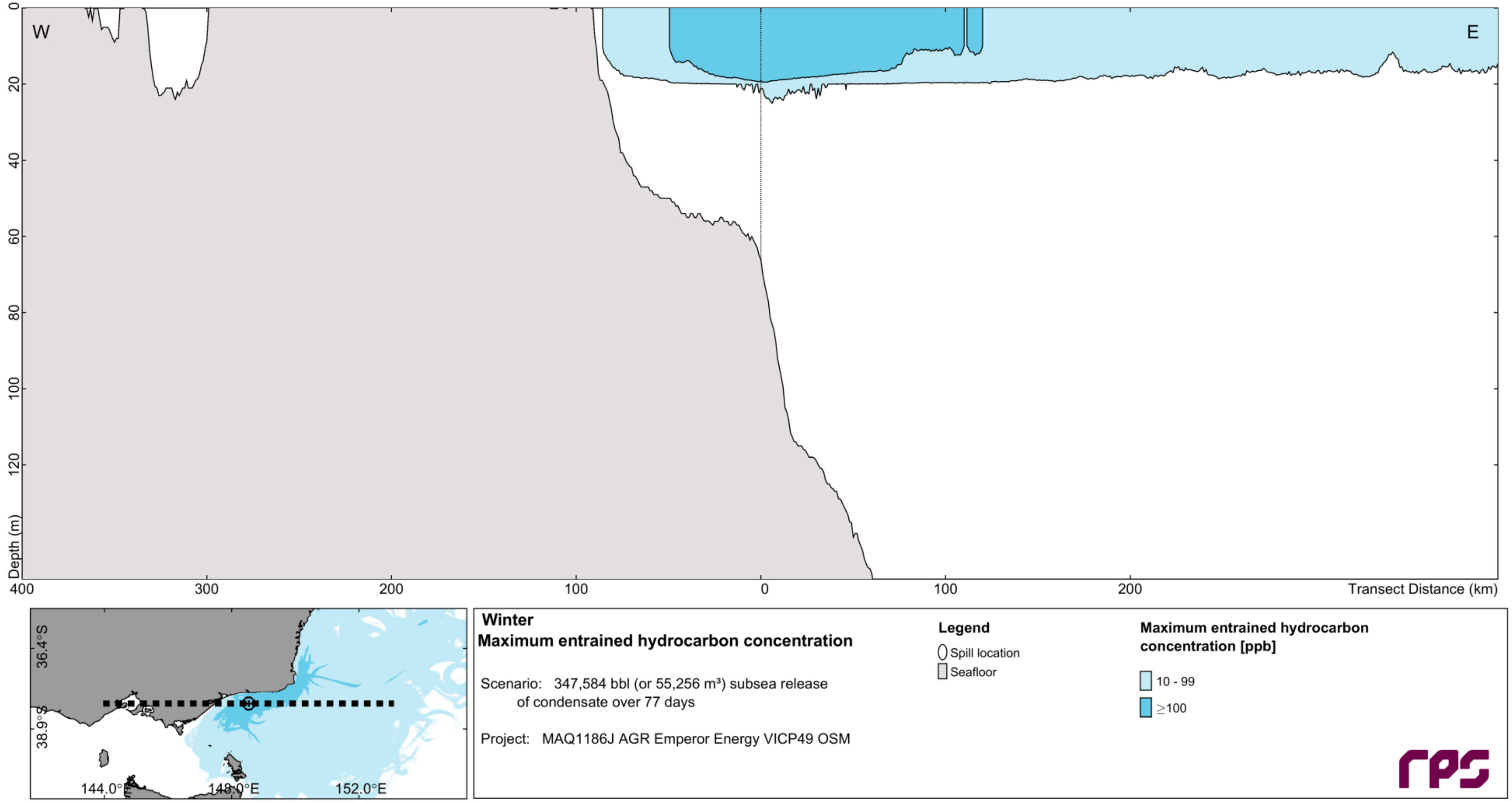


Figure 14.17 East-west cross-section transect of entrained hydrocarbon concentrations from a subsea LOWC during winter conditions. The results were calculated from 100 spill simulations.

14.3 Deterministic Analysis

The simulation that resulted in the largest volume of hydrocarbons ashore of 28.1 m^3 was identified as run number 54 and commenced during winter conditions, 10 pm 3rd June 2013.

Figure 14.18 presents the extent of the predicted floating oil exposure zones on the sea surface (swept area) and the shoreline loading over the entire simulation (107 days). Initial shoreline accumulation occurred on day 11.

The extent of the predicted entrained and dissolved hydrocarbon exposure zones in the 0–10 m depth layer over the entire 120 day simulation are presented in Figure 14.19and Figure 14.20, respectively.

Figure 14.21 presents the fates and weathering for the corresponding simulation. At the conclusion of the simulation (day-107), approximately 47,554 m^3 (~86%) was lost to the atmosphere through evaporation. Approximately, 6,866 m^3 (~12%) of the released volume decayed, while approximately 834 m^3 (~2%) was predicted to remain within the water column and less than 1 m^3 (<1%) was present on the shorelines.

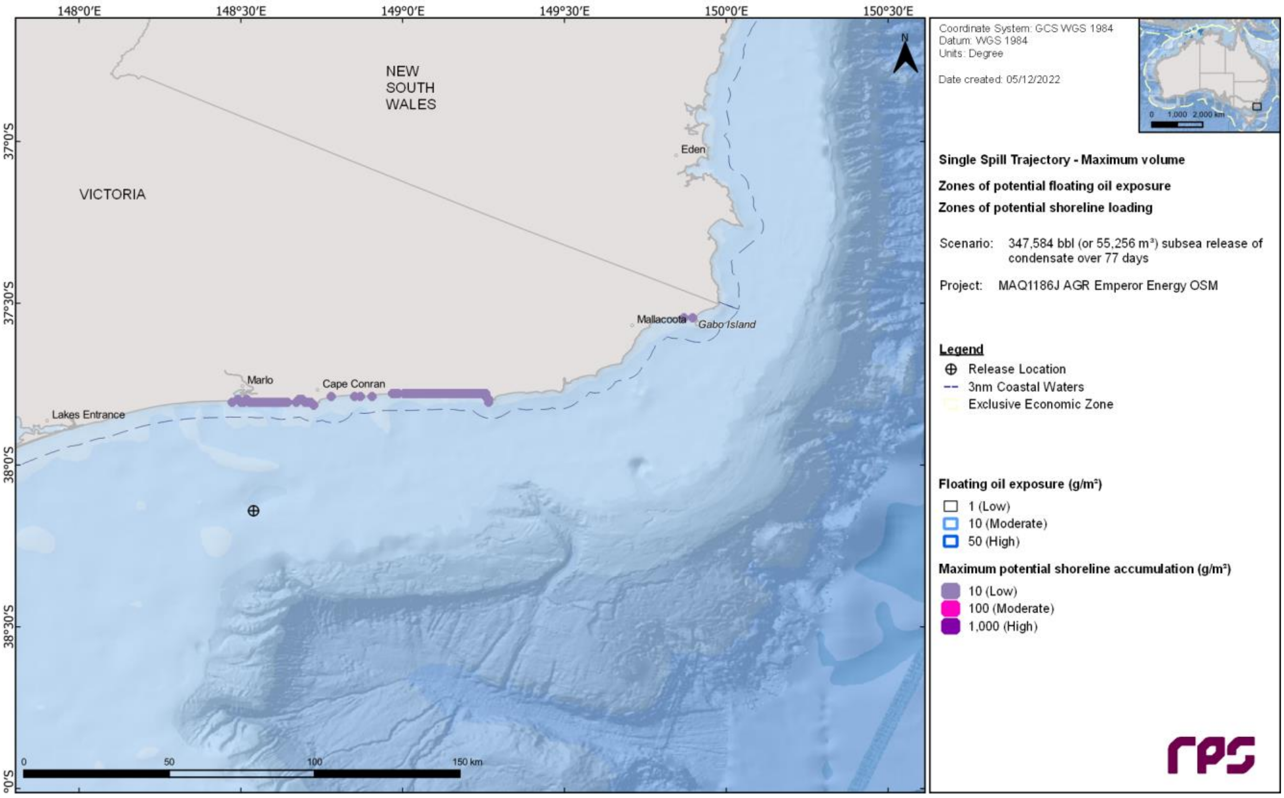


Figure 14.18 Predicted extent of the floating oil exposure and shoreline loading over the entire 107 days of the simulation that led to the largest volume of oil ashore from a subsea LOWC.

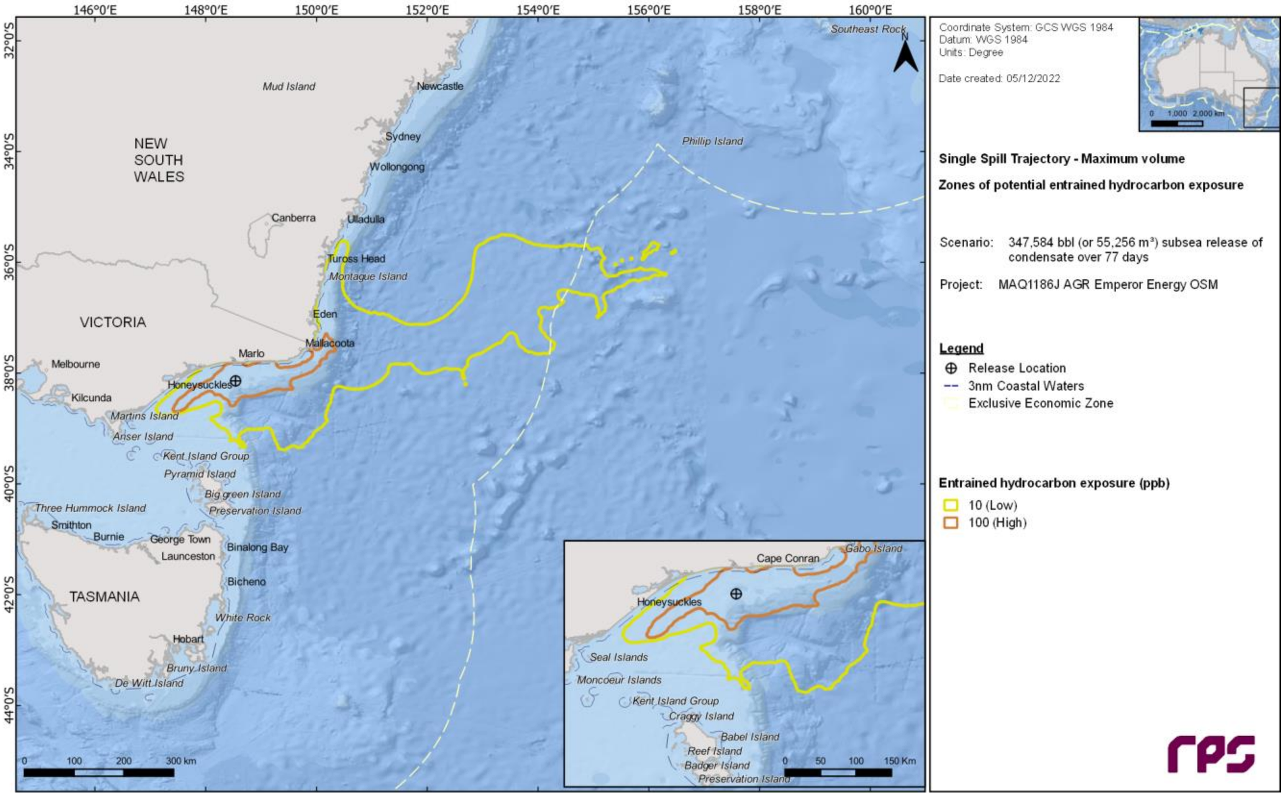


Figure 14.19 Predicted extent of the entrained hydrocarbons exposure over the entire 107 days of the simulation that led to the largest volume of oil ashore from a subsea LOWC.

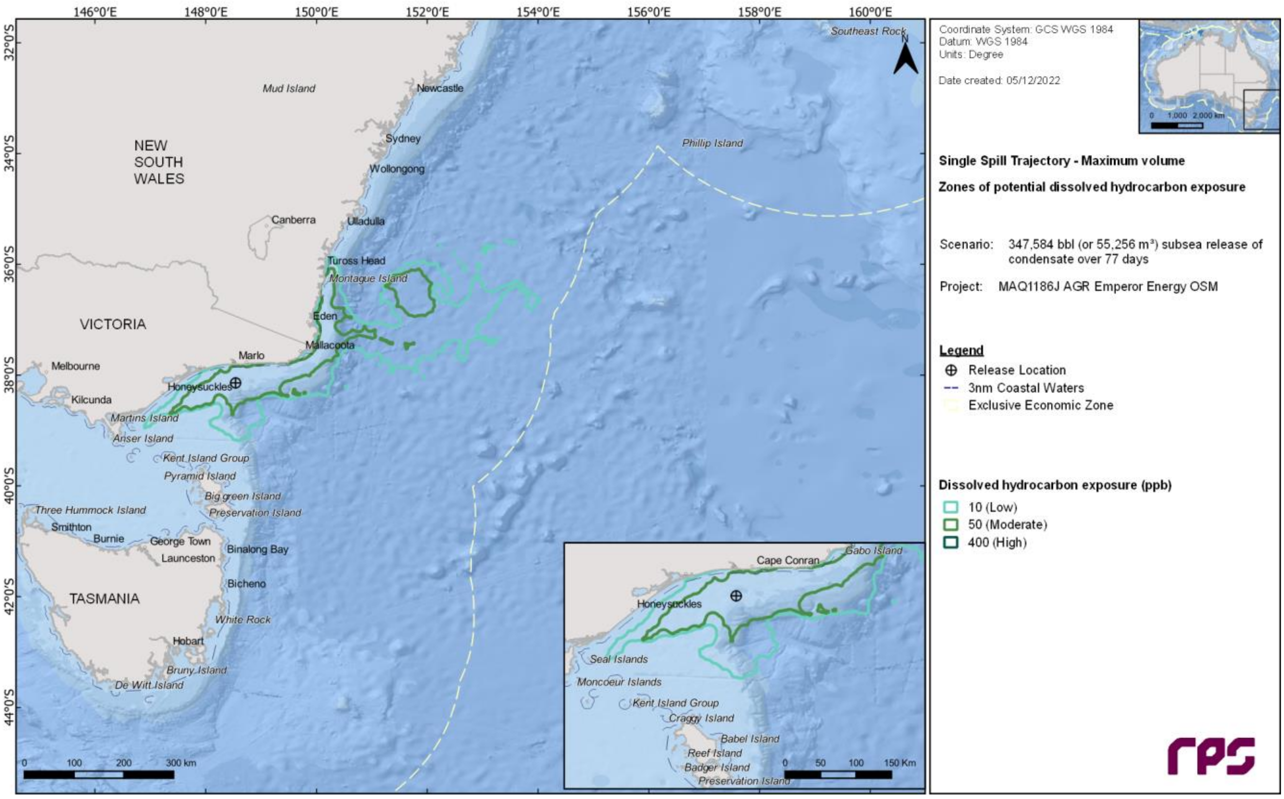


Figure 14.20 Predicted extent of the dissolved hydrocarbons exposure over the entire 107 days of the simulation that led to the largest volume of oil ashore from a subsea LOWC.

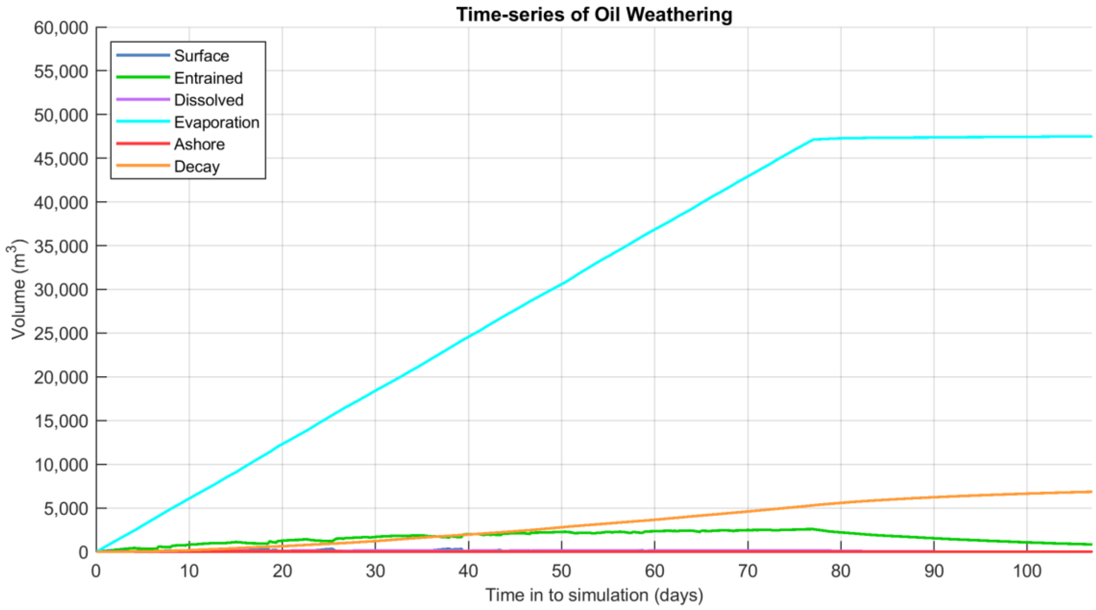


Figure 14.21 Predicted weathering and fates for the simulation that led to the largest volume of oil ashore from a subsea LOWC.

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APPENDIX D STAKEHOLDER CONSULTATION - CORRESPONDENCE SUMMARY

Stakeholder Consultation Correspondence Summary

Resources were developed and distribute to relevant stakeholders to support initial consultation post December 2022. The summary of consultation correspondence and contact method was logged using the reference codes listed in Table 9-1. Consultation correspondence records have been provided to NOPSEMA separately as 'Sensitive Information' under Regulation 26(8) of the OPGGS(E).

Table 9-1: Summary of stakeholder consultation and Emperor Energy assessment of objections and claims

RELEVANT PERSON	TYPE	REF#	DATE	HOW	EMPEROR INFORMATION AND RESPONSE INCLUDING ANY MEASURES ADOPTED.	RELEVANT PERSON RESPONSE	MERIT ASSESSMENT
Commonwealth Department or Agency							
Australian Fisheries Management Authority (AFMA)	Cwth Government	AFMA-01	16/12/2022	Email	Introduction email with attached information sheet (Dec 2022)	No response	N/A
		AFMA-02	24/11/2024	Email	Provided information sheet version 2 with updated timing – see Section 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.3 have been provided. No further information has been requested, and no matters raised remain outstanding. Relevant person was first contacted in Dec 2022; no additional time has been requested.			
Australian Hydrological Office (AHO)	Cwth Government	AHO-01	30/12/2024	Email	Provided information sheet version 2 with updated timing – see Section 7.1.3. An offer to meet was also provided.		N/A
		AHO-02	02/01/2025	Email	Measures adopted: Advice agreed and will be followed	Acknowledged receiving data of Judith-2 well location to be registered on Navigational Charting products. No claims or queries raised.	No objections or claims
		AHO-03	23/01/2025	Email	Measures adopted: Advice agreed and captured in Section 7.2	Advised AHO has no concerns with any Judith-2 activities. Provided link to fact sheet on reporting maritime activities. Advised contact with AHO is only required once activity commences.	No objections or claims
		AHO-04	24/01/2025	Email	Confirmed AHO requirements for AHO notifications. Queried notification period for AHO.		N/A
		AHO-05	28/01/2025	Email	Measures adopted: Advice agreed and captured in Section 7.2	Confirmed notification period of 21 days prior to activity commencing.	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested, and no matters raised remain outstanding. Relevant person was first contacted in Dec 2024; no additional time has been requested.			
Australian Maritime Safety Authority (AMSA)	Cwth Government	AMSA-01	16/12/2022	Email	Introduction email with attached information sheet (Dec 2022). Measures adopted: Advice agreed and captured in Section 7.2		No objections or claims
		AMSA-02	20/12/2022	Email	Measures adopted: Advice agreed and captured in Section 7.2	AMSA replied to the introduction email to inform on distribution of Maritime Safety Information to recommended agencies. Also to ensure vessels comply with COLREGs.	No objections or claims

RELEVANT PERSON	TYPE	REF#	DATE	HOW	EMPEROR INFORMATION AND RESPONSE INCLUDING ANY MEASURES ADOPTED.	RELEVANT PERSON RESPONSE	MERIT ASSESSMENT
		AMSA-03	21/12/2022	Email	Reply to confirm these requirements will be included in the Judith-2 Exploration Drilling Environment Plan.		N/A
		AMSA-04	24/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided. Checked as to whether prior advice remained current.		N/A
		AMSA-05	26/11/2024	Email	Measures adopted: Advice agreed captured in Section 7.2 and other agency consulted.	AMSA provided details of further agencies to consult or notify and regulations to comply with suggested timeframes before activities commence.	No objections or claims
		AMSA-06	27/11/2024	Email	Confirmed that Emperor Energy will comply with requirements.		
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested, and no matters raised remain outstanding. Relevant person was first contacted in Dec 2022; no additional time has been requested.			
Commonwealth Department of Climate Change, Energy, the Environment and Water- Underwater Cultural Heritage	Cwth Government	UCHD-01	12/06/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		UCHD-02	13/12/2024	Email	Provided information sheet version 2 with updated timing – see Section 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in June 2023; no additional time has been requested.			
Department of Agriculture, Fisheries and Forestry (DAFF) - Biosecurity (marine pests)	Cwth Government	DAFF-MP-01	19/12/2022	Email	Introduction email with attached information sheet (Dec 2022)	No response	N/A
		DAFF-MP-02	24/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided. Checked as to whether prior advice remained current.	No response	N/A
		DAFF-MP-03	24/11/2024	Email		Undelivered email return. No response.	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in Dec 2022; no additional time has been requested.			
Department of Agriculture, Fisheries and Forestry (DAFF) - Biosecurity (vessel, aircraft and personnel)	Cwth Government	DAFF-VAP-01	19/12/2022	Email	Introduction email with attached information sheet (Dec 2022)	No response	N/A
		DAFF-VAP-02	24/11/2024	Email	Provided information sheet version 2 with updated timing – see Section 7.1.3. An offer to meet was also provided. Checked as to whether prior advice remained current.	N/A	N/A

RELEVANT PERSON	TYPE	REF#	DATE	HOW	EMPEROR INFORMATION AND RESPONSE INCLUDING ANY MEASURES ADOPTED.	RELEVANT PERSON RESPONSE	MERIT ASSESSMENT
		DAFF-VAP-03	24/11/2024	Email		Undelivered email return. No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in Dec 2022; no additional time has been requested. Initial email delivered successfully, recent follow up email bounced, and alternate email contact could not be found. But emails to DAFF Biosecurity Marine Pests was successful.			
Department of Agriculture, Fisheries and Forestry (DAFF) - Fisheries	Cwth Government	DAFF-FISH-01	16/12/2022	Email	Introduction email with attached information sheet (Dec 2022)	No response	N/A
		DAFF-FISH-02	02/07/2023	Email	Follow up email to introductory email	No response	N/A
		DAFF-FISH-03	24/11/2024	Email	Provided information sheet version 2 with updated timing – see Section 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in Dec 2022; no additional time has been requested.			
Department of Defence (DoD)	Cwth Government	DOD-01	21/12/2022	Email	Introduction email with attached information sheet (Dec 2022) and Map showing title details, OA, defence areas and potential UXO sites.		N/A
		DOD-02	23/01/2023	Email	Measures adopted: Advice agreed and captured in Section 7.2. UXO advice captured in Section 4.7.3.3	DoD replied to the introduction email to notify that proposed operations are located outside Defence Training Areas and restricted airspace. Hwover, advised that UXO may be present on the seafloor, and Emperor Energy must understand the risks associated. DoD also advised liaison with AHS for Notices to Mariners, in particular notifying AHS 3-weeks prior to commencement of activities.	No objections or claims.
		DOD-03	23/02/2023	Email	Reply to confirm these requirements will be actioned.		N/A
		DOD-04	24/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided. Checked as to whether prior advice remained current.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested, and no matters raised remain outstanding. Relevant person was first contacted in Dec 2022; no additional time has been requested.			
Director of National Parks - Parks Australia	Cwth Government	DNP-01	19/12/2022	Email	Introduction email with attached information sheet (Dec 2022) and Map showing AMPs within OA and Hydrocarbon Exposure Area	No response	N/A

RELEVANT PERSON	TYPE	REF#	DATE	HOW	EMPEROR INFORMATION AND RESPONSE INCLUDING ANY MEASURES ADOPTED.	RELEVANT PERSON RESPONSE	MERIT ASSESSMENT
		DNP-02	13/12/2024	Email	Provided package of data in line with the NOPSEMA/DNP consultation guidance note: *Petroleum activities and Australian Marine Parks*		
		DNP-03	13/12/2024	Email		Undeliverable email. No response	Emails delivered to multiple DNP email addresses.
		DNP-04	10/01/2025	Email	Advice agreed and acknowledged and already captured in EP.	Acknowledged that Judith-2 activities do not overlap Australian Marine Parks and does not require authorisation or further action from DNP. Advised that the EP follows the objectives and values complying with marine parks. Sought further advise on the activities that occur within the operational area. Provided information in the case that a hydrocarbon incident occur and may impact a marine park. Advised that further notification is not required.	No objections or claims.
		DNP-05	21/01/2025	Email	Confirmed EP complies with marine park management and confirmed operational area activities. Confirmed hydrocarbon incident notification requirements and procedures.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested, and no matters raised remain outstanding. Information provided in the form requested by relevant person. Relevant person was first contacted in Dec 2024; no additional time has been requested.			
Conservation groups/ Environmental NGOs							
Australian Coastal Society	Conservation groups/ Environmental NGOs	AUCS-01	1/05/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		AUCS-02	13/12/2024	Email	Provided information sheet version 2 with updated timing – see Section 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in May 2023; no additional time has been requested.			
Australian Conservation Foundation	Conservation groups/ Environmental NGOs	ACF-01	1/05/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		ACF-02	13/12/2024	Email	Provided information sheet version 2 with updated timing – see Section 7.1.3. An offer to meet was also provided.	No response	N/A

RELEVANT PERSON	TYPE	REF#	DATE	HOW	EMPEROR INFORMATION AND RESPONSE INCLUDING ANY MEASURES ADOPTED.	RELEVANT PERSON RESPONSE	MERIT ASSESSMENT
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in May 2023; no additional time has been requested.			
Australian Marine Conservation Society	Conservation groups/ Environmental NGOs	AMCS-01	1/05/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		AMCS-02	13/12/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in May 2023; no additional time has been requested.			
Environment Tasmania	Conservation groups/ Environmental NGOs	TAS-ET-01	1/05/2023	Email	Introduction email with attached information sheet (March 2023) (email incorrectly sent to Victorian office)	No response	N/A
		TAS-ET-02	13/12/2024	Email	Provided information sheet version 2 with updated timing – see Section 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.3 have been provided. No further information has been requested. Relevant person was first contacted in May 2023; no additional time has been requested.			
Environment Victoria	Conservation groups/ Environmental NGOs	VIC-EV-01	1/05/2023	Email	Introduction email with attached information sheet (March 2023)		N/A
		VIC-EV-02	5/05/2023	Email		Request for stakeholder consultation timeframes and development of Environmental Plan	N/A
		VIC-EV-03	12/05/2023	Email		Auto-response	N/A
		VIC-EV-04	12/05/2023	Email	In response to query, request for feedback in the next 30 days, and provided expected timing for submission of EP.		N/A
		VIC-EV-05	13/12/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.		N/A
		VIC-EV-06	13/12/2024	Email	Measures adopted: Contacts register updated	Auto-response stating Staff member email address is no longer correct and supplied correct email address to direct to	N/A
		VIC-EV-07	13/12/2024	Email	Measures adopted: Contacts register updated	Auto-response stating Staff member email address is no longer correct. Supplied correct email address to direct to	N/A
		VIC-EV-08	13/12/2024	Email	Provided information sheet version 2 with updated timing to Staff member – see 7.1.3. An offer to meet was also provided.		N/A

RELEVANT PERSON	TYPE	REF#	DATE	HOW	EMPEROR INFORMATION AND RESPONSE INCLUDING ANY MEASURES ADOPTED.	RELEVANT PERSON RESPONSE	MERIT ASSESSMENT
		VIC-EV-09	16/12/2024	Email	Measures adopted: Contacts register updated	Supplied updated contact email address for relevant staff member	N/A
		VIC-EV-10	16/12/2024	Email	Measures adopted: Contacts register updated	Supplied updated contact email address for relevant staff member	N/A
		VIC-EV-11	08/01/2025	Email		Auto-reply	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.3 have been provided. Information requested was provided. No further information has been requested. Relevant person was first contacted in May 2023; no additional time has been requested.			
Friends of the Earth Melbourne	Conservation groups/ Environmental NGOs	VIC-FOE-01	1/05/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		VIC-FOE-02	13/12/2024	Email	Provided information sheet version 2 with updated timing – see Section 7.1.3. An offer to meet was also provided.		N/A
		VIC-FOE-03	13/12/2024	Email		Auto reply out of office. No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.3 have been provided. No further information has been requested. Relevant person was first contacted in May 2023; no additional time has been requested.			
Greenpeace Australia	Conservation groups/ Environmental NGOs	GPA-01	1/05/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		GPA-02	13/12/2024	Email	Provided information sheet version 2 with updated timing – see Section 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.3 have been provided. No further information has been requested. Relevant person was first contacted in May 2023; no additional time has been requested.			
Sea Shepherd Australia	Conservation groups/ Environmental NGOs	SSA-01	1/05/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		SSA-02	13/12/2024	Email	Provided information sheet version 2 with updated timing – see Section 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.3 have been provided. No further information has been requested. Relevant person was first contacted in May 2023; no additional time has been requested.			
Surfers for Climate	Conservation groups/ Environmental NGOs	SFC-01	1/05/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		SFC-02	13/12/2024	Email	Provided information sheet version 2 with updated timing – see Section 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.3 have been provided. No further information has been requested. Relevant person was first contacted in May 2023; no additional time has been requested.			

RELEVANT PERSON	TYPE	REF#	DATE	HOW	EMPEROR INFORMATION AND RESPONSE INCLUDING ANY MEASURES ADOPTED.	RELEVANT PERSON RESPONSE	MERIT ASSESSMENT
Whale and Dolphin Conservation Australia	Conservation groups/ Environmental NGOs	WDCA-01	1/05/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		WDCA-02	13/12/2024	Email	Provided information sheet version 2 with updated timing – see Section 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.3 have been provided. No further information has been requested. Relevant person was first contacted in May 2023; no additional time has been requested.			
Wilderness Society	Conservation groups/ Environmental NGOs	WS-01	1/05/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		WS-02	13/12/2024	Email	Provided information sheet version 2 with updated timing – see Section 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.3 have been provided. No further information has been requested. Relevant person was first contacted in May 2023; no additional time has been requested.			
World Wildlife Fund Australia	Conservation groups/ Environmental NGOs	WWFA-01	1/05/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		WWFA-02	13/12/2024	Email	Provided information sheet version 2 with updated timing – see Section 7.1.3. An offer to meet was also provided.	No response	N/A
		WWFA-03	13/12/2024	Email		Auto reply acknowledging email has been received. No response	
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.3 have been provided. No further information has been requested. Relevant person was first contacted in May 2023; no additional time has been requested.			
Energy Industry and Port Operators							
Carnarvon Hibiscus Pty Ltd	Energy Industry	CH-01	29/05/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		CH-02	29/05/2023	Email	Re-sent to generic email as previous email bounced		N/A
		CH-03	30/05/2023	Email		Response stating organisation does not wish to be consulted further	No objections or claims. Relevant person has been provided sufficient information, and has advised there is no need to meet or to be kept informed. Closed.
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.3 have been provided. No further information has been requested and noted they do not need to be consulted further on this activity. Relevant person was first contacted in May 2023; no additional time has been requested.			

RELEVANT PERSON	TYPE	REF#	DATE	HOW	EMPEROR INFORMATION AND RESPONSE INCLUDING ANY MEASURES ADOPTED.	RELEVANT PERSON RESPONSE	MERIT ASSESSMENT
Amplitude Energy (previously Cooper Energy)	Energy Industry	CE-01	28/02/2023	Email		Cooper Energy email to inform of 2023 activities, includes fact sheet. Cooper Energy request to be informed on Emperor Energy offshore activity.	N/A
		CE-02	12/05/2023	Email	Acknowledgement of email with no objections. Invitation to comment on proposed drilling activities of Judith-2		N/A
		CE-03	26/05/2023	Email	Measures adopted: Request to be informed agreed and will be captured as per Section 7.2.	Response requesting to be kept informed, especially approaching commencement	No objections or claims.
		CE-04	28/05/2023	Email	Acknowledged		
		CE-05	24/11/2024	Email	Provided information sheet version 2 with updated timing to Amplitude (Cooper Energy)– see Section 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.3 have been provided. No further information has been requested. Relevant person was first contacted in May 2023; no additional time has been requested.			
ESSO	Energy Industry	ESSO-01	12/05/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		ESSO-02	13/12/2024	Email	Provided information sheet version 2 with updated timing – see Section 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.3 have been provided. No further information has been requested. Relevant person was first contacted in May 2023; no additional time has been requested.			
Flotation Energy	Energy Industry	FE-01	29/05/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		FE-02	13/12/2024	Email	Provided information sheet version 2 with updated timing – see Section 7.1.3. An offer to meet was also provided.		N/A
		FE-03	16/12/2024	Email		Responded to state that Judith-2 activity is unlikely to interfere with Flotation activity. Other matter raised of a commercial nature and included in sensitive information report.	No objections or claims.
		FE-04	08/01/2025	Email	Acknowledged response.		Noted that Judith-2 activity is unlikely to interfere with Flotation activity
		FE-05	08/01/2025	Email		Auto-response	N/A

RELEVANT PERSON	TYPE	REF#	DATE	HOW	EMPEROR INFORMATION AND RESPONSE INCLUDING ANY MEASURES ADOPTED.	RELEVANT PERSON RESPONSE	MERIT ASSESSMENT
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.3 have been provided. No further information has been requested. Relevant person was first contacted in May 2023; no additional time has been requested.			
Qube Ports	Energy Industry	QP-01	28/05/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		QP-02	13/12/2024	Email	Provided information sheet version 2 with updated timing – see Section 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.3 have been provided. No further information has been requested. Relevant person was first contacted in May 2023; no additional time has been requested.			
Oceanex	Energy Industry	OE-01	29/05/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		OE-02	13/12/2024	Email	Provided information sheet version 2 with updated timing – see Section 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.3 have been provided. No further information has been requested. Relevant person was first contacted in May 2023; no additional time has been requested.			
Port Anthony Renewables	Renewable Energy Developer	PA-01	28/05/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		PA-02	13/12/2024	Email	Provided information sheet version 2 with updated timing – see Section 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.3 have been provided. No further information has been requested. Relevant person was first contacted in May 2023; no additional time has been requested.			
First Nations							
Aboriginal Land Council of Tasmania	First Nations	TAS-ALCT-01	16/12/2022	Email	Introduction email with attached information sheet (Dec 2022)		
		TAS-ALCT-02	16/12/2022	Email		Auto reply message – email- not public email	No objections or claims
		TAS-ALCT-03	16/12/2022	Email	Introduction email to member with attached information sheet (Dec 2022)	No response	N/A
		TAS-ALCT-04	21/12/2022	Phone	Introduced Emperor Energy and that contacting ALCT in relation to Emperor's activities off Victoria and that we would like some support from them in 2023 as to how we would consult with Indigenous persons and groups. As we are new to this type of consultation, we are looking for some support.	ALCT provided updated contact email and would forward email on to the relevant person.	N/A
		TAS-ALCT-05	21/12/2022	Email	Introduction email with attached information sheet sent (Dec 2022) to the updated email	No response	N/A

RELEVANT PERSON	TYPE	REF#	DATE	HOW	EMPEROR INFORMATION AND RESPONSE INCLUDING ANY MEASURES ADOPTED.	RELEVANT PERSON RESPONSE	MERIT ASSESSMENT
		TAS-ALCT-06	13/12/2024	Email	Provided information sheet version 2 with updated timing – see Section 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.3 have been provided. No further information has been requested. Additional contact made by phone, but no further response received. Relevant person was first contacted in Dec 2022; no additional time has been requested.			
Batemans Bay Local Aboriginal Land Council (NSW)	First Nations	NSW-BBLALC-01	3/04/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		NSW-BBLALC-02	13/12/2024	Email	Provided information sheet version 2 with updated timing – see Section 7.1.3. An offer to meet was also provided. Requested guidance as to whether management could act on behalf of members and requested that email be shared with members if appropriate to do so.	No response	N/A
		NSW-BBLALC-03	28/01/2025	Email	Follow up email to the previous email. Provided an opportunity to meet.	No response	N/A
		NSW-BBLALC-04	07/02/2025	Phone call	Left a message with contact number and advised I would follow up next week.	No response	N/A
		NSW-BBLALC-05	12/02/2025	Phone call	Left a message advising I was following up on the call from the 07/02/2025 to follow up on consultation. Advised they could contact via phone or via email	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.3 have been provided. No further information has been requested. Additional contact made by phone, but no further response received. Relevant person was first contacted in April 2023; no additional time has been requested.			
Bega Local Aboriginal Council (NSW ALC)	First Nations	NSW-BLALC-01	20/03/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		NSW-BLALC-02	13/12/2024	Email	Provided information sheet version 2 with updated timing – see Section 7.1.3. An offer to meet was also provided. Requested guidance as to whether management could act on behalf of members and requested that email be shared with members if appropriate to do so.	No response	N/A
		NSW-BLALC-03	28/01/2025	Email	Follow up email to the previous email. Provided an opportunity to meet.	No response	N/A
		NSW-BLALC-04	07/02/2025	Phone Call	Spoke with administration who advised the email of the best contact.	Advised they would address with member and provided email address	N/A
		NSW-BLALC-05	07/02/2025	Email	Provided information sheet version 2 with updated timing to updated email address to member– see Section 7.1.3. An offer to meet was also provided. Requested guidance as to whether management could act on behalf of members and requested that	No response	N/A

RELEVANT PERSON	TYPE	REF#	DATE	HOW	EMPEROR INFORMATION AND RESPONSE INCLUDING ANY MEASURES ADOPTED.	RELEVANT PERSON RESPONSE	MERIT ASSESSMENT
					email be shared with members if appropriate to do so.		
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.3 have been provided. No further information has been requested. Additional contact made by phone, but no further response received. Email was directed to person as advised by administrative staff. Relevant person was first contacted in March 2023; no additional time has been requested.			
Bodalla Local Aboriginal Land Council (NSW)	First Nations	NSW-BodLALC-01	3/04/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		NSW-BodLALC-02	13/12/2024	Email	Provided information sheet version 2 with updated timing – see Section 7.1.3. An offer to meet was also provided. Requested guidance as to whether management could act on behalf of members and requested that email be shared with members if appropriate to do so.	No response	N/A
		NSW-BodLALC-03	28/01/2025	Email	Follow up email to the previous email. Provided an opportunity to meet.	No response	N/A
		NSW-BodLALC-04	07/02/2025	Phone call	Left a message with contact number and advised I would follow up next week.	No response	N/A
		NSW-BodLALC-05	12/02/2025	Phone call	Left a message advising I was following up on the call from the 07/02/2025 to follow up on consultation. Advised they could contact via phone or via email	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.3 have been provided. No further information has been requested. Additional contact made by phone, but no further response received. Relevant person was first contacted in April 2023; no additional time has been requested.			
Bunurong Land Council Aboriginal Corporation (VIC)	First Nations	VIC-BLCAC-01	30/12/2024	Email	Provided information sheet version 2 with updated timing – see Section 7.1.3. An offer to meet was also provided. Requested guidance as to whether management could act on behalf of members and requested that email be shared with members if appropriate to do so.	No response	N/A
		VIC-BLCAC-02	30/12/2024	Email		Auto-reply BLC Admin	N/A
		VIC-BLCAC-03	30/12/2024	Email		Auto-reply for staff member	N/A
		VIC-BLCAC-04	28/01/2025	Email	Follow up email to the previous email. Provided an opportunity to meet.	No response	N/A
		VIC-BLCAC-05	29/01/2025	Email		Read receipt of staff member viewing email sent 28.01.2025	N/A
		VIC-BLCAC-06	29/01/2025	Email		Read receipt of BLCAC staff viewing email sent 28.01.2025	N/A

EMPEROR ENERGY LIMITED

RELEVANT PERSON	TYPE	REF#	DATE	HOW	EMPEROR INFORMATION AND RESPONSE INCLUDING ANY MEASURES ADOPTED.	RELEVANT PERSON RESPONSE	MERIT ASSESSMENT
		VIC-BLCAC-07	07/02/2025	Phone call	Spoke with office staff who advised best contacts and supplied email addresses. I advised I would provide information on the project.	Provided updated email addresses for correct contacts at BLCAC	No objections or claims.
		VIC-BLCAC-08	07/02/2025	Email	Provided information sheet version 2 with updated timing to updated contacts– see Section 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Additional contact made by phone, but no further response received. Relevant person was first contacted in April 2023; no additional time has been requested.			
Cobowra Local Aboriginal Land Council (NSW)	First Nations	NSW-CLALC-01	3/04/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		NSW- CLALC -02	13/12/2024	Email	Provided information sheet version 2 with updated timing – see Section 7.1.3. An offer to meet was also provided. Requested guidance as to whether management could act on behalf of members and requested that email be shared with members if appropriate to do so.	No response	N/A
		NSW-CLALC-03	28/01/2025	Email	Follow up email to the previous email. Provided an opportunity to meet.	No response	N/A
		NSW-CLALC-04	07/02/2025	Phone Call	Spoke with staff member of Cobowra who is also staff member of Walbunja Aboriginal Corporation. Advised that we would coordinate a time for Emperor CEO to contact.	CEO advised that he would like to be consulted further under both of these corporations and advised that Cobowra Country is within Walbunja Country which is part of the same dreaming as Gunakurnai. He also queried water depth throughout the Bass Strait area, which we discussed using bathymetry maps for the area.	Reasonable request, but unable to proceed as no further response received in spite of multiple efforts to elicit a response.
		NSW-CLALC-05	07/02/2025	Email	Follow up email to phone call to arrange a time to discuss further with Emperor CEO.	No response	N/A
		NSW-CLALC-06	13/02/2025	Phone call	Message bank was full so unable to leave a message.	No response	N/A
		NSW-CLALC-07	17/02/2025	Email	Follow up email to previous phone calls. Requested to arrange a time to have a phone call with Cobowra and Emperor on 17/02/2025. Further context on low likelihood of impacts from a spill were provided and offers on how Emperor Energy could commit to covering costs for cultural knowledge holders to support response efforts in the unlikely event of a spill were provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.3 have been provided. No further information has been requested. Additional contact made by phone, but no further response received.			

RELEVANT PERSON	TYPE	REF#	DATE	HOW	EMPEROR INFORMATION AND RESPONSE INCLUDING ANY MEASURES ADOPTED.	RELEVANT PERSON RESPONSE	MERIT ASSESSMENT
				Expressed interest in consultation, but Emperor Energy has been unable to get any further response to calls or emails. Context provided may have resulted in less interest in consultation. Relevant person was first contacted in April 2023; no additional time has been requested.			
Eden Local Aboriginal Land Council (NSW)	First Nations	NSW-ELALC-01	20/03/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		NSW-ELALC-02	13/12/2024	Email	Provided information sheet version 2 with updated timing – see Section 7.1.3. An offer to meet was also provided. Requested guidance as to whether management could act on behalf of members and requested that email be shared with members if appropriate to do so.	No response	N/A
		NSW-ELALC-03	28/01/2025	Email	Follow up email to the previous email. Provided an opportunity to meet.	No response	N/A
		NSW-ELALC-04	10/02/2025	Phone call	Phoned both numbers. Left a message for the a office with contact number and advised I would follow up next week.	No response	N/A
		NSW-ELALC-05	12/02/2025	Phone call	Called the office and left a message advising I was following up on the call from the 07/02/2025 to follow up on consultation. Advised they could contact via phone or via email	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.3 have been provided. No further information has been requested. Additional contact made by phone, but no further response received. Relevant person was first contacted in March 2023; no additional time has been requested.			
Gunaikurnai Land & Waters Aboriginal Corporation	First Nations	GLAWAC-01	16/12/2022	Email	Introduction email with attached information sheet (Dec 2022)	Response received 22/3	N/A
		GLAWAC-02	22/03/2023	Email		Request to remained informed on the progress of the activity and meet for further discussions.	N/A
		GLAWAC-03	12/05/2023	Email	Acknowledgement of email and proposal date for online meeting	No response. Meeting not arranged.	N/A
		GLAWAC-04	13/12/2024	Email	Provided information sheet version 2 with updated timing – see Section 7.1.3. An offer to meet was also provided. Requested guidance as to whether GLaWAC management could act on behalf of members and requested that email be shared with members if appropriate to do so.	No response	N/A
		GLAWAC-05	28/01/2025	Email	Follow up email to the previous email. Provided an opportunity to meet.	No response	N/A
		GLAWAC-06	07/02/2025	Phone Call	Called the office. No answer, so left a message stating I was following up on the emails sent regarding	No response	N/A

RELEVANT PERSON	TYPE	REF#	DATE	HOW	EMPEROR INFORMATION AND RESPONSE INCLUDING ANY MEASURES ADOPTED.	RELEVANT PERSON RESPONSE	MERIT ASSESSMENT
					the project and would try again early next week.		
		GLAWAC-07	07/02/2025	Phone Call	Received return phone call from GLaWAC staff, who advised that they would follow up with the relevant person on the project and have them contact Emperor via phone call or reply to the email.	Return call from staff who advised they would inform the relevant person on the project and have them contact Emperor.	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.3 have been provided. No further information has been requested. Additional contact made by phone, but no further response received. Expressed interest in consultation, but Emperor Energy has been unable to get any further response to calls or emails. Relevant person was first contacted in Dec 2022; no additional time has been requested.			
Illawarra Local Aboriginal Land Council (NSW)	First Nations	NSW-ILALC-01	3/04/2023	Email	Introduction email with attached information sheet (March 2023)		N/A
		NSW-ILALC-02	3/04/2023	Email		Reply stating wish to be consulted and request for meeting to further discuss	No objections or claims
		NSW-ILALC-03	12/05/2023	Email	Reply acknowledging request for meeting and suggestion of online meeting to discuss, and then proposed in person meeting if required thereafter	No response	N/A
		NSW- ILALC-04	13/12/2024	Email	Provided information sheet version 2 with updated timing – see Section 7.1.3. An offer to meet was also provided. Requested guidance as to whether management could act on behalf of members, and requested that email be shared with members if appropriate to do so.	No response	N/A
		NSW- ILALC-05	28/01/2025	Email	Follow up email to the previous email. Provided an opportunity to meet.	No response	N/A
		NSW- ILALC-06	10/02/2025	Phone call	Called the office who provided the relevant email to contact. The staff member advised they would send it through and advise the relevant person.	Provided best email address to contact and advised they would inform relevant person.	No objections or claims, and advice agreed and followed
		NSW- ILALC-07	10/02/2025	Email	Follow up email with the relevant email addresses following the phone conversation. Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided. Requested guidance as to whether management could act on behalf of members, and requested that email be shared with members if appropriate to do so.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.3 have been provided. No further information has been requested. Additional contact made by phone, but no further response received. Confirmed information would go to CEO.			

RELEVANT PERSON	TYPE	REF#	DATE	HOW	EMPEROR INFORMATION AND RESPONSE INCLUDING ANY MEASURES ADOPTED.	RELEVANT PERSON RESPONSE	MERIT ASSESSMENT
				Relevant person was first contacted in Dec 2022; no additional time has been requested.			
Jerrinja Local Aboriginal Land Council (NSW)	First Nations	NSW-JLALC-01	3/04/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		NSW-JLALC-02	13/12/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided. Requested guidance as to whether management could act on behalf of members, and requested that email be shared with members if appropriate to do so.	No response	N/A
		NSW-JLALC-03	28/01/2025	Email	Follow up email to the previous email. Provided an opportunity to meet.	No response	N/A
		NSW-JLALC-04	10/02/2025	Phone call	Called both contact numbers, including the admin office. No answer so left a contact number and advised I would try to call again later in the week.	No response	N/A
		NSW-JLALC-05	12/02/2025	Phone call	Called the office and left a message advising I was following up on the call from the 07/02/2025 to follow up on consultation. Advised they could contact Emperor via phone or via email.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.3 have been provided. No further information has been requested. Additional contact made by phone, but no further response received. Relevant person was first contacted in April 2023; no additional time has been requested.			
Merrimans Local Aboriginal Land Council (NSW)	First Nations	NSW-MLALC-01	3/04/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		NSW- MLALC-02	13/12/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided. Requested guidance as to whether management could act on behalf of members, and requested that email be shared with members if appropriate to do so.	No response	N/A
		NSW- MLALC-03	19/12/2024	Email		Request for in person consultation. No request for information	No objections or claims, and advice agreed and followed
		NSW- MLALC-04	30/12/2024	Email	Advised information consultation with Traditional Owners of Judith-2 well location and provided opportunity to meet.	No response	N/A
		NSW- MLALC-05	28/01/2025	Email	Follow up email to the previous email. Provided an opportunity to meet.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.3 have been provided. No further information has been requested. Additional contact made by phone, but no further response received.			

RELEVANT PERSON	TYPE	REF#	DATE	HOW	EMPEROR INFORMATION AND RESPONSE INCLUDING ANY MEASURES ADOPTED.	RELEVANT PERSON RESPONSE	MERIT ASSESSMENT
				Expressed interest in consultation, but Emperor Energy has been unable to get any further response to calls or emails. Relevant person was first contacted in April 2023; no additional time has been requested.			
Mogo Local Aboriginal Land Council (NSW)	First Nations	NSW-MogoLALC-01	3/04/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		NSW- MogoLALC -02	13/12/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided. Requested guidance as to whether management could act on behalf of members, and requested that email be shared with members if appropriate to do so.		
		NSW-MogoLALC-03	28/01/2025	Email	Follow up email to the previous email. Provided an opportunity to meet.		
		NSW-MogoLALC-04	10/02/2025	Phone call	Follow up phone call. Unable to leave a message		
		NSW-MogoLALC-05	12/02/2025	Phone call	Follow up phone call. Unable to leave a message	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.3 have been provided. No further information has been requested. Additional contact made by phone, but no further response received. Relevant person was first contacted in April 2023; no additional time has been requested.			
New South Wales Aboriginal Land Council	First Nations	NSW-ALC-01	16/12/2022	Email	Introduction email with attached information sheet (Dec 2022)		N/A
		NSW-ALC-02	16/12/2022			Read receipt from staff member	N/A
		NSW-ALC-03	16/12/2022			Read receipt from staff member	N/A
		NSW-ALC-04	14/03/2023	Email	Follow up email to ALC requesting information on NSW ALC, specifically structure of the organisation and contact details for relevant groups within the Sydney/Newcastle and South Coast regions of the ALC.		No objections or claims
		NSW-ALC-05	14/03/2023	Phone	Call with ALC-	Provided overview of the ALC structure. Each LALC is independent with its own board and CEO, therefore, each LALC will need to be contacted for consultation.	N/A
		NSW-ALC-06	14/03/2023	Email		Contact details sent for the Newcastle/Sydney LALC CEOs.	No objections or claims
		NSW-ALC-07	14/03/2023	Email	Reply, includes an overview of phone conversation		N/A

RELEVANT PERSON	TYPE	REF#	DATE	HOW	EMPEROR INFORMATION AND RESPONSE INCLUDING ANY MEASURES ADOPTED.	RELEVANT PERSON RESPONSE	MERIT ASSESSMENT
		NSW-ALC-08	15/03/2023	Email	Follow up to communicate that that there is no overlap with Newcastle/Sydney region LALCs and the socio-economic area of exposure. However, overlap exists with the South Coast region and will contact that zone for more information.		N/A
		NSW-ALC-09	15/03/2023	Email		Acknowledged.	No objections or claims
		NSW-ALC-10	17/03/2023	Phone	Call with South Coast Zone ALC - discussion on South Coast region, in particular informing of the Regional Forum cycle occurring every two months with the next taking place later this month.	Communication with South Coast (SC) Region of the NSW Aboriginal Land Council (ALC). Information received on the meeting cycle for the SC ALC and contact details received for the LALCs within the SC region for further consultation.	No objections or claims
		NSW-ALC-11	17/03/2023	Email	Follow up email to the phone call containing introduction material with attached information sheet (Mar 2023)		N/A
		NSW-ALC-12	20/03/2023	Email	Request for contact information for CEOs of the South Coast region LALCs.		N/A
		NSW-ALC-13	28/03/2023	Email		Contact information sent for South Coast region LALCs.	N/A
		NSW-ALC-14	28/03/2023	Email	Reply from EMP		N/A
		NSW-ALC-15	13/12/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3 so as to share with the Zone director information that was being sent to individual LALCs.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.3 have been provided. No further information has been requested. Additional contact made by phone, but no further response received. Primary function of ALC is support and guidance for individual LALCs, so no feedback expected. Relevant person was first contacted in Dec 2022; no additional time has been requested.			
Ngambri Local Aboriginal Land Council (NSW)	First Nations	NSW-NLALC-01	3/04/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		NSW-NLALC -02	13/12/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided. Requested guidance as to whether management could act on behalf of members, and requested that email be shared with members if appropriate to do so.		
		NSW-NLALC-03	28/01/2025	Email	Follow up email to the previous email. Provided an opportunity to meet.		

RELEVANT PERSON	TYPE	REF#	DATE	HOW	EMPEROR INFORMATION AND RESPONSE INCLUDING ANY MEASURES ADOPTED.	RELEVANT PERSON RESPONSE	MERIT ASSESSMENT
		NSW-NLALC-04	10/02/2025	Phone call	Spoke with NLALC staff member	Spoke with the staff member who advised that Ngambri is located near Canberra, inland and an offshore project is unlikely to impact Ngambri Country. They advised that the relevant staff member will reply to the emails sent if they deem it relevant to Ngambri Country.	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Additional contact made by phone, but no further response received. While admin staff noted no concerns, Emperor Energy is uncertain as to authority to speak on cultural matters. Confirmed information would go to CEO but no further response received. Relevant person was first contacted in April 2023; no additional time has been requested.			
Nowra Local Aboriginal Land Council (NSW)	First Nations	NSW-NowLALC-01	3/04/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		NSW- NowLALC -02	13/12/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided. Requested guidance as to whether management could act on behalf of members and requested that email be shared with members if appropriate to do so.	No response	N/A
		NSW-NowLALC -03	28/01/2025	Email	Follow up email to the previous email. Provided an opportunity to meet.	No response	N/A
		NSW-NowLALC-04	12/02/2025	Phone call	No answer, left a message on the project		
		NSW-NowLALC-05	12/02/2025	Phone call	Member of the board returned the call.	Spoke with a member of the board who advised that they would like the project with the board at an upcoming AGM. Advised they would like to be consulted further and may have members that might be interested in the project.	No queries or claims
		NSW-NowLALC-06	12/02/2025	Email	Follow up email to the phone call to discuss further consultation. Advised that Nowra is on the outer extent of the EMBA. Provided the opportunity to meet should the board decide they would like to be consulted after the AGM decision.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Additional contact made by phone, but no further response received. Expressed interest in consultation, but Emperor Energy has been unable to get any further response to calls or emails. Context provided may have resulted in less interest in consultation. Relevant person was first contacted in April 2023; no additional time has been requested.			

RELEVANT PERSON	TYPE	REF#	DATE	HOW	EMPEROR INFORMATION AND RESPONSE INCLUDING ANY MEASURES ADOPTED.	RELEVANT PERSON RESPONSE	MERIT ASSESSMENT
Tasmanian Aboriginal Centre	First Nations	TAC-01	20/03/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		TAC-02	24/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Additional contact made by phone, but no further response received. Relevant person was first contacted in March 2023; no additional time has been requested.			
Ulladulla Local Aboriginal Land Council (NSW)	First Nations	NSW-ULALC-01	20/03/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		NSW-ULALC-02	13/12/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided. Requested guidance as to whether management could act on behalf of members and requested that email be shared with members if appropriate to do so.	No response	N/A
		NSW-ULALC-03	28/01/2025	Email	Follow up email to the previous email. Provided an opportunity to meet.	No response	N/A
		NSW-ULALC-04	12/02/2025	Phone call	Spoke with a staff member who advised to send another follow up email. Staff also took Emperor contact details and advised they would inform the relevant staff member of the call.	Staff member advised to send follow up email and advised they would inform the relevant staff member of the project	No objections or claims, and advice agreed and followed
		NSW-ULALC-05	12/02/2025	Email	Follow up email sent providing information as advised by phone call with the Ulladulla LALC office.		N/A
		NSW-ULALC-06	13/02/2025	Email		Email from staff member stating a change of members and that the matter has not been raised with the board or members as Gippsland is not within the cultural boundary. Staff member stated personal view against offshore drilling and recommended consultation be taken with Gippsland Traditional Owners.	No objections or claims, and advice agreed and followed
		NSW-ULALC-07	14/02/2025	Email	Acknowledged response and confirmed consultation has been undertaken with Gunaikurnai.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Additional contact made by phone; ULALC advised by email that the area is outside their cultural boundary, so no further consultation required. Relevant person was first contacted in March 2023; no additional time has been requested.			
Victorian Aboriginal	First Nations	VIC-VAHC-01	20/03/2023	Email	Introduction email with attached information sheet (March 2023)		N/A

RELEVANT PERSON	TYPE	REF#	DATE	HOW	EMPEROR INFORMATION AND RESPONSE INCLUDING ANY MEASURES ADOPTED.	RELEVANT PERSON RESPONSE	MERIT ASSESSMENT
Heritage Council		VIC-VAHC-02	22/03/2023	Email		Reply email to advise that the activity is on Gunaikurnai Country and to contact them for information.	Noted and advice followed. No objections or claims
		VIC-VAHC-03	12/05/2023	Email	Reply to VAHC informing them that we have been in contact with the Gunaikurnai Land and Waters Aboriginal Corporation. Asked if they would want to be consulted or kept informed on the project.		No objections or claims, and advice agreed and followed
		VIC-VAHC-04	19/05/2023	Email		Response requesting to be kept informed of any updates	No objections or claims, and advice agreed and followed
		VIC-VAHC-05	24/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided. Noted that we would continue to consult with GLaWAC.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Advice provided by VAHC has been followed. Relevant person was first contacted in March 2023; no additional time has been requested.			
Wagonga Local Aboriginal Land Council (NSW)	First Nations	NSW-WLALC-01	3/04/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		NSW-WLALC-02	13/12/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided. Requested guidance as to whether management could act on behalf of members and requested that email be shared with members if appropriate to do so.	No response	N/A
		NSW-WLALC-03	28/01/2025	Email	Follow up email to the previous email. Provided an opportunity to meet.	No response	N/A
		NSW-WLALC-04	12/02/2025	Phone call	Follow up phone call to previous email. No answer so left a voicemail providing contact number and details of the email sent.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Additional contact made by phone. Relevant person was first contacted in April 2023; no additional time has been requested.			
Individual persons							
IP-1	Individual Persons	IP-1-01	19/12/2024	Email		Information request, presumably in response to advertisement for consultation. Raised concerns about spills and decommissioning.	Reasonable request for information made and responded to.
		IP-1-02	30/12/2024	Email	Provided information sheet version 2, pointing to where concerns raised were address. No measures adopted as concerns raised already being addressed.	No response	N/A

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Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheet as described in Section 7.1.2 has been provided. Additional information has been provided and there are no outstanding requests for further information. Relevant person was first contacted in Dec 2024; no additional time has been requested.			
IP-2	Individual Persons	IP-2-01	14/04/2023	Email		General information request in response to advertisement for consultation.	N/A
		IP-2-02	19/04/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		NM-03	24/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. Additional information has been provided and there are no outstanding requests for further information. Relevant person was first contacted in April 2023; no additional time has been requested.			
Local Government and Regional Development							
Bega Valley Shire Council (NSW)	Local Government (NSW)	NSW-BVSC-01	16/12/.2022	Email	Introduction email with attached information sheet (Dec 2022)		N/A
		NSW-BVSC-02	16/12/2022			Auto reply message	N/A
		NSW-BVSC-03	21/12/2022	Email	Measures adopted: provided the additional information that was requested.	Query on affected area relevant to the Bega Shire	No objections or claims;
		NSW-BVSC-04	21/12/2022	Email	Advised that coastal area could be affected in the unlikely event of a spill. [Requested information provided]		N/A
		NSW-BVSC-05	24/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.		N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. Additional information has been provided and there are no outstanding requests for further information. Relevant person was first contacted in Dec 2022; no additional time has been requested.			
Break O'Day Council (Tas)	Local Government (Tas)	TAS-BODC-01	16/12/2022	Email	Introduction email with attached information sheet (Dec 2022)		N/A
		TAS-BODC-02	2/05/2023	Phone	Phoned council and email was received. It will be forwarded to relevant department for feedback. Requested an email reply to determine if council would like ongoing consultation / had any queries / would like progress updates only.		No objections or claims.
		TAS-BODC-03	2/05/2023	Email		Council response that meeting is not necessary but suggest writing to council requesting for comment with details that have been provided and provide information on	No objections or claims. Requests followed

RELEVANT PERSON	TYPE	REF#	DATE	HOW	EMPEROR INFORMATION AND RESPONSE INCLUDING ANY MEASURES ADOPTED.	RELEVANT PERSON RESPONSE	MERIT ASSESSMENT
						risk assessment for oil spill or other hazards for the municipality for the planned activities. Also provided link to list of local groups and organisations to consider for consultation.	
		TAS-BODC-04	12/05/2023	Email	Reply acknowledging non-request for a meeting. Request for risk assessment acknowledged and will be provided when document is finalised. Confirmed Emperor Energy had contacted local fisheries and tourism, and requested contact details for any local fishers or tourism operators that may be relevant persons. Noted Emperor ran an advertisement in a regional paper that cover Brea O'day Council.		N/A
		TAS-BODC-05	12/05/2023	Email		Auto-response	N/A
		TAS-BODC-06	28/01/2025	Email	Provided information sheet version 2 with updated timing – see 7.1.3 to council as suggested. An offer to meet was also provided. Risk assessment provided noting Break O'Day Council on outer edge of EMBA with a very low probability of impact in the event of a spill, and no shorelines predicted to be impacted.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. Additional information has been provided and there are no outstanding requests for further information. Relevant person was first contacted in Dec 2022; no additional time has been requested.			
Dorset Council (Tas)	Local Government (Tas)	TAS-DC-01	24/04/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		TAS-DC-02		Email		Automatic reply	N/A
		TAS-DC-03	3/05/2023	Phone	Spoke with a staff member who requested the email be resent for review. Email will be resent as requested.	Staff member requested the email be resent for review.	No objections or claims.
		TAS-DC-04	3/05/2023	Email	Introduction email and attachments resent as requested during phone conversation.	No response	N/A
		TAS-DC-05	13/12/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
		TAS-DC-06	13/12/2024	Email		Auto-reply acknowledging email has been received.	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. Additional information has been provided and there are no outstanding requests for further information.			

RELEVANT PERSON	TYPE	REF#	DATE	HOW	EMPEROR INFORMATION AND RESPONSE INCLUDING ANY MEASURES ADOPTED.	RELEVANT PERSON RESPONSE	MERIT ASSESSMENT
				Relevant person was first contacted in April 2023; no additional time has been requested.			
Flinders Council (Tas)	Local Government (Tas)	TAS-FC-01	16/12/2022	Email	Introduction email with attached information sheet (Dec 2022)		
		TAS-FC-02	3/05/2023	Phone	Spoke with staff member at Flinders Council. Email will be resent as requested.	Requested the introduction email and information be resent for review.	No objections or claims.
		TAS-FC-03	3/05/2023	Email	Updated information email and attached information sheet (Mar 2023) sent as per phone conversation.	No response	N/A
		TAS-FC-04	22/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. Additional information has been provided and there are no outstanding requests for further information. Relevant person was first contacted in Dec 2022; no additional time has been requested.			
East Gippsland Shire Council (Vic)	Local Government (Vic)	VIC-EGSC-01	16/12/2022	Email	Introduction email with attached information sheet (Dec 2022)	No response	N/A
		VIC-EGSC-02	23/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in Dec 2022; no additional time has been requested.			
Eurobodalla Shire Council (NSW)	Local Government (NSW)	NSW-ESC-01	16/12/2022	Email	Introduction email with attached information sheet (Dec 2022)	No response	N/A
		NSW-ESC-02	16/12/2022	Email		Auto reply message	N/A
		NSW-ESC-03	24/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
		NSW-ESC-04	24/11/2024	Email		Auto reply message	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in Dec 2022; no additional time has been requested.			
Shoalhaven Shire Council (NSW)	Local Government (NSW)	NSW-SSC-01	16/12/2022	Email	Introduction email with attached information sheet (Dec 2022)	No response	N/A
		NSW-SSC-02	24/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
		NSW-SSC-03	24/11/2024	Email		Auto reply	N/A

Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in Dec 2022; no additional time has been requested.			
South Gippsland Shire Council	Local Government (Vic)	VIC-SGSC-01	20/02/2023	Email	Introduction email with attached information sheet (March 2023)		N/A
		VIC-SGSC-02	20/02/2023	Email		Auto reply	N/A
		VIC-SGSC-03	22/03/2023	Email		Request for a meeting to discuss the activity and spill plans (initial meeting over Team or Zoom).	N/A
		VIC-SGSC-04	10/05/2023	Email		Follow up email from council for request for meeting to discuss the activity via Zoom or Teams	N/A
		VIC-SGSC-05	12/05/2023	Email	Proposed meeting date sent		N/A
		VIC-SGSC-06	15/05/2023	Email		Reply from council proposing a new meeting date for an online meeting as there was a conflict with previously proposed date	N/A
		VIC-SGSC-07	23/05/2023	Email	Response from Emperor Energy asking if meeting date and time is still acceptable, if so, meeting invitation will be sent		N/A
		VIC-SGSC-08	23/05/2023	Email		Municipal Emergency Management Planning Committee and provided opportunity to meet.	N/A
		VIC-SGSC-09	24/05/2023	Meeting	Emperor Energy provided a project overview covering items included in the information sheet.	South Gippsland Shire suggested contacting staff member for Parks Victoria, and staff member of Qube Ports. Measures adopted: New contacts added to relevant persons list	No objections or claims
		VIC-SGSC-10	24/05/2023	Email		Response appreciated overview and provided contacts for Parks Victoria, Port Anthony and Qube Ports	No objections or claims. Measures adopted: New contacts added to relevant persons list
		VIC-SGSC-11	24/02/2025	Email	Follow up email providing OPEP and sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.		
		VIC-SGSC-12	25/02/2025	Email		Acknowledged receipt. Advised it would be shared with appropriate council officers and will contact if there are any queries. Queried communications with wider community	No objections or claims.
		VIC-SGSC-13	25/02/2025	Email	Confirmed Emperor is engaging with relevant stakeholders.		
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. Information requested has been provided. No further information has been requested. Relevant person was first contacted in Feb 2023; no additional time has been requested.			
Wellington Shire Council	Local Government (Vic)	VIC-WSC-01	20/03/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		VIC-WSC-02	20/03/2023			Auto reply	N/A

		VIC-WSC-03	24/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
		VIC-WSC-04	24/11/2024	Email		Auto reply	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in March 2023; no additional time has been requested.			
State Government							
Department of Primary Industries and Regional Development NSW	State Government (NSW)	DPIRD-01	11/05/2023	Email	Formal request for fishing data		N/A
		DPIRD-02	19/05/2023	Email		Email response asking for informal action of request	N/A
		DPIRD-03	19/05/2023	Email	Acceptance of informal action		
		DPIRD-04	24/05/2023	Email		Fishing data received as email attachment	N/A
		DPIRD-05	13/12/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.		N/A
		DPIRD-06	17/12/2024	Email		Confirmed that activity is not relevant to NSW Resources.	No objections or claims.
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Activity not considered relevant by the department. Relevant person was first contacted in March 2023; no additional time has been requested.			
Transport for NSW	State Government (NSW)	NSW-DOT-01	02/01/2025	email	Provided information sheet version 2 with updated timing and OPEP – see 7.1.3. An offer to meet was also provided.		N/A
		NSW-DOT-02	02/01/2025	Email		Auto-reply	N/A
		NSW-DOT-03	03/01/2025	Email		Provided comments to update information for the NSW spill response in the OPEP.	No objections or claims. Advice agreed and acknowledged
		NSW-DOT-04	03/01/2025	Email		Provided updated NSW Coastal Waters Marine Pollution Plan for OPEP.	No objections or claims. Advice agreed and acknowledged
		NSW-DOT-05	10/01/2025	Email	Acknowledged advice. Measures adopted: updates incorporated in OPEP.		
		NSW-DOT-06	24/02/2025	Email	Sent email with updated OPEP Rev B		
		NSW-DOT-07	24/02/2025	Email		Auto-reply	
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided along with draft OPEP. No further information has been requested. Relevant person was first contacted in March 2023; no additional time has been requested.			
Tasmania Department of Premier and	State Government (Tas)	TAS-DPAC-01	20/03/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A

Cabinet - Aboriginal Partnerships		TAS-DPAC-02	24/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
Tasmania Department of Primary Industries, Parks, Water and Environment (DPIPWE) – EPA	State Government (Tas)	TAS-EPA-01	23/5/23	Meeting	Meeting with DoT staff members and Emperor and presented the modelling overview presentation of hydrocarbon properties and response		No objections or claims
		TAS-EPA-02	24/05/2023	Email	Introductory email and provided spill presentation		N/A
		TAS-EPA-03	24/06/2023	Email	Follow up to previous email with draft OPEP rev B 2023		N/A
		TAS-EPA-04	10/07/2023	Email	Follow up email to previous email		N/A
		TAS-EPA-05	10/07/2023	Email		Requested information on deadline of OPEP review	No objections or claims
		TAS-EPA-06	10/07/2023	Email	Provided deadline of OPEP review for end of July		N/A
		TAS-EPA-07	10/07/2023	Email		Confirmed review could be completed by end of July	No objections or claims
		TAS-EPA-08	10/07/2023	Email	Provided opportunity to speak over the phone		N/A
		TAS-EPA-09	02/01/2025	Email	Provided information sheet version 2 with updated timing and OPEP – see 7.1.3. An offer to meet was also provided.	No response	N/A
		TAS-EPA-10	02/01/2025	Email		Auto-reply	N/A
		TAS-EPA-11	02/01/2025	Email	Follow up email on progression of OPEP review.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided along with draft OPEP. No further information has been requested. Relevant person was first contacted in March 2023; no additional time has been requested.			
Victorian Department of Premier and Cabinet – First Peoples State Relations	State Government (Vic)	VIC-FPSR-01	30/12/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
		VIC-FPSR-02	30/12/2024	Email		Auto-reply	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in Dec 2024; no additional time has been requested.			
Department of Transport and Planning (DTP) (Vic)	State Government (Vic)	VIC-DTP-01	19/12/2022	Email	Introduction email with attached information sheet (Dec 2022), Map showing proposed well location and Hydrocarbon Exposure Area, as well as OPEP Guidance Note		N/A
		VIC-DTP - 02	10/02/2023	Email		Staff member from Vic DoT invited an initial online meeting as part of consultation.	N/A
		VIC-DTP - 03	16/02/2023	Email	Emperor Energy will be in touch to arrange the meeting.		N/A

		VIC-DTP - 04	17/02/2023	Email		Acknowledged.	N/A
		VIC-DTP - 05	22/5/23	Meeting	Meeting with DoT staff members and Emperor and presented the modelling overview presentation of hydrocarbon properties and response		No objections or claims
		VIC-DTP - 06	24/06/2023	Email	Follow up email to meeting in May. Provided draft of OPEP and information on hydrocarbon properties		N/A
		VIC-DTP - 07	28/06/2023	Email		Confirmed receipt and provided date for OPEP review to be 14/07/2023	No objections or claims
		VIC-DTP - 08	12/07/2023	Email		Requested extension of OPEP review to 21/07/2023	N/A
		VIC-DTP - 09	12/07/2023	Email	Confirmed extension of OPEP review		N/A
		VIC-DTP - 10	21/07/2023	Email		Provided review of OPEP with comments to update Vic DTP department details and capacities	No objections or claims. Advise followed
		VIC-DTP-11	02/01/2025	Email	Provided information sheet version 2 with updated timing and OPEP – see 7.1.3. An offer to meet was also provided.		N/A
		VIC-DTP-12	02/01/2025	Email		Auto-reply for staff member supplying alternate email address	N/A
		VIC-DTP-13	02/01/2025	Email	Provided information sheet version 2 with updated timing and OPEP to S.D – see 7.1.3. An offer to meet was also provided		N/A
		VIC-DTP-14	02/01/2025	Email		Auto-reply for staff member	N/A
		VIC-DTP-15	03/01/2025	Email		Acknowledge receiving of information sheet and OPEP and advised a review would be provided by end of January.	N/A
		VIC-DTP-16	05/01/2025	Email	Acknowledged response.		N/A
		VIC-DTP-17	05/01/2025	Email		Auto-reply for staff member	N/A
		VIC-DTP-18	10/01/2025	Email		Supplied emergency contact details for Vic DOT.	N/A
		VIC-DTP-19	22/01/2025	Email	Acknowledged emergency contact details had been included in emergency contacts register		N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided along with draft OPEP. No further information has been requested. Relevant person was first contacted in Dec 2022; no additional time has been requested.			
Parks Victoria	State Government (Vic)	VIC-PV-01	28/05/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A

		VIC-PV-02	29/05/2023	Email		Reply from Parks Victoria with a contact for the person to consult	N/A
		VIC-PV-03	29/05/2023	Email	Reply from EMP asking if they would like to have a meeting		N/A
		VIC-PV-04	23/06/2023	Email	Measures adopted: Will keep advised and capture as per Section 7.2	Reply from Parks Victoria advising that meeting not required, but requested to be kept informed.	N/A
		VIC-PV-05	13/12/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.		N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in May 2023; no additional time has been requested.			
Victorian Department of Energy, Environment and Climate Action – Earth Resources Regulation (DEECA-ERR) (Previously Department of Jobs, Precincts and Regions (DJPR)) (Vic)	State Government (Vic)	VIC-DJPR-01	19/12/2022	Email	Introduction email with attached information sheet (Dec 2022)	No response	
		VIC-DJPR-02	19/12/2022	Email		Out of office message with additional email provided in message	N/A
		VIC-DJPR-03	19/12/2022	Email		Intro email forwarded to this email but bounced back.	N/A
		VIC-DJPR-04	9/01/2023	Email		Read receipt from staff member	N/A
		VIC-DJPR-05	24/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided. Checked as to whether proposed notifications were appropriate.		
		VIC-DJPR-06	24/11/2024	Email		Email bounce	N/A
		VIC-DJPR-07	23/02/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided. Checked as to whether proposed notifications were appropriate.		N/A
		VIC-DJPR-08	24/02/2024	Email		Acknowledged receipt of email. Advised they would be in touch should they have any questions	No objections or claims
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in Dec 2022; no additional time has been requested.			
Victorian Fisheries Authority	State Government (Vic)	VIC-VFA-01	13/09/2022	Phone	Follow up from website enquiry - requesting fishing effort and vessel activity for Victorian fisheries between 2011 - 2021.		N/A
		VIC-VFA-02	13/09/2022	Email		Clarification on fisheries data	N/A
		VIC-VFA-03	13/09/2022		Outline of fisheries data request		N/A
		VIC-VFA-04	13/09/2022	Email		Outline of data request to the Catch and Effort Unit within VFA	N/A

		VIC-VFA-05	13/09/2022	Email	Clarification on fisheries data		N/A
		VIC-VFA-06	27/10/2022	Email		Package of data received including catch effort data and fisheries management area maps	No objections or claims
		VIC-VFA-07	13/12/2022	Email	Clarification on fisheries data		
		VIC-VFA-08	15/12/2022	Email		Clarification on fisheries data	No objections or claims
		VIC-VFA-09	15/12/2022	Email	Clarification on sea urchin data		N/A
		VIC-VFA-10	20/12/2022	Email		Provided data on sea urchin fisheries	No objections or claims
		VIC-VFA-11	13/12/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested.			
Regulation 25(3) requires provision of a reasonable period:				Relevant person was first contacted in Sept 2022; no additional time has been requested.			
Victoria – Heritage Victoria	State Government (Vic)	VIC-HV-01	30/12/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.		
		VIC-HV-02	30/12/2024	Email		Acknowledged email and noted 30 day consultation response period.	No objections or claims
		VIC-HV-03	29/01/2025	Email		Provided information on UCH shipwrecks that are found within the region. Recommended a historic UCH study and submerged Aboriginal cultural heritage study undertaken by a qualified maritime archaeologist and appropriate specialists to identify UCH values in the area. Would like to review EP when open for public consultation.	No objections or claims
		VIC-HV-04	04/02/2025	Email	Confirmed that UCH shipwrecks within 50 km of operational area have been listed. Noted the likelihood of Aboriginal UCH is low given the location and impact area listed EPO5, EPO6. CM20 described the geophysical survey which will be undertaken to survey the seabed. Advised that Emperor has not engaged a qualified maritime archaeologist. Enquired whether they would like to be notified when the EP is open for public consultation.		N/A
Regulation 25(2) requires provision of sufficient information:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested.			
Regulation 25(3) requires provision of a reasonable period:				Relevant person was first contacted in Sept 2022; no additional time has been requested.			
Fisheries							

Abalone Council Australia Ltd	Commercial Fisheries	ACA-01	17/04/2023	Email	Introduction email with attached information sheet (March 2023) and map	No response	N/A
		ACA-02	27/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in April 2023; no additional time has been requested.			
Abalone Victoria Central Zone (Vic)	Commercial Fisheries	VIC-AVCZ-01	17/04/2023	Email	Introduction email with attached information sheet (March 2023) and map	No response	N/A
		VIC-AVCZ-02	27/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in April 2023; no additional time has been requested.			
Australian Southern Bluefin Tuna Industry Association	Commercial Fisheries	ASBTIA-01	17/04/2023	Email	Introduction email with attached information sheet (March 2023) and map	No response	N/A
		ASBTIA-02	27/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
		ASBTIA-03	13/12/2024	Email		Acknowledged that ASBTIA remains a relevant person. Advised no operational concerns or immediate impacts with the activity	No objections or claims
		ASBTIA-04	13/12/2024	Email	Acknowledged response and invited further feedback.		N/A
		ASBTIA-05	13/12/2024	Email		Acknowledged response.	No objections or claims
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in April 2023; no additional time has been requested.			
Commonwealth Fisheries Association	Commercial Fisheries	CFA-01	17/04/2023	Email	Introduction email with attached information sheet (March 2023) and map	No response	N/A
		CFA-02	24/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in April 2023; no additional time has been requested.			
Eastern Victoria Sea Urchin Divers Association (Vic)	Commercial Fisheries	VIC-EVSUDA-01	17/04/2023	Email	Introduction email with attached information sheet (March 2023) and map	No response	N/A
		VIC-EVSUDA-02		Email		One address bounced but other ok	N/A
		VIC-EVSUDA-03	27/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
		VIC-EVSUDA-04	27/11/2024	Email		Returned email with unknown address	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in April 2023; no additional time has been requested. (Licence holders also covered by SIV and Eastern zone abalones industry association)			

Eastern Zone Abalone Industry Association (Vic)	Commercial Fisheries	VIC-EZAIA-01	17/04/2023	Email	Introduction email with attached information sheet (March 2023) and map	No response	N/A
		VIC-EZAIA-02	27/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in April 2023; no additional time has been requested.			
Lakes Entrance Fishing Co-Operative (Vic)	Commercial Fisheries	VIC-LEFCO-01	17/04/2023	Email	Introduction email with attached information sheet (March 2023) and map	No response	N/A
		VIC-LEFCO-02	27/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in April 2023; no additional time has been requested.			
San Remo Fisherman's Co-op (Vic)	Commercial Fisheries	VIC-SRFC-01	17/04/2023	Email	Introduction email/s with attached information sheet (March 2023)	No response	N/A
		VIC-SRFC-02	27/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in April 2023; no additional time has been requested.			
Scallop Fishermans Association Inc. (Vic)	Commercial Fisheries	VIC-SFA-01	17/04/2023	Email	Introduction email with attached information sheet (March 2023) and map	No response	N/A
		VIC-SFA-02	24/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in April 2023; no additional time has been requested.			
Scallop Fishermans Association of Tasmania (Tas)	Commercial Fisheries	TAS-SFAT-01	17/04/2023	Email	Introduction email with attached information sheet (March 2023) and map		N/A
		TAS-SFAT-02	17/04/2023	Email	Well location is outside of the area of interest for Bass Strait Central Zone Scallop fishermen.	SFAT advised the well location is outside of the area of interest for Bass Strait Central Zone Scallop fishermen.	No objections or claims
		TAS-SFAT-03	17/04/2023	Email	Acknowledged response		N/A
					No update provided as previously advised location well outside their area of interest		N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in April 2023; no additional time has been requested, and relevant person noted well outside zone of interest			
Seafood Industry Tasmania (previously Tasmanian Seafood Industry Council)	Commercial Fisheries	TAS-TSIC-01	17/04/2023	Email	Introduction email with attached information sheet (March 2023), map and table	No response	N/A
		TAS-TSIC-02	24/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in April 2023; no additional time has been requested.			

Seafood Industry Victoria (Vic)	Commercial Fisheries	VIC-SIV-01	17/04/2023	Email	Introduction email with attached information sheet (March 2023)		N/A
		VIC-SIV-02	19/04/2023	Email	Auto response: Out of Office		N/A
		VIC-SIV-03	19/04/2023	Email		Request for video conference meeting to discuss further in May	N/A
		VIC-SIV-04	12/05/2023	Email	Reply to acknowledge request of meeting. Proposed date given.		N/A
		VIC-SIV-05	15/05/2023	Email	(Meeting did not occur)	Reply to propose meeting the week of June 19th	N/A
		VIC-SIV-06	13/12/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. Requested setting up a support agreement for consultation with state fisheries licence holders.		N/A
		VIC-SIV-07	13/12/2024	Email		Provided standard services agreement	N/A
		VIC-SIV-08	13/01/2025	Email	Requested a call to discuss execution of services agreement.		N/A
		VIC-SIV-09	14/01/2025	Email		Provided standard services agreement	N/A
		VIC-SIV-10	15/01/2025	Email	Provided draft advertisement for SIV newsletter and information sheet version 2 with updated timing – see 7.1.3.		N/A
		VIC-SIV-11	16/01/2025	Email		Provided draft of newsletter and requested more information on seismic activity. Confirmed information would be included in members newsletter dated 17 Jan 2025	N/A
		VIC-SIV-12	16/01/2025	Email	Approved newsletter and provided information on seismic survey area.		N/A
		VIC-SIV-13	17/01/2025	Email	Provided additional information on seismic survey. Size ~ 2km x 2kms, up to 4 days duration. Purpose is to identify any drilling hazards.		N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. Information sent to members 17 January 2025. No further information has been requested. Relevant person was first contacted in April 2023; no additional time has been requested.			
South East Trawl Fishing Industry Association (SETFIA)	Commercial Fisheries	SETFIA-01	21/12/2022	Phone	Call to find out best way for Emperor Energy to engage with SETFIA. Explained drilling of one exploration well and 2D shallow seismic to identify shallow gas. Measures adopted: Advice agreed and followed.	SETFIA said to send an email in new year with information about the well and 2D and will look at. Charges for SMS messaging. Also said need to contact VFA.	No objections or claims.
		SETFIA-02	17/04/2023	Email	Introduction email with attached information sheet (March 2023) and map		N/A

SETFIA-03	19/04/2023	Email		Reply acknowledging impact and requesting a meeting via Zoom. Attachments including policy document for seismic survey and flyer illustrating how they assist the oil and gas industry. Reply requesting a meeting via Zoom	No objections or claims
SETFIA-04	12/05/2023	Email	Response sent with proposed date for online meeting	Proposal of date of meeting	N/A
SETFIA-05	15/05/2023	Email	Response confirming that the proposed date and time for meeting suits	Acceptance of proposed meeting date and time	N/A
SETFIA-06	22/05/2023	Email	Email with background info (attached) to read		N/A
SETFIA-07	20/06/2023	Email		Request for meeting via teams	N/A
SETFIA-08	13/12/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. Requested setting up a support agreement for consultation with members of the following fisheries: • South East Trawl Fishery (Cth) • Gillnet Hook and Trap Fishery (Cth) • Eastern Zone Rock Lobster Fishery (Vic) • Central Zone Scallop Fishery (Cth) Small Pelagic Fishery (Cth)		N/A
SETFIA-09	17/12/2024	Email		Commercial discussion-sensitive information	N/A
SETFIA-10	13/01/2025	Email	Clarification on services agreements with relevant fisheries that interact with the EMBA.		N/A
SETFIA-11	14/01/2025	Email		Provided advice on engaging with relevant fisheries and draft example of data reporting SETFIA can complete. Had queries regarding impacts of surveys on fisheries -size of survey and impacts to fishing gear.	No objections or claims
SETFIA-12	23/01/2025	Email	Provided feedback to queries with Judith-2 activities, particularly seismic survey impacts on fisheries.		N/A
SETFIA-13	24/01/2025	Email/meeting	Meeting with SETFIA. Provided high level overview of proposed activities in line with information sheet. Follow up email from discussion and provided information for engagement with fisheries.	Agreed to support consultation with members.	No objections or claims
SETFIA-14	24/01/2025	Email		Provided draft notification to SETFIA members on Judith-2 activity.	No objections or claims.

		SETFIA-15	24/01/2025	Email		Confirmed responses from email sent to SETFIA on 23/01/2025. Acknowledged that seismic will have minimal impacts.	No objections or claims. Will keep informed
		SETFIA-16	25/01/2025	Email	Acknowledged response and confirmed consultation with SETFIA members to go ahead.		
		SETFIA-17	29/01/2025	Email		Confirmation of text to be sent to SETFIA members.	
		SETFIA-18	29/01/2025	Email	Acknowledged email.		
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. Information sent to members 17 January 2025. No further information has been requested. Information sent to members 29 January 2025; no additional information has been requested by members. Relevant person was first contacted in April 2023; no additional time has been requested. Information sent to members 29 January 2025,			
Southern Rock Lobster Ltd	Commercial Fisheries	SRLL-01	17/04/2023	Email	Introduction email with attached information sheet (March 2023) and map	No response	N/A
		SRLL-02	27/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.		N/A N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheets as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in April 2023; no additional time has been requested.			
Trinsand Fisheries	Commercial fisheries	TF-01	27/01/2025	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided. Copied in email chain sent to CFA (CFA-02) for reference. Requested setting up a support agreement for consultation.		N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheet as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in January 2025; no additional time has been requested.			
Tuna Australia	Commercial fisheries	TA-01	13/12/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided. Requested setting up a support agreement for consultation. Copied in email chain sent to CFA (CFA-02) for reference		N/A
		TA-02	13/12/2024	Email		Provided draft agreement that would cover licence holders in Eastern Tuna and Billfish and Eastern Skipjack fisheries, and some Southern Bluefin Tuna longliners. SBT purse-sein fishers covered by ASBTIA.	N/A
		TA-03	16/01/2025	Email	Provided service agreement		N/A
		TA-04	24/01/2025	Email	Provided information sheet version 2 with updated timing – see 7.1.3. Provided summery for TA to supply to members.		N/A
		TA-05	24/01/2025	Email		Confirmed timing for consultation with members.	N/A

		TA-06	25/01/2025	Email	Acknowledged TA confirmation to consult with TA members.		N/A
		TA-07	28/02/2025	Email		Provided overview of Judith-2 interaction with TA's members' interests and provided statistics that described commercial fishing activities within represented fisheries by members. Reported high level of reach to members during TA consultation with its members. Concluded that Judith-2 poses low risk to tuna fishing industry. Emphasised the importance of migratory pathways for SBT and ETBF in the Bass Strait. Raised concerns regarding potential access from exclusion zones, cumulative impacts, hydrocarbon leaks from abandoned well, and if we had consulted with surrounding fisheries.	No objections or claims. Reasonable concerns raised have been addressed (TA-08)
		TA-08	12/03/2025	Email	Noted that the activity poses a low risk to tuna fisheries. Addressed responses to concerns regarding short-term exclusion area around MODU and short-term nature or survey activities. Noted that we had consulted widely with fisheries in the area and addressed cumulative impacts in the EP. Addressed that risks associated with hydrocarbons leaking from P&A wells is low as Judith-2 will be following industry standards and WOMP. No new measures adopted.		No objections or claims. Reasonable concerns raised have been addressed
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheet as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in January 2025; no additional time has been requested.			
Tourism and Recreation							
Australian Tourism Industry Council	Tourism and Recreation	ATIC-01	24/04/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		ATIC-02	13/12/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.		
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheet as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in April 2023; no additional time has been requested.			
Boating Industry Association of Victoria (Vic)	Tourism and Recreation	VIC-BIAV-01	17/04/2023	Email	Introduction email with attached information sheet (March 2023) and map	No response	N/A
		VIC-BIAV-02	03/05/2023	Phone	Spoke with staff member, who advised the relevant staff member is on leave. Relevant staff member will review the email after returning from leave.	N/A	N/A
		VIC-BIAV-03	02/05/2023	Email		Reply to email saying that the distance of the activity from shore is not likely to	No objections or claims. Will keep informed

						be of consequence to recreational boating, but would like to be kept informed.	
		VIC-BIAV-04	29/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.		
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheet as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in April 2023; no additional time has been requested.			
Destination Gippsland (Vic)	Tourism and Recreation	VIC-DG-01	24/04/2023	Email	Introduction email with attached information sheet (March 2023)		
		VIC-DG-02	24/04/2023	Email		Reply email to inform unable to meet for consultation but would like to be kept informed on project updates.	No objections or claims. Will keep informed
		VIC-DG-03	24/04/2023	Email	Confirmed that Emperor will keep DG informed of updates		
		VIC-DG-04	13/12/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.		
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheet as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in April 2023; no additional time has been requested.			
Destination NSW (NSW)	Tourism and Recreation	NSW-DNSW-01	19/12/2024	Online Form	Request for email address for consultation purposes.	No response	N/A
		NSW-DNSW-02	19/12/2024	Email		Auto-response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Request for contact details for consultation purposes made, but no response. No further information has been requested. Relevant person was first contacted in December 2024 seeking email address for consultation purposes via webform; no additional time has been requested.			
Marlo Angling Club (Vic)	Tourism and Recreation	VIC-MAC-01	17/04/2023	Email	Introduction email with attached information sheet (March 2023) and map	No response	N/A
		VIC-MAC-02	3/05/2023	Phone	Spoke with a staff member and the email was received and is on the agenda for discussion at the monthly committee meeting	Staff member advised the email was received and is on the agenda for discussion at the monthly committee meeting	No objections or claims
		VIC-MAC-03	29/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.		N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheet as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in April 2023; no additional time has been requested.			
Ocean Racing Club of Victoria (Vic)	Tourism and Recreation	VIC-ORCV-01	17/04/2023	Email	Introduction email with attached information sheet (March 2023) and map		N/A
		VIC-ORCV - 02	17/04/2023	Email		Reply email to request updates and location of the well location due to yacht race in Feb-Apr 2025 in the region. Plan to advise members of PSZ exclusion area for the race.	No objections or claims

		VIC-ORCV-03	17/04/2023	Email	Confirmed that requested updates would be provided		N/A
		VIC-ORCV-04	27/11/2024	Email	Provided information update as committed; information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.		N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheet as described in Section 7.1.2 have been provided. No further information has been requested. Revised timing means no impact on planned race Feb-Apr 2025. Relevant person was first contacted in April 2023; no additional time has been requested.			
Recreational Fishing Alliance of NSW (NSW)	Tourism and Recreation	NSW-RFANSW-01	17/04/2023	Email	Introduction email with attached information sheet (March 2023) and map	No response	N/A
		NSW-RFANSW-02	4/05/2023	Email	Follow-up email sent.	No response	N/A
		NSW-RFANSW-03	27/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheet as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in April 2023; no additional time has been requested.			
Royal Yacht Club Victoria (Vic)	Tourism and Recreation	VIC-RYCV-01	24/04/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		VIC-RYCV-02	3/05/2023	Phone	Spoke with staff member and email was received but relevant staff member will review and respond (if required). Message of the follow up call will be passed on.	Staff member advised email was received and relevant staff member will review and respond. Message of the follow up call will be passed on.	No objections or claims.
		VIC-RYCV-03	13/12/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheet as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in April 2023; no additional time has been requested.			
Scuba Divers Federation of Victoria (Vic)	Tourism and Recreation	VIC-SDFV-01	17/04/2023	Email	Introduction email with attached information sheet (March 2023) and map	No response	N/A
		VIC-SDFV-02	28/04/2023	Phone	Tried to call the number on the website to follow up since sending the intro email but the number was disconnected.	No response	N/A
		VIC-SDFV-03	4/05/2023	Email	Follow-up email sent.	No response	N/A
		VIC-SDFV-04	27/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheet as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in April 2023; no additional time has been requested.			
Surf Life Saving Club Lakes Entrance (Vic)	Tourism and Recreation	VIC-SLSCLE-01	17/04/2023	Email	Introduction email with attached information sheet (March 2023) and map	Bounced mail from club	N/A
		VIC-SLSCLE-02	1/05/2023	Phone	Spoke with Lakes Entrance Surf Life Saving Club.	Staff member requested the email be forwarded to his email with the club cc'd. At this time, the club does not intend to respond and do not wish to organise a meeting. However, they request to be	Information re-sent as requested and request to be informed acknowledged. No objections or claims

						kept informed (via the club's email) on the progress of the activity.	
		VIC-SLSCLE-03	1/05/2023	Email	Introduction email and attachments forwarded as requested during phone conversation.	No response	N/A
		VIC-SLSCLE-04	27/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheet as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in April 2023; no additional time has been requested.			
Surfing Victoria (Vic)	Tourism and Recreation	VIC-SV-01	17/04/2023	Email	Introduction email with attached information sheet (March 2023) and map	No response	N/A
		VIC-SV-02	1/05/2023	Phone	Spoke to Surfing Victoria. Email was received with no comments at this time. Would not like to meet but would like to be kept informed on the progress of the project via email.	No response	N/A
		VIC-SV-03	27/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheet as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in April 2023; no additional time has been requested.			
Tasmanian Association for Recreational Fishing (Tas)	Tourism and Recreation	TAS-TARF-01	17/04/2023	Email	Introduction email with attached information sheet (March 2023) and map	No response	N/A
		TAS-TARF-02	1/05/2023	Phone	Phoned the number on the website and left a voicemail requesting a call back on my mobile regarding Emperor Energy's proposed offshore project.	No response	N/A
		TAS-TARF-03	27/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheet as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in April 2023; no additional time has been requested.			
Tourism Tasmania (Tas)	Tourism and Recreation	TAS-TT-01	24/04/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		TAS-TT-02	8/05/2023	Email		Correspondence was shared with relevant tourism organisations: West by North West and Visit Northern Tasmania	No objections or claims
		TAS-TT-03	12/05/2023	Email	Acknowledged.	N/A	N/A
		TAS-TT-04	13/12/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheet as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in April 2023; no additional time has been requested.			
Victoria Game Fishing Club (Vic)	Tourism and Recreation	VIC-VGFC-01	17/04/2023	Email	Introduction email with attached information sheet (March 2023) and map	No response	N/A
		VIC-VGFC-02	28/04/2023	Phone	Phoned organisation and left a voicemail and advised to contact	No response	N/A

					Emperor regarding Emperor Energy's proposed offshore project.		
		VIC-VGFC-03	27/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheet as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in April 2023; no additional time has been requested.			
Victorian Recreational Fishing (Vic)	Tourism and Recreation	VIC-VRF-01	17/04/2023	Email	Introduction email with attached information sheet (March 2023) and map	No response	N/A
		VIC-VRF-02	24/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
		VIC-VRF-03	24/11/2024	Email		Auto reply	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheet as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in April 2023; no additional time has been requested.			
Victorian Tourism Industry Council (Vic)	Tourism and Recreation	VTIC-01	24/04/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		VTIC-02	26/02/2025	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheet as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in April 2023; no additional time has been requested.			
Visit Northern Tasmania (Tas)	Tourism and Recreation	TAS-TT-02	8/05/2023	Email	Introduction email with attached information sheet (March 2023) forwarded correspondence by Tourism Tasmania as per correspondence # TAS-TT-02	No response	N/A
		VNT-01	13/12/2024	Email	Correspondence with Tourism Tasmania - Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheet as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in May 2023; no additional time has been requested.			
West by North West (Tas)	Tourism and Recreation	TAS-TT-02	8/05/2023	Email	Introduction email with attached information sheet (March 2023) forwarded correspondence by Tourism Tasmania as per correspondence # TAS-TT-02	No response	N/A
		WBNW-01	2/12/2024	Email	Correspondence with Tourism Tasmania - Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheet as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in May 2023; no additional time has been requested.			
Windsurfing Victoria (Vic)	Tourism and Recreation	VIC-WV-01	24/04/2023	Email	Introduction email with attached information sheet (March 2023)	No response	N/A
		VIC-WV-02	03/05/2023	Phone	Left a voice mail on relevant staff member mobile requesting a call back or email reply to confirm receipt of introduction email.	No response	N/A
		VIC-WV-03	13/12/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheet as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in April 2023; no additional time has been requested.			

Other

Fathom Pacific (Vic)	AMP Permit Holder	VIC-FP-01	17/04/2023	Email	Introduction email with attached information sheet (March 2023) and map	No response	N/A
		VIC-FP-02	1/05/2023	Phone	Phoned organisation and left a voicemail requesting a call back to Emperor regarding Emperor Energy's proposed offshore project.	No response	N/A
		VIC-FP-03	27/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheet as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in April 2023; no additional time has been requested.			
iXblue	AMP Permit Holder	iXblue-01	17/04/2023	Email	Introduction email with attached information sheet (March 2023) and map	No response	N/A
		iXblue-02	1/05/2023	Phone	Tried phoning the number the organisation, and the number was unavailable.	No response	N/A
		iXblue-03	4/05/2023	Email	Follow-up email sent.	No response	N/A
		iXblue-04	27/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheet as described in Section 7.1.2 have been provided. No further information has been requested. Relevant person was first contacted in April 2023; no additional time has been requested.			
Major Projects	AMP Permit Holder	MP-01	17/04/2023	Email	Introduction email with attached information sheet (March 2023) and map	No response	N/A
		MP-02	4/05/2023	Email	Follow-up email sent.	No response	N/A
		MP-03	4/05/2023	Email		Reply stating that no further information is required	No objections or claims
		MP-04	27/11/2024	Email	Provided information sheet version 2 with updated timing – see 7.1.3. An offer to meet was also provided.	No response	N/A
Regulation 25(2) requires provision of sufficient information: Regulation 25(3) requires provision of a reasonable period:				Information sheet as described in Section 7.1.2 have been provided. No further information has been requested. Relevant persons advised no further information was required. Relevant person was first contacted in April 2023; no additional time has been requested.			

APPENDIX E GHG EMISSIONS ASSESSMENT

Emperor Energy Ltd

Judith EP Update

GHG Emissions Technical Summary

ASSIGNMENT P100245-S03
DOCUMENT P-100245-S03-A-REPT-001

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REVISIONS & APPROVALS

REV	DATE	DESCRIPTION	ISSUED	CHECKED	APPROVED	CLIENT
R0	27/03/2025	Issued for Use	FC	MH	KR	Emperor/AGR

GHG EMISSIONS TECHNICAL SUMMARY

A GHG assessment was conducted to estimate the GHG emissions generated from Judith-2 Exploration Well activity. The GHG assessment covers all emissions scopes – scopes 1, 2 and scope 3, defined as below:

- Scope 1 emissions are the direct GHG emissions released into the atmosphere as a result of the activity, e.g., flaring and venting.
- Scope 2 emissions are the indirect GHG emissions from the consumption of purchased electricity, steam, heat or cooling, which are produced outside the boundary of the activity. Given there is no purchased electricity/energy involved, there will be no scope 2 emissions.
- Scope 3 emissions are the indirect GHG emissions, other than the scope 2 emissions, generated as a result of the activity. Scope 3 emissions cover both upstream (e.g., purchased goods and services and capital goods), downstream (e.g., waste treatment/disposal), vessel (and MODU) operations, and helicopter operations.

The GHG emissions sources and scope included in the assessment and relevant to the activity are summarised in Table 1. Scope 1 emissions were estimated according to the methodology in NGER Determination 2008 and scope 3 emissions were estimated according to the GHG Protocol Scope 3 Standard. Emissions from fugitives and employee commuting (road travel and fixed wing aircraft) were assumed to be immaterial.

Table 1: Emissions sources and scopes included in the GHG assessment.

Scope	Site Surveys	Drilling Activities
Scope 1	-	• Flaring during well test
Scope 3	Vessels (including ROV)[1]	• Vessels and MODU (including ROV)[1] • Helicopter • Materials[2] • Waste generated[3]

[1] Included vessel and MODU activities within the operational area only, as per the EP scope.
[2] Included embodied carbon for the major items only – cement, casing, and water-based mud (WBM).
[3] Included landfilling of the wellhead retrieved assuming immaterial emissions from waste discharge.

As summarised in Table 2, the total GHG emissions resulting from the activity are expected to be approximately 45 kt CO_2-e, consisting of 58% and 42% of scope 1 and scope 3 respectively. The GHG emissions were estimated using the maximum durations of the activities and flared volume.

Drilling activities (including well test and well P&A) are expected to generate approximately 31 kt CO_2-e, ~70% of the total GHG emissions, whilst support activities (vessels and helicopter) are expected to generate approximately 13 kt CO_2-e, ~30% of the total GHG emissions.

Table 2: Summary of GHG assessment results.

Emissions Source \ Scope	Scope 1 Emissions	Scope 3 Emissions	Total Emissions	Percentage
	t CO_2-e	t CO_2-e	t CO_2-e	%
Drilling Activities	25,960	5,230	31,190	69.9
Flaring[1]	25,960		25,960	58.2
Materials[2]		4,710	4,710	10.5
Waste[3]		520	520	1.2
Support Activities		13,420	13,420	30.1
Vessels[4]		13,390	13,390	30.0
Helicopter[5]		30	30	0.1
Total GHG Emissions (t CO_2-e)	25,960	18,640	44,610	100.0
Percentages (%)	58.2	41.8	100.0	-

[1] Well test flaring at 60 MMscf/d, for up to 144 hours.
[2] Major materials required for well drilling and well P&A: 600 t cement; 940 t casing; and 400 m^3 WBM.
[3] Weight of wellhead retrieved for landfill: 400 tonnes.
[4] Vessels and MODU for the drilling activities up to 60 days; semisubmersible MODU type on DP used for conservatism; site surveys up to 9 days; vertical seismic profiling for 4 hours and post operation ROV survey up to 2 days.
[5] Helicopter flights 5 times a week on average during drilling activities, with a flight distance of ~50 km.

APPENDIX F JASCO UNDERWATER ACOUSTIC MODELLING REPORT

Emperor Energy Judith–2 Drilling Operations

Acoustic Modelling for Assessing Marine Fauna Sound Exposures

JASCO Applied Sciences (Australia) Pty Ltd

26 March 2025

Submitted to:

Phil McNamara
Emperor Energy
Contract 2025-04

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Executive Summary

JASCO Applied Sciences (JASCO) performed a modelling study of underwater sound levels associated with Emperor Energy's drilling Judith-2 exploration activities and operations. The considered noise generating activities include drilling and vessel operations, vertical seismic profiling (VSP) and a 2D seismic survey for shallow water hazard identification. This study can be used to assist in understanding the potential acoustic impact on key regional receptors including marine mammals, sea turtles, and fish.

Five vessel and drilling operation scenarios were considered in this study. One scenarios considered three Anchor Handling Tug Support (AHTS) vessels setting up (two on transit and one under dynamic positioning). Once scenario considered the Mobile Offshore Drilling Unit (MODU) conducting drilling operations. Two scenarios considered the MODU with an associated offshore supply vessel (OSV) either conducting re–supply of the MODU under DP for 8 hours, or standing by under slow transit. The final modelled vessel scenario considered an ROV cutter at the seafloor performing cutting operations at the MODU location, supported by an OSV on stand-by. This study considered scenarios to represent operations that could occur concurrently.

For the consideration of VSP, one site was modelled considering a 600 in^3 static seismic source. The modelling assumed that a VSP is stationed at the centre of the Judith-2 well location. A total of 5, 10, 25, 50, 100, 150, 200, 250, and 300 impulses were considered independently to inform the assessment of different operational configurations over a 24 hour period.

For the shallow hazards seismic survey, one 24–hour acquisition scenario was modelled considering a single 160 in^3 seismic source. The acquisition pattern comprised a 1x1 km square area centred around the Judith-2 well location. The model parameterisation considered a survey vessel sailing along the transect lines at 8 knots, towing one 160 in^3 source, with an impulse interval (inter–pulse interval) of 22.2 m and a line separation of 100 m. For modelling purposes, the seismic source was assumed not to operate during line turns. The modelled scenario comprised 495 impulses during the 24–hour scenario.

This modelling study specifically assessed distances from operations where underwater sound levels reached thresholds corresponding to behavioural response, temporary reduction in hearing sensitivity or TTS, permanent threshold shift or PTS. The animals considered here included low–, high–, and very high–frequency cetaceans, otariid seals, fish (including fish larvae and eggs), and sea turtles.

The modelling methodology considered scenario–specific source levels and range–dependent environmental properties. Estimated underwater acoustic levels for non–impulsive (continuous) noise sources are presented as sound pressure levels (SPL, L_p), and as accumulated sound exposure levels (SEL, L_E) as appropriate for different noise effect criteria. The SPL metric is the root–mean–square pressure level over a stated frequency band over a specified time window. In this study, for continuous noise, a time window of 1 s was used.

In this report, to evaluate the potential for accumulated sound exposure levels (SEL), the duration of the SEL accumulation was defined as integrated over a 24–hour period. 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. The corresponding SEL_{24h} radii represent an unlikely worst–case scenario. More realistically, marine mammals (as well as fish and turtles) would not stay in the same location for 24 hours. Therefore, a reported radius for SEL_{24h} criteria does not mean that marine fauna travelling within this radius of the source will be injured, but rather that an animal could be exposed to the sound level associated with impairment if it remained in that location for 24 hours.

The key results of this modelling study are summarised in the marine mammal, sea turtle and fish sections below. Maps are provided in the report to assist with contextualising tabulated distances.

Vessel and Drilling Modelling – Marine Mammals

The maximum distances to the NOAA (2024) marine mammal behavioural response criterion of 120 dB re 1 µPa (SPL, for continuous noise) ranged between 2.24 km (Scenario 2) and 23.7 km (Scenario 1) (Table 1). For TTS, the maximum distance for accumulated weighted SEL_{24h} scenarios was between 0.31 km (Scenario 5, VHF cetaceans) and 8.20 km (Scenario 1, LF cetaceans). For PTS, the maximum distances for accumulated weighted SEL_{24h} criteria from NMFS (2024) varied between distances of 0.03 m (Scenario 5, VHF cetaceans) and 0.44 km (in Scenario 1, LF cetaceans).

Table 1. Summary of marine mammal results from vessel and drilling modelling: Summary of maximum (R_{max}) horizontal distances (in km), from all scenarios considered, to the NOAA (2024) marine mammal behavioural response criterion of 120 dB re 1 µPa (SPL, unweighted) and frequency–weighted SEL_{24h} TTS and PTS thresholds based on NMFS (2024). TTS and PTS results are presented for the hearing group that resulted in the maximum range.

Scenario Number	Description	Marine Mammal Behavioural Response – SPL [a] R_{max} (km)	TTS – SEL_{24h} [b]	PTS – SEL_{24h} [b]
			R_{max} (km)	R_{max} (km)
1	Prelay and Anchor Setup	23.7	8.20 (LF-cetacean)	0.44 (LF-cetacean)
2	MODU Drilling	2.24	0.99 (VHF-cetacean)	0.06 (VHF-cetacean)
3	MODU Drilling with OSV on Standby	3.31	0.99 (VHF-cetacean)	0.06 (VHF-cetacean)
4	MODU Drilling with OSV under DP (8 hours)	5.22	1.07 (LF-cetacean)	0.13 (VHF-cetacean)
5	OSV on Standby with ROV Cutting	3.06	0.31 (VHF-cetacean)	0.03 (VHF-cetacean)

Noise exposure criteria: [a] NOAA (2024) and [b] NMFS (2024).
A dash indicates the level was not reached within the limits of the modelled resolution (20 m).

Vessel and Drilling Modelling – Sea Turtles

The threshold criteria from Finneran et al. (2017) were used to assess TTS and PTS for sea turtles. Across all scenarios, the maximum distances to threshold were 220 m for TTS and less than the modelling resolution (20 m) for PTS. The maximum distance to the SEL_{24h} metrics for TTS and PTS onset for sea turtles (Finneran et al. 2017) are outlined in Table 2. As is the case with marine mammals, a reported radius for SEL_{24h} criteria does not mean that sea turtles travelling within this radius of the source will be injured, but rather that an animal could be exposed to the sound level associated with either TTS or PTS if it remained in that location for 24 hours.

Table 2: Summary of sea turtle results: Summary of horizontal distances (in km) to turtle behavioural response criteria, temporary threshold shift (TTS), and permanent threshold shift (PTS).

Hearing group	Frequency–weighted SEL_{24h} threshold ($L_{E,24h}$; dB re 1 µPa²·s)	Scenario 1:		Scenario 2:		Scenario 3:		Scenario 4:		Scenario 5:	
		R_{max} (km)	Area (km²)	R_{max} (km)	Area (km²)	R_{max} (km)	Area (km²)	R_{max} (km)	Area (km²)	R_{max} (km)	Area (km²)
PTS											
Sea turtles	220	–	–	–	–	–	–	–	–	–	–
TTS											
Sea turtles	200	0.22	0.15	–	–	–	–	–	–	–	–

A dash indicates the level was not reached within the limits of the modelled resolution (20 m).

Vessel and Drilling Modelling – Fish

This modelling study assessed the ranges for quantitative criteria based on Popper et al. (2014) and considered SPL metrics associated with recoverable injury and TTS, as appropriate for non-impulsive noise. Table 3 summarises the maximum distances to effect criteria for fish.

Table 3: Summary of fish results: Maximum (R_{max}) horizontal distances (in km), from all scenarios considered, to sound pressure level (SPL) criteria based on Popper et al. (2014).

SPL (L_p; dB re 1 µPa)	Scenario 1:		Scenario 2:		Scenario 3:		Scenario 4:		Scenario 5:	
	R_{max} (km)	$R_{95\%}$ (km)	R_{max} (km)	R_{max} (km)	$R_{95\%}$ (km)	R_{max} (km)	$R_{95\%}$ (km)	$R_{95\%}$ (km)	R_{max} (km)	$R_{95\%}$ (km)
Recoverable injury (48 h)[1]	–	–	–	–	–	–	–	–	–	–
TTS (12 h)[2]	0.08	0.08	–	–	–	–	–	–	–	–

[1] 48 h threshold for recoverable injury for fish with a swim bladder involved in hearing (Popper et al. 2014).
[2] 12 h threshold for TTS for fish with a swim bladder involved in hearing (Popper et al. 2014).
A dash indicates the level was not reached within the limits of the modelled resolution (20 m).

Vertical Seismic Profiling

In addition to vessel and drilling noise modelling, the modelling study also considered Vertical Seismic Profiling (VSP) at the well centre with a maximum of 300 impulses over a 24 hour period. The VSP location was centred at the Judith-2 well location be representative of the range of water depths around the exploration area.

As VSP is an impulsive noise source, the noise effect criteria are different to those in the vessel and drilling scenarios.

Vertical Seismic Profiling – *Marine Mammals:*

This modelling study applied the criteria from NMFS 2024, which requires two metrics (PK and SEL_{24h}) to be considered when assessing marine mammal TTS and PTS, with the longest distance associated with either metric being required to be applied. Table 4 summarises the maximum distances for TTS and PTS, along with the relevant metric associated with the maximum distance for the VSP results. The maximum distance where the NOAA (2024) marine mammal behavioural response criterion of 160 dB re 1 µPa (SPL) is also presented in Table 4.

Table 4. Summary of maximum (R_{max}) horizontal distances (in km) from any modelled site to behavioural response thresholds and temporary threshold shift (TTS) and permanent threshold shift (PTS) for marine mammals.

Hearing group	Modelled distance to effect threshold (R_{max} km)				
	Behavioural response [a]	Impairment: TTS [b,c]	Impairment: PTS [b,c]	Impairment: TTS [b,d]	Impairment: PTS [b,d]
Low–frequency (LF) cetaceans	2.82	4.82	0.85	–	–
High–frequency (HF) cetaceans		0.03	–	–	–
Very high–frequency (VHF) cetaceans		0.16	–	0.28	0.07

Noise exposure criteria: [a] NOAA (2024) and [b] NMFS (2024)
[c] Longest distance to threshold from SEL_{24h} results, with 300 impulses
[d] Longest distance to threshold from PK results
A dash indicates the threshold was not reached within the limits of the modelling resolution (20 m).

Vertical Seismic Profiling – *Sea turtles:*

- The PK sea turtle criteria of 226 dB re 1 µPa for TTS and 232 dB re 1 µPa for PTS from Finneran et al. (2017) were not exceeded at a distance longer than 20 m from the acoustic centre of the source.
- The maximum distances to the SEL_{24h} metrics for TTS and PTS (Finneran et al. 2017) of 189 dB re 1 µPa^{2}s for TTS and 204 dB re 1 µPa^{2}s for PTS was 0.53 km for TTS onset and 0.05 km for PTS onset for the 600 in^3 seismic source with the 300 shots configuration (summarised in Table 5). As is the case with marine mammals, a reported radius for SEL_{24h} criteria does not mean that sea turtles travelling within this radius of the source will be injured, but rather that an animal could be exposed to the sound level associated with either TTS or PTS if it remained in that location for 24 hours.
- The maximum distances to the behavioural response criteria for sea turtles of 166 dB re 1 µPa (SPL) and the 175 dB re 1 µPa (SPL) threshold for behavioural disturbance (McCauley et al. 2000) were 1.74 km and 0.54 km, respectively for the 600 in^3 seismic source (summarised in Table 5).

Table 5. Summary of maximum horizontal distances (in km) from any modelled site to behavioural response thresholds and temporary threshold shift (TTS) and permanent threshold shift (PTS) for marine turtles.

Hearing group	Behavioural response[1]	Behavioural disturbance[1]	Impairment: TTS[2]	Impairment: PTS[2]
Sea Turtles	1.74 (SPL)	0.54 (SPL)	0.53 (SEL_{24h})	0.05 (SEL_{24h})

Noise exposure criteria: [1] McCauley et al. (2000), and [2] Finneran et al. (2017)

Vertical Seismic Profiling – *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 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, and
- Fish eggs and fish larvae.

Table 6 summarises the maximum distances to effect criteria for fish, fish eggs, and fish larvae along with the relevant metric.

Table 6. Summary of maximum fish, fish eggs, and larvae injury and temporary threshold shift (TTS) onset distances for any modelled site, for single impulse and 24 h sound exposure level (SEL_{24h}) modelled scenarios.

Relevant hearing group	Effect criteria	Water column	
		Metric associated with longest distance to criteria	R_{max} (km)
Fish: No swim bladder	Recoverable injury	–	–
	TTS	SEL_{24h}	1.07
Fish: Swim bladder not involved in hearing and Swim bladder involved in hearing	Recoverable injury	SEL_{24h}	0.06
	TTS	SEL_{24h}	1.07
Fish eggs, and larvae	Injury	SEL_{24h}	0.02
Fish	TTS	PK	0.05

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

Vertical Seismic Profiling – *Benthic invertebrates:*

To assist with assessing the potential effects on crustaceans from VSP operations, the following results were determined:

- The sound level of 202 dB re 1 µPa PK–PK from Payne et al. (2008), which is representative of no effects, was considered for seafloor sound levels; the sound level was reached at 184 m from the acoustic centre of the VSP array.
- Sound levels of 209 – 212 dB re 1 µPa PK–PK from Day et al. (2016b) and 213 dB re 1 µPa from Day et al. (2016a), which are related to impairment in crustaceans, were considered; the levels reached for a receiver 5 cm above the seafloor are shown in Table 7.

Table 7: Maximum (R_{max}) horizontal distances (in m) from the seismic source to modelled seafloor (receiver located 5 cm above seafloor) peak–peak pressure levels (PK–PK) within the modelling area. Results included in relation to benthic invertebrates.

PK–PK (L_{pk-pk}; dB re 1 µPa)	Distance R_{max} (m)
	Receiver Depth: 66.65 m
213[1,2,3]	*
212[2,3]	19
210[1,2]	51
209[1,2]	64
202[4]	184

[1] Day et al. (2019), lobster
[2] Day et al. (2016a), lobster and scallops
[3] Day et al. (2017), scallops.
[4] Payne et al. (2008), lobster

2D Seismic Surveying

In addition to vessel and drilling noise and VSP modelling, the modelling study also considered seismic surveying with a towed array surveying within a 1 km^2 area with a maximum of 495 shots over a 24–hour period.

As the seismic source considered for the 2D shallow hazards seismic survey is an impulsive noise source, the noise effect criteria are the same as those applied with regard to the VSP modelling scenario.

2D Seismic Survey – *Marine Mammals:*

The results for marine mammal injury applied the criteria from NMFS 2024, which requires two metrics (PK and SEL_{24h}) to be considered when assessing marine mammal TTS and PTS, with the longest distance associated with either metric being required to be applied. Table 8 summarises the maximum distances for TTS and PTS, along with the relevant metric associated with the maximum distance for the seismic survey results. The maximum distance where the NOAA (2024) marine mammal behavioural response criterion of 160 dB re 1 µPa (SPL) is also presented in Table 8.

Table 8. Summary of maximum (R_{max}) horizontal distances (in km) from any modelled site to behavioural response thresholds and temporary threshold shift (TTS) and permanent threshold shift (PTS) for marine mammals.

Hearing group	Modelled distance to effect threshold (R_{max} km)				
	Behavioural response [a]	Impairment: TTS [b,c]	Impairment: PTS [b,c]	Impairment: TTS [b,d]	Impairment: PTS [b,d]
Low–frequency (LF) cetaceans	1.48	2.00	0.04	–	–
High–frequency (HF) cetaceans		–	–	–	–
Very high–frequency (VHF) cetaceans		–	–	0.05	0.03

Noise exposure criteria: [a] NOAA (2024) and [b] NMFS (2024)
[c] Longest distance to threshold from SEL_{24h} results
[d] Longest distance to threshold from PK results
A dash indicates the threshold was not reached within the limits of the modelling resolution (20 m).

2D Seismic Survey – *Sea Turtles:*

- The PK sea turtle criteria of 226 dB re 1 µPa for TTS and 232 dB re 1 µPa for PTS from Finneran et al. (2017) were not exceeded at a distance longer than 20 m from the acoustic centre of the source.
- The maximum distances to the SEL_{24h} metrics for TTS and PTS (Finneran et al. 2017) of 189 dB re 1 µPa^{2}s for TTS and 204 dB re 1 µPa^{2}s for PTS were less than the modelling resolution of 20 m for the 160 in^3 seismic source; therefore it is likely that the 2D seismic survey will exceed PTS and TTS thresholds only within 20 m distance of the source, if at all.
- The maximum distances to the behavioural response criteria for sea turtles of 166 dB re 1 µPa (SPL) and the 175 dB re 1 µPa (SPL) threshold for behavioural disturbance (McCauley et al. 2000) were 0.17 km and 0.07 km, respectively for the 160 in^3 seismic source (summarised in Table 5).

Table 9. Summary of maximum horizontal distances (in km) from any modelled site to behavioural response thresholds and temporary threshold shift (TTS) and permanent threshold shift (PTS) for marine turtles.

Hearing group	Behavioural response[1]	Behavioural disturbance[1]
Sea Turtles	0.17 (SPL)	0.07 (SPL)

Noise exposure criteria: [1] McCauley et al. (2000).

2D Seismic Survey – *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 and SEL_{24h} metrics associated with mortality and potential mortal injury as well as impairment (recoverable injury and TTS) 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, and
- Fish eggs and fish larvae.

Table 10 summarises the maximum distances to effect criteria for fish, fish eggs, and fish larvae along with the relevant metric. The PK metric thresholds for fish were not exceed in this modelling.

Table 10. Summary of maximum fish, fish eggs, and larvae injury and temporary threshold shift (TTS) onset distances for any modelled site, for single impulse and 24 h sound exposure level (SEL_{24h}) modelled scenarios.

Relevant hearing group	Effect criteria	Water column	
		Metric associated with longest distance to criteria	R_{max} (km)
Fish: No swim bladder	Recoverable injury	–	–
	TTS	SEL_{24h}	0.10
Fish: Swim bladder not involved in hearing and Swim bladder involved in hearing	Recoverable injury	SEL_{24h}	–
	TTS	SEL_{24h}	0.10
Fish eggs, and larvae	Injury	SEL_{24h}	–

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

2D Seismic Survey – *Benthic invertebrates:*

To assist with assessing the potential effects on crustaceans from surveying operations, the following results were determined:

- The sound level of 202 dB re 1 µPa PK–PK from Payne et al. (2008), which is representative of no effects, was considered for seafloor sound levels; the sound level was reached at 3.55 m (Table 11).
- Sound levels of 209–212dB re 1 µPa PK–PK from Day et al. (2016b) and 213 dB re 1 µPa from Day et al. (2016a), which are related to impairment in crustaceans, were considered; these levels were not reached for a receiver 5 cm above the seafloor (Table 11).

Table 11. Maximum (R_{max}) horizontal distances (in m) from the seismic source to modelled seafloor (receiver located 5 cm above seafloor) peak–peak pressure levels (PK–PK) within the modelling area. Results included in relation to benthic invertebrates.

PK–PK (L_{pk-pk}; dB re 1 µPa)	Distance R_{max} (m) Receiver Depth: 66.65 m
213[1,2,3]	*
212[2,3]	*
210[1,2]	*
209[1,2]	*
202[4]	3.55

[1] Day et al. (2019), lobster
[2] Day et al. (2016a), lobster and scallops
[3] Day et al. (2017), scallops.
[4] Payne et al. (2008), lobster
An asterisk indicates that the sound level was not reached.

1. Introduction

JASCO Applied Sciences (JASCO) performed a modelling study of underwater sound levels associated with Emperor Energy's Judith-2 exploratory drilling campaign activities and operations. The considered noise generating activities include drilling and vessel operations, vertical seismic profiling (VSP) and a 2D seismic survey for shallow water hazard identification. This study can be used to assist in understanding the potential acoustic impact on key regional receptors including marine mammals, sea turtles, and fish. The modelling study predicted the distances from operations at which underwater sound levels reached noise effect thresholds and criteria. The marine mammal thresholds include levels associated with behavioural response, temporary threshold shift (TTS), and permanent threshold shift (PTS). The marine mammal functional hearing groups considered were low–, high–, very high–frequency cetaceans, and Otariid seals.

Estimated underwater acoustic levels associated with the drilling and vessel activities and operations are presented as sound pressure levels (SPL, L_{p}), and accumulated sound exposure levels (over 24 hours) (SEL$_{24h}$, $L_{\mathrm{E,24h}}$), as appropriate for non–impulsive (continuous) noise sources. Estimated underwater acoustic levels associated with the VSP and the 2D seismic survey operations 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. Complementary underwater acoustic propagation models were used in conjunction with the source models or source levels to estimate sound levels considering site–specific environmental influences. Sound fields were predicted for individual sources, and accumulated sound exposure fields were predicted for the representative scenarios considering an assessment period of 24 hours. A conservative sound speed profile that would be most supportive of sound propagation conditions for the potential operational period was defined and applied within the parameterisation of the models.

For the VSP modelling, this study considered a seismic source with a total volume of 600 in^3, fixed at 5 m depth. For the 2D shallow hazard survey scenario, this study considered a single airgun with a total volume 160 in^3, towed at 7 m depth at 8 knots. JASCO's specialised Airgun Array Source Model (AASM) was used to predict the acoustic signature and spectra for each seismic source. AASM accounts for individual airgun volumes, airgun bubble interactions, and array geometry to yield accurate source predictions. The modelling methodology considered source directivity and range–dependent environmental properties. Estimated underwater acoustic levels associated with VSP scenarios are presented as SEL$_{24h}$, for multiple pulses (5, 10, 25, 50, 100, 150, 200, 250, 300) over a 24 hour period.

This report is further structured as follows, the remainder of Section 1 provides details on the scenarios considered for modelling, Section 2 explains the metrics used to represent underwater acoustic fields and the effect criteria considered for both non-impulsive and impulsive noise sources. Section 3 details the methodology for predicting the source levels and modelling the sound propagation, including the specifications of the considered sound sources and the environmental parameters. Section 4 presents the acoustic results as tabulated ranges to thresholds and sound level contour maps. Modelling results are then discussed in Section 5.

1.1. Modelling Scenarios – Vessels and Drilling

This study considered the following vessel and drilling activities:

- Vessel noise from two Anchor Handling Tug Supply (AHTS) vessels on slow transit to represent pre-lay activities, and an AHTS under dynamic positioning (DP) during anchor hookup operations. All AHTS were modelled within the vicinity of the well site location,
- Drilling noise from an anchored Mobile Offshore Drilling Unit (MODU),

- Vessel noise from the Offshore Supply Vessels (OSV) on slow transit in standby operation, modelled as following a random track in a 2x4 km box approximately 2 km east of the MODU,
- Noise from an OSV under DP during cargo resupply operations (for 8 hours),
- Noise from an ROV undertaking cutting operations occurring at the seafloor near the MODU.

Tables 12 and 13 outline the modelling locations and scenarios.

Table 12. Modelled site locations and source information.

Site	Source/Vessel Description	Latitude (°S)	Longitude (°E)	MGA[1] Zone 55		Water depth (m)
				X (m)	Y (m)	
1	AHTS (Transit)	38°08'32.31''	148°30'59.26''	636896	57773587	66.7
2	AHTS (Transit)	38°08'28.92''	148°33'43.70''	632898	5777318	66.7
3	AHTS (Anchor Hook–up, DP)	38°08'47.61''	148°32'22.46''	634901	5776821	66.7
4	Anchored MODU (Drilling)	38°08'30.87''	148°32'21.8''	634897	5777320	66.7
5	OSV (Transit)	38°08'29.7131''	148°33'46.8094''	636967	5777321	72.8
6	OSV (Resupply, DP)	38°08'30.7983''	148°32'24.6740''	634967.3	5777321	66.9
7	ROV Ops	38°08'30.87''	148°32'21.8''	636967	5777321	66.7

[1]Map Grid of Australia (MGA)

Table 13. Description of modelled scenarios.

Scenario	Site(s)	Operation Name	Operation Description	Operation Time
1	1,2,3	Prelay and Anchor Setup	2 x AHTS (Transit) + 1 AHTS (Anchor Hook–up, DP)	24 hr
2	4	MODU Drilling	MODU Drilling	24 hr
3	4, 5	MODU Drilling + OSV Standby	MODU Drilling + OSV Standby	24 hr
4	4,6	MODU Drilling + OSV Resupply	MODU Drilling + OSV (Resupply, DP)	Drilling 24 hr Resupply 8 hr
5	5,7	OSV (Transit) + ROV Operations	OSV Standby + ROV Ops	24 hr

Figure 1 displays an overview of the vessel and drilling operation modelling area showing modelling locations, Biologically Important Areas (BIAs) for southern right whales (*Eubalaena australis*) and pygmy blue whales (*Balaenoptera musculus brevicauda*), and the regional bathymetry.

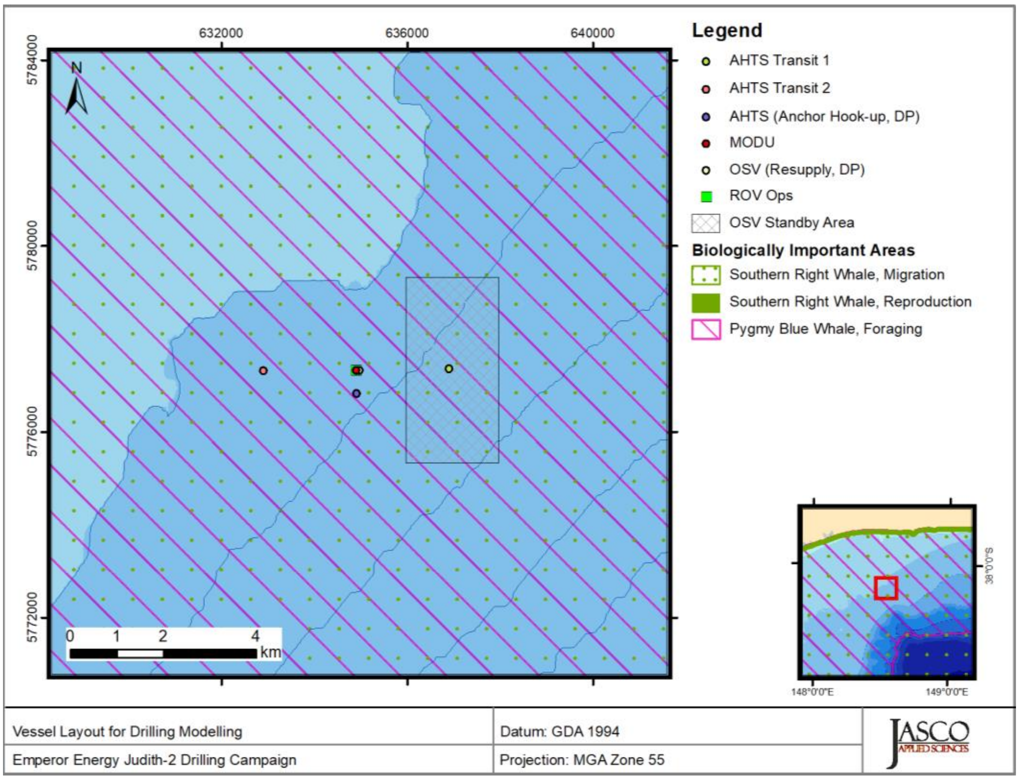

Figure 1: Overview map of drilling modelling sites

1.2. Modelling Scenarios – VSP

For VSP modelling, one site was modelled considering a 600 in^3 seismic source. The modelling assumed that a VSP is stationed at the centre of the well site, we understand the VSP source will be operated and lowered into the water via crane from the MODU. A total of 5, 10, 25, 50, 100, 150, 200, 250, and 300 impulses were considered independently to inform the assessment of different operational configurations over a 24-hour period. The location of the modelled site is provided in Table 16, and the acquisition scenarios are detailed in Table 17, with the considered site shown in Figure 2.

Table 14. Location details for the single impulse modelled sites.

Site	Latitude (S)	Longitude (E)	MGA[1] Zone 55		Water depth (m)
			X (m)	Y (m)	
8	38°08'30.87''	148°32'21.8''	634897	5777320	66.7

[1] Map Grid of Australia (MGA)

Table 15. Parameters for modelled scenarios.

Scenario	Source volume (in^3)	Tow depth (m)	Number of Shots
1	600	5	5
			10
			25
			50
			100
			150
			200
			250
			300

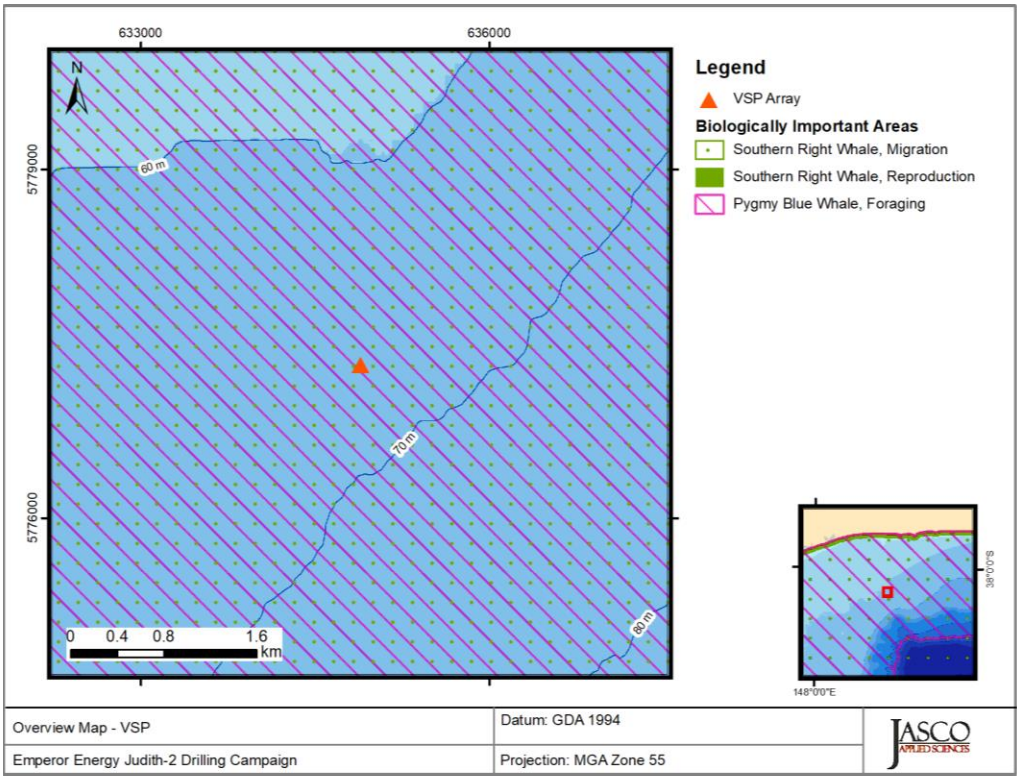

Figure 2. Overview map of VSP site.

1.3. Modelling Scenarios – 2D Shallow Hazards Seismic Survey

For the shallow hazards seismic survey, one 24–hour acquisition scenario was modelled considering a single 160 in^3 seismic source. The location of the modelled site (located at the well site) is provided in Table 16, and the acquisition scenario (termed Scenario 1) is detailed in Table 17. The acquisition pattern considered is presented in Figure 3. The acquisition pattern and lines were derived from the best available data provided by the client at the time of this study. The model parameterisation considered that a survey vessel sailed along survey lines at 8 knots, towing one 160 in^3 source, with an impulse interval (inter–pulse interval) of 22.2 m and a line separation of 100 m. For modelling purposes, the seismic source was assumed not to operate during line turns. Scenario 1 accounted for 495 impulses during the 24–hour acquisition scenario.

Table 16. Location details for the single impulse modelled sites.

Site	Latitude (S)	Longitude (E)	MGA[1] Zone 55		Water depth (m)
			X (m)	Y (m)	
9	38°08'30.87''	148°32'21.8''	634897	5777320	66.7

[1] Map Grid of Australia (MGA)

Table 17. Parameters for modelled scenarios.

Scenario	Source volume (in³)	Tow depth (m)	Tow direction (°)	Impulse interval (m)	Discharged impulses
1	160	7	0/180	22.2	495

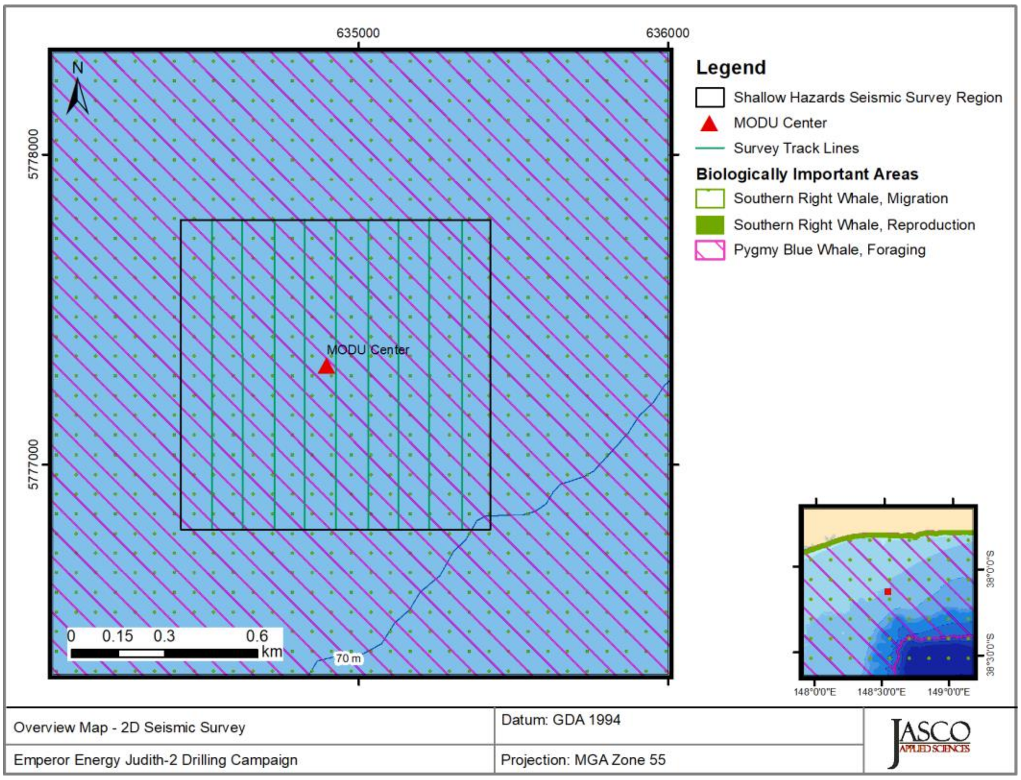

Figure 3. Overview map of 2D shallow hazards seismic survey modelled site and acquisition scenario.

2. Noise Effect Criteria

To assess the potential effects of a sound–producing activity, it is necessary to first establish exposure criteria (thresholds) for which sound levels may be expected to have an adverse effect on animals. Whether acoustic levels might injure or disturb marine fauna is an active research topic. Since 2007, several expert groups have developed SEL–based assessment approaches for evaluating auditory injury, with key works including Southall et al. (2007b), Finneran and Jenkins (2012), Popper et al. (2014), United States National Marine Fisheries Service (NMFS 2018), Southall et al. (2019) and NMFS (2024). The number of studies that investigate the level of behavioural disturbance to marine fauna by anthropogenic sound has also increased substantially.

The perceived loudness of sound, especially impulsive noise such as from seismic survey or VSP, 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.3). The period of accumulation associated with SEL is defined, with this report referencing either a "per–pulse" assessment or over 24 h. For non–impulsive sound sources, such as vessels, SPL and SEL are the relevant metrics. The acoustic metrics in this report reflect the ISO standard for acoustic terminology, ISO/DIS 18405:2017 (2017).

The following thresholds and guidelines 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. Marine Mammals:
    a. Peak pressure levels (PK; L_{pk}) and frequency–weighted accumulated sound exposure levels (SEL; $L_{E,24h}$) from NMFS (2024) for the onset of permanent threshold shift (PTS) and temporary threshold shift (TTS) in marine mammals for impulsive sources.
    b. Frequency–weighted accumulated sound exposure levels (SEL; $L_{E,24h}$) from NMFS (2024) for the onset of permanent threshold shift (PTS) and temporary threshold shift (TTS) in marine mammals for non–impulsive sound sources.
    c. Marine mammal behavioural thresholds based on the current interim U.S. National Oceanic and Atmospheric Administration (NOAA) (2024) unweighted criterion for marine mammals of 160 dB re 1 µPa (SPL; L_p) for impulsive sound sources and 120 dB re 1 µPa (SPL; L_p) for non–impulsive sound sources.
2. Fish, fish eggs, and larvae:
    a. Sound exposure guidelines for fish, fish eggs, and larvae (used as a surrogate for plankton) (Popper et al. 2014).
3. Sea turtles
    a. Frequency–weighted accumulated sound exposure levels (SEL; $L_{E,24h}$) from Finneran et al. (2017) for the onset of PTS and TTS in turtles for non–impulsive and impulsive sound sources.
    b. Sea turtle behavioural response threshold of 166 dB re 1 µPa (SPL; L_p) for impulsive noise, along with a sound level associated with behavioural disturbance 175 dB re 1 µPa (SPL; L_p) (McCauley et al. 2000).

The following sections (along with Appendices A.3 and A.4), expand on the thresholds, guidelines and sound levels for all marine fauna.

2.1. Non–impulsive Noise

Vessel, drilling and ROV operations have been assessed as non–impulsive noise sources consistent with the considered thresholds and guidelines below.

2.1.1. Marine Mammals

The NMFS (2024) criteria applied in this study to assess possible effects of non–impulsive noise sources on marine mammals are summarised in Table 18. Low, high and very-high frequency cetaceans, and Otariid seals were identified as the marine mammals requiring assessment. Details on thresholds related to auditory threshold shifts or hearing loss and behavioural response are provided in Appendix A.3, with frequency weighting explained in detail in Appendix A.4.

Table 18. Criteria for effects of non–impulsive noise exposure, including vessel noise, for marine mammals: unweighted SPL and weighted SEL_{24h} thresholds.

Hearing group	NOAA (2024)	NMFS (2024)	
	Behaviour	TTS onset thresholds (received level)	PTS onset thresholds (received level)
	SPL (L_p; dB re 1 µPa)	Weighted SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²·s)	Weighted SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²·s)
Low–frequency (LF) cetaceans	120	177	197
High–frequency (HF) cetaceans		181	201
Very High–frequency (VHF) cetaceans		161	181
Otariid seals		179	199

L_p denotes sound pressure level 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 µPa²·s.

2.1.1.1. Behavioural Response

The NOAA continuous noise criterion was selected for this assessment because it represents the most commonly applied behavioural response criterion by regulators. The distances at which behavioural responses could occur are therefore determined by areas ensonified above an unweighted SPL of 120 dB re 1 µPa (NMFS 2014, NOAA 2024). Appendix A.3 provides more information about the development of this criteria.

2.1.2. Injury and Hearing Sensitivity Changes

There are two categories of auditory threshold shifts or hearing loss: permanent threshold shift (PTS), a physical injury to an animal's hearing organs; and temporary threshold shift (TTS), a temporary reduction in an animal's hearing sensitivity as the result of receptor hair cells in the cochlea becoming fatigued.

To assist in assessing the potential for effect on marine mammals, this report applies the criteria recommended by NMFS (2024), considering both TTS and PTS (see Table 18). Appendix A.3 provides more information about the NMFS (2024) criteria.

2.1.3. Fish, Sea Turtles, Fish Eggs, and Fish Larvae

Table 19 lists the relevant effects thresholds from Popper et al. (2014) for shipping and continuous noise. Some evidence suggests that fish sensitive to acoustic pressure show a recoverable loss in hearing sensitivity, or injury when exposed to high levels of noise (Scholik and Yan 2002, Amoser and Ladich 2003, Smith et al. 2006); this is reflected in the SPL thresholds for fish with a swim bladder involved in hearing (shaded cells in Table 19). Finneran et al. (2017) presented revised thresholds for sea turtle PTS and TTS onset from continuous noise sources, considering frequency weighted SEL, which have been applied in this study (Table 20).

Table 19. Criteria for vessel noise exposure for fish and sea turtles, 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)	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(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 (particle motion detection)	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) Moderate (I) Moderate (F) Low
Fish: Swim bladder involved in hearing (primarily pressure detection)	(N) Low (I) Low (F) Low	170 dB SPL for 48 h	158 dB SPL for 12 h	(N) High (I) High (F) High	(N) High (I) Moderate (F) Low
Sea Turtles	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Moderate (I) Low (F) Low	(N) High (I) High (F) Moderate	(N) High (I) Moderate (F) Low
Fish eggs and fish larvae	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) Low (I) Low (F) Low	(N) High (I) Moderate (F) Low	(N) Moderate (I) Moderate (F) Low

Sound pressure level dB re 1 µPa.
Relative risk (high, moderate, low) is given for animals at three distances from the source defined in relative terms as near (N) – tens of metres, intermediate (I) – hundreds of metres, and far (F) – thousands of metres.

Table 20. Acoustic effects of continuous noise on sea turtles, weighted SEL_{24h}, Finneran et al. (2017).

PTS onset thresholds (received level)	TTS onset thresholds (received level)
Weighted SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²s)	Weighted SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²s)
220	200

L_E denotes cumulative sound exposure over a 24 h period and has a reference value of 1 µPa²s.

2.1. Impulsive Noise

VSP and seismic surveying activities have been assessed as impulsive noise sources consistent with the considered thresholds and guidelines.

2.1.1.1. Marine Mammals

The NMFS (2024) criteria applied in this study to assess possible effects of impulsive noise sources on marine mammals are summarised Table 21; cetaceans and seals were identified as the hearing group requiring assessment.

There are two categories of auditory threshold shifts or hearing loss: permanent threshold shift (PTS), a physical injury to an animal's hearing organs; and temporary threshold shift (TTS), a temporary reduction in an animal's hearing sensitivity as the result of receptor hair cells in the cochlea becoming fatigued. Details on thresholds related to auditory threshold shifts or hearing loss and behavioural response are provided in Appendix A.3, with frequency weighting explained in detail in Appendix A.4. The behavioural response criteria from NOAA (2024) has been applied.

Table 21. Acoustic effects of impulsive noise on marine mammals: Unweighted SPL, SEL_{24h}, and PK thresholds.

Hearing group	NOAA (2024)	NMFS (2024)			
	Behaviour	TTS onset thresholds* (received level)		PTS 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 (LF) cetaceans	160	168	216	183	222
High–frequency (HF) cetaceans		178	224	193	230
Very High–frequency (VHF) cetaceans		144	196	159	202
Otariid Seals		170	224	185	230

* Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating TTS or PTS onset.
L_p denotes sound pressure level and has a reference value of 1 µPa.
L_{pk} denotes peak sound pressure is flat weighted or unweighted and has a reference value of 1 µPa.
$L_{E,24h}$ denotes cumulative sound exposure over a 24 h period and has a reference value of 1 µPa²s.

2.1.1.2. Fish, Fish Eggs, and Fish Larvae

In 2006, the Working Group on the Effects of Sound on Fish and Sea Turtles was formed to continue developing noise exposure criteria for fish and sea turtles, work begun by a NOAA panel two years earlier. The Working Group developed guidelines with specific thresholds for different levels of effects for several species groups (Popper et al. 2014). The guidelines define quantitative thresholds 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, and
- TTS.

Masking and behavioural effects can be assessed qualitatively, by assessing relative risk rather than by specific sound level thresholds. However, as these depend upon activity–based subjective ranges, these effects are not addressed in this report and are included in Tables 22 for completeness only. Because the presence or absence of a swim bladder has a role in hearing, fish's susceptibility to injury from noise exposure depends on the species and the presence and possible role of a swim bladder in hearing. Thus, different thresholds were proposed for fish without a swim bladder (also appropriate for sharks), fish with a swim bladder not used for hearing, and fish that use their swim bladders for hearing. Sea turtles, fish eggs, and fish larvae are considered separately.

Impulsive noise from seismic activities are assessed in this study based on the relevant effects thresholds from Popper et al. (2014) listed in Table 22. In general, whether an impulsive sound adversely effects fish behaviour depends on the species, the state of the individual exposed, and other factors.

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, an exposure evaluation time must be defined. Southall et al. (2007b) defines the exposure evaluation time as the greater of 24 h or the duration of the activity. Popper et al. (2014) recommend a standard period of the duration of the activity; however, the publication also includes caveats about considering the actual exposure times if fish move. 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), Southall et al. (2019) and NMFS (2024).

Table 22. Criteria for seismic noise exposure for fish, 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

Peak sound pressure level: 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, low) is given for animals at three distances from the source defined in relative terms as near (N), intermediate (I), and far (F).

2.1.1.3. 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 (including PTS) 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. (2000) 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

Recovery Plan for Marine Turtles in Australia (Department of the Environment and Energy et al. 2017) acknowledges the 166 dB re 1 µPa SPL reported (McCauley et al. 2000) as the level that may result in a behavioural response to marine turtles. The 175 dB re 1 µPa level from McCauley et al. (2000) is recommended as a criterion for behavioural disturbance; these thresholds are shown in Table 23.

Table 23. Acoustic effects of impulsive noise on sea turtles: Unweighted sound pressure level (SPL), 24–hour sound exposure level (SEL_{24h}), and peak pressure (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	McCauley et al. (2000)	166	NA	
Behavioural disturbance		175		
PTS onset thresholds[1] (received level)	Finneran et al. (2017)	NA	204	232
TTS onset thresholds[1] (received level)			189	226

[1] 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 and has a reference value of 1 µPa.
L_{pk} denotes peak sound pressure is flat weighted or unweighted and has a reference value of 1 µPa.
$L_{E,24h}$ denotes cumulative sound exposure over a 24 h period and has a reference value of 1 µPa^{2}s.

2.1.2. Benthic Invertebrates

Research is ongoing into the relationship between sound and its effects on crustaceans, 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.

The pressure and acceleration examples provided in Day et al. (2016a) 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.

In consideration of the evolving research, for crustaceans a PK–PK sound level of 202 dB re 1 µPa (Payne et al. 2008) is considered to be associated with no effect. PK–PK sound levels exceeding

202 dB re 1 µPa are therefore assessed here. Additionally for context related to different levels of potential impairment, the PK–PK sound levels of 209–212 dB re 1 µPa determined by Day et al. (2016b) to affect crustaceans, and 213 dB re 1 µPa from Day et al. (2019), 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) and Day et al. (2017) for scallops and pearl shell oyster at which behavioural and physiological effects occurred.

Particle acceleration from the seismic source is also considered here for comparing to the results in Table 7 of Day et al. (2016a), where the maximum particle acceleration assessed for scallops was 37.57 m/s^2.

3. Methods and Parameters

The modelled sites for the activities considered in this study were located around a well site location, indicative of the Judith-2 exploratory drilling program. The modelled sites were situated in water depths of approximately 67–73 m and are considered representative of Emperor Energy's operations within the operational area (refer to wide regional bathymetry in Appendix C.1.1).

To allow for operational flexibility, the sound speed profile implemented within the modelling was selected through a sensitivity analysis considering all months of the year. The month of June was found to be the most favourable for sound propagation, resulting in the largest ranges to considered isopleths criteria, due to the presence of a slightly upward refracting sound speed profile. As such, June was selected as the conservative choice for modelling. Additional detail can be found in Appendix C.1.2.

The seabed beneath the modelled sites will likely consist of coarse sand underlain by limestone. The geologic and geoacoustic profiles of the seabed were generated using borehole analysis from Holdgate et al. (2003) and Mitchell et al. (2007). Further details on the associated geoacoustic properties used in this modelling study are provided in Appendix C.1.3.

Section 3.1 provides a description of the inputs used for the vessel and drilling noise modelling study. The sections are divided into subsections detailing the source inputs for the vessels (Section 3.1.1) with Sections 3.1.2–3.1.3 providing details on the applied modelling techniques and model configuration information.

Section 3.2 provides a description of the inputs used for the VSP component of this study. The sections are divided into subsections detailing the acoustic source inputs for the airgun array (Section 3.2.1) with Sections 3.2.2 – 3.2.3 providing details on the applied modelling techniques and model configuration information.

Section 3.3 provides a description of the inputs used for the 2D shallow hazards seismic survey modelling component of this study. The sections are divided into subsections detailing the acoustic source inputs for the airgun source (Section 3.3.1) with Sections 3.3.2 – 3.3.3 providing details on the applied modelling techniques and model configuration information.

3.1. Vessels and Drilling

3.1.1. Noise Sources

Underwater sound that radiates from vessels is produced mainly by propeller and thruster cavitation, with a smaller fraction of noise produced by sound transmitted through the hull, such as by engines, gearing, and other mechanical systems. Sound levels tend to be the highest when thrusters are used to position the vessel and when the vessel is transiting at high speeds. A vessel's sound signature depends on the vessel's size, power output, propulsion system (e.g., conventional propellers vs. Voith Schneider propulsion), and the design characteristics of the given system (e.g., blade shape and size). A vessel produces broadband acoustic energy with most of the energy emitted below a few kilohertz. Sound from onboard machinery, particularly sound below 200 Hz, dominates the sound spectrum before cavitation begins (Spence et al. 2007).

Figure 4 presents a summary plot of all considered source spectra for comparison purposes. The source spectra plot shows the distribution of sound across the decidecade frequency bands that the modelling considers. Additional detail on the sources is provided in Sections 3.1.1.1 and 3.1.1.2.

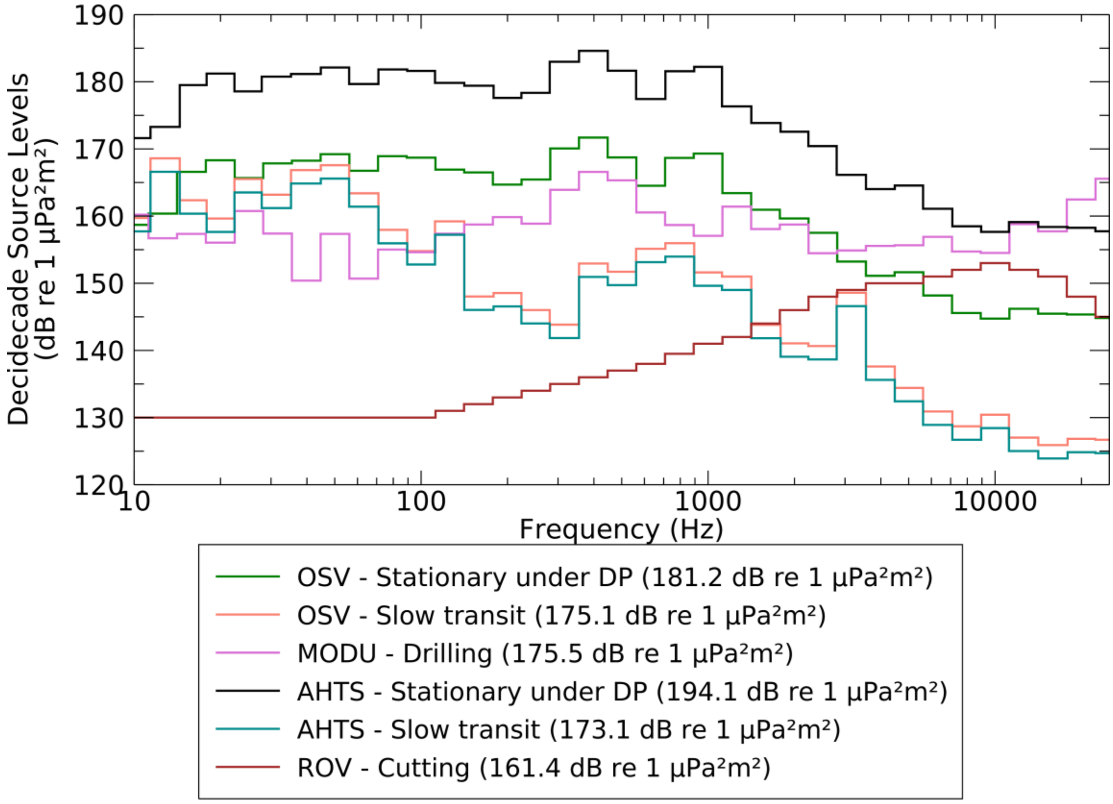

Figure 4. Monopole source level (MSL) spectra (in decidecade frequency–band) for all sound sources.

3.1.1.1. Mobile Offshore Drilling Unit (MODU)

The MODU, or semi–submersible platform, considered in this study is likely similar to the *Ocean Onyx*, (Figure 5). While in operation, it will be held in position via anchors and chains, as opposed to using thrusters. Underwater sound from the MODU while drilling is expected to originate primarily from onboard equipment vibrations, while a smaller portion of the sound is expected to be transmitted directly into the water via the rotating drill string (Austin et al. 2018a). Since the dominant vibration sources (e.g. pumps, generators, and machinery) are located on or below the main deck of the platform, the modelled depth of the point source representing the MODU was set to 11.6 m, which is approximately half the draft of the *Ocean Onyx*.

The Ocean Onyx (Figure 5) was measured by JASCO while anchored and drilling (McPherson et al. 2021), and had a broadband (10 Hz to 31 kHz) source level of 175.4 dB re 1 µPa m.

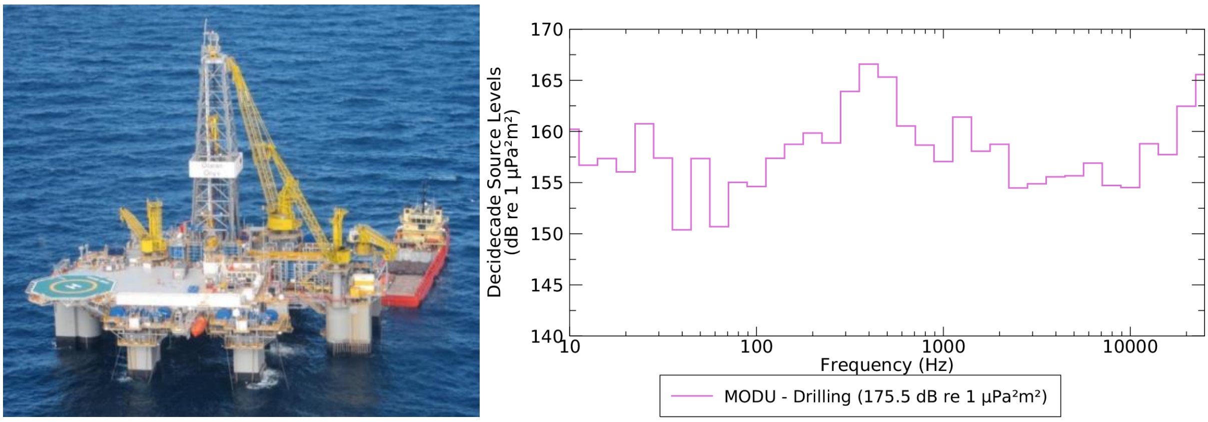

Figure 5. *Ocean Onyx* semi–submersible platform (left) and the source spectrum (right) (Photo source: Offshore Energy, 2020).

3.1.1.2. Vessel Radiated Noise

Underwater sound that radiates from vessels is produced mainly by propeller and thruster cavitation, with a smaller fraction of noise produced by sound transmitted through the hull, such as by engines, gearing, and other mechanical systems. Sound levels tend to be the highest when thrusters are used to position the vessel and when the vessel is transiting at high speeds. A vessel's sound signature depends on the vessel's size, power output, propulsion system (e.g., conventional propellers vs. Voith Schneider propulsion), and the design characteristics of the given system (e.g., blade shape and size). A vessel produces broadband acoustic energy with most of the energy emitted below a few kilohertz. Sound from onboard machinery, particularly sound below 200 Hz, dominates the sound spectrum before cavitation begins (Spence et al. 2007).

3.1.1.2.1. Anchor Handling Tug (AHT)

At this stage, the exact vessel specifications as well as the precise operational scenarios are not known. As such, estimates of the source levels for the Anchor Handling Tug Supply (AHTS) operations were based on a generic design AHTS vessel. The AHTS was based on the Siem VS491 CD design AHTS vessel and its specifications were used to form a basis for vessel source level estimation and source depth for acoustic modelling purposes. The general specification of these vessels is that they have a bollard pull of 285–310 t, and an overall length, beam, and draft of 91.0 m, 22.0 m and 7.95 m respectively.

The measured monopole source levels (MSLs) and spectra for the AHTS were taken from McPherson et al. (2021). For scenarios where the AHTS was under dynamic positioning (DP), the spectra from Section 5.5.2 in McPherson et al. (2021) were used.

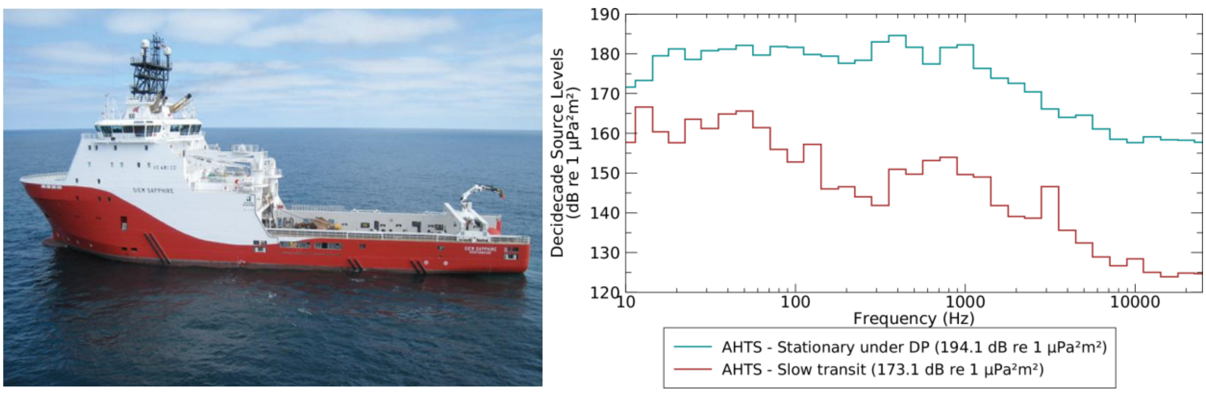

Figure 6. Photo of an Anchor Handling Tug Supply (AHTS) vessel (left) and the source spectra (right) (Photo source: Siem Offshore 2010).

3.1.1.2.2. Offshore Supply Vessel (OSV)

The vessel specifications for the OSV were based on the *MMA Leeuwin*, a platform supply vessel 82.2 m in length, 17 m in width, and a draft of 6.3 m. The *MMA Leeuwin* has a maximum installed thruster power of 4920 kW from two 1600 kW fixed pitch azimuth thrusters and two 880 kW controllable pitch tunnel thrusters. For the modelled scenarios in this study, the vessel was considered to be on stationary holding position whilst on DP for the resupply scenarios. For the operational scenario that included an OSV on standby, it was modelled as moving slowly (4 knots) in a defined area (refer to Section 1.1 to review scenario particulars).

The broadband (10 Hz to 25 kHz) source level of the *MMA Leeuwin* under DP has been measured to be 181.2 dB re 1 μPa^{2}m^2 and while on standby is 181.3 dB re 1 μPa^{2}m^2 (Esso 2021). Measurements for the transiting *MMA Leeuwin* from (Esso 2021) where recorded at a vessel speed of 8.8 knots, to achieve the source level for a 4 knots speed, the overall level was scaled down using the recommended speed scaling factor for tugs (the most similar vessel category to the *MMA Leeuwin*) by MacGillivray and Li (2018) to 175.1 dB re 1 µPa^{2}m^2.

A nominal spectral shape of the *MMA Leeuwin* was selected based on the *Siem Sapphire* measured on DP and standby transit (McPherson et al. 2021); this shape was adjusted to match the broadband levels discussed above.

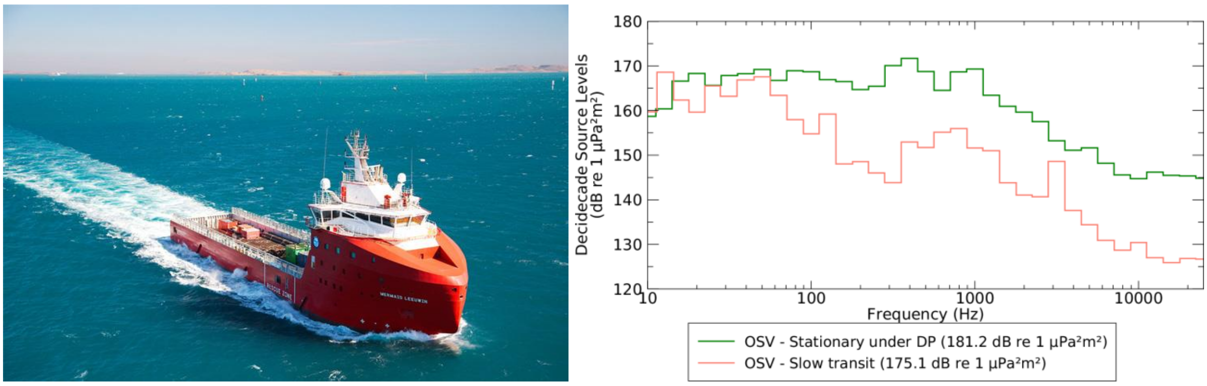

Figure 7. Photo of an Offshore Supply Vessel (OSV) (left) and the source spectra (right) (Photo source: MMA Offshore, 2024).

3.1.1.2.3. ROV

At the time of this underwater noise study, the exact types of activities to be performed by an ROV were unknown. A typical noise–generating activity involving an ROV was assumed to inform the assessment of operations involving an ROV. Nominal ROV cutting activities were considered representative of such operations, with the cutting tool likely to be similar to a diamond wire saw. The available literature, both published and grey, quantifying underwater sound fields generated by diamond wire saws or similar cutting technologies is very limited.

Pangerc et al. (2016) described the underwater sound measurement data during an underwater diamond wire cutting of a 32” conductor (10 m above seabed in approximately 80 m depth) and found that at lower frequencies, the operation was generally indistinguishable above the background noise; however, the sound that could be associated with the diamond wire cutting was primarily detectable above the background noise at the higher acoustic frequencies (above around 5 kHz). The background noise levels were substantially higher at lower frequencies, while it is likely that the spectra of the noise from the cutter peaks at higher frequencies, which has been approximated between 2.5 and 20 kHz.

In another study, the US Navy measured underwater sound levels when the diamond saw was cutting caissons for replacing piles at an old fuel pier at Naval Base Point Loma and reported an average SPL for a single cutter at 136.1–141.4 dB re 1 µPa at 10 m, as reported in Fairweather Science (2018).

In the absence of other information, the information provided in Pangerc et al. (2016) was used to estimate a representative decidecade–band spectra for the diamond wire saw underwater, which was then scaled to have a level of 141.4 dB re 1 µPa at 10 m and then backpropagated using spherical spreading ($20\,log_{10}(R)$) to determine an energy source level (ESL) spectra (in decidecade frequency–band), yielding a broadband level of 161.4 dB re 1 µPa·m.

Figure 8 shows the representative decidecade–band ESL and the legend indicates the broadband ESL for the cutter used in this modelling work.

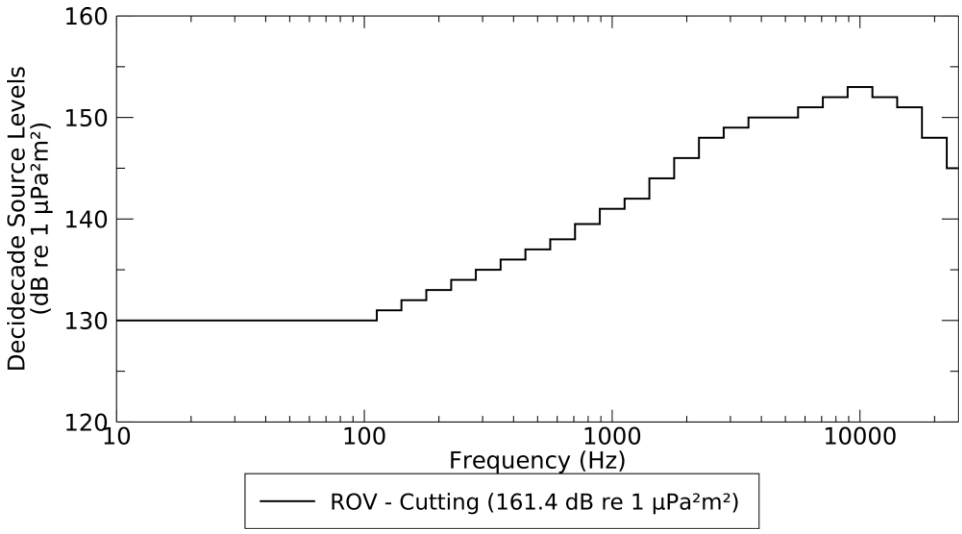

Figure 8. Energy source level (ESL) spectra (in decidecade frequency–band) for the diamond wire saw cutter.

3.1.2. Geometry and Modelled Regions

JASCO's Marine Operations Noise Model (MONM–BELLHOP; see Appendix C.2.2) was used to predict the acoustic field at frequencies of 10 Hz to 25 kHz for all vessels. To supplement the MONM results (10 Hz to 1 kHz), high–frequency results for propagation loss were modelled using BELLHOP (Porter and Liu 1994a) for frequencies from 1.26 to 25 kHz. The MONM and BELLHOP results were combined to produce results for the full frequency range of interest.

The sound field modelling calculated propagation losses up to 100 km from the source, with a horizontal separation of 20 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 4000 m.

To produce the maps of received sound level isopleths, and to 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 levels were then resampled (by linear triangulation) to produce a regular Cartesian grid. The contours and threshold ranges were calculated from these grids of the modelled acoustic fields.

3.1.3. Accumulated SEL

In the vessel scenarios, the sound sources were considered to be continuously operating with new sound energy constantly being introduced to the environment. The reported source levels are usually in terms of sound pressure levels (SPL), representing the average instantaneous acoustic level of a considered source. The evaluation of the cumulative sound field (i.e., in terms of SEL_{24h}) depends on the number of seconds of operation during the accumulation period.

The SPL modelling results were converted to SEL by the duration of the measurement, which is appropriate for a non–impulsive noise source. Here, SEL for the OSV under DP was assessed over 8 h, the duration of its operations, and the SEL for all other sites was assessed over 24 h. For a stationary vessel, the conversion from SPL was obtained by increasing the levels by $10*\log_{10}(T)$, where T is 86,400 (the number of seconds in 24 h). For scenarios where a vessel was transiting along a track, a similar adjustment to the SPL was applied, however the time factor was determined based on the step size along the track and the vessel's speed. See Appendix C.6 for details.

3.2. Vertical Seismic Profiling

3.2.1. Acoustic Source Model

The pressure signature of the individual airguns and the composite decidecade bands point–source equivalent directional levels (i.e., source levels) of the seismic source 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.

The seismic source was modelled over AASM's full frequency range, up to 25 kHz. Appendix B.1 details this model.

3.2.2. 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, 10 Hz to 25 kHz).
- Full Waveform Range–dependent Acoustic Model (FWRAM, 10 to 1024 Hz).
- Wavenumber integration model (VSTACK,10 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 C.2 provides further detailed information about each model.

MONM–BELLHOP was used to calculate SEL of a 360° area around each source location. FWRAM was used to model synthetic seismic pulses and to calculate water column PK and PK–PK levels. FWRAM was also used to generate a generalised SEL to SPL conversion function for the considered modelled sites. The conversion function was applied to predicted per–pulse SEL results from MONM–BELLHOP to estimate SPL values.

VSTACK was used to calculate close range PK and PK–PK levels along transects at the seafloor for the endfire and broadside directions for the VSP array and the 2D shallow hazards seismic survey.

3.2.2.1. Geometry and Modelled Regions

To assess sound levels with MONM–BELLHOP, the sound field modelling calculated propagation losses up to distances of 100 km from the source in each cardinal direction, with a horizontal separation of 20 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. The single–impulse sound fields were modelled within a 100 × 100 km box area. Receiver depths were chosen to span the entire water column, from 2 m to a maximum of 150 m, with step sizes that increased with depth. To supplement the MONM results, high–frequency propagation loss was modelled using BELLHOP for frequencies from 1.25 to 25 kHz. The MONM and BELLHOP results were combined to produce results for the full frequency range of interest.

FWRAM was run to 100 km with a 20 m receiver range step, which increases with distance from the source along four radials (fore and aft endfire, and port and starboard broadside). This was done to compute SEL–to–SPL conversions (Appendix C.5) but also to quantify water column PK levels.

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 receiver depths at 5 m and 5 cm above the seafloor.

3.2.3. Accumulated SEL

For the VSP sound source considered in this study, some criteria are based on the per–pulse energy released, others, such as the marine mammal and fish SEL criteria used in this report (Section 2), account for the total acoustic energy marine fauna is subjected to over a specified duration. The duration is defined in this report as 24 hours. An accurate assessment of the accumulated sound energy depends not only on the parameters of each VSP impulse but also on the number of impulses delivered in a duration.

For the VSP source, SEL accumulated over 24 h and for a stationary source was obtained by increasing the levels by $10*\log_{10}(N)$, where N is the number of shots within a 24 h period. This study considered 5, 10, 25, 50, 100, 150, 200, 250, 300 of impulses independently.

To produce maps of accumulated received sound level distributions and calculate distances to specified sound level thresholds, the maximum–over–depth and seafloor levels were calculated at each sampling point within the modelled region. The radial grids of maximum–over–depth 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 (see 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 unweighted (fish) and frequency–weighted 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 VSP source were rendered.

3.3. 2D Shallow Hazards Seismic Survey

3.3.1. Acoustic Source Model

The 2D Shallow seismic source were modelled with JASCO’s Airgun Array Source Model (AASM). The characteristics of AASM are specified in Section 3.2.1. The 2D seismic source was modelled over AASM’s full frequency range, up to 25 kHz. Appendix C.3 details this model.

3.3.2. Sound Propagation Models

The three sound propagation models used to predict the acoustic field around the seismic sources were described in Section 3.2.2.

VSTACK was used to calculate close range PK and PK–PK levels along transects at the seafloor for the endfire and broadside directions for the VSP array and the 2D shallow hazards seismic survey.

3.3.2.1. Geometry and Modelled Regions

To assess sound levels with MONM–BELLHOP, the sound field modelling calculated propagation losses up to distances of 100 km from the source in each cardinal direction, with a horizontal separation of 20 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. The single–impulse sound fields were modelled within a 100 × 100 km box area. Receiver depths were chosen to span the entire water column, from 2 m to a maximum of 150 m, with step sizes that increased with depth. To supplement the MONM results, high–frequency propagation loss was modelled using BELLHOP for frequencies from 1.25 to 25 kHz. The MONM and BELLHOP results were combined to produce results for the full frequency range of interest.

FWRAM was run to 100 km with a 20 m receiver range step, which increases with distance from the source along four radials (fore and aft endfire, and port and starboard broadside). This was done to compute SEL–to–SPL conversions (Appendix C.5) but also to quantify water column PK levels.

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 receiver depths at 5 m and 5 cm above the seafloor.

3.3.3. Accumulated SEL

During a seismic survey, new sound energy is introduced into the environment with each pulse from the seismic source. While some impact criteria are based on the per–pulse energy released, others, such as the marine mammal and fish SEL criteria used in this report (Section 2), account for the total acoustic energy marine fauna is subjected to over a specified duration. The duration is defined in this report as 24 hours. An accurate assessment of the accumulated sound energy depends not only on the parameters of each seismic impulse but also on the number of impulses delivered in a duration and the relative positions of the impulses.

When there are many seismic impulses, it becomes computationally prohibitive to perform sound propagation modelling for every single event. When the distance between the consecutive seismic impulses is small enough, such that the environmental parameters that influence sound propagation are virtually the same for many impulse points, the acoustic fields can 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.

Estimating the cumulative sound field with the described approach is not as precise as modelling sound propagation at every impulse location. Nonetheless, 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 maps of accumulated received sound level distributions and calculate distances to specified sound level thresholds, the maximum–over–depth and seafloor levels were 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 (see 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 unweighted (fish) and frequency–weighted 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.

4. Results

4.1. Results for Vessel and Drilling Modelling

The maximum–over–depth sound fields for the modelled scenarios are presented below in two formats: as tables of distances to sound levels and, where the distances are long enough, as contour maps showing the directivity and range to various sound levels.

For the results below, the distances to isopleths/thresholds were reported from either the centroid of several sources or from the most dominant single source. When an isopleth completely envelopes multiple sources the centroid was used. When several closed isopleths exist the most dominant source was used. Maps are provided in Section 4.1.2 to assist with contextualising tabulated distances.

4.1.1. Tabulated Results

Table 24 presents the maximum and 95% horizontal distances to specific SPL contours. The SPL sound footprints represent instantaneous sound fields and do not depend on time accumulation. Table 25 presents the maximum distances to frequency–weighted SEL_{24h} thresholds, as well as total ensonified areas.

Table 24. *SPL*: Maximum (R_{max}) and 95% ($R_{95\%}$) horizontal distances (in km) to sound pressure level (SPL) from most appropriate location for considered sources per scenario. Scenario descriptions are provided in Table 12.

SPL (L_p; dB re 1 µPa)	Scenario 1 (2xAHTS Transit + 1 AHTS DP)		Scenario 2 (MODU Drilling)		Scenario 3 (MODU Drilling + OSV Transit)		Scenario 4 (MODU Drilling + OSV DP)		Scenario 5 (ROV Cutting + OSV Transit)	
	R_{max} (km)	$R_{95\%}$ (km)	R_{max} (km)	$R_{95\%}$ (km)	R_{max} (km)	$R_{95\%}$ (km)	R_{max} (km)	$R_{95\%}$ (km)	R_{max} (km)	$R_{95\%}$ (km)
180	–	–	–	–	–	–	–	–	–	–
170[1]	–	–	–	–	–	–	–	–	–	–
160	0.07	0.06	–	–	–	–	–	–	–	–
158[2]	0.08	0.08	–	–	–	–	–	–	–	–
150	0.42	0.39	0.02	0.02	1.03	1.03	0.09	0.09	–	–
140	2.11	1.73	0.07	0.07	1.10	1.09	0.30	0.26	2.10	2.10
130	7.20	6.06	0.44	0.41	1.46	1.37	1.40	1.32	2.82	2.24
120[3]	23.7	18.8	2.24	2.11	3.31	2.93	5.22	4.76	3.06	2.88
110	72.6	61.2	8.85	7.88	9.79	8.51	19.1	15.8	5.22	4.68

[1] 48 h threshold for recoverable injury for fish with a swim bladder involved in hearing (Popper et al. 2014).
[2] 12 h threshold for TTS for fish with a swim bladder involved in hearing (Popper et al. 2014).
[3] Threshold for marine mammal behavioural response to non–impulsive noise (NOAA Fisheries 2024).
A dash indicates the level was not reached within the limits of the modelled resolution (20 m).

Table 25. *SEL_{24h}*: Maximum (R_{max}) horizontal distances (in km) to frequency–weighted SEL_{24h} PTS and TTS thresholds based on NMFS (2024) and Finneran et al. (2017) from most appropriate location for considered sources per scenario, along with ensonified area (km^2).

Hearing group	Frequency–weighted SEL_{24h} threshold ($L_{E,24h}$; dB re 1 µPa²·s)	Scenario 1 (2x AHTS + 1 AHTS DP)		Scenario 2 (MODU Drilling)		Scenario 3 (MODU Drilling + OSV Transit)		Scenario 4 (MODU Drilling + OSV DP)		Scenario 5 (ROV Cutting + OSV Transit)	
		R_{max} (km)	Area (km^2)	R_{max} (km)	Area (km^2)	R_{max} (km)	Area (km^2)	R_{max} (km)	Area (km^2)	R_{max} (km)	Area (km^2)
PTS											
LF cetaceans	197	0.44	0.55	0.03	0.00	0.03	0.00	0.09	0.01	–	–
HF cetaceans	201	0.04	0.00	–	–	–	–	–	–	–	–
VHF cetaceans	181	0.06	0.01	0.06	0.01	0.06	0.01	0.13	0.01	0.03	0.00
Sea turtles	220	–	–	–	–	–	–	–	–	–	–
Otariid seals	199	0.03	0.00	–	–	–	–	–	–	–	–
TTS											
LF cetaceans	177	8.20	157.8	0.53	0.82	0.63	0.84	1.07	3.19	0.05	0.01
HF cetaceans	181	0.92	1.81	0.08	0.02	0.08	0.02	0.16	0.03	0.03	0.00
VHF cetaceans	161	0.98	2.84	0.99	3.06	0.99	3.06	1.06	3.08	0.31	0.28
Sea turtles	200	0.22	0.15	–	–	–	–	–	–	–	–
Otariid seals	179	0.86	1.10	0.08	0.02	0.08	0.02	0.16	0.03	0.04	0.00

A dash indicates the level was not reached within the limits of the modelled resolution (20 m).

4.1.2. Sound Field Maps

Maps of the estimated sound fields, threshold contours, and isopleths of interest for SPL and SEL_{24h} sound fields are presented for the modelled scenarios.

4.1.2.1. SPL Sound Level Contour Maps

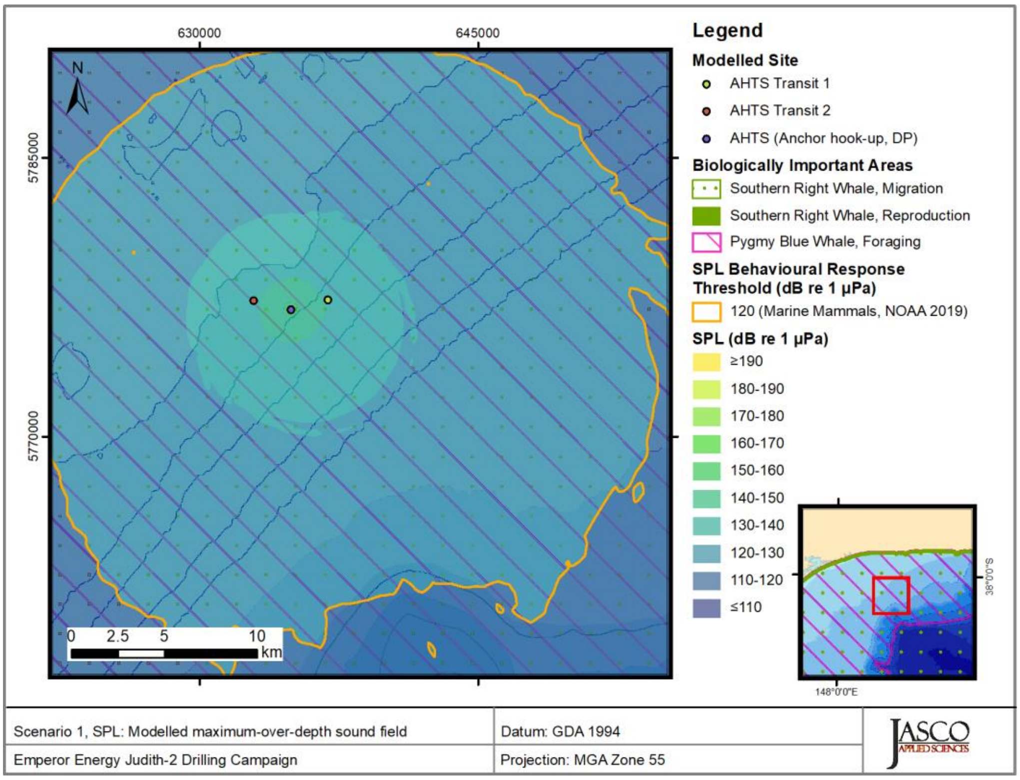

Figure 9. *Scenario 1: 2 AHTS Transit for Prelay + 1 AHTS DP for Anchor Hookup, SPL*: Sound level contour map showing the unweighted maximum–over–depth sound field in 10 dB steps, and the isopleths for behavioural response threshold for marine mammals.

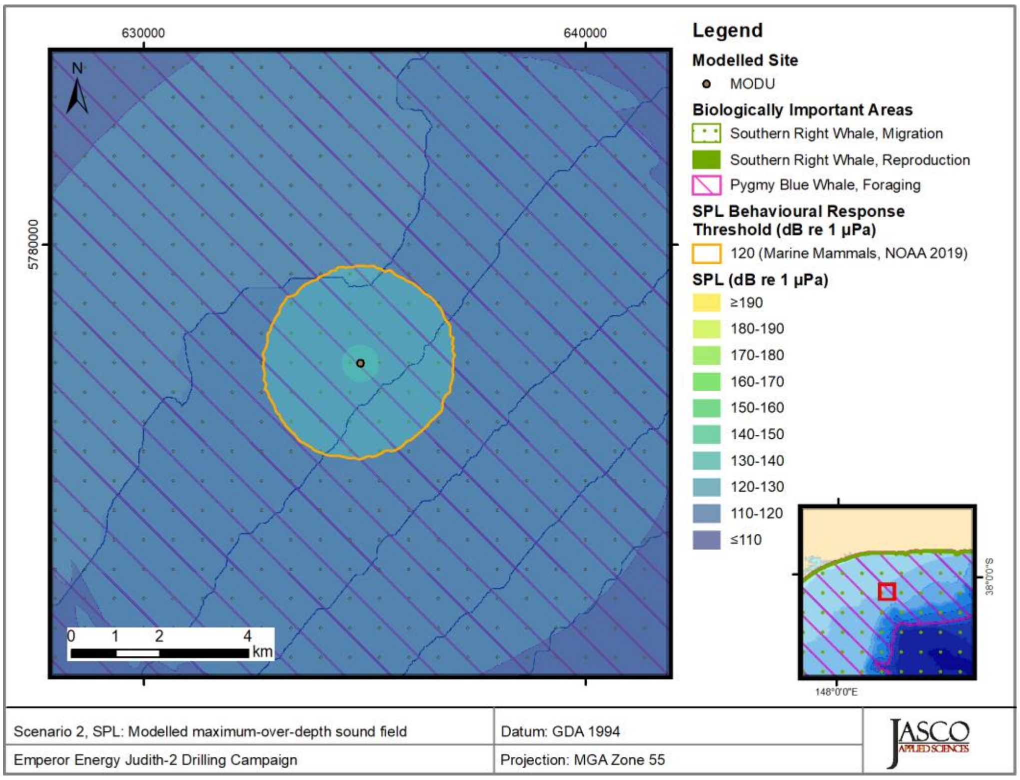

Figure 10. *Scenario 2: MODU Drilling, SPL*: Sound level contour map showing the unweighted maximum–over–depth sound field in 10 dB steps, and the isopleths for behavioural response threshold for marine mammals.

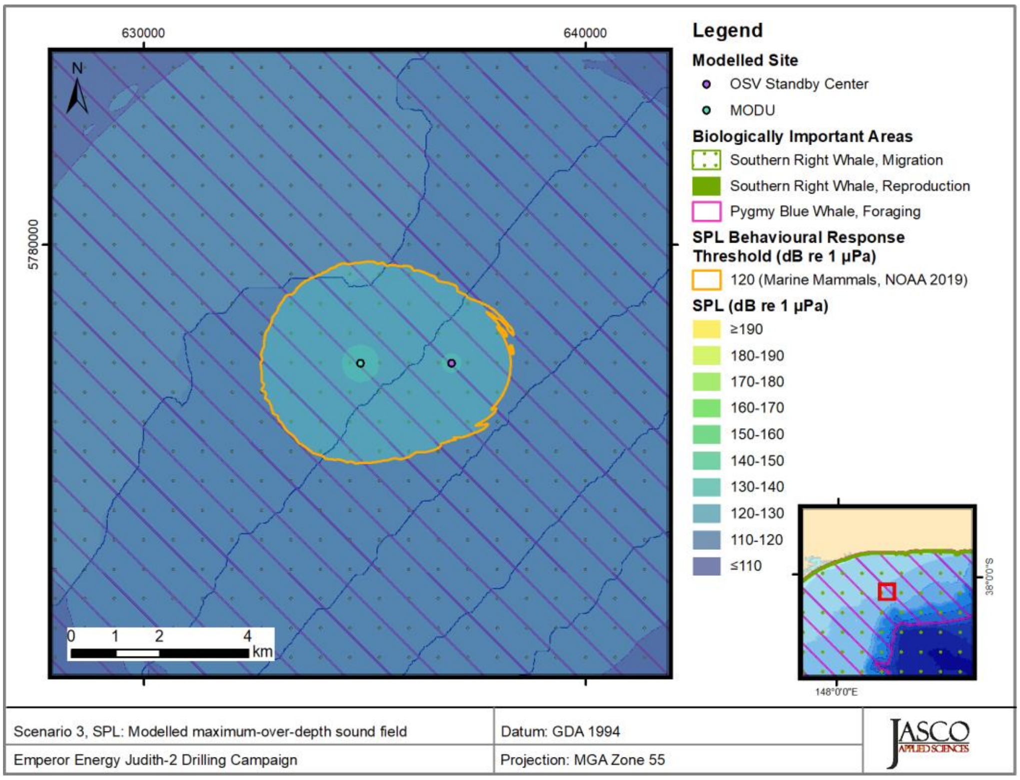

Figure 11. *Scenario 3: MODU Drilling + OSV Transit, SPL*: Sound level contour map showing the unweighted maximum–over–depth sound field in 10 dB steps, and the isopleths for behavioural response threshold for marine mammals.

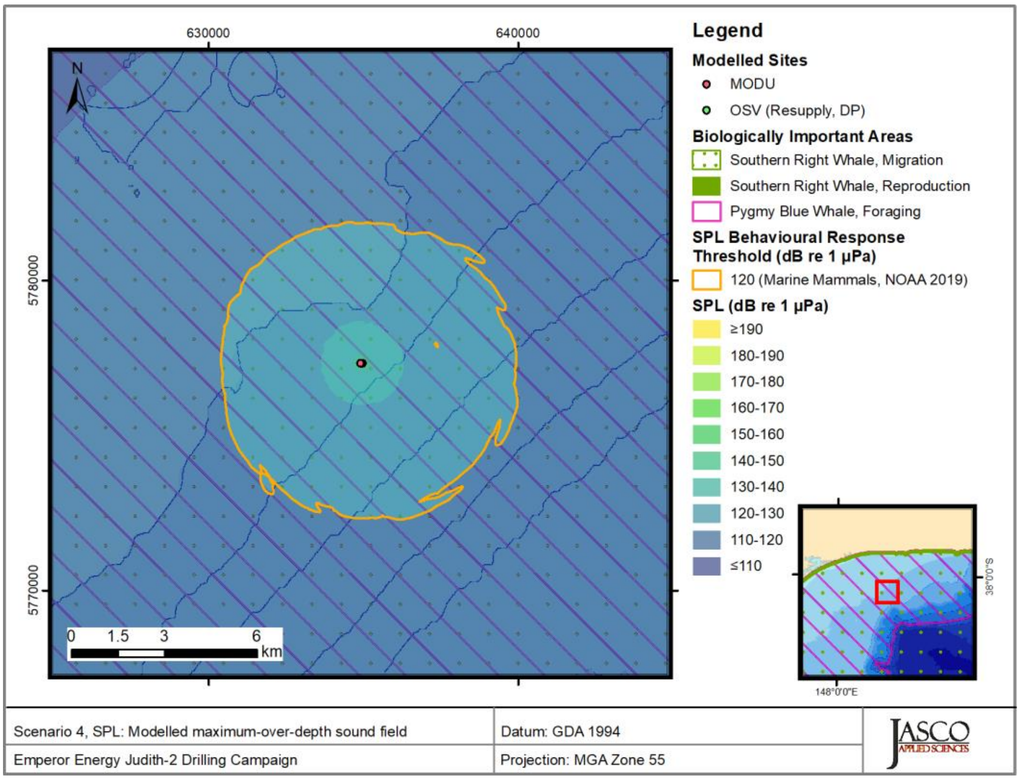

Figure 12. *Scenario 4: MODU Drilling + OSV under DP, SPL*: Sound level contour map showing the unweighted maximum–over–depth sound field in 10 dB steps, and the isopleths for behavioural response threshold for marine mammals.

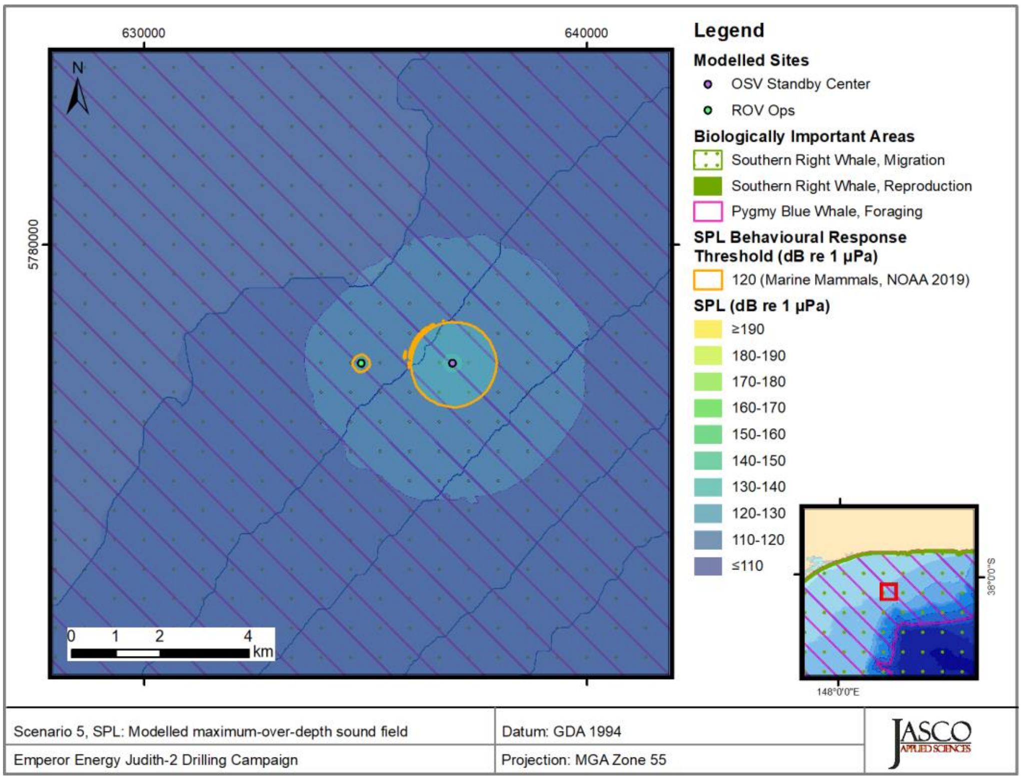

Figure 13. *Scenario 5: ROV Cutting + OSV Transit, SPL*: Sound level contour map showing the unweighted maximum–over–depth sound field in 10 dB steps, and the isopleths for behavioural response threshold for marine mammals.

4.1.2.2. Accumulated SEL_{24h} Sound level Contour Maps

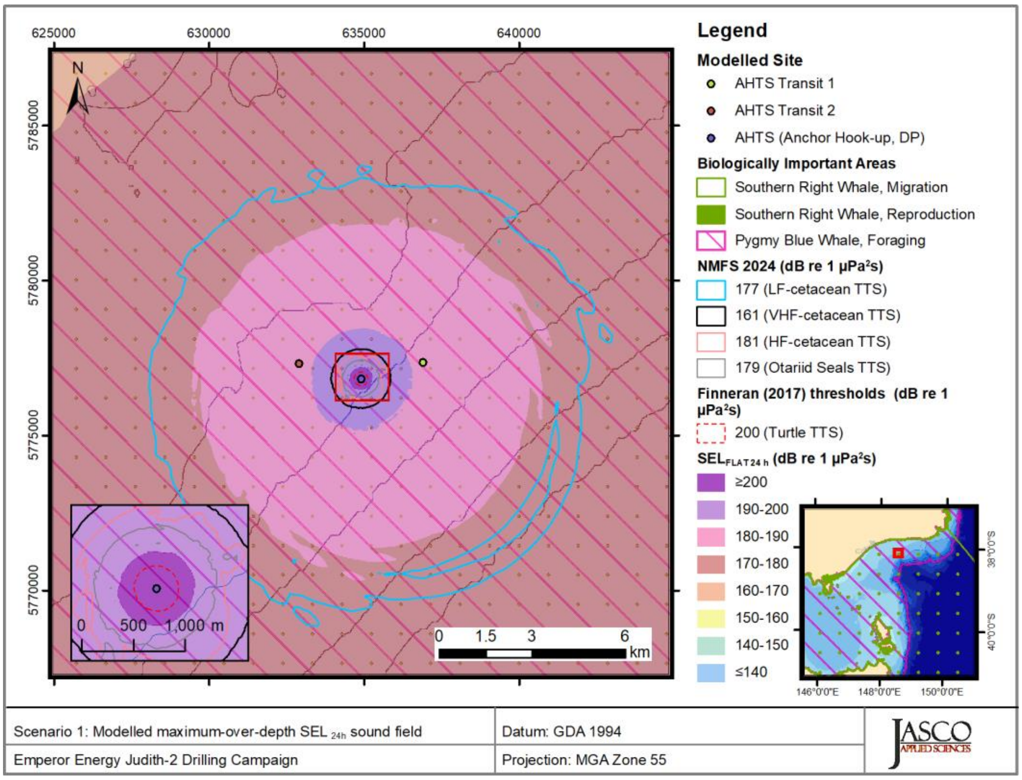

Figure 14. *Scenario 1: 2 AHTS Transit for Prelay + 1 AHTS DP for Anchor hookup*: Sound level contour map showing maximum–over–depth SEL_{24h} results (unweighted/flat), along with frequency weighted isopleths for TTS in low, high, very high–frequency cetaceans, otariid seals and turtles. Thresholds omitted here were not reached or not long enough to display graphically.

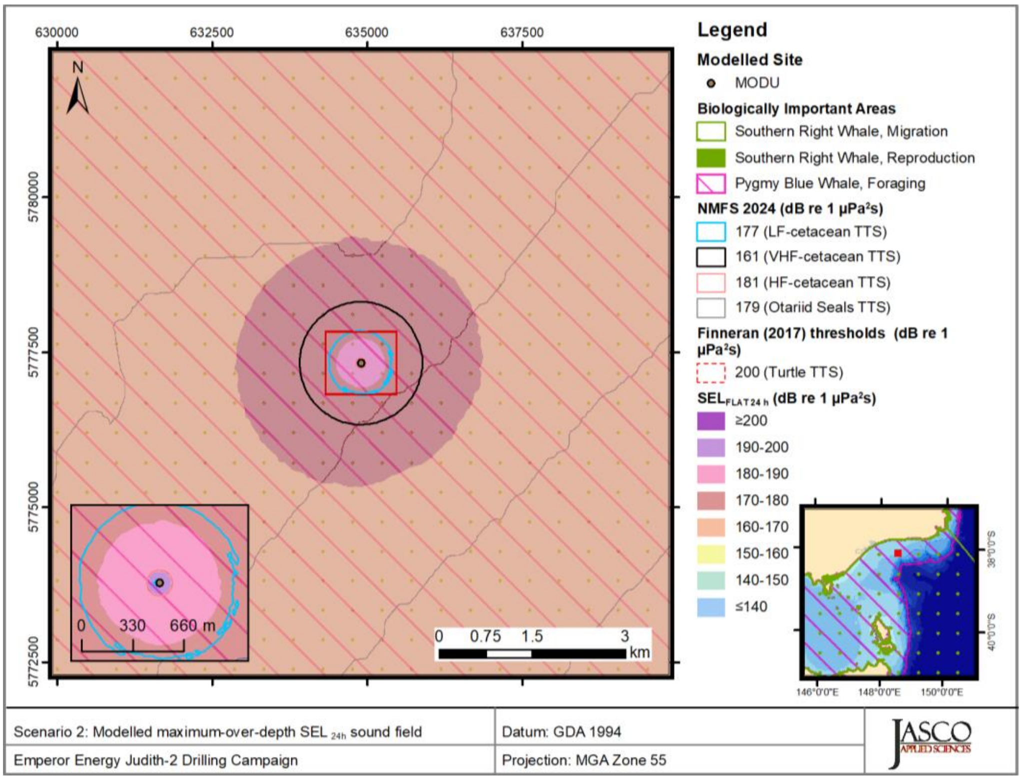

Figure 15*. Scenario 2: MODU Drilling*: Sound level contour map showing maximum–over–depth SEL_{24h} results (unweighted/flat), along with frequency weighted isopleths for TTS in low, high, very high–frequency cetaceans, otariid seals and turtles. Thresholds omitted here were not reached or not long enough to display graphically.

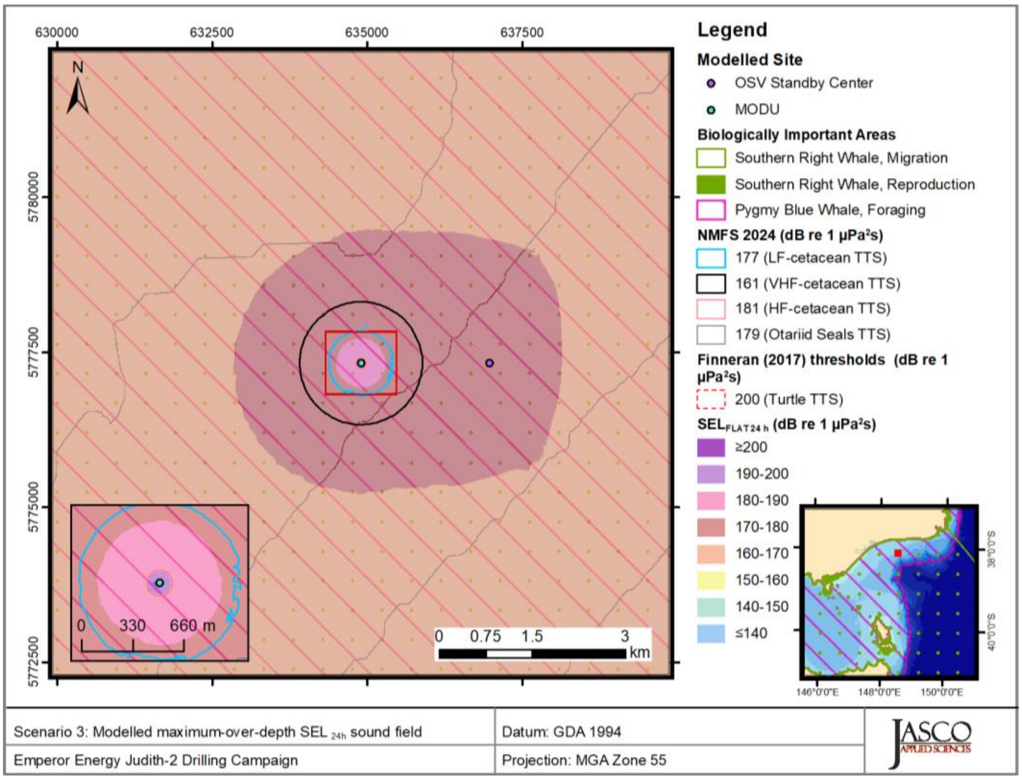

Figure 16. *Scenario 3: MODU Drilling + OSV Transit*: Sound level contour map showing maximum–over–depth SEL_{24h} results (unweighted/flat), along with frequency weighted isopleths for TTS in low, high, very high–frequency cetaceans, otariid seals and turtles. Thresholds omitted here were not reached or not long enough to display graphically.

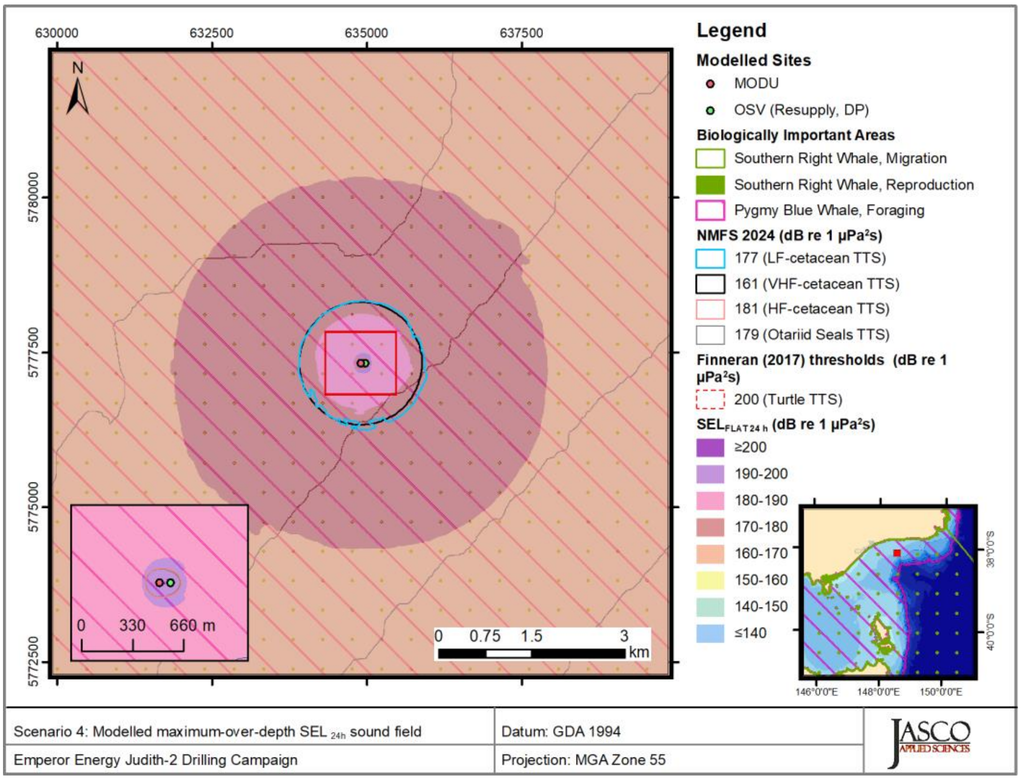

Figure 17. *Scenario 4: MODU Drilling + OSV DP*: Sound level contour map showing maximum–over–depth SEL_{24h} results (unweighted/flat), along with frequency weighted isopleths for TTS in low, high, very high–frequency cetaceans, otariid seals and turtles. Thresholds omitted here were not reached or not long enough to display graphically.

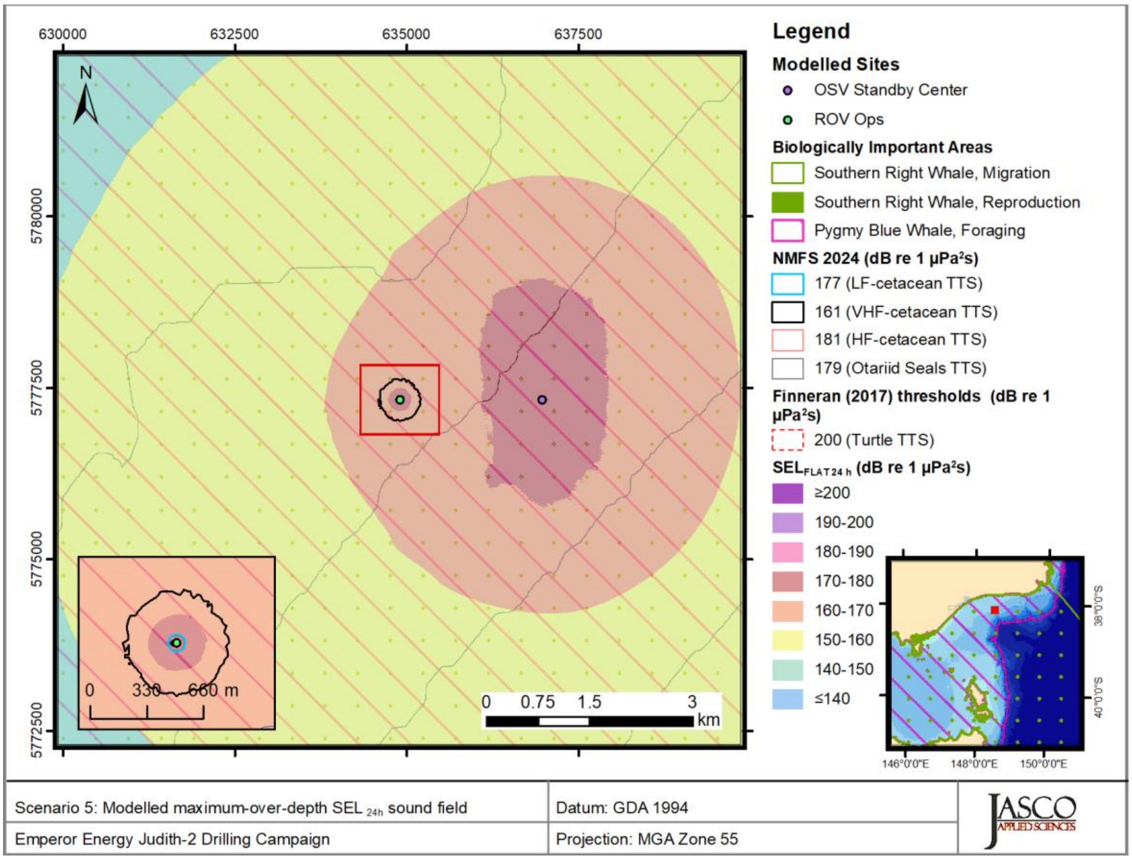

Figure 18. *Scenario 5: ROV Cutting + OSV Transit*: Sound level contour map showing maximum–over–depth SEL_{24h} results (unweighted/flat), along with frequency weighted for TTS in low, high, very high–frequency cetaceans, otariid seals and turtles. Thresholds omitted here were not reached or not long enough to display graphically.

4.2. Results for VSP Modelling

4.2.1. Acoustic Source Levels and Directivity

AASM (Appendix B.1) was used to predict the horizontal and vertical overpressure signatures and corresponding power spectrum levels for the seismic source, with results provided in Appendix B.2.1 along with the horizontal directivity plots for the selected source.

Table 26 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 for the modelled array signature (a 600 in^3 seismic source). 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 to other seismic source models.

Figure B–3 in Appendix B.2.1 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 26. Far–field source level specifications for the 600 in^3 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 re 1 µPa^{2}m^{2}s)	
		10–2000 Hz	2000–25000 Hz
Broadside	240.6	214.7	170.6
Endfire	239.2	214.3	172.6
Vertical	241.1	214.9	175.1
Vertical (surface affected source level)	241.1	216.6	178.3

4.2.2. Per–Pulse Sound Fields

This section presents the per–pulse sound fields in terms of maximum–over–depth SPL, SEL, and 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 Section 2).
- Per–pulse SEL sound fields are used as inputs into the 24 h SEL scenarios and to provide 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 (Section 2).

The maximum and 95% distances to per–pulse SEL and SPL metrics are presented in Table 27 and Table 28. The SPL sound fields, and distances to relevant isopleths can be visualised on the contour maps presented in Section 4.1.2.1.

Maximum distances to maximum–over–depth water column PK thresholds were calculated for all single impulse sites and are presented in Table 29. Seafloor sound levels were assessed at 2 representative depths within the survey area (66.2 m and 66.65 m) and Table 30 and Table 31 present the PK and PK–PK results.

4.2.2.1. Tabulated Results

4.2.2.1.1. Water Column

Table 27. Maximum (R_{max}) and 95% ($R_{95\%}$) horizontal distances (in km) from the VSP source to modelled maximum–over–depth and maximum–over–azimuth unweighted per–pulse sound exposure level (SEL) isopleths from the modelled single impulse sites, with the water depth indicated.

Per–pulse SEL (L_E; dB re 1 µPa²·s)	Site VSP (66.7 m)	
	R_{max} (km)	$R_{95\%}$ (km)
190	–	–
180	0.05	0.05
170	0.27	0.26
160[1]	1.32	1.15
150	3.64	3.13
140	8.33	7.24
130	25.5	21.3
120	71.2	58.8

[1] Low power zone assessment criteria DEWHA (2008).

Table 28. Maximum (R_{max}) and 95% ($R_{95\%}$) horizontal distances (in km) from the VSP source to modelled maximum–over–depth and maximum–over–azimuth per–pulse sound pressure level (SPL) isopleths from the modelled single impulse sites, with the water depth indicated.

SPL (L_p; dB re 1 µPa)	Site VSP (66.7 m)	
	R_{max} (km)	$R_{95\%}$ (km)
200	–	–
190	0.04	0.04
180	0.23	0.22
175[1]	0.54	0.50
170	1.20	1.02
166[2]	1.74	1.54
160[3]	2.82	2.51
150	6.96	6.14
140	22.3	18.7

[1] Threshold for turtle behavioural disturbance from impulsive noise (McCauley et al. 2000).
[2] Threshold for turtle behavioural response to impulsive noise (McCauley et al. 2000, NSF 2011).
[3] Marine mammal behavioural threshold for impulsive sound sources (NOAA 2024).

Table 29. Maximum (R_{max}) horizontal distances (in km) from the VSP source to modelled maximum–over–depth peak pressure level (PK) thresholds based on NMFS (2024) for marine mammals, and Popper et al. (2014) for fish and Finneran et al. (2017) for sea turtles, at the modelled single impulse sites, with the water depth indicated.

Hearing group	PK threshold (L_{pk}; dB re 1 µPa)	Distance R_{max} (km)
Low–frequency cetaceans (PTS)	222	–
High–frequency cetaceans (PTS)	230	–
Very high–frequency cetaceans (PTS)	202	0.07
Otariid Seals (PTS)	230	–
Sea Turtles (PTS)	232	–
Low–frequency cetaceans (TTS)	216	–
High–frequency cetaceans (TTS)	224	–
Very high–frequency cetaceans (TTS)	196	0.28
Otariid Seals (TTS)	224	–
Sea Turtles (TTS)	226	–
Fish: No swim bladder (also applied to sharks)[1]	213	0.02
Fish: Swim bladder not involved in hearing[1], Swim bladder involved in hearing[1] Fish eggs, and larvae[2]	207	0.41

[1] Mortality and potential mortal injury, and recoverable injury threshold
[2] Mortality and potential mortal injury threshold
A dash indicates the threshold is not reached within the limits of the modelling resolution (20 m).

4.2.2.1.2. Seafloor

Ranges presented at the seafloor provided in Tables 30 and 31 are different to those for the maximum–over–depth modelling results presented in Table 29. This is because the model used for the water column results, FWRAM (Appendix C.3.2) does not represent the maximum sound levels at the seafloor close to the array. This is because FWRAM is based on a wide–angle parabolic equation (PE) algorithm which is valid to only approximately 70° down angle from the horizontal, and while it provides accurate predictions in the horizontal direction, it cannot predict sound levels directly under the array. The VSTACK model (Appendix C.3.3) is therefore used to determine the levels at the seafloor directly under the array, and due to seafloor interactions, these can be greater than those elsewhere in the water column.

Table 30. Maximum (R_{max}) horizontal distances (in m) from the VSP source to modelled seafloor (receiver located 0.5 m above seafloor) peak pressure level thresholds (PK) within the modelling area.

Hearing group/animal type	PK threshold (L_{pk}; dB re 1 µPa)	Distance R_{max} (m)
		Receiver Depth: 66.2 m
Sound levels for sponges and corals[1]	226	*
Fish: I	213	*
Fish: II, III, Fish eggs, and larvae	207	21.3

[1] Heyward et al. (2018)
An asterisk indicates that the sound level was not reached.
Fish I–No swim bladder; Fish II–Swim bladder not involved with hearing; Fish III–Swim bladder involved with hearing.

Table 31. Maximum (R_{max}) horizontal distances (in m) from the VSP source to modelled seafloor (receiver located 5 cm above seafloor) peak–peak pressure levels (PK–PK) within the modelling area. Results included in relation to benthic invertebrates.

PK–PK (L_{pk-pk}; dB re 1 µPa)	Distance R_{max} (m) Receiver Depth: 66.65 m
213[1,2,3]	*
212[2,3]	18.7
210[1,2]	51.2
209[1,2]	63.9
202[4]	184.4

1 Day et al. (2019), lobster
2 Day et al. (2016a), lobster and scallops
3 Day et al. (2017), scallops.
4 Payne et al. (2008), lobster
An asterisk indicates that the sound level was not reached.

4.2.2.2. Sound Field Map

A sound level contour map of VSP SPL results is included in this section.

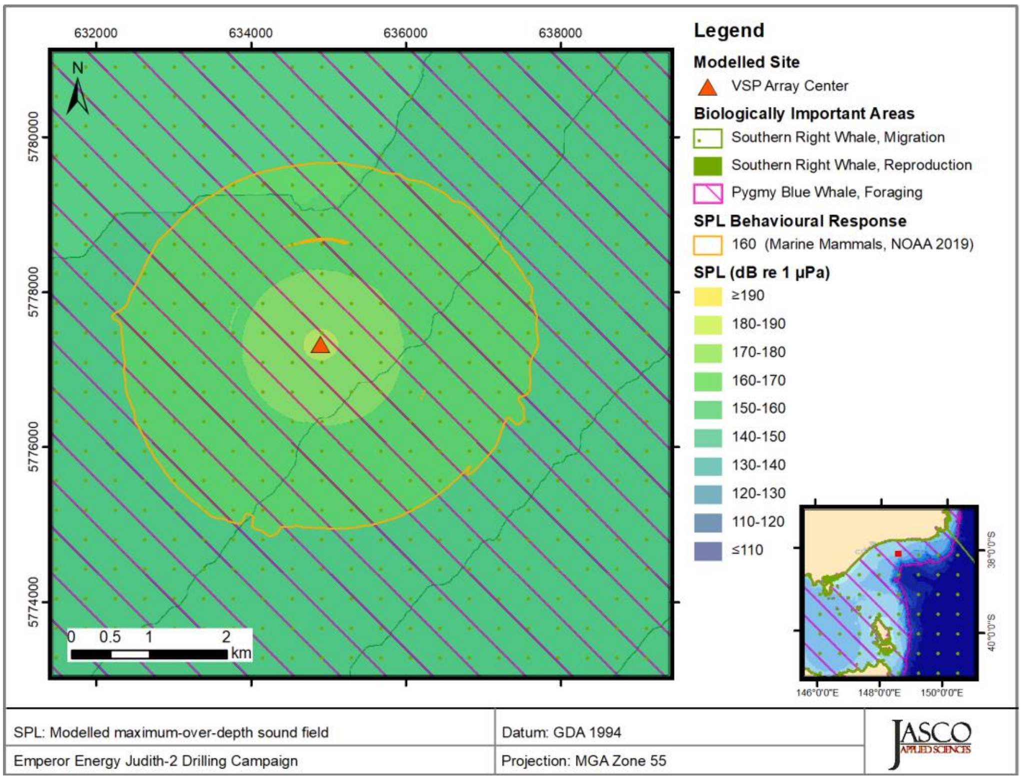

Figure 19. *VSP Site, static source*: Sound level contour map maximum–over–depth SPL sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals.

4.2.2.3. Particle Motion Metrics

Figure 20 shows modelled maximum particle acceleration as a function of horizontal range in four perpendicular directions from the centre of the 600 in^3 seismic source at water depth 66.7 m corresponding to the VSP site (refer to Section 1.2). The modelling considered a resolution of 20 m, and a receiver positioned 5 cm off the seafloor. The maximum distance to a particle acceleration of 37.57 ms^{-2} is not predicted to occur at a water depth of 66.7 m.

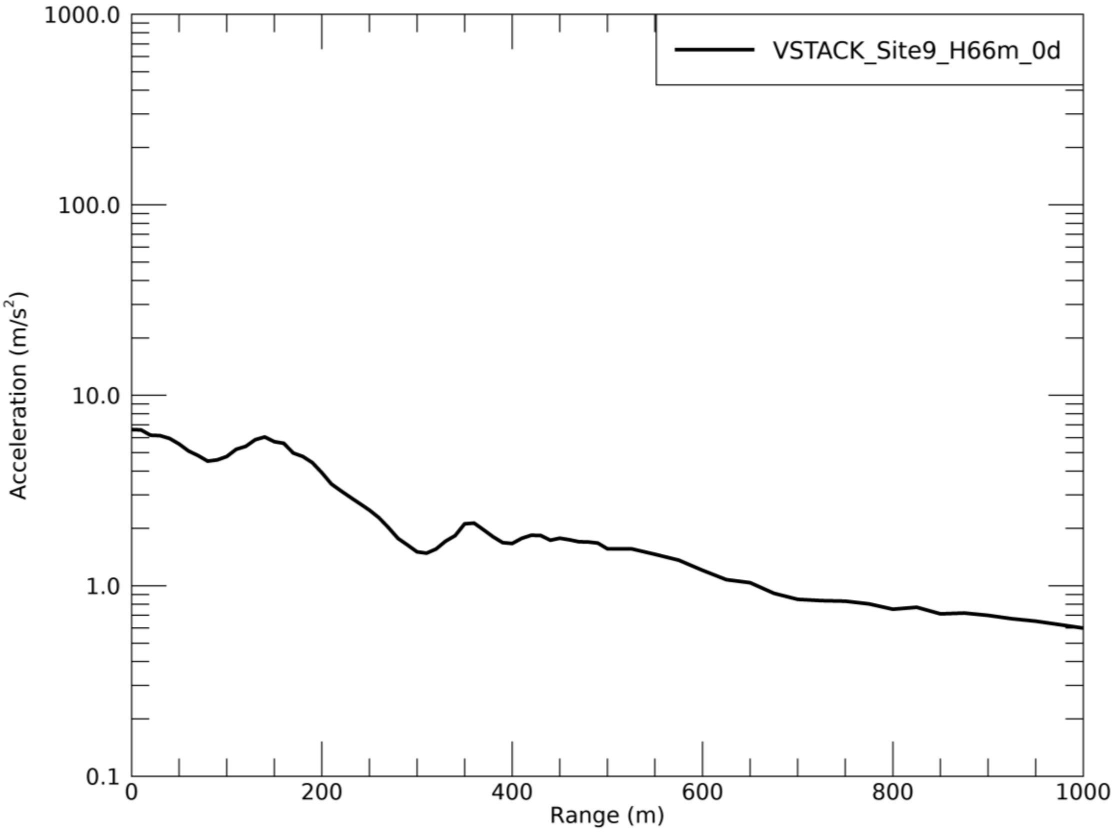

Figure 20. 600 in^3 VSP seismic source at 66.7 m water depth: Peak particle acceleration magnitude at the seafloor as a function of horizontal range from the centre of the seismic source along four directions.

Particle motion was modelled at a depth of 5 cm above the seafloor for an associated assessment for invertebrates. The peak particle acceleration magnitude of 37.57 ms^{-2} was not reached (Table 32) at the modelled water depth. This particle acceleration threshold was assessed for invertebrates by Day et al. (2016a).

Table 32. Maximum (R_{max}) horizontal distances (in m) from the 600 in^3 to particle motion level: Peak acceleration magnitude level (m/s^2), 5 cm above the seafloor. Results included in relation to benthic invertebrates (Section 2.1.2).

Hearing group/animal type	Peak Acceleration Magnitude (m/s^2)	Water Depth 66.65 m Distance R_{max} (m)
Benthic invertebrates	37.57	*

An asterisk indicates that the particle motion level was not reached.

4.2.3. Multiple Pulse Sound Fields

This section presents the sound fields in terms of SEL accumulated over 24 h of survey, for the modelled scenario (Section 1.3) with 9 activation configurations. 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 5.4.C.4) to marine mammals and turtle TTS and PTS thresholds (listed in Table 33), and to estimate maximum distance and the area to injury and TTS guidelines for fish (Table 34).

The SEL_{24h} sound fields are presented as contour maps in Section 4.2.3.2 for the modelled scenarios. The maps present the unweighted SEL_{24h} in 10 dB steps, as well as the isopleths corresponding to thresholds or guidelines for which R_{max} was greater than 20 m.

4.2.3.1. Tabulated Results

Table 33. VSP, multiple–pulse SEL: Maximum–over–depth distances (in km) to frequency–weighted 24 hour sound exposure level (SEL_{24h}) based permanent threshold shift (PTS) and temporary threshold shift (TTS) for marine mammals (NMFS 2024) and sea turtles Finneran et al. (2017) from VSP operations, assuming different numbers of impulses during a 24 h period.

Hearing group	Threshold for SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²·s)	Number of Shots								
		5 R_{max} (km)	10 R_{max} (km)	25 R_{max} (km)	50 R_{max} (km)	100 R_{max} (km)	150 R_{max} (km)	200 R_{max} (km)	250 R_{max} (km)	300 R_{max} (km)
PTS										
LF cetaceans	183	0.04	0.06	0.17	0.26	0.37	0.51	0.63	0.74	0.85
HF cetaceans	193	–	–	–	–	–	–	–	–	–
VHF cetaceans	159	–	–	–	–	–	–	–	–	–
Sea turtles	204	–	–	–	–	0.02	0.03	0.03	0.04	0.05
Otariid Seals	185	–	–	–	–	–	–	–	–	–
TTS										
LF cetaceans	168	0.54	0.89	1.54	2.24	2.98	3.71	4.08	4.58	4.82
HF cetaceans	178	–	–	–	–	–	0.02	0.02	0.03	0.03
VHF cetaceans	144	–	0.02	0.03	0.05	0.06	0.09	0.09	0.11	0.16
Sea turtles	189	0.03	0.05	0.06	0.17	0.26	0.31	0.38	0.46	0.53
Otariid Seals	170	–	–	–	–	0.03	0.03	0.04	0.05	0.05

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

Table 34. Distances to 24 hour sound exposure level (SEL_{24h}) based fish criteria in the water column for the 600 in^3 array.

Marine fauna group	Threshold for SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²·s)	Number of Shots								
		5 R_{max} (km)	10 R_{max} (km)	25 R_{max} (km)	50 R_{max} (km)	100 R_{max} (km)	150 R_{max} (km)	200 R_{max} (km)	250 R_{max} (km)	300 R_{max} (km)
Mortality and potential mortal injury										
I	219	–	–	–	–	–	–	–	–	–
II, fish eggs and fish larvae	210	–	–	–	–	–	–	0.02	0.02	0.02
III	207	–	–	–	–	0.02	0.02	0.03	0.03	0.03
Fish recoverable injury										
I	216	–	–	–	–	–	–	–	–	–
II, III	203	–	–	–	0.02	0.03	0.04	0.05	0.05	0.06
Fish temporary threshold shift (TTS)										
I, II, III	186	0.05	0.14	0.22	0.31	0.51	0.71	0.83	0.96	1.07

Fish I–No swim bladder;
Fish II–Swim bladder not involved with hearing;
Fish III–Swim bladder involved with hearing.
An asterisk indicates that the threshold was not reached.

4.2.3.2. Sound Level Contour Map

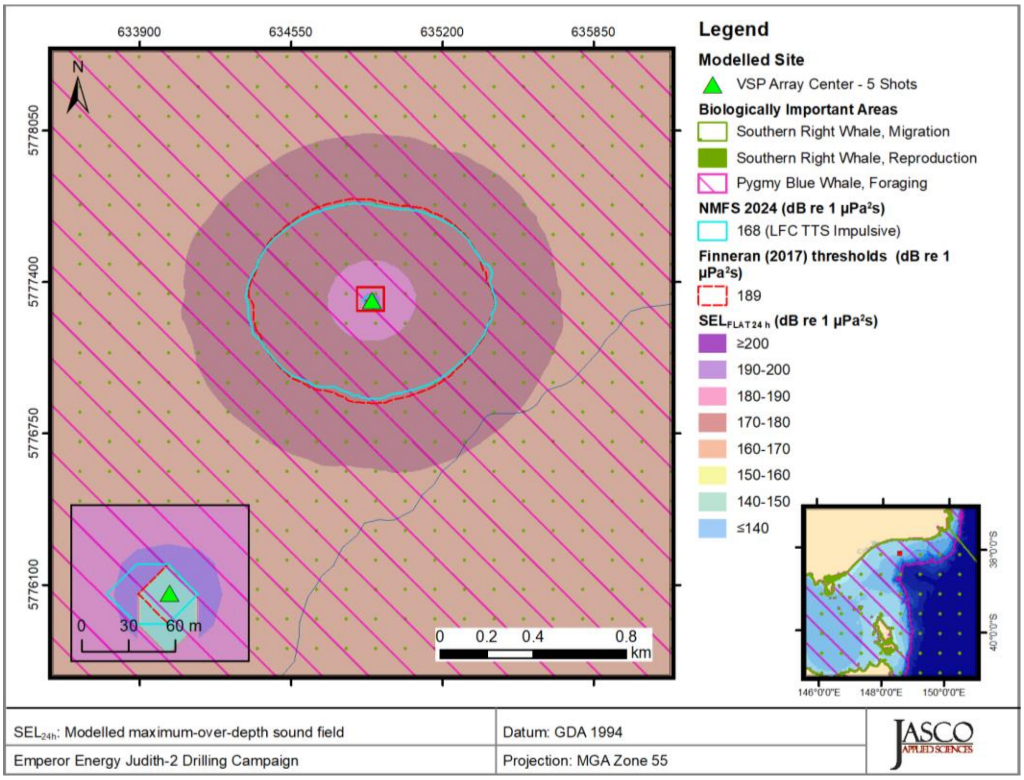

Figure 21. *VSP with 5 Shots*: Sound level contour map of unweighted maximum–over–depth SEL_{24h} results, along with isopleths for cetaceans, and turtles. Thresholds omitted here were not reached or not large enough to display graphically. Refer to Tables 33 and 34 for threshold distances.

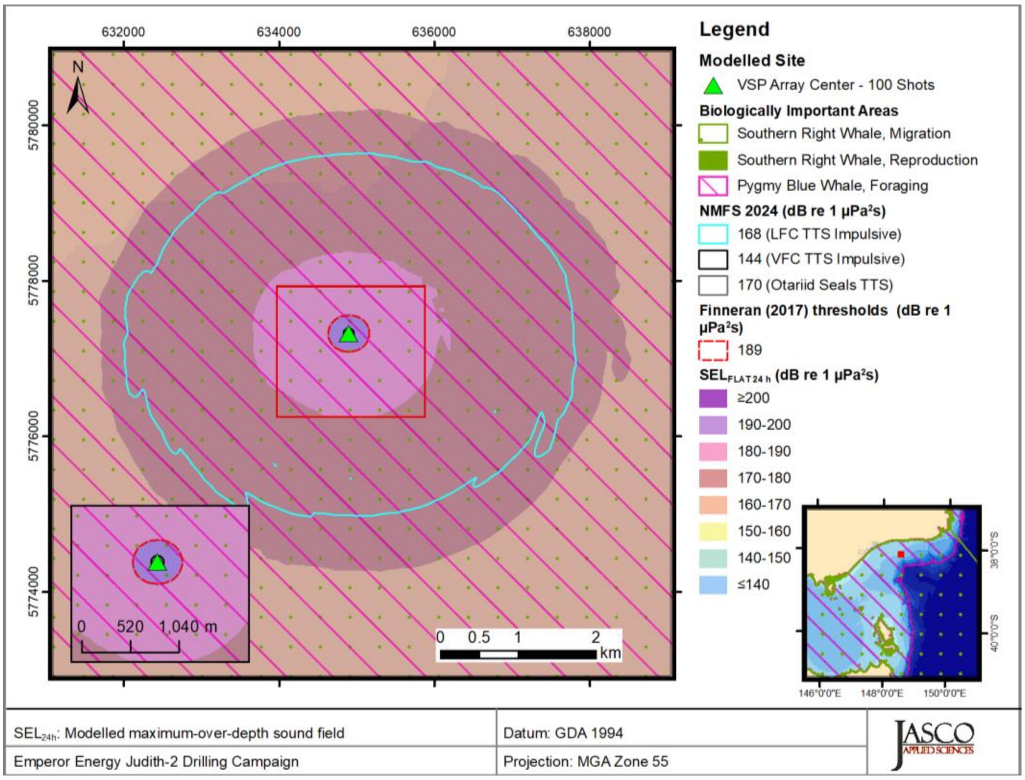

Figure 22. *VSP with 100 Shots*: Sound level contour map of unweighted maximum–over–depth SEL_{24h} results, along with isopleths for cetaceans and turtles. Thresholds omitted here were not reached or not large enough to display graphically. Refer to Tables 33 and 34 for threshold distances.

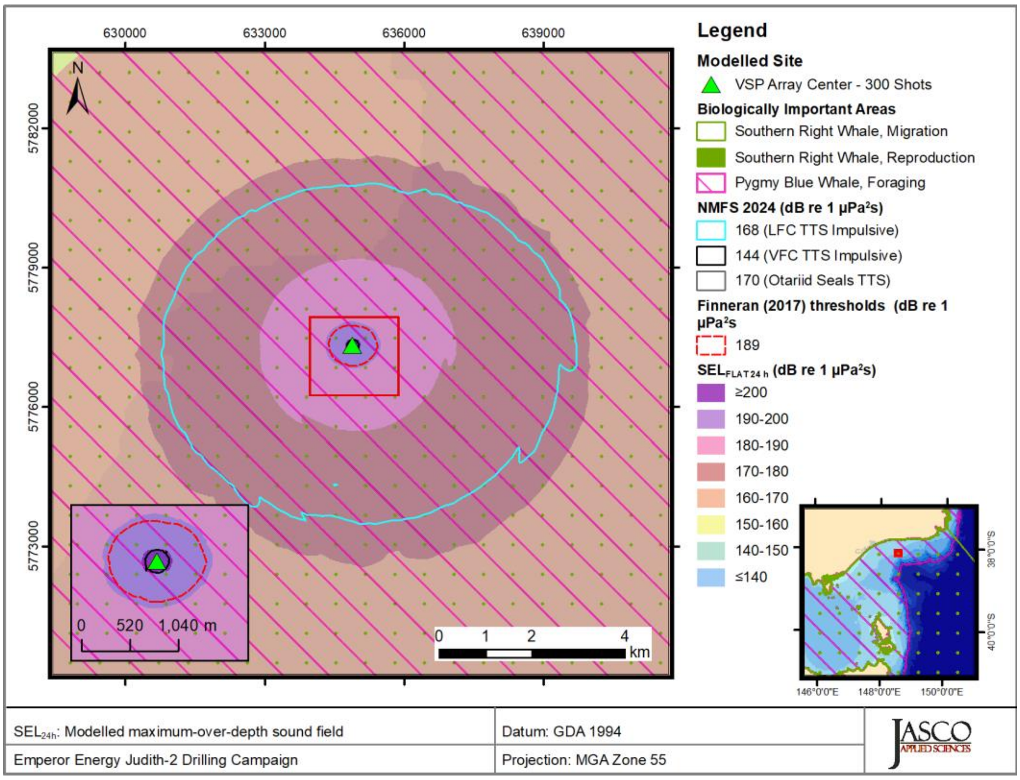

Figure 23. *VSP with 300 Shots*: Sound level contour map of unweighted maximum–over–depth SEL_{24h} results, along with isopleths for cetaceans and turtles. Thresholds omitted here were not reached or not large enough to display graphically. Refer to Tables 33 and 34 for threshold distances.

4.3. Results for 2D Shallow Hazards Seismic Survey Modelling

4.3.1. Acoustic Source Levels and Directivity

AASM (Appendix B.1) was used to predict the horizontal and vertical overpressure signatures and corresponding power spectrum levels for the seismic source, with results provided in Appendix B.2.1 along with the horizontal directivity plots for the selected source.

Table 26 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 for the modelled array signature (a 160 in^3 seismic source). 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 to other seismic source models.

Figure B–3 in Appendix B.2.1 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 35. Far–field source level specifications for the 160 in^3 source, for a 7 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 re 1 µPa^{2}m^{2}s)	
		10–2000 Hz	2000–25000 Hz
Broadside	230.1	208.4	170.4
Endfire	230.1	208.4	170.4
Vertical	230.1	208.4	170.4
Vertical (surface affected source level)	230.1	209.1	173.4

4.3.2. Per–Pulse Sound Fields

This section presents the per–pulse sound fields in terms of maximum–over–depth SPL, SEL, and 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 Section 2).
- Per–pulse SEL sound fields are used as inputs into the 24 h SEL scenario/s and to provide 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 (Section 2).

The maximum and 95% distances to per–pulse SEL and SPL metrics are presented in Table 27 and Table 28. The SPL sound fields, and distances to relevant isopleths can be visualised on the contour maps presented in Section 4.3.2.2.

Maximum distances to maximum–over–depth water column PK thresholds were calculated for the single impulse site and are presented in Table 29. Seafloor sound levels were assessed at 2 representative depths within the survey area (66.2 m and 66.65 m) and Tables 30 and 31 present the PK and PK–PK results.

4.3.2.1. Tabulated Results

4.3.2.1.1. Water Column

Table 36. Maximum (R_{max}) and 95% ($R_{95\%}$) horizontal distances (in km) from the seismic source to modelled maximum–over–depth and maximum–over–azimuth unweighted per–pulse sound exposure level (SEL) isopleths from the modelled single impulse sites, with the water depth indicated.

Per–pulse SEL (L_E; dB re 1 µPa²·s)	Site 2D Seismic (66.7 m)	
	R_{max} (km)	$R_{95\%}$ (km)
190	–	–
180	–	–
170	0.06	0.06
160[1]	0.43	0.42
150	1.77	1.65
140	4.43	4.02
130	11.0	9.96
120	34.1	28.8

[1] Low power zone assessment criteria DEWHA (2008).

Table 37. Maximum (R_{max}) and 95% ($R_{95\%}$) horizontal distances (in km) from the seismic source to modelled maximum–over–depth and maximum–over–azimuth per–pulse sound pressure level (SPL) isopleths from the modelled single impulse sites, with the water depth indicated.

SPL (L_p; dB re 1 µPa)	Site 2D Seismic (66.7 m)	
	R_{max} (km)	$R_{95\%}$ (km)
200	–	–
190	–	–
180	0.05	0.05
175[1]	0.17	0.17
170	0.40	0.39
166[2]	0.70	0.64
160[3]	1.48	1.34
150	3.52	3.16
140	9.66	8.64

[1] Threshold for turtle behavioural disturbance from impulsive noise (McCauley et al. 2000).
[2] Threshold for turtle behavioural response to impulsive noise (McCauley et al. 2000, NSF 2011).
[3] Marine mammal behavioural threshold for impulsive sound sources (NOAA 2024).

Table 38. Maximum (R_{max}) horizontal distances (in km) from the seismic source to modelled maximum–over–depth peak pressure level (PK) thresholds based on NMFS (2024) for marine mammals, and Popper et al. (2014) for fish and Finneran et al. (2017) for sea turtles, at the modelled single impulse sites, with the water depth indicated.

Hearing group	PK threshold (L_{pk}; dB re 1 µPa)	Distance R_{max} (km)
Low–frequency cetaceans (PTS)	222	–
High–frequency cetaceans (PTS)	230	–
Very high–frequency cetaceans (PTS)	202	0.03
Otariid Seals (PTS)	230	–
Sea Turtles (PTS)	232	–
Low–frequency cetaceans (TTS)	216	–
High–frequency cetaceans (TTS)	224	–
Very high–frequency cetaceans (TTS)	196	0.05
Otariid Seals (TTS)	224	–
Sea Turtles (TTS)	226	–
Fish: No swim bladder (also applied to sharks)[1]	213	–
Fish: Swim bladder not involved in hearing[1], Swim bladder involved in hearing[1] Fish eggs, and larvae[2]	207	–

[1] Mortality and potential mortal injury, and recoverable injury threshold
[2] Mortality and potential mortal injury threshold
A dash indicates the threshold is not reached within the limits of the modelling resolution (20 m).

4.3.2.1.2. Seafloor

Ranges presented at the seafloor provided in Tables 30 and 31 are different to those for the maximum–over–depth modelling results presented in Table 29. This is because the model used for the water column results, FWRAM (Appendix C.3.2), does not represent the maximum sound levels at the seafloor close to the array. This is because FWRAM is based on a wide–angle parabolic equation (PE) algorithm which is valid to only approximately 70° down angle from the horizontal, and while it provides accurate predictions in the horizontal direction, it cannot predict sound levels directly under the array. The VSTACK model (Appendix C.3.3) is therefore used to determine the levels at the seafloor directly under the array, and due to seafloor interactions, these can be greater than those elsewhere in the water column.

Table 39. Maximum (R_{max}) horizontal distances (in m) from the seismic source to modelled seafloor (receiver 5 cm above seafloor) peak pressure level thresholds (PK) within the modelling area.

Hearing group/animal type	PK threshold (L_{pk}; dB re 1 µPa)	Distance R_{max} (m)
		Receiver Depth:66.2 m
Sound levels for sponges and corals[1]	226	*
Fish: I	213	*
Fish: II, III, Fish eggs, and larvae	207	*

[1] Heyward et al. (2018)

An asterisk indicates that the sound level was not reached.
Fish I–No swim bladder; Fish II–Swim bladder not involved with hearing; Fish III–Swim bladder involved with hearing.

Table 40. Maximum (R_{max}) horizontal distances (in m) from the seismic source to modelled seafloor (receiver located and 5 cm above seafloor) peak–peak pressure levels (PK–PK) within the modelling area. Results included in relation to benthic invertebrates.

PK–PK (L_{pk-pk}; dB re 1 µPa)	Distance R_{max} (m)
	Receiver Depth: 66.65 m
213[1,2,3]	*
212[2,3]	*
210[1,2]	*
209[1,2]	*
202[4]	3.6

[1] Day et al. (2019), lobster
[2] Day et al. (2016a), lobster and scallops
[3] Day et al. (2017), scallops.
[4] Payne et al. (2008), lobster
An asterisk indicates that the sound level was not reached.

4.3.2.2. Sound Field Maps and Graphs

4.3.2.2.1. Sound Level Contour Maps

Sound level contour maps of SPL are included in this section.

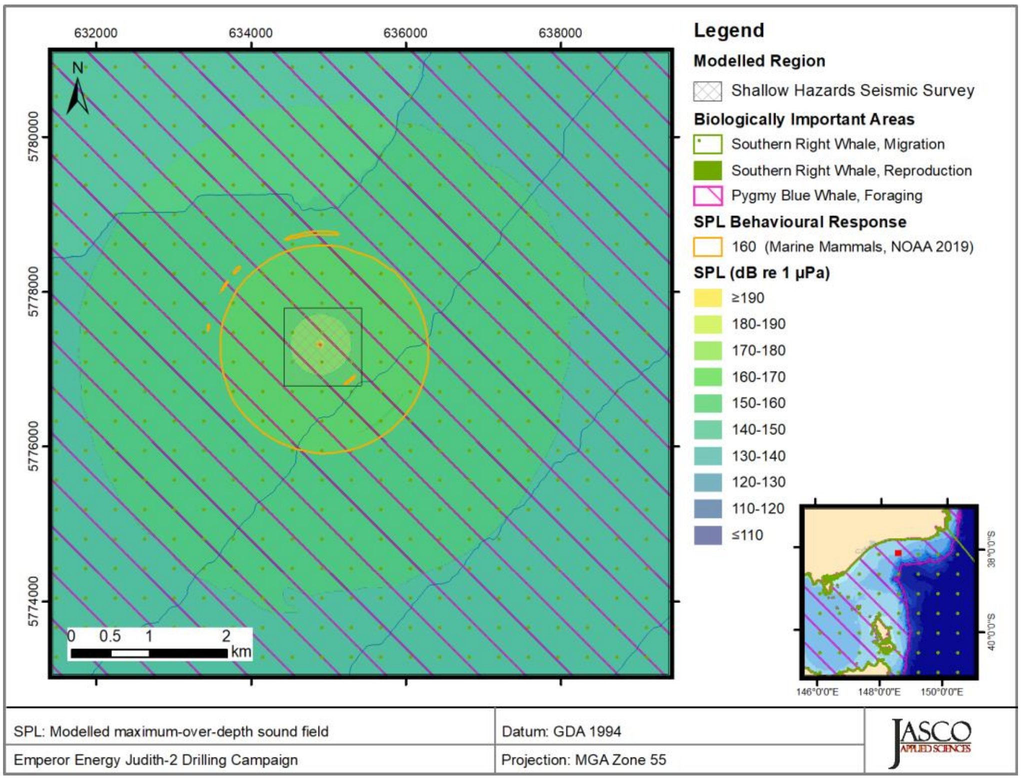

Figure 24. *2D Shallow Hazards Seismic Survey Site, tow azimuth 0°*: Sound level contour map of maximum–over–depth SPL sound field in 10 dB steps, and the isopleths for behavioural response thresholds for marine mammals.

4.3.2.3. Particle Motion Metrics

Figure 20 shows modelled maximum particle acceleration as a function of horizontal range in four perpendicular directions from the centre of the 160 in^3 seismic source at water depth 66.65 m corresponding to the 2D Seismic centre (Site 81 in the graph). The modelling considered a resolution of 20 m, and a receiver positioned 5 cm off the seafloor. The maximum distance to a particle acceleration 37.57 ms^{-2} is not predicted to occur at a water depth of 66.65 m.

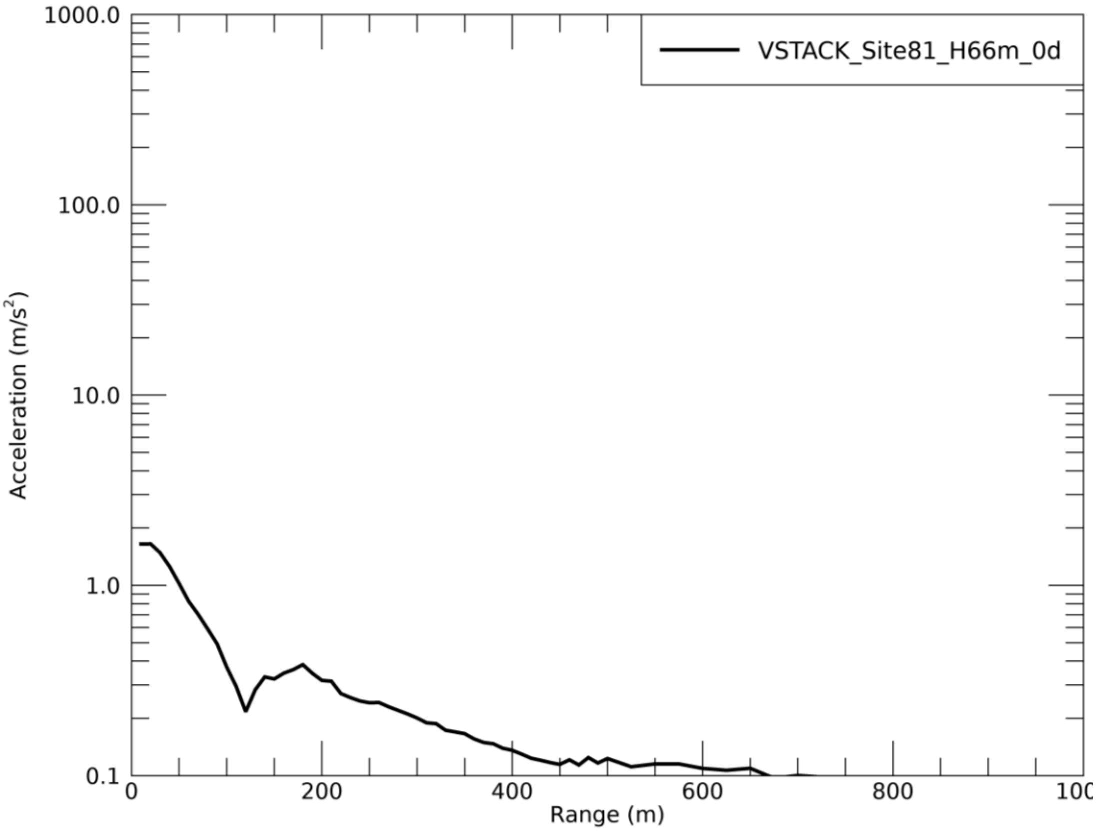

Figure 25. 160 in^3 seismic source at 66.65 m water depth: Peak particle acceleration magnitude at the seafloor as a function of horizontal range from the centre of the seismic source along four directions.

Particle motion was modelled at a depth of 5 cm above the seafloor for an associated assessment for invertebrates. The maximum distances in metres to a peak particle acceleration magnitude of 37.57 ms^{-2} are presented in Table 32 for 1 considered water depths. This particle acceleration threshold was assessed for invertebrates by Day et al. (2016a).

Table 41. Maximum (R_{max}) horizontal distances (in m) from the 160 in^3 to particle motion level: Peak acceleration magnitude level (m/s^2), 5 cm above the seafloor. Results included in relation to benthic invertebrates (Section 2.1.2).

Hearing group/animal type	Peak Acceleration Magnitude (m/s^2)	Water Depth 66.65 m Distance R_{max} (m)
Benthic invertebrates	37.57	*

An asterisk indicates that the particle motion level was not reached.

4.3.3. Multiple Pulse Sound Fields

This section presents the sound fields in terms of SEL accumulated over 24 h of survey, for the modelled scenario (Section 1.3). 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.4) to marine mammals and turtle PTS and TTS thresholds (listed in Table 33), and to estimate maximum distance and the area to injury and TTS guidelines for fish (Table 34).

The SEL_{24h} sound fields are presented as contour maps in Section 4.3.3.2 for the modelled scenarios. The maps present the unweighted SEL_{24h} in 10 dB steps, as well as the isopleths corresponding to thresholds or guidelines for which R_{max} was greater than 20 m.

4.3.3.1. Tabulated Results

Table 42. Maximum–over–depth distances (in km) to frequency–weighted 24 hour sound exposure level (SEL_{24h}) based permanent threshold shift (PTS) and temporary threshold shift (TTS) for marine mammals (NMFS (2024) et al. 2019) and sea turtles Finneran et al. (2017) using the 160 in^3 array.

Hearing group	Threshold for SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²·s)	Scenario 2D Seismic	
		R_{max} (km)	Area (km²)
PTS			
LF cetaceans	183	0.02	0.17
HF cetaceans	193	–	–
VHF cetaceans	159	–	–
Sea turtles	204	–	–
Otariid Seals	185	–	–
TTS			
LF cetaceans	168	2.00	18.95
HF cetaceans	178	–	–
VHF cetaceans	144	–	–
Sea turtles	189	–	–
Otariid Seals	170	–	–

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

Table 43. Distances to 24-hour sound exposure level (SEL_{24h}) based fish criteria in the water column for the 160 in^3 array.

Marine fauna group	Threshold for SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²·s)	Scenario 2D Seismic	
		R_{max} (km)	Area (km²)
Mortality and potential mortal injury			
I	219	–	–
II, fish eggs and fish larvae	210	–	–
III	207	–	–
Fish recoverable injury			
I	216	–	–
II, III	203	–	–
Fish temporary threshold shift (TTS)			
I, II, III	186	0.10	1.29

Fish I–No swim bladder;
Fish II–Swim bladder not involved with hearing;
Fish III–Swim bladder involved with hearing.
An asterisk indicates that the threshold was not reached.

4.3.3.2. Sound Level Contour Map

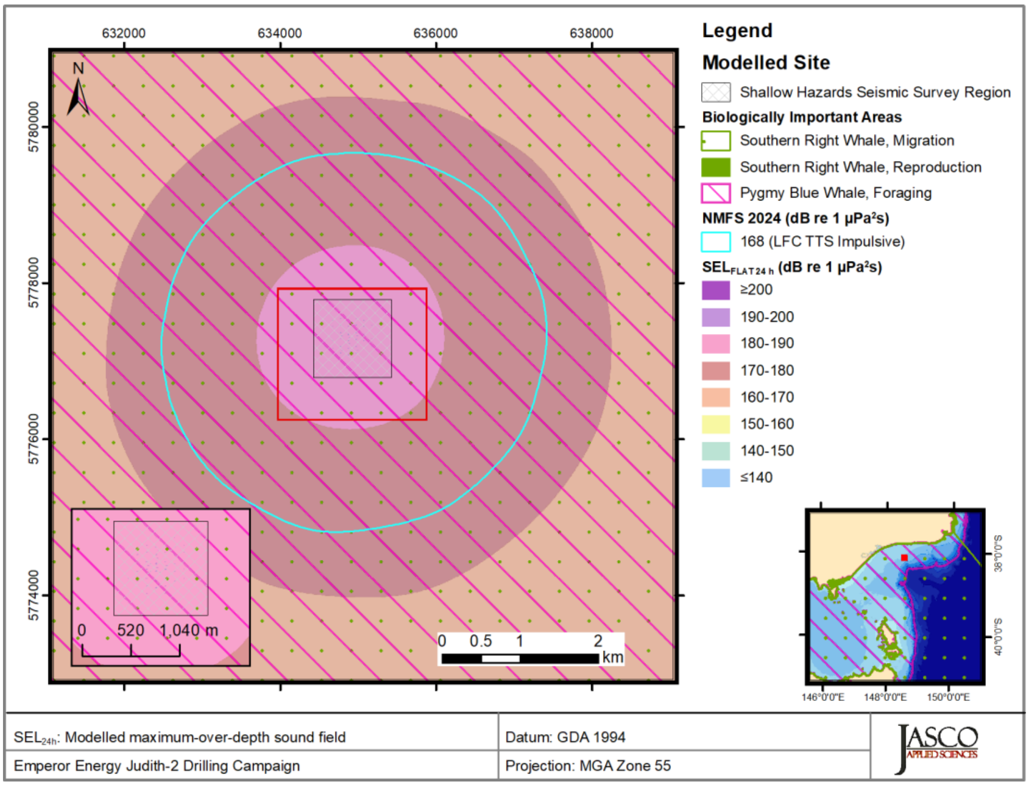

Figure 26. *Scenario 2D Seismic Survey*: Sound level contour map of unweighted maximum–over–depth SEL_{24h} results, along with isopleths for low frequency cetaceans. Thresholds omitted here were not reached or not large enough to display graphically. Refer to Tables 33 and 34 for threshold distances.

5. Discussion

This modelling study predicted underwater sound levels associated with Emperor Energy's activities and operations at the Judith-2 exploration site. The modelled sound–emitting activities were vessel and drilling operations, vertical seismic profiling (VSP) and 2D seismic survey for shallow water hazard identification. The modelling study considered 5 vessel and drilling scenarios (Scenario 1–5), a VSP site, and a 2D seismic survey scenario. Maximum, 95th percentile ranges (R_{max} and $R_{95\%}$) and ensonified area were computed to PTS, TTS, and behavioural response thresholds.

5.1. Acoustic Modelling – Vessels and Drilling Scenarios

Table 44 summarises the maximum horizontal distances to behavioural (unweighted SPL) and physiological effects (weighted TTS and PTS) thresholds across all five modelled individual vessel and drilling activity scenarios.

For the results tables presented in Section 4.1.1, where a dash is used in place of a horizontal distance, these thresholds may or may not be reached. Due to the discretely sampled 20 m calculation grids of the modelled sound fields, distances to these levels could not be estimated for practicable computational purposes. It is likely that SPL isopleths could be reached at distances between the source and the modelled horizontal resolution (20 m); however, distances to injurious accumulated SEL thresholds may not be reached at any range due the species–specific frequency weighing functions. Additionally, if close–to–source radii are comparable to the dimensions of the modelled vessel then they may only be reached within close proximity to a vessel, if at all.

Table 44. Summary of marine mammal results from vessel and drilling modelling: Summary of maximum (R_{max}) horizontal distances (in km), from all scenarios considered, to the NOAA (2024) marine mammal behavioural response criterion of 120 dB re 1 µPa (SPL, unweighted) and frequency–weighted SEL_{24h} TTS and PTS thresholds based on NMFS (2024). TTS and PTS results are presented for the hearing group that resulted in the maximum range. Associated ensonified areas are also provided for TTS and PTS thresholds.

Scenario Number	Description	Marine Mammal Behavioural Response – SPL [a] R_{max} (km)	TTS – SEL_{24h} [b] R_{max} (km)	PTS – SEL_{24h} [b] R_{max} (km)
1	Prelay and Anchor Setup	23.7	8.20 (LF-cetacean)	0.44 (LF-cetacean)
2	MODU Drilling	2.24	0.99 (VHF-cetacean)	0.06 (VHF-cetacean)
3	MODU Drilling with OSV on Standby	3.31	0.99 (VHF-cetacean)	0.06 (VHF-cetacean)
4	MODU Drilling with OSV under DP (8 hours)	5.22	1.07 (LF-cetacean)	0.13 (VHF-cetacean)
5	OSV on Standby with ROV Cutting	3.06	0.31 (VHF-cetacean)	0.03 (VHF-cetacean)

Noise exposure criteria: [a] NOAA (2024) and [b] NMFS (2024).
A dash indicates the level was not reached within the limits of the modelled resolution (20 m).

The shortest horizontal distances to effect thresholds were generally associated with scenario 2 that modelled the MODU drilling with no additional vessels in action; its behavioural response distance was 2.24 km, and its largest low–frequency (LF) cetacean TTS zone was 0.53 km (Tables 25 and 26).

In Scenario 1, the prelay and anchor setup scenario generally resulted in the longest distances to effect thresholds (Tables 25 and 26). The 120 dB SPL marine mammal behavioural effect zone from

AHTS vessel activities featured a maximum radius of 23.7 km with the AHTS under dynamic positioning (DP) being the most dominant source.

5.2. Acoustic Modelling – VSP Scenario

The VSP produces generally symmetric sound source level across the horizontal–plane and vertical directions for the modelled array signature (a 600 in^3 seismic source) as shown in Table 26.

Table 33 shows that as the number of shots over the 24 hours period increases, the range to effect criteria increases; modelling with 300 number of shots over the 24 hour period resulted in the largest ranges to considered effect criteria.

Marine mammals:

Marine mammal injury criteria, from NMFS (2024), requires two metrics (PK and SEL_{24h}) to be considered for impulsive noise when assessing marine mammal TTS and PTS with the longest distance associated with either metric required to be applied. In this study, the longest horizontal distances to the low–frequency cetacean TTS and PTS thresholds were associated with the SEL24h metric for the modelled scenario with 300 shots (4.82 and 0.85 km, respectively), while the longest horizontal distances to the very high–frequency cetacean TTS and PTS thresholds were associated with the PK metric (0.28 and 0.07 km, respectively).

The maximum distance to the NOAA (2024) marine mammal behavioural response criterion of 160 dB re 1 µPa (SPL) was 2.82 km.

Sea turtles:

For sea turtles, the maximum distance to the SEL_{24h} metrics of 189 dB re 1 µPa^{2}s for TTS and 204 dB re 1 µPa^{2}s for PTS was 0.53 km for TTS onset and 0.05 km for PTS onset for the 600 in^3 seismic source with 300 shots over the 24 hour modelled period (Finneran et al. 2017). As is the case with marine mammals, a reported radius for SEL_{24h} criteria does not mean that sea turtles travelling within this radius of the source will be injured, but rather that an animal could be exposed to the sound level associated with either PTS or TTS if it remained in that location for 24 hours.

Neither the PK sea turtle injury criteria of 226 dB re 1 µPa for TTS nor 232 dB re 1 µPa for PTS from Finneran et al. (2017) were not exceeded at a distance longer than 20 m from the acoustic centre of the source.

The maximum distances to the behavioural response criteria for sea turtles of 166 dB re 1 µPa (SPL) and the 175 dB re 1 µPa (SPL) threshold for behavioural disturbance were 1.74 km and 0.54 km, respectively for the 600 in^3 seismic source (McCauley et al. 2000).

Fish, fish eggs, and fish larvae:

The effects of sound exposure on fish were considered in relation to both PK and SEL_{24h} metrics associated with mortality, potential mortal injury and impairment, based on quantitative criteria from Popper et al. (2014) for 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, and
- Fish eggs and fish larvae.

Table 45 summarises the maximum distances to effect criteria for fish, fish eggs, and fish larvae along with the relevant metric across all three modelled locations.

Table 45. Summary of maximum fish, fish eggs, and larvae injury and temporary threshold shift (TTS) onset distances for any modelled site, for single impulse and 24 h sound exposure level (SEL_{24h}) modelled scenarios.

Relevant hearing group	Effect criteria	Water column	
		Metric associated with longest distance to criteria	R_{max} (km)
Fish: No swim bladder	Recoverable injury	–	–
	TTS	SEL_{24h}	1.07
Fish: Swim bladder not involved in hearing and Swim bladder involved in hearing	Recoverable injury	SEL_{24h}	0.06
	TTS	SEL_{24h}	1.07
Fish eggs, and larvae	Injury	SEL_{24h}	0.02

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

Benthic invertebrates:

The maximum radius of ensonified areas where sound levels exceeded 202 dB re 1 µPa PK–PK (Payne et al. 2008) was considered for seafloor sound levels; the sound level was reached at 184.4 m from the acoustic centre of the VSP array in a water depth of 66.7 m; in this area crustaceans may be negatively affected by sound. Sound levels of 209 to 213 dB re 1 µPa PK–PK (Day et al. (2016a); Day et al (2016b)), which are related to crustacean impairment, were also considered in this study; the levels reached for VSP modelling site at a depth of 5 cm above the seafloor are shown in Table 46.

Table 46: Maximum (R_{max}) horizontal distances (in m) from the seismic source to modelled seafloor (receiver located 5 cm above seafloor) peak–peak pressure levels (PK–PK) within the modelling area. Results included in relation to benthic invertebrates.

PK–PK (L_{pk-pk}; dB re 1 µPa)	Distance R_{max} (m)
	Receiver Depth: 66.65 m
213[1,2,3]	*
212[2,3]	18.7
210[1,2]	51.2
209[1,2]	63.9
202[4]	184.4

1 Day et al. (2019), lobster
2 Day et al. (2016a), lobster and scallops
3 Day et al. (2017), scallops.
4 Payne et al. (2008), lobster

5.3. Acoustic Modelling – 2D Shallow Hazards Seismic Scenario

The single airgun seismic source produces symmetric sound source level across the horizontal–plane broadside (perpendicular to the tow direction), endfire (along the tow direction), and vertical directions for the modelled array signature (a 160 in^3 seismic source) as shown in Table 35.

Marine mammals:

Marine mammal injury criteria, from NMFS (2024), requires two metrics (PK and SEL_{24h}) to be considered for impulsive noise when assessing marine mammal PTS and TTS with the longest distance associated with either metric required to be applied. In this study, the longest horizontal distances to the low–frequency cetacean PTS and TTS thresholds were associated with the SEL24h metric (0.02 km and 2.00 km, respectively), while the longest horizontal distances to the very–high–frequency cetacean PTS and TTS thresholds were associated with the PK metric (0.03 km and 0.05 km, respectively).

The maximum distance to the NOAA (2024) marine mammal behavioural response criterion of 160 dB re 1 µPa (SPL) was 1.48 km.

Sea turtles:

For sea turtles, the SEL_{24h} thresholds of 189 dB re 1 µPa^{2}s for TTS and 204 dB re 1 µPa^{2}s for PTS were not reached within the modelling resolution limit of 20 m (Finneran et al. 2017).

The PK sea turtle injury criteria of 226 dB re 1 µPa for TTS and 232 dB re 1 µPa for PTS from Finneran et al. (2017) were also not exceeded at a distance longer than 20 m from the acoustic centre of the source.

The maximum distances to the behavioural response criteria for sea turtles of 166 dB re 1 µPa (SPL) and the 175 dB re 1 µPa (SPL) threshold for behavioural disturbance were 0.70 km and 0.17 km, respectively for the 160 in^3 seismic source (McCauley et al. 2000).

Fish, fish eggs, and fish larvae:

The effects of sound exposure on fish were considered in relation to both PK and SEL_{24h} metrics associated with mortality, potential mortal injury and impairment, based on quantitative criteria from Popper et al. (2014) for 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, and
- Fish eggs and fish larvae.

Table 47 summarises the maximum distances to effect criteria for fish, fish eggs, and fish larvae along with the relevant metric across all three modelled locations. The PK metric thresholds for fish were not exceed in this modelling.

Table 47. Summary of maximum fish, fish eggs, and larvae injury and temporary threshold shift (TTS) onset distances for the modelled seismic survey, for single impulse and 24 h sound exposure level (SEL_{24h}).

Relevant hearing group	Effect criteria	Water column	
		Metric associated with longest distance to criteria	R_{max} (km)
Fish: No swim bladder	Recoverable injury	–	–
	TTS	SEL_{24h}	0.10
Fish: Swim bladder not involved in hearing and Swim bladder involved in hearing	Recoverable injury	SEL_{24h}	–
	TTS	SEL_{24h}	0.10
Fish eggs, and larvae	Injury	SEL_{24h}	–

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

Benthic invertebrates:

To assist with assessing the potential effects on crustaceans from seismic surveying operations, the following results were determined:

- The sound level of 202 dB re 1 µPa PK–PK from Payne et al. (2008), which is representative of no effects, was considered for seafloor sound levels; the sound level was reached at 3.6 m from the acoustic centre within a water depth of 66.7 m.
- Sound levels of 209–212dB re 1 µPa PK–PK from Day et al. (2016b) and 213 dB re 1 µPa from Day et al. (2016a), which are related to impairment in crustaceans, was considered; these levels were not reached (Table 48).

Table 48. Maximum (R_{max}) horizontal distances (in m) from the seismic source to modelled seafloor (receiver located 5 cm above seafloor) peak–peak pressure levels (PK–PK) within the modelling area. Results included in relation to benthic invertebrates.

PK–PK (L_{pk-pk}; dB re 1 µPa)	Distance R_{max} (m)
	Receiver Depth: 66.65 m
213[1,2,3]	*
212[2,3]	*
210[1,2]	*
209[1,2]	*
202[4]	3.6

[1] Day et al. (2019), lobster
[2] Day et al. (2016a), lobster and scallops
[3] Day et al. (2017), scallops.
[4] Payne et al. (2008), lobster
An asterisk indicates that the sound level was not reached.

5.4. Conclusion

This modelling study predicted underwater sound levels associated with Emperor Energy's activities and operations at the Judith-2 exploration site. The modelling study predicted the distances from operations at which underwater sound levels reached noise effect thresholds and criteria for marine mammals, sea turtles and fish.

The greatest horizontal distances were associated with vessel and drilling scenario 1 – prelay and anchor setup up activity, which involved three AHTS vessels. Two AHTSs were modelled on slow transit to represent prelay activities and the third AHTS was modelled under dynamic positioning (DP) during anchor hookup operations. The AHTS on DP was the most dominant source within the scenario. In all modelling scenarios, the combination of source level and source location contributes to each scenario's resulting horizontal distance to effect thresholds.

The VSP modelling results demonstrated that the longest horizontal distances to the low–frequency cetacean PTS and TTS thresholds were associated with the SEL_{24h} metric for the modelled scenario with 300 shots (0.85 km and 4.82 km, respectively), while the longest horizontal distances to the very–high–frequency cetacean PTS and TTS thresholds were associated with the PK metric (0.07 km and 0.28 km, respectively). The maximum distance to the 160 dB re 1 µPa (SPL) marine mammal behavioural response criterion was 2.82 km. For sea turtles, behavioural disturbance could occur up to 0.54 km from the VSP acoustic centre, and the PTS and TTS injury criteria was not exceeded at a distance longer than 20 m from the acoustic centre of the source. All effect zones for fish recoverable injury were less than 60 m and for TTS was 1.07 km. Crustaceans may be affected within 184.4 m of the VSP centre.

Finally, the 2D seismic survey as modelled as a single source array towed on survey lines within a 1 × 1 km^2 area centred on the well centre location. The 2D seismic survey modelling results demonstrated that the longest horizontal distances to the low–frequency cetacean PTS and TTS thresholds were 0.02 km and 2.00 km, respectively. The maximum distance to the 160 dB re 1 µPa (SPL) marine mammal behavioural response criterion was 1.48 km. For sea turtles, behavioural disturbance could occur up to 0.17 km, and the PTS and TTS injury criteria was not exceeded at a distance longer than 20 m from the acoustic centre of the source. All effect zones for fish recoverable injury were less than 0.02 km and for TTS was 0.10 km. Crustaceans are not affected by the source and the sound level of 202 dB re 1 µPa PK–PK was reached at 3.6 m at water depth 66.65 m from the acoustic centre.

Glossary

Unless otherwise stated in an entry, these definitions are consistent with ISO 18405 (2017).

1/3-octave

One third of an octave. *Note*: A 1/3-octave is approximately equal to one decidecade (1/3 oct ≈ 1.003 ddec).

absorption

The conversion of sound energy to heat energy. Specifically, the reduction of sound pressure amplitude due to particle motion energy converting to heat in the propagation medium.

acoustic noise

Sound that interferes with an acoustic process.

acoustic self-noise

Sound at a receiver caused by the deployment, operation, or recovery of a specified receiver, and its associated platform (ISO 18405:2017).

agent-based modelling

A computer simulation of autonomous agents (sometimes called animats) acting in an environment, used to assess the agents' experience of the environment and/or their effect on the environment. See also animal movement modelling.

ambient sound

Sound that would be present in the absence of a specified activity (ISO 18405:2017). It is usually a composite of sound from many sources near and far, e.g., shipping vessels, seismic activity, precipitation, sea ice movement, wave action, and biological activity.

animal movement modelling

Simulation of animal movement based on behavioural rules for the purpose of predicting an animal's experience of an environment. A type of agent-based modelling.

attenuation

The gradual loss of acoustic energy from absorption and scattering as sound propagates through a medium. Attenuation depends on frequency—higher frequency sounds are attenuated faster than lower frequency sounds.

audiogram

A graph or table of hearing threshold as a function of frequency that describes the hearing sensitivity of an animal over its hearing range.

auditory frequency weighting

The process of applying an auditory frequency-weighting function. An example for marine mammals are the auditory frequency-weighting functions published by Southall et al. (2007b).

auditory frequency-weighting function

Frequency-weighting function describing a compensatory approach accounting for a species' (or functional hearing group's) frequency-specific hearing sensitivity.

background noise

Combination of ambient sound, acoustic self-noise, and, where applicable, sonar reverberation (ISO 18405:2017) that is detected, measured, or recorded with a signal.

bandwidth

A range within a continuous band of frequencies. Unit: hertz (Hz).

broadband level

The total level measured over a specified frequency range. If the frequency range is unspecified, the term refers to the entire measured frequency range.

cavitation

A rapid formation and collapse of vapor cavities (i.e., bubbles or voids) in water, most often caused by a rapid change in pressure. Fast-spinning vessel propellers typically cause cavitation, which creates a lot of noise.

cetacean

Member of the order Cetacea. Cetaceans are aquatic 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 a longitudinal wave. In seismology/geophysics, it's called a primary wave or P-wave. Shear waves in the seabed can be converted to compressional waves in water at the water-seabed interface.

conductivity-temperature-depth (CTD)

Measurement data of the ocean's conductivity, temperature, and depth; used to compute sound speed profiles and salinity.

continuous sound

A sound whose sound pressure level remains above the background noise during the observation period and may gradually vary in intensity with time, e.g., sound from a marine vessel.

critical band

The auditory bandwidth within which background noise strongly contributes to masking of a single tone. Unit: hertz (Hz).

critical ratio level

The difference between the sound pressure level of a masked tone, which is barely audible, and the spectral density level of the background noise at similar frequencies, referenced to 1 Hz. Unit: decibel (dB).

decade

Logarithmic frequency interval whose upper bound is ten times larger than its lower bound (ISO 80000-3:2006). For example, one decade up from 1000 Hz is 10,000 Hz, and one decade down is 100 Hz.

decibel (dB)

Unit of level used to express the ratio of one value of a power quantity to another on a logarithmic scale. Especially suited to quantify variables with a large dynamic range.

decidecade

One tenth of a decade. Approximately equal to one third of an octave (1 ddec ≈ 0.3322 oct), and for this reason sometimes referred to as a 1/3-octave.

decidecade band

Frequency band whose bandwidth is one decidecade. *Note*: The bandwidth of a decidecade band increases with increasing centre frequency.

delphinid

Member of the family of oceanic dolphins (Delphinidae), composed of approximately 35 extant species, including dolphins, porpoises, and killer whales.

energy source level

A property of a sound source equal to the sound exposure level measured in the far field plus the propagation loss from the acoustic centre of the source to the receiver position. Unit: decibel (dB). Reference value: 1 $\mu Pa^2\, m^2\, s$.

ensonified

Exposed to sound.

equal-loudness-level contour

Curve that shows, as a function of frequency, the sound pressure level required to produce a given loudness for a listener having normal hearing, listening to a specified kind of sound in a specified manner (ANSI S1.1-2013).

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.

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.

frequency weighting

The process of applying a frequency-weighting function.

frequency-weighting function

The squared magnitude of the sound pressure transfer function (ISO 18405:2017). For sound of a given frequency, the frequency-weighting function is the ratio of output power to input power of a specified filter, sometimes expressed in decibels. Examples include the following:

- *Auditory frequency-weighting function*: compensatory frequency-weighting function accounting for a species' (or functional hearing group's) frequency-specific hearing sensitivity.
- *System frequency-weighting function*: frequency-weighting function describing the sensitivity of an acoustic recording system, which typically consists of a hydrophone, one or more amplifiers, and an analog-to-digital converter.

functional hearing group

Category of animal species when classified according to their hearing sensitivity, hearing anatomy, and susceptibility to sound. For marine mammals, initial groupings were proposed by Southall et al. (2007b), and revised groupings are developed as new research/data becomes available. Revised groupings proposed by Southall et al. (2019) and NMFS (2024) include low-frequency cetaceans, high-frequency cetaceans, very high-frequency cetaceans, phocid carnivores in water, other carnivores in water, and sirenians. See auditory frequency-weighting functions, which are often applied to these groups. Example hearing groups for fish include species for which the swim bladder is involved in hearing, species for which the swim bladder is not involved in hearing, and species without a swim bladder (Popper et al. 2014).

geoacoustic

Relating to the acoustic properties of the seabed.

harmonic

A sinusoidal sound component that has a frequency that is an integer multiple of the frequency of a sound to which it is related. For a sound with a fundamental frequency of f, the harmonics have frequencies of $2f$, $3f$, $4f$, etc.

hearing threshold

For a given species or functional hearing group, the sound level for a given signal that is barely audible (i.e., that would be barely audible for a given individual in the presence of specified background noise during a specific percentage of experimental trials).

hertz (Hz)

Unit of frequency defined as one cycle per second. Often expressed in multiples such as kilohertz (1 kHz = 1000 Hz).

high-frequency (HF) cetaceans

See functional hearing group. *Note*: The mid- and high-frequency cetaceans groups proposed by Southall et al. (2007b) were renamed high- and very-high-frequency cetaceans, respectively, by Southall et al. (2019) and NMFS (2024).

hydrophone

An underwater sound pressure transducer. A passive electronic device for recording or listening to underwater sound.

hydrostatic pressure

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).

impulsive sound

Qualitative term meaning sounds that are typically transient, brief (less than 1 s), broadband, with rapid rise time and rapid decay. They can occur in repetition or as a single event. Sources of impulsive sound include, among others, explosives, seismic airguns, and impact pile drivers.

isopleth

A line drawn on a map through all points having the same value of some specified quantity (e.g., sound pressure level isopleth).

knot (kn)

Unit of vessel speed equal to 1 nautical mile per hour.

level

A measure of a quantity expressed as the logarithm of the ratio of the quantity to a specified reference value of that quantity. For example, a value of sound pressure level with reference to 1 μPa^2 can be written in the form *x* dB re 1 μPa^2.

low-frequency (LF) cetaceans

See functional hearing group.

masking

Obscuring of sounds of interest by other sounds at similar frequencies.

median

The 50th percentile of a statistical distribution.

mid-frequency (MF) cetaceans

See functional hearing group. *Note*: The mid-frequency cetaceans group proposed by Southall et al. (2007b) was renamed high-frequency cetaceans by Southall et al. (2019) and NMFS (2024).

monopole source level (MSL)

A source level that has been calculated using an acoustic model that accounts for the effect of the sea-surface and seabed on sound propagation, assuming a point source (monopole). Often used to quantify source levels of vessels or industrial operations from measurements. See also radiated noise level.

Monte Carlo simulation

A method of investigating the distribution of a non-linear multi-variate function by random sampling of its input variable distributions.

multiple linear regression

A statistical method that seeks to explain the response of a dependent variable using multiple explanatory variables.

M-weighting

A set of auditory frequency-weighting functions proposed by Southall et al. (2007b).

mysticete

Member of the Mysticeti, a suborder of cetaceans. Also known as baleen whales, mysticetes have baleen plates (rather than teeth) that they use to filter food from water (or from sediment as for grey whales). This group includes rorquals (Balaenopteridae, such as blue, fin, humpback, and minke whales), right and bowhead whales (Balaenidae), and grey whales (*Eschrichtius robustus*).

***N* percent exceedance level**

The sound level exceeded *N* % of the time during a specified time interval. See also percentile level.

non-impulsive sound

Sound that is not an impulsive sound. Not necessarily a continuous sound.

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

Member of Odontoceti, a suborder of cetaceans. These whales, dolphins, and porpoises have teeth (rather than baleen plates). Their skulls are mostly asymmetric, an adaptation for their echolocation. This group includes sperm whales, killer whales, belugas, narwhals, dolphins, and porpoises.

otariid

Member of the family Otariidae, one of the three groupings of pinnipeds (along with phocids and walrus). These eared seals, commonly called fur seals and sea lions, are adapted to semi-aquatic life; they use their large fore flippers for propulsion underwater and can walk on all four limbs on land.

otariid pinnipeds underwater (OW)

See functional hearing group.

other marine carnivores in water (OCW)

See functional hearing group.

parabolic equation method

A computationally efficient solution to the acoustic wave equation that is used to model propagation loss. The parabolic equation approximation omits effects of backscattered sound (which are negligible for most ocean-acoustic propagation problems), simplifying the computation of propagation loss.

particle acceleration, particle displacement, particle motion, particle velocity

See sound particle acceleration, sound particle displacement, sound particle motion, sound particle velocity.

peak sound pressure level (PK), zero-to-peak sound pressure level

The level (L_{pk}) of the squared maximum magnitude of the sound pressure (p_{pk}^2) in a stated frequency band and time window. Defined as $L_{\mathrm{pk}} = 10\log_{10}(p_{\mathrm{pk}}^2/p_0^2) = 20\log_{10}(p_{pk}/p_0)$. Unit: decibel (dB). Reference value (p_0^2) for sound in water: 1 μPa^2.

peak-to-peak sound pressure

The difference between the maximum and minimum sound pressure over a specified frequency band and time window. Unit: pascal (Pa).

percentile level

The sound level not exceeded *N* % of the time during a specified time interval. The *N*th percentile level is equal to the (100−*N*) % exceedance level. See also N percent exceedance level.

permanent threshold shift (PTS)

An irreversible loss of hearing sensitivity caused by excessive noise exposure. Considered auditory injury. Compare with temporary threshold shift.

phocid

Member of the family Phocidae, one of the three groupings of pinnipeds (along with otariids and walrus). 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 underwater.

phocid pinnipeds underwater (PW), phocid carnivores in water (PCW)

See functional hearing group.

pinniped

Member of the superfamily Pinnipedia, which is composed of 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.

propagation loss (PL)

Difference between a source level (SL) and the level at a specified location, $\mathrm{PL}(x) = \mathrm{SL} - L(x)$. Unit: decibel (dB). See also transmission loss.

radiated noise level (RNL)

A source level that has been calculated assuming sound pressure decays geometrically with distance from the source, with no influence of the sea-surface or seabed. Often used to quantify source levels of vessels or industrial operations from measurements. See also monopole source level.

received level

The level of a given field variable measured (or that would be measured) at a given location.

reference value

Standard value of a quantity used for calculating underwater sound level. The reference value depends on the quantity for which the level is being calculated:

Quantity	Reference value
Sound pressure	p_0^2 = 1 μPa^2 or p_0 = 1 μPa
Sound exposure	E_0 = 1 μPa^2 s
Sound particle displacement	δ_0^2 = 1 pm^2
Sound particle velocity	u_0^2 = 1 nm^2/s^2
Sound particle acceleration	a_0^2 = 1 μm^2/s^4

sensation level

Difference between the sound pressure level and hearing threshold at a specified frequency. Unit: decibel (dB).

shear wave

A mechanical vibration wave in which the direction of particle motion is perpendicular to the direction of propagation. Also called a 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.

sirenians (SI)

Members of the order Sirenia, which includes several manatee species and the dugong. See also functional hearing group.

sound

A time-varying disturbance in the pressure, stress, or material displacement of a medium propagated by local compression and expansion of the medium. In common meaning, a form of energy that propagates through media (e.g., water, air, ground) as pressure waves.

sound exposure

Time integral of squared sound pressure over a stated time interval in a stated frequency band. The time interval can be a specified time duration (e.g., 24 h) or from start to end of a specified event (e.g., a pile strike, an airgun pulse, a construction operation). Unit: pascal squared second (Pa^2 s). Symbol: E.

sound exposure level (SEL)

The level (L_E) of the sound exposure (E) in a stated frequency band and time window: $L_E = 10\log_{10}(E/E_0)$ (ISO 18405:2017). Unit: decibel (dB). Reference value (E_0) for sound in water: 1 μPa^2 s.

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 (ISO 18405:2017). Unit: pascal squared second per hertz (Pa^2 s/Hz).

sound field

Region containing sound waves.

sound intensity

Product of the sound pressure and the sound particle velocity (ISO 18405:2017). The magnitude of the sound intensity is the sound energy flowing through a unit area perpendicular to the direction of propagation per unit time. Unit: watt per metre squared (W/m^2). Symbol: I.

sound particle acceleration

The rate of change of sound particle velocity. Unit: metre per second squared (m/s^2). Symbol: a.

sound particle motion

Movement caused by the action of sound of the smallest volume of a medium that represents its mean physical properties. Important for determining effects of underwater noise on fishes and invertebrates because their hearing organs sense particle motion rather than sound pressure.

sound particle displacement

Displacement of a material element caused by the action of sound, where a material element is the smallest element of the medium that represents the medium's mean density (ISO 18405:2017). Unit: metre (m). Symbol: δ.

sound particle velocity

The velocity of a particle in a material moving back and forth in the direction of the pressure wave. Unit: metre per second (m/s). Symbol: u.

sound pressure

The contribution to total pressure caused by the action of sound (ISO 18405:2017). Unit: pascal (Pa). Symbol: p.

sound pressure level (SPL), rms sound pressure level

The level (L_p) of the time-mean-square sound pressure (p^2_{rms}) in a stated frequency band and time window: $L_p = 10\log_{10}(p^2_{\text{rms}}/p^2_0) = 20\log_{10}(p_{rms}/p_0)$, where rms is the abbreviation for root-mean-square. Unit: decibel (dB). Reference value (p^2_0) for sound in water: 1 μPa^2. SPL can also be expressed in terms of the root-mean-square (rms) with a reference value of p_0 = 1 μPa. The two definitions are equivalent.

sound speed profile

The speed of sound in the water column as a function of depth below the water surface.

soundscape

The characterization of the ambient sound in terms of its spatial, temporal, and frequency attributes, and the types of sources contributing to the sound field (ISO 18405:2017).

source level (SL)

A property of a sound source equal to the sound pressure level measured in the far field plus the propagation loss from the acoustic centre of the source to the receiver position. Unit: decibel (dB). Reference value: 1 μPa^2 m^2.

spectrogram

A visual representation of acoustic amplitude over time and frequency. A spectrogram's resolution in the time and frequency domains should generally be stated as it determines the information content of the representation.

spectrum

Distribution of acoustic signal content over frequency, where the signal's content is represented by its power, energy, mean-square sound pressure, or sound exposure.

surface duct

The upper portion of a water column within which the gradient of the sound speed profile causes sound to refract upward and therefore reflect repeatedly off the surface resulting in relatively long-range sound propagation with little loss.

temporary threshold shift (TTS)

Reversible loss of hearing sensitivity caused by noise exposure. Compare with permanent threshold shift.

thermocline

A depth interval near the ocean surface that experiences larger temperature gradients than the layers above and below it due to warming or cooling by heat conduction from the atmosphere and by warming from the sun.

transmission loss (TL)

The difference between a specified level at one location and that at a different location: $\text{TL}(x_1,x_2) = L(x_1) - L(x_2)$ (ISO 18405:2017). Unit: decibel (dB). See also propagation loss.

unweighted

Term indicating that no frequency-weighting function is applied.

very high-frequency (VHF) cetaceans

See functional hearing group.

wavelength

Distance over which a wave completes one cycle of oscillation. Unit: metre (m). Symbol: λ.

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Appendix A. Acoustic Metrics

This section describes in detail the acoustic metrics, impact criteria, and frequency weighting relevant to the modelling study.

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 International Organization for Standardization definitions and symbols for sound metrics (e.g., ISO 2017, ANSI S1.1-2013).

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, $p(t)$:

$$L_{p,\mathrm{pk}} = 10\log_{10}\frac{\max|p^2(t)|}{p_0^2} = 20\log_{10}\frac{\max|p(t)|}{p_0} \tag{A-1}$$

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, $p(t)$:

$$L_{p,\mathrm{pk\text{-}pk}} = 10\log_{10}\frac{[\max(p(t)) - \min(p(t))]^2}{p_0^2} \tag{A-2}$$

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 are referred to as 90% SPL ($L_{p,90\%}$).

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:

$$L_{E,N} = 10\log_{10}\sum_{i=1}^{N} 10^{\frac{L_{E,i}}{10}} \quad \text{(A-5)}$$

If applied, the frequency weighting of an acoustic event should be specified, as in the case of weighted SEL (e.g., $L_{E,LF,24h}$; see Appendix A.4) or auditory-weighted SPL ($L_{p,ht}$). The use of fast, slow, or impulse exponential-time-averaging or other time-related characteristics should also be specified.

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. A decidecade is sometimes referred to as a "1/3 octave" because one tenth of a decade is approximately equal to one third of an octave. Each decade represents a factor 10 in sound frequency. Each octave represents a factor 2 in sound frequency. The centre frequency of the ith band, $f_c(i)$, is defined as:

$$f_c(i) = 10^{\frac{i}{10}}\,\text{kHz} \quad \text{(A–6)}$$

and the low (f_{lo}) and high (f_{hi}) frequency limits of the ith decade band are defined as:

$$f_{lo,i} = 10^{\frac{-1}{20}} f_c(i) \quad \text{and} \quad f_{hi,i} = 10^{\frac{1}{20}} f_c(i) \quad \text{(A–7)}$$

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 10 (f_c (10) = 10 Hz) to band 44 ($f_c(44)$ = 25 kHz).

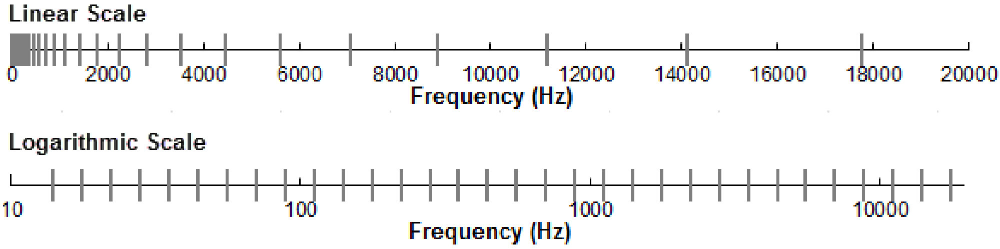


Figure A–1. Decidecade frequency bands (vertical lines) shown on a linear frequency scale and a logarithmic scale.

The sound pressure level in the ith band ($L_{p,i}$) is computed from the spectrum $S(f)$ between $f_{\text{lo},i}$ and $f_{\text{hi},i}$:

$$L_{p,i} = 10\, log_{10} \int_{f_{\text{lo},i}}^{f_{\text{hi},i}} S(f)\, \mathrm{d}f \;\; \text{dB} \qquad \text{(A–8)}$$

Summing the sound pressure level of all the bands yields the broadband sound pressure level:

$$\text{Broadband SPL} = 10 \log_{10} \sum_i 10^{\frac{L_{p,i}}{10}} \;\text{dB} \qquad \text{(A–9)}$$

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 sound signal. Because the decidecade bands are wider than 1 Hz, 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.

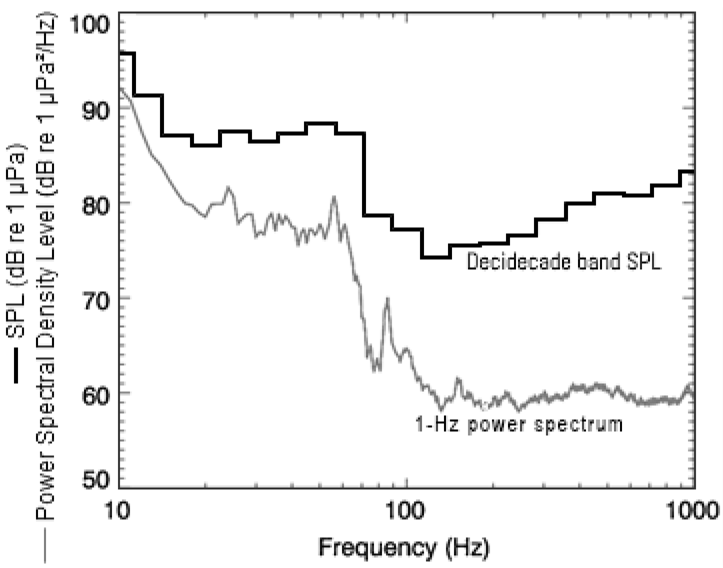


Figure A–2. Sound pressure spectral density levels and the corresponding decidecade band sound pressure levels of example ambient noise shown on a logarithmic frequency scale.Because the decidecade bands are wider with increasing frequency, the decidecade band SPL is higher than the power spectrum.

A.3. Marine Mammal Noise Effect Criteria

It has been long recognised that marine mammals can be adversely affected by underwater anthropogenic noise. For example, Payne and Webb (1971) suggest 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 injury. 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 auditory injury, impairment, and disturbance. The following sections summarise the recent development of thresholds; however, this field remains an active research topic.

A.3.1. Injury and Hearing Sensitivity Changes

In recognition of shortcomings of the SPL–only based auditory injury criteria, in 2005 NMFS sponsored the Noise Criteria Group to review literature on marine mammal hearing to propose new noise exposure criteria. Some members of this expert group published a landmark paper (Southall et al. 2007b) that suggested assessment methods similar to those applied for humans. The resulting recommendations introduced dual auditory injury criteria for impulsive sounds that included peak pressure level thresholds and SEL_{24h} thresholds, where the subscripted 24h refers to the accumulation period for calculating SEL. The peak pressure level criterion is not frequency weighted whereas SEL_{24h} is frequency weighted according to one of four marine mammal species hearing groups: low–, mid– and high–frequency cetaceans (LF, MF, and HF cetaceans, respectively) and Pinnipeds in Water (PINN). These weighting functions are referred to as M–weighting filters (analogous to the A–weighting filter for humans; see Appendix A.4). The SEL_{24h} thresholds were obtained by extrapolating measurements of onset levels of Temporary Threshold Shift (TTS) in belugas by the amount of TTS required to produce Permanent Threshold Shift (PTS) in chinchillas. The Southall et al. (2007b) recommendations do not specify an exchange rate, which suggests that the thresholds are the same regardless of the duration of exposure (i.e., it implies a 3 dB exchange rate).

Wood et al. (2012) refined NMFS (2024) et al.'s (2007b) thresholds, suggesting lower PTS and TTS values for LF and HF cetaceans while retaining the filter shapes. Their revised thresholds were based on TTS–onset levels in harbour porpoises from Lucke et al. (2009), which led to a revised impulsive sound PTS threshold for HF cetaceans of 179 dB re 1 $\mu Pa^2 \cdot s$. Because there were no data available for baleen whales, Wood et al. (2012) based their recommendations for LF cetaceans on results obtained from MF cetacean studies. In particular they referenced the Finneran and Schlundt (2010) research, which found mid–frequency cetaceans are more sensitive to non–impulsive sound exposure than Southall et al. (2007b) assumed. Wood et al. (2012) thus recommended a more conservative TTS–onset level for LF cetaceans of 192 dB re 1 $\mu Pa^2 \cdot s$.

As of present, a definitive approach is still not apparent. There is consensus in the research community that an SEL–based method is preferable, either separately or in addition to an SPL–based approach to assess the potential for injuries. In August 2016, after substantial public and expert input into three draft versions and based largely on the above–mentioned literature (NOAA 2013, 2015, 2016), NMFS finalised technical guidance for assessing the effect of anthropogenic sound on marine mammal hearing (NMFS 2016). The guidance describes auditory injury criteria with new thresholds and frequency weighting functions for the five hearing groups described by Finneran and Jenkins (2012). The latest revision to this work was published in 2024 (NMFS 2024).

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. 2007b, Ellison and Frankel 2012, Southall et al. 2016).

For impulsive noise, NMFS currently uses a step function threshold of 160 dB re 1 µPa SPL (unweighted) to assess and regulate noise–induced behavioural impacts for marine mammals (NOAA 2018, NOAA 2024). 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. (2007a) 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.

NMFS currently uses a step function (all–or–none) threshold of 120 dB re 1 µPa SPL (unweighted) for non–impulsive sounds to assess and regulate noise–induced behavioural impacts on marine mammals (NOAA (2024)). The 120 dB re 1 µPa threshold is associated with continuous sources and was derived based on studies examining behavioural responses to drilling and dredging (NOAA 2018), referring to Malme et al. (1983), Malme et al. (1984), and Malme et al. (1986), which were considered in Southall et al. (2007b). Malme et al. (1986) found that playback of drillship noise did not produce clear evidence of disturbance or avoidance for levels below 110 dB re 1 µPa (SPL), possible avoidance occurred for exposure levels approaching 119 dB re 1 µPa. Malme et al. (1984) determined that measurable reactions usually consisted of rather subtle short–term changes in speed and/or heading of the whale(s) under observation. It has been shown that both received level and proximity of the sound source is a contributing factor in eliciting behavioural reactions in humpback whales (Dunlop et al. 2017, Dunlop et al. 2018).

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 US 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:

$$G(f) = K + 10\log_{10}\left[\left(\frac{(f/f_{lo})^{2a}}{\left[1+(f/f_{lo})^2\right]^a\left[1+(f/f_{hi})^2\right]^b}\right)\right] \qquad \text{(A–10)}$$

Finneran (2015) proposed five functional hearing groups for marine mammals in water: low–, mid– and high–frequency cetaceans (LF, MF, and HF cetaceans, respectively), 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 acoustic impacts on marine mammals (NMFS 2018), and in the latest guidance by NMFS (2024). The updates did not affect the content related to either the definitions of frequency–weighting functions or the threshold values, however, the terminology for mid– and high–frequency cetaceans was changed to high– and very high–frequency cetaceans (VHF cetaceans). Table A–1. lists the frequency–weighting parameters for each hearing group relevant to this assessment, and 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 (2024).

Functional hearing group	NMFS (2024)				
	a	b	f_1 (Hz)	f_2 (Hz)	K[1] (dB)
Low-frequency cetaceans	0.99	5	168	26,600	0.12
High-frequency cetaceans	1.55	5	1,730	129,000	0.32
Very high-frequency cetaceans	2.23	5	5,930	186,000	0.91
Otariid pinnipeds underwater	1.58	5	2530	43,800	1.37

[1] In NMFS (2018) and NMFS (2024), this constant is symbolized by C.

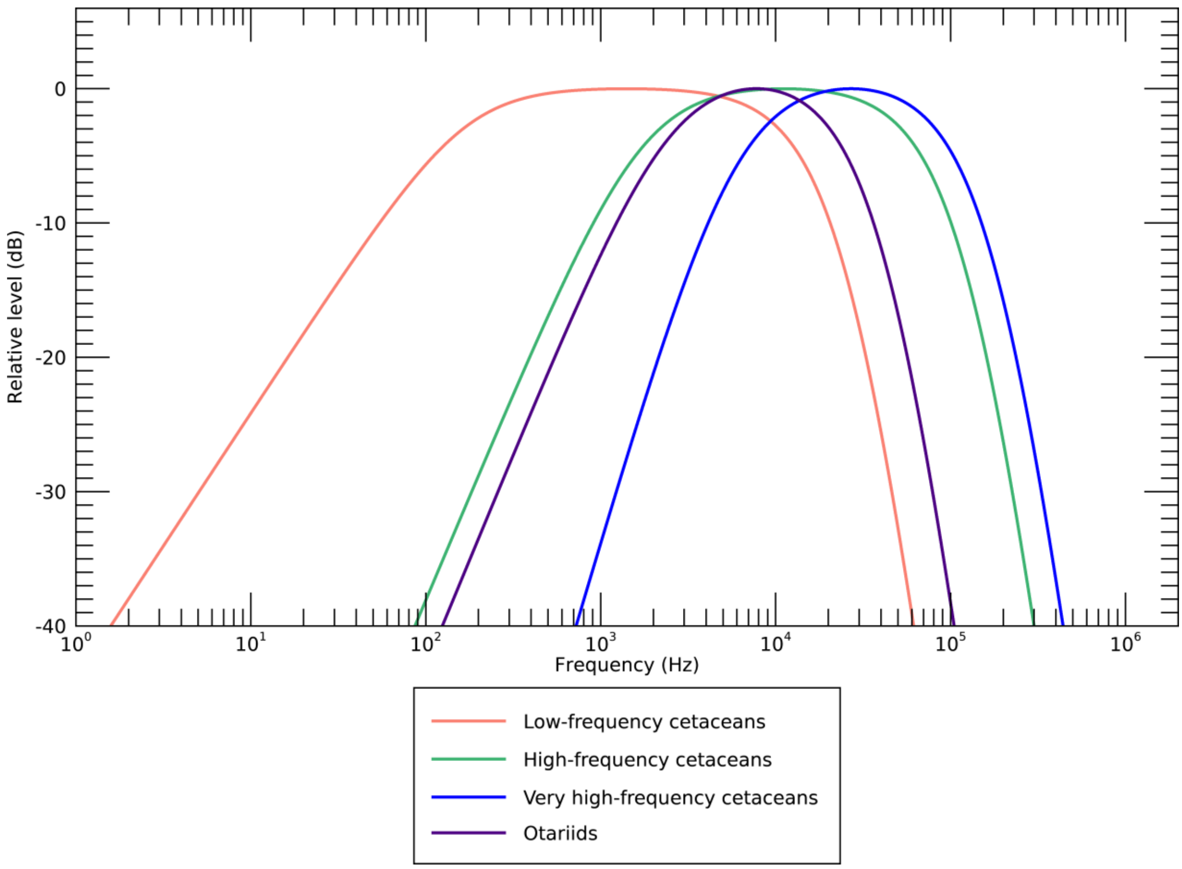


Figure A–3. Auditory weighting functions for functional marine mammal hearing groups used in this project as recommended by NMFS (2024).

Appendix B. Acoustic Source Model

B.1. Airgun Array 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–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:

$$R_{\mathrm{nf}} < \frac{l^2}{4\lambda} \qquad \text{(B–1)}$$

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. VSP Modelling

B.2.1. VSP Seismic Source

Figure B–1 shows the layout of the 600 in^3 seismic source used for VSP modelling in this study. Table B–1 provides details of the airgun parameters.

For the modelled array, the layout is presented in a nominal cartesian coordinate system. In this coordinate system the direction of vessel travel determines the relative position of the array elements as plotted and tabulated. The layout used for acoustic modelling was produced by transforming the coordinates of client supplied layouts such that the resultant layouts correspond to a vessel travel direction along the positive X–axis and the array is centred on the X–Y origin. When used with an acoustic model the positive X–axis in this nominal coordinate system aligns with the vessel tow direction or survey line azimuth.

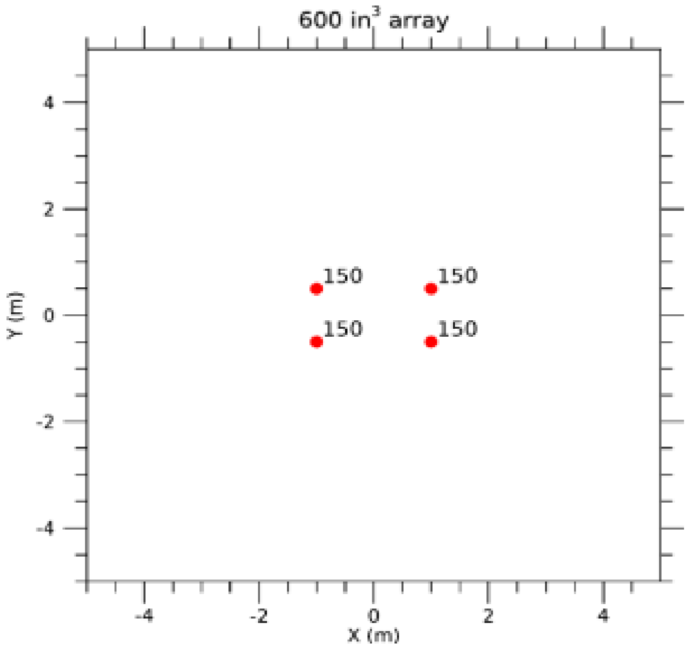


Figure B–1. Layout of the modelled 600 in^3 VSP seismic source. Tow depth is 5 m. The labels indicate the firing volume (in cubic inches) for each airgun. Also see Table B–1.

Table B–1. Layout of the modelled 600 in^3 VSP seismic source. Tow depth is 5 m. Firing pressure for all guns was 1800 psi. Greyed out values indicate spares. Also see Figure B–1.

String	Gun	x(m)	y(m)	z(m)	Vol(in^3)
1	1	1.0	0.5	5	150
	2	–1.0	0.5		150
	3	1.0	–0.5		150
	4	–1.0	–0.5		150

B.2.2. Array Source Levels and Directivity

Figure B–2 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 600 in^3 VSP array (Appendix B.2.1). Horizontal decidecade–band source levels are shown as a function of band centre frequency and azimuth in Figure B–3.

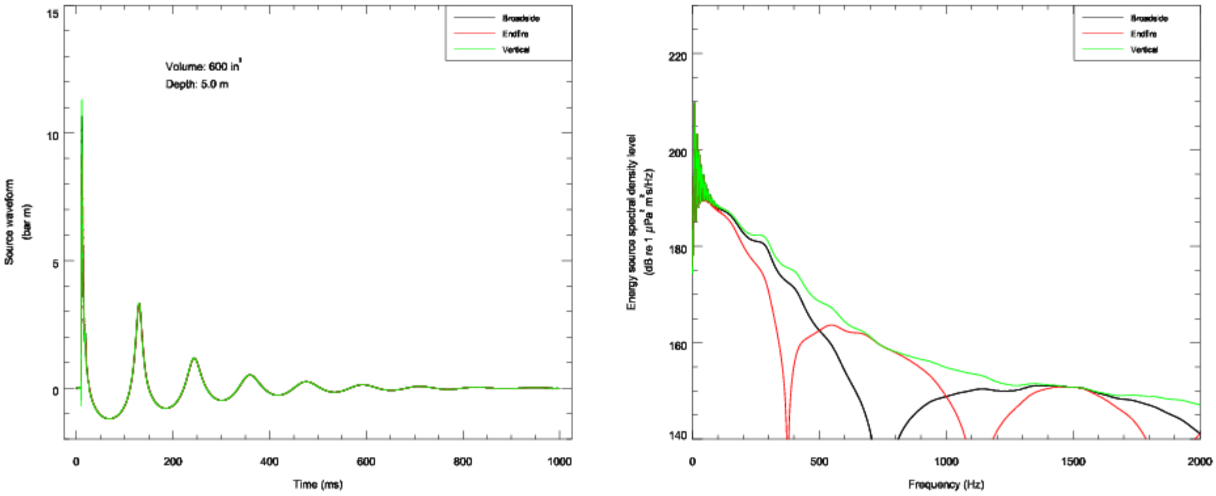


Figure B–2. Predicted source level details for the 600 in^3 array at 5 m towed depth. The power spectrum for in–plane horizontal (broadside)/perpendicular (endfire), and vertical directions (no surface ghost).

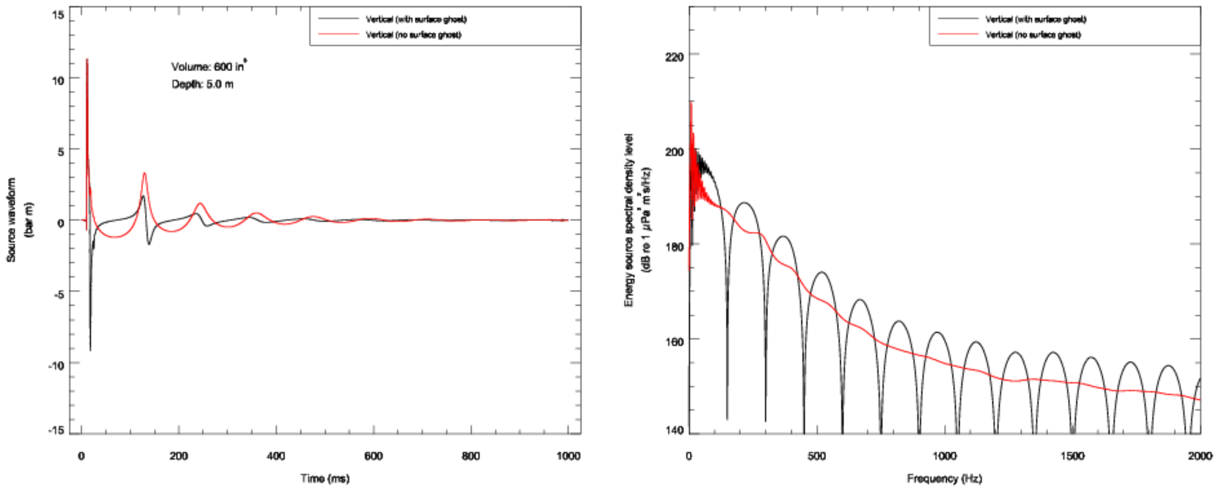


Figure B–3. Predicted source level details for the 600 in^3 array at 5 m towed depth. (Bottom) the overpressure signature.

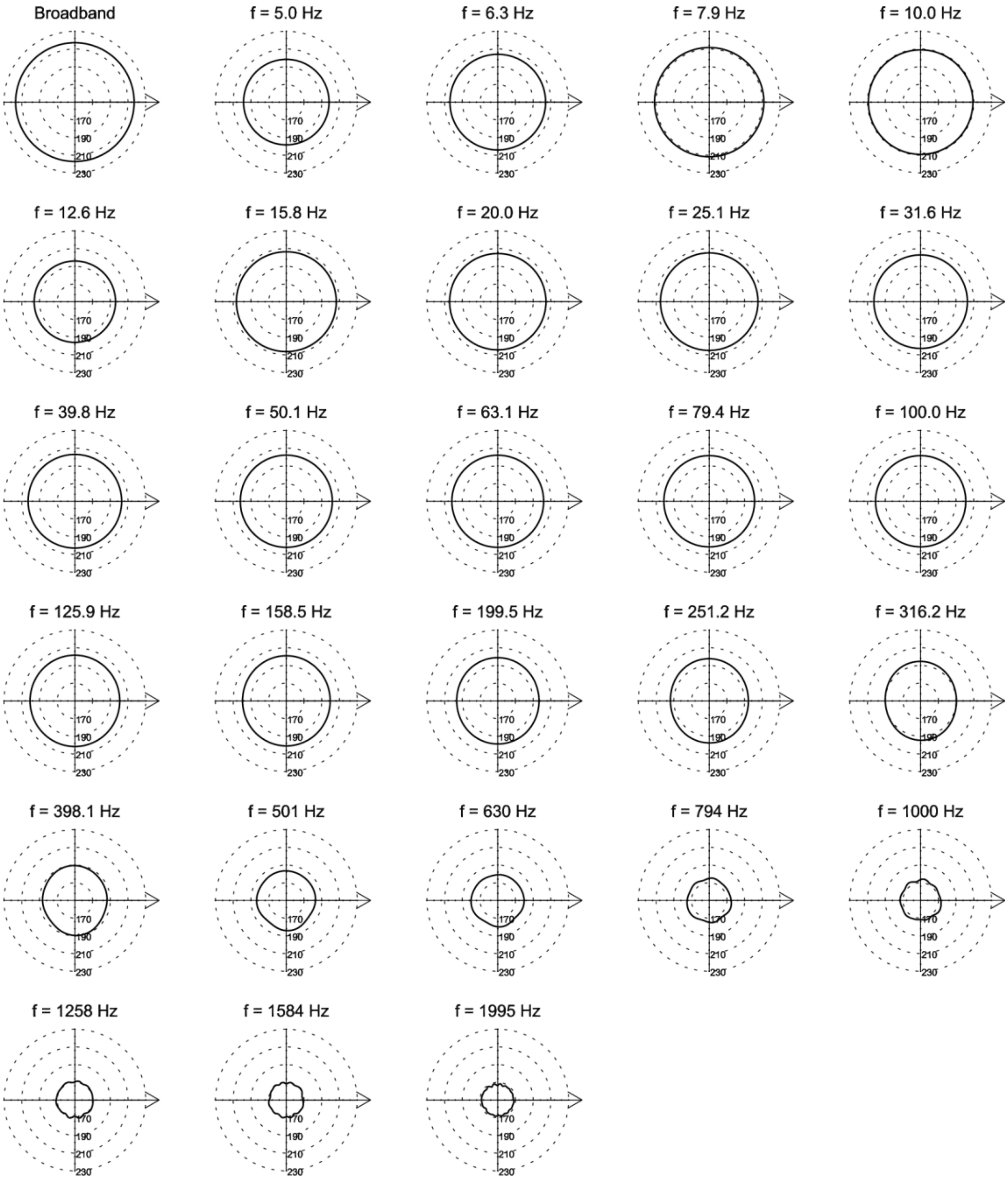


Figure B–4. Directionality of the predicted horizontal source levels for the 600 in^3 VSP seismic source, 5 Hz to 2 kHz. Source levels (in dB re 1 μPa^2·s m^2) are shown as a function of azimuth for the centre frequencies of the decidecade bands modelled; frequencies are shown above the plots. Tow depth is 5 m (see Figure B–2).

B.3. 2D Shallow Hazards Seismic Modelling

B.3.1. Seismic Source

Figure B–1 shows the layout of the 160 in^3 seismic source used for seismic survey modelling in this study. Table B–1 provides details of the airgun parameters.

For the modelled array, the layout is presented in a nominal cartesian coordinate system. In this coordinate system the direction of vessel travel determines the relative position of the array elements as plotted and tabulated. The layout used for acoustic modelling was produced by transforming the coordinates of client supplied layouts such that the resultant layouts correspond to a vessel travel direction along the positive X–axis and the array is centred on the X–Y origin. When used with an acoustic model the positive X–axis in this nominal coordinate system aligns with the vessel tow direction or survey line azimuth.

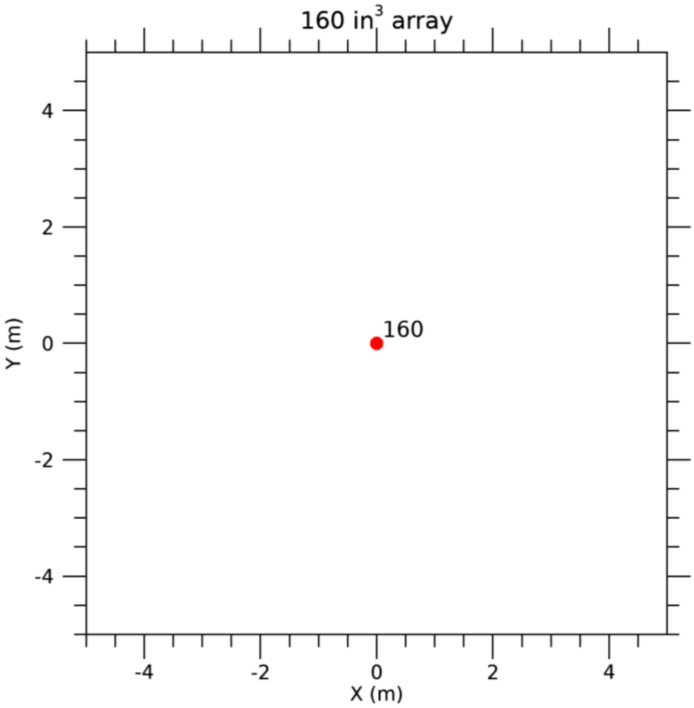


Figure B–5. Layout of the modelled 160 in^3 seismic source. Tow depth is 7 m. The labels indicate the firing volume (in cubic inches) for each airgun. Also see Table B–2.

Table B–2. Layout of the modelled 160 in^3 seismic source. Tow depth is 7 m. Firing pressure for all guns was 2000 psi. Also see Figure B–5.

String	Gun	x(m)	y(m)	z(m)	Vol(in^3)
1	1	0	0	7	160

B.3.2. Array Source Levels and Directivity

Figure B–6 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 160 in^3 array (Appendix B.3.1). Note that due to the single point source in the array, the source level and pressure signature will be the same as an omni–directional source. Horizontal decidecade–band source levels are shown as a function of band centre frequency and azimuth in Figure B–4.

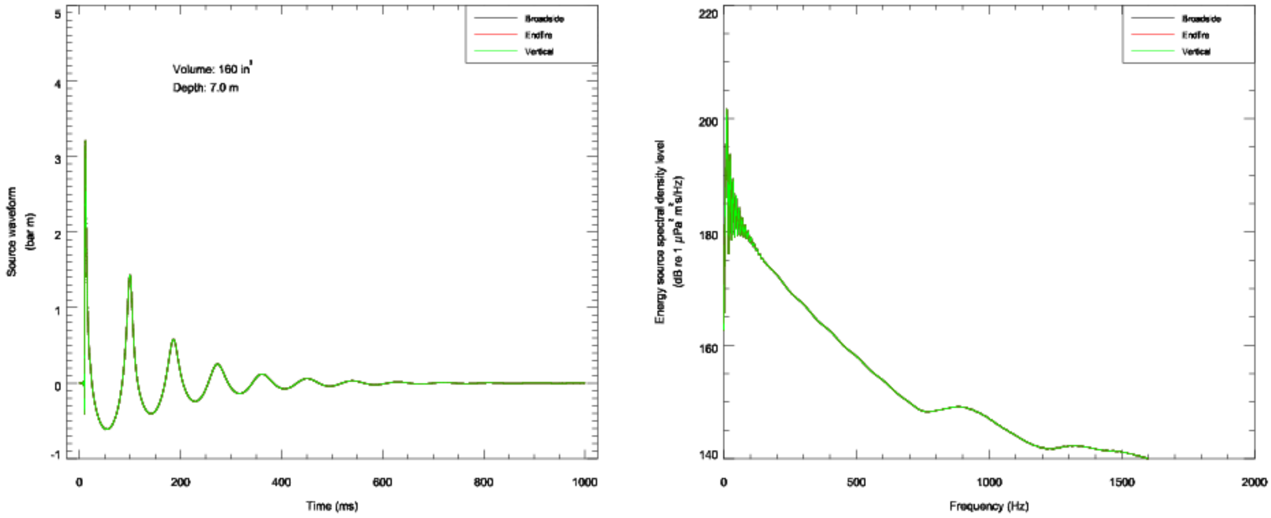


Figure B–6. Predicted source level details for the 160 in^3 seismic source. Tow depth is 7 m. The power spectrum for in–plane horizontal (broadside)/ perpendicular (endfire), and vertical directions (no surface ghost).

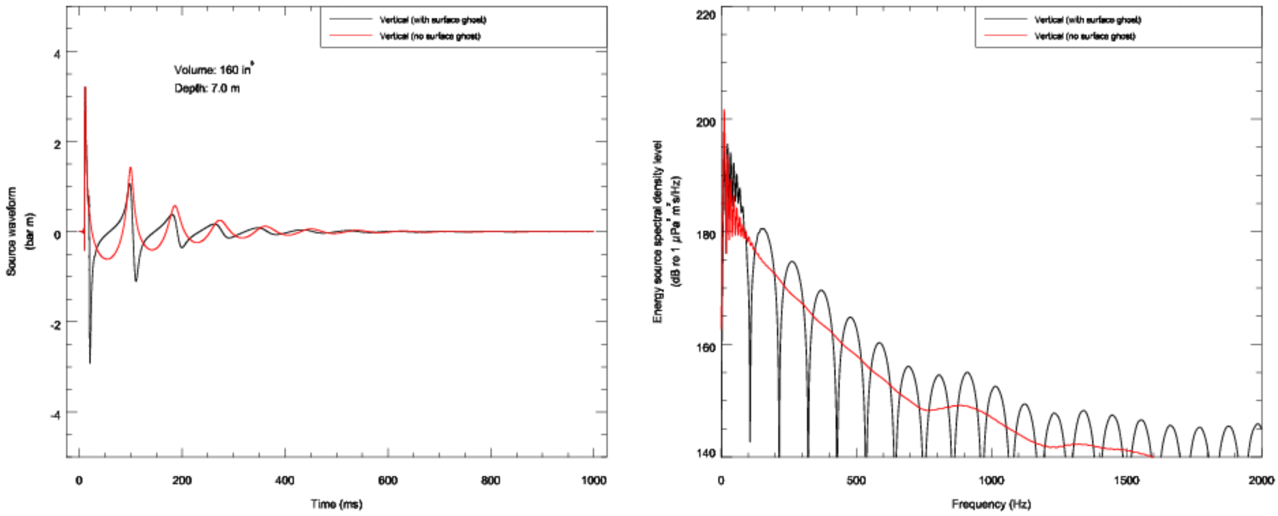


Figure B–7. Predicted source level details for the 160 in^3 seismic source. Tow depth is 7 m. The overpressure signature.

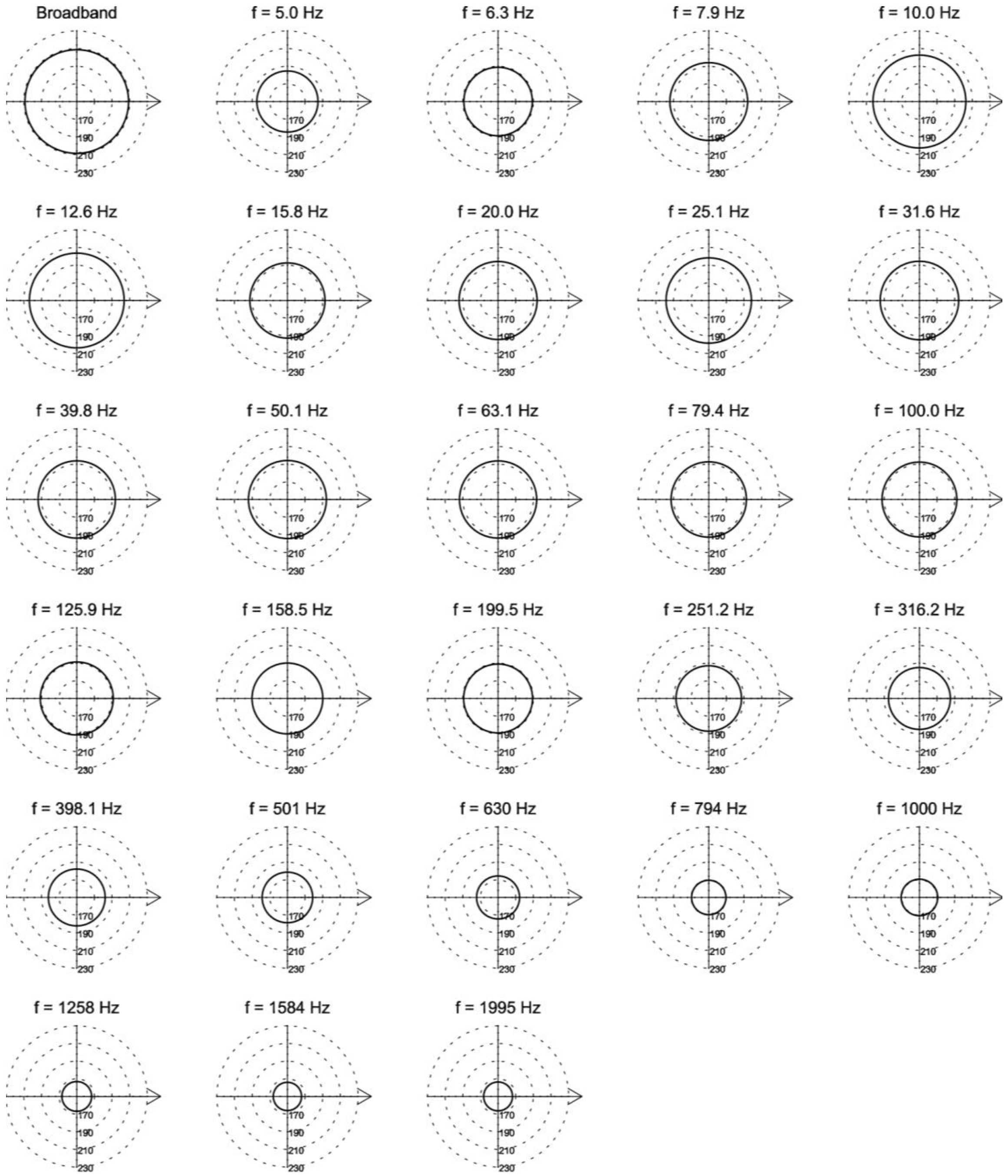


Figure B–8. Directionality of the predicted horizontal source levels for the 160 in^3 seismic source, 5 Hz to 2 kHz. Source levels (in dB re 1 μPa^2·s m^2) are shown as a function of azimuth for the centre frequencies of the decidecade bands modelled; frequencies are shown above the plots. Tow depth is 7 m (see Figure B–3).

Appendix C. Methods and Parameters

C.1. Environmental Parameters

C.1.1. Bathymetry

Bathymetry throughout the modelled area was extracted from the AusBathyTopo 250 m grid regional-scale depth model for Australian waters (Beaman 2023). Bathymetry data were re–gridded and combined onto a Map Grid of Australia (MGA) coordinate projection (Zone 55) with a regular grid spacing of 250 × 250 m (Figure C–1).

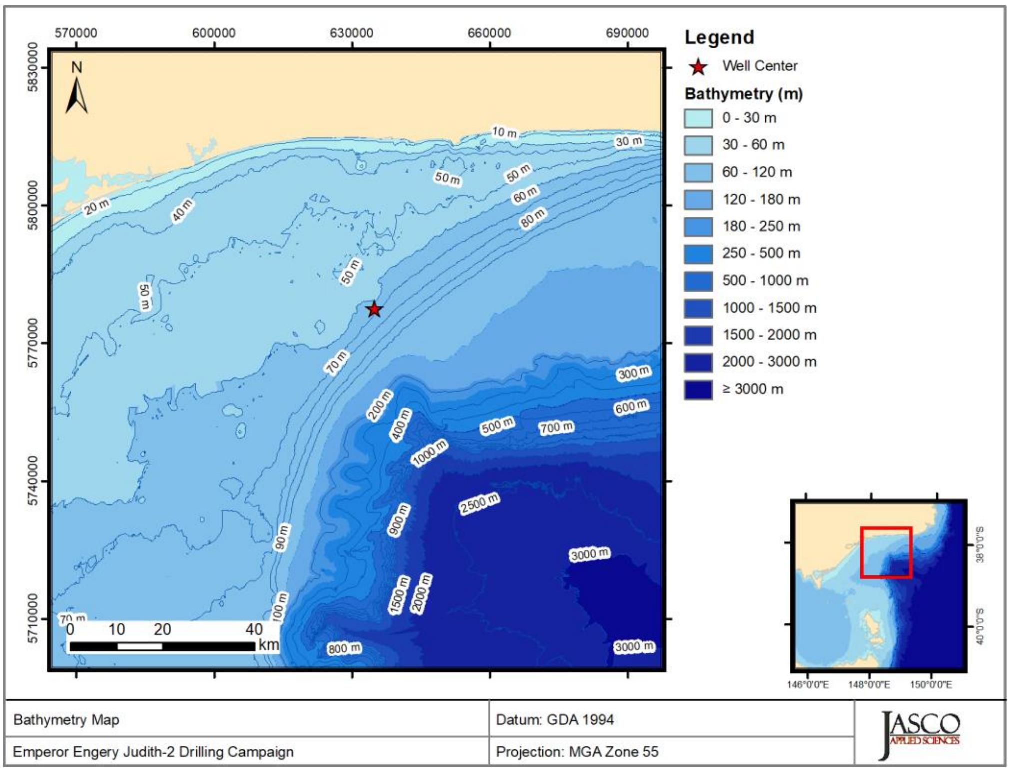


Figure C–1. Bathymetry in the modelled area.

C.1.2. Sound Speed Profile

The sound speed profile in the area was 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 monthly sound speed profiles were derived from the GDEM profiles in the locality of the modelled sites. Following a sensitivity analysis, the June sound speed profile was found to be most favourable to longer–range sound propagation. As such, June was selected for sound propagation modelling to ensure precautionary estimates of distances to received sound level thresholds. Figure C–2 shows the resulting profile, which was used as input to the sound propagation modelling.

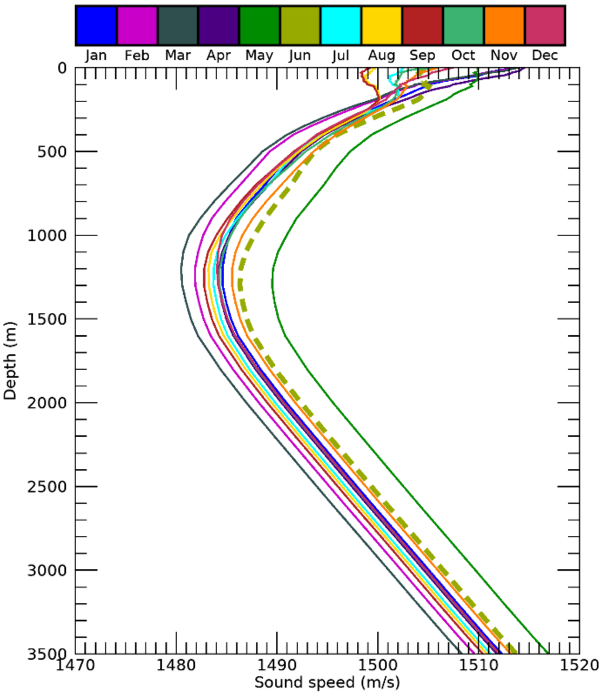


Figure C–2. Sound speed profiles for all months, with the applied month (June) displayed as a dotted line : full profile (left) and top 100 m (right) Profiles are calculated from temperature and salinity profiles from Generalized Digital Environmental Model V 3.0 (GDEM; Teague et al. 1990, Carnes 2009).

C.1.3. Geoacoustics

The available borehole that is nearest to the Judith-2 well site is a borehole made at Tuna site by Mitchell et al. (2007). The geology here consists of mostly coarse carbonate sand underlain by Limestone. Since the modelled area is a circular area with a radius of 150 km around the well centre, geological variation within the modelled radius exists. Realistically, the Tuna profile approximates an average profile near this region. In the shallower regions less than 40m depth, coarse sands dominated the most, and by looking at the other boreholes which are in various directions around the Judith-2 well, most of the profiles show dominantly coarse sands sitting on top of the limestone. Hence, the proposed geoacoustic layers are coarse sand layer over limestone layer.

For sediment layers representative grain sizes were used in the grain–shearing model proposed by Buckingham (2005) to estimate the geoacoustic parameters required by the sound propagation models. The Limestone parameters are determined using Duncan et al. (2013), representing the layer as well–cemented calcarenite. Table C–1 presents the geoacoustic profile used for all modelled sites at Judith-2 Exploration Well.

Note that MONM takes single values for shear wave parameters, so shear parameters at a shallower depth of 5m is used in the modelling since it can account for worst–case reflections and its parameter values represent an average estimation within the range in the current literature on sands (Hamilton and Bachman 1982) and Hamilton (1987).

Table C–1. Geoacoustic profile for all modelled scenarios. 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)
0–40	Coarse quartz–carbonate sand	2.1	1661.6–2180.3	0.199–1.647	397	3.65
>40	Limestone	2.7	2600	0.5		

C.2. Vessel Sound Source Propagation Models

C.2.1. Propagation Loss

The propagation of sound through the environment was modelled by predicting the acoustic propagation loss—a measure, in decibels, of the decrease in sound level between a source and a receiver some distance away. Geometric spreading of acoustic waves is the predominant way by which propagation loss occurs. Propagation loss also happens when the sound is absorbed and scattered by the seawater, and absorbed scattered, and reflected at the water surface and within the seabed. Propagation loss depends on the acoustic properties of the ocean and seabed; its value changes with frequency.

If the acoustic energy source level (ESL), expressed in dB re 1 $\mu Pa^2 \cdot s\ m^2$, and propagation loss (PL), in units of dB, at a given frequency are known, then the received level (RL) at a receiver location can be calculated in dB re 1 $\mu Pa^2 \cdot s$ by:

$$\mathrm{RL} = \mathrm{SL} - \mathrm{PL}. \tag{C–1}$$

C.2.2. MONM–BELLHOP

Long–range sound fields were computed using JASCO's Marine Operations Noise Model (MONM). While other models may be more accurate for steep–angle propagation in high–shear environment, MONM is well suited for effective longer–range estimation. This model computes sound propagation at frequencies of 10 Hz to 1.6 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 > 1.6 kHz via the BELLHOP Gaussian beam acoustic ray–trace model (Porter and Liu 1994b).

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 propagation 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 C–3).

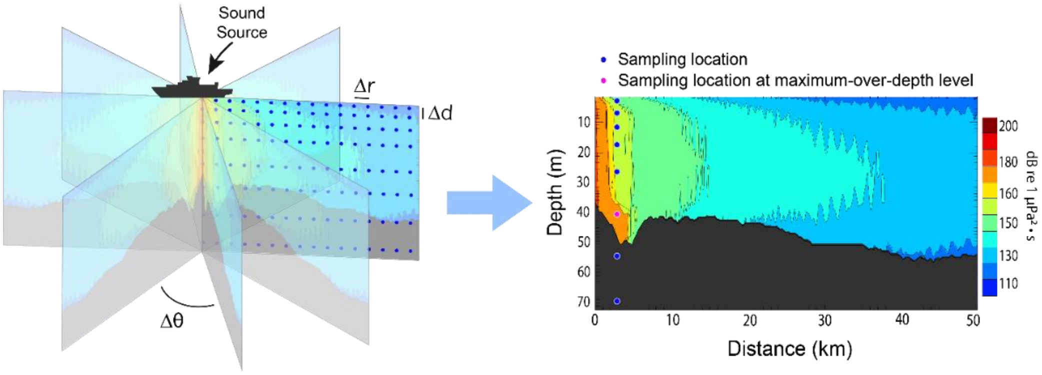


Figure C–3. The N×2–D and maximum–over–depth modelling approach used by MONM.

MONM treats frequency dependence by computing acoustic propagation loss at the centre frequencies of decidecade bands. Sufficiently many decidecade frequency–bands, starting at 10 Hz, are modelled to include most of the acoustic energy emitted by the source. At each centre frequency, the propagation loss is modelled within each of the N vertical planes as a function of depth and range from the source. The decidecade received per–second SEL are computed by subtracting the band propagation loss values from the directional source level in that frequency band. Composite broadband received per–second SEL are then computed by summing the received decidecade levels.

The received 1–s 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–second 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–second SEL. These maximum–over–depth per–second SEL are presented as colour contours around the source.

C.3. Seismic Sound Propagation Models

C.3.1. MONM–BELLHOP

See above section Appendix C.2.2.

C.3.2. 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.

C.3.3. 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.

C.3.3.1. Particle Motion

VSTACK was also used to compute estimates of particle acceleration and velocity at two sites for the 600 in^3 and 160 in^3 seismic source. Particle motion waveforms were modelled, and pulse metrics were computed from the time–domain traces. VSTACK uses the wavenumber integration approach to solve the exact acoustic wave equation for arbitrarily layered range–independent acoustic environments.

The VSTACK model setup for the particle velocity scenarios was identical to that for the peak pressure scenarios (Section 3.2.2) in terms of source treatment, frequency range and environmental model. The particle acceleration and velocity waveforms were computed to a maximum distance of 1000 m in the broadside and endfire directions from the centre of the airgun array for a receiver 5 cm above the seafloor.

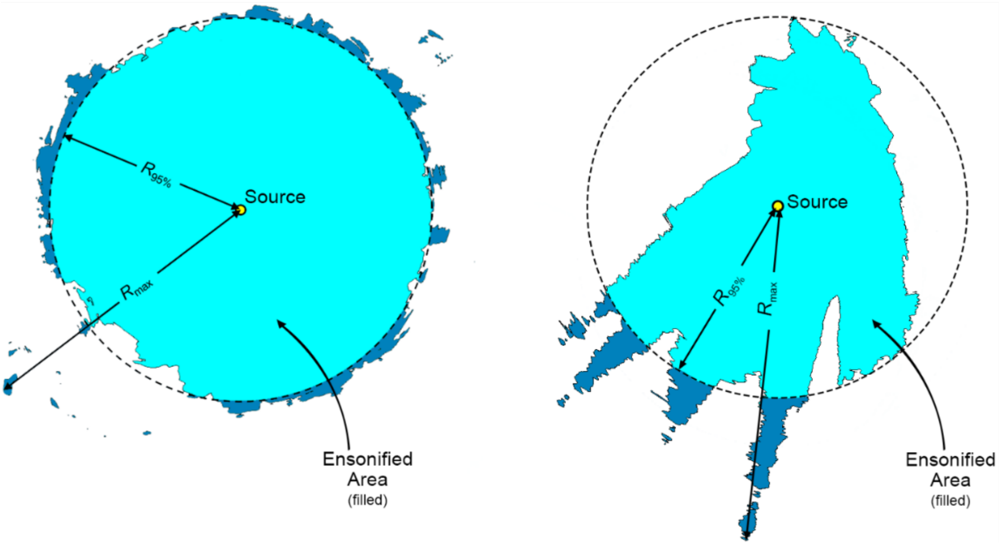
As discussed above in Appendix C.3.3, particle velocity (v) is the physical speed of a particle in a material. It can be derived from the pressure gradient and Euler's linearised momentum equation where ρ_0 is the density of the medium. Since the wavenumber integration kernel is a product of analytic expressions in terms of range and depth, VSTACK computes particle velocity by computing the spatial gradient of the pressure field analytically in the frequency domain. Fourier synthesis is applied to compute time series synthetic pressure and/or velocity waveforms at depth and range receivers by convolving the source waveforms with the impulse response of the waveguide. Particle velocity metrics at each receiver location were calculated from the modelled particle motion along three perpendicular axes (horizontal and along the source–receiver path, horizontal and perpendicular to the source–receiver path, and vertical).

The particle velocity results were converted to acceleration by time differentiation. The peak particle acceleration and velocity were calculated from the maximum of the predicted acceleration and velocity magnitude, defined as "peak magnitude" and are presented as plots of peak value versus range.

C.4. 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–4).

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–4(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–4(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.



(a) (b)

Figure C–4. Sample areas ensonified to an arbitrary sound level with R_{max} and R95% 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.5. Estimating SPL from Modelled SEL Results – Impulsive Signals

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 (Tfix = 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 C.3.2) was used to model synthetic seismic pulses over the frequency range 5–1024 Hz. This was performed along all broadside and endfire radials. 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 applied to predicted per–pulse SEL results from MONM to model SPL values. Figure C–5 and C–6 show the conversion offset for the VSP array and the 160 in^3 airgun. The conversion to SPL from SEL was conducted considering the water depth and seabed geology at the modelled site.

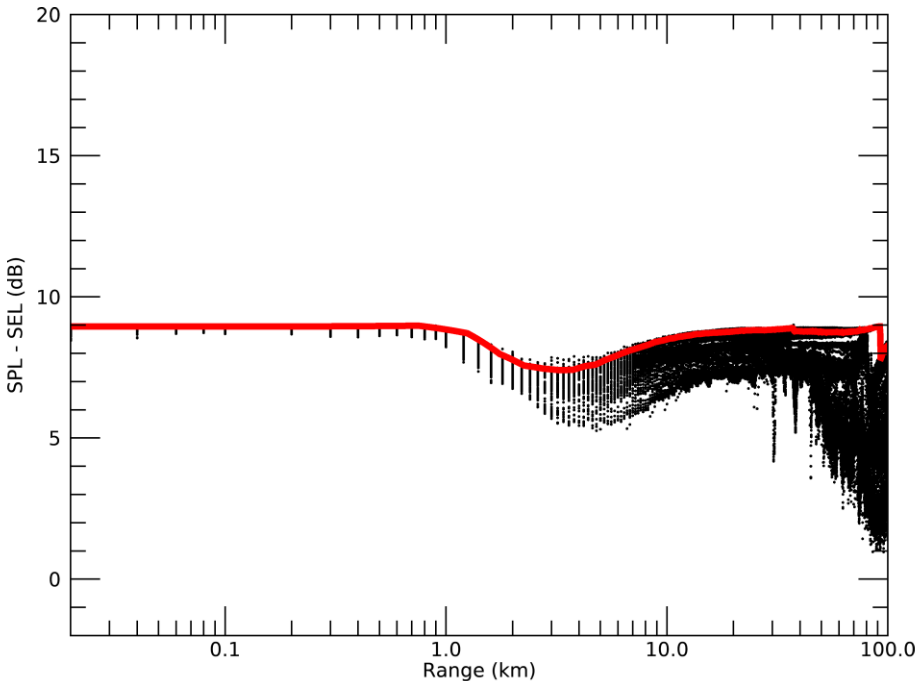


Figure C–5. *600 in^3 VSP source*: Range–and–depth–dependent conversion offsets for converting sound exposure level (SEL) to sound pressure level (SPL) for seismic pulses. Black lines are the modelled differences between SEL and SPL across different radials and receiver depths; the solid red line is the 90th percentile of the modelled differences at each range.

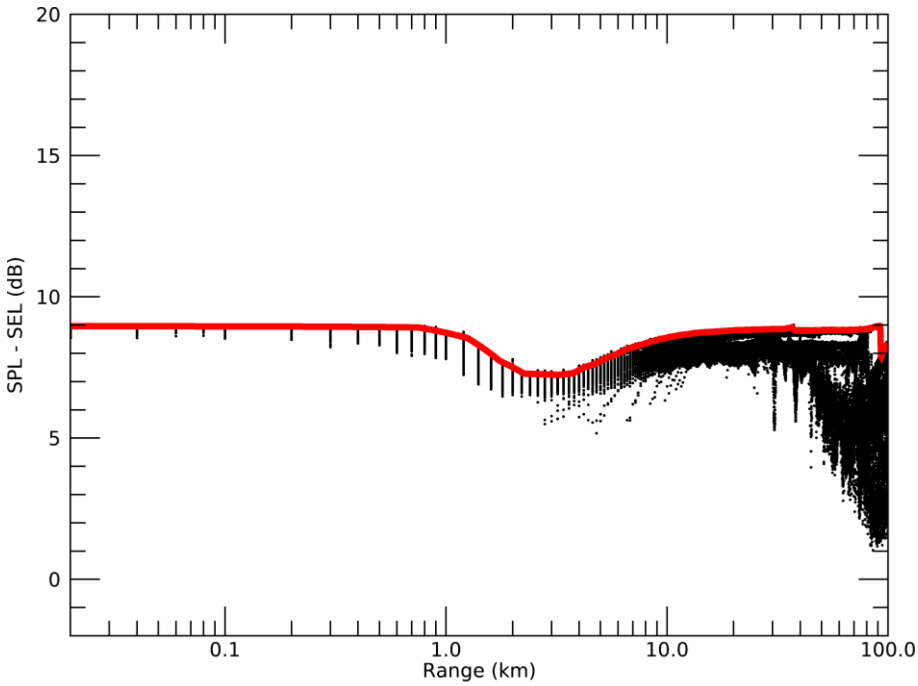


Figure C–6. *160 in[3] seismic source*: Range–and–depth–dependent conversion offsets for converting sound exposure level (SEL) to sound pressure level (SPL) for seismic pulses. Black lines are the modelled differences between SEL and SPL across different radials and receiver depths; the solid red line is the 90th percentile of the modelled differences at each range.

C.6. Estimating Sound Fields from Moving Vessels

During vessel transit, new sound energy is constantly being introduced to the environment. The noise footprint for the transiting vessels considered in this report were estimated by modelling the 1–s maximum over depth SEL footprints for the vessel at one location, and by translating and summing these footprints along the vessel transit routes. The vessel locations along the tracks were spaced uniformly, with an approximate step of $\Delta s \approx 10$ m.

The SEL sound field at any given point along the track is dependent upon the time duration within each 10 m segment of the track. When the track segment spacing is fixed, the duration of exposure depends upon the speed of the vessel during each segment of the transit. The 1–s SEL footprint at each vessel location (i) was therefore scaled based on the speed of the vessel following:

$$\mathrm{SEL}_i = \mathrm{SEL}_{1s} + 10\log_{10}\left(\frac{\Delta s}{v}\right) . \qquad \text{(C–2)}$$

where v represents the vessel speed in m/s.

The present method acceptably reflects large–scale sound propagation features, primarily dependent on water depth, which dominate the cumulative field and is thus considered to provide a meaningful estimate of the SEL_{24h} field.

C.7. Model Validation Information

Predictions from JASCO's 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 programs in the United States and Canadian Arctic, 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 that 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, Austin et al. 2018b, Beach Energy Limited 2020).

Emperor Energy Geophysical Survey Sources

DATE:	26 March 2025
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FROM:	Steven Connel, Matthew Koessler (JASCO Applied Sciences (Australia) Pty Ltd)
TO:	Emperor Energy

Subject: Geophysical Survey Investigation Sources: Acoustic Effect Estimation

JASCO Applied Sciences (JASCO) performed an estimation study of underwater sound levels to support Emperor Energy's geographical and geophysical subsea infrastructure investigations. This study was commissioned to help assess sounds from geophysical survey equipment that may affect marine fauna. Acoustic sources that are planned to be used for the proposed investigations comprise side scan sonars (SSSs) and sub-bottom profilers (SBPs). Collectively these sources can be referred to high-resolution geophysical (HRG) survey equipment.

Site and source specific modelling were not conducted, however JASCO completed a review of previously completed public and confidential studies to inform this estimation study.

1. Noise Effect Criteria

Different noise effect criteria for marine fauna are applicable depending on whether a sound source is classified as impulsive or non-impulsive. Non-impulsive sound sources can be continuous or intermittent, and produce sounds that can be broadband, narrowband or tonal, and brief or prolonged. Non-impulsive sources do not have the high peak sound pressure with rapid rise time typical of impulsive sounds.

[NMFS] National Marine Fisheries Service (US) (2023) suggest classifying some sonar sources as non-impulsive sound sources; however, some types of equipment may have impulsive characteristics. NMFS further divides non-impulsive sources as either intermittent or continuous depending on their sound characteristics. One of the characteristics that has been used to categorise HRG surveying equipment as either impulsive or non-impulsive sources is the repetition rate at which they operate. A 10 Hz repetition rate has been used as the value to discriminate whether a HRG source should be classified as impulsive or non-impulsive (Vineyard Wind and JASCO Applied Sciences 2020), JASCO recommends the following:

- SSSs be treated as continuous non-impulsive sources if their repetition rate is equal to or above 10 Hz,
- SSSs be treated as intermittent non-impulsive sources if their repetition rate is less than 10 Hz,
- SBPs be treated as impulsive sources due to their high peak sound pressure with rapid rise time.

The perceived loudness of sound, especially impulsive noise, is not generally proportional to the instantaneous acoustic pressure. Rather, perceived loudness depends on the pulse rise-time and duration, and the frequency content of the sound. Several sound level metrics, such as peak sound pressure (PK), sound pressure level (SPL), and sound exposure levels (SEL), are commonly used to evaluate noise and its effects on marine life. The acoustic metrics in this report reflect the updated ANSI and ISO standards for acoustic terminology, ANSI-ASA (2013) and ISO/DIS 18405 (2017).

The metrics used to describe considered sound sources are:

- Sound exposure level (SEL or L_E; dB re 1 µPa^2·s), which is the time-integral of the squared acoustic pressure over a duration (T).
- Sound pressure level (SPL or L_p; dB re 1 µPa), which 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 a rms pressure level and therefore not instantaneous pressure. An historic approach used to evaluate SPL of impulsive signals underwater is to calculate the sound pressure level over the 90 %-energy time window of a pulse, referred to as SPL ($L_{p,90\%}$). T_{90} is the time interval over which the cumulative energy rises from 5 to 95 % of the total pulse energy. This is the approach that has been applied within the cited literature below.
- Additionally, for sonar sources, peak sound pressure (PK or L_{pk}; dB re 1 µPa) can be used as an additional descriptor, which is the decibel level of the maximum instantaneous acoustic pressure.

JASCO chose the following noise criteria for this study because they are relevant to the sources being considered and because they represent the best available science at the time:

- Peak pressure levels (PK; L_{pk}) and frequency-weighted accumulated sound exposure levels (SEL; $L_{E,24h}$) from NMFS (2024) for the onset of permanent threshold shift (PTS) and temporary threshold shift (TTS) in marine mammals (Table 1). Peak pressure levels (PK; L_{pk}) apply to impulsive sources only (Table 1).
- Marine mammal behavioural response threshold based on the current US National Oceanic and Atmospheric Administration (NOAA 2019) and NMFS (2023) criteria for marine mammals of 160 dB re 1 µPa (SPL; L_p) for impulsive and intermittent non-impulsive sound sources, and 120 dB re 1 µPa (SPL; L_p) for continuous non-impulsive sound sources (Table 3).
- Sound exposure guidelines for fish, fish eggs and larvae, and turtles (Popper et al. 2014) for impulsive and non-impulsive sound sources.
- Peak pressure levels (PK; L_{pk}) for impulsive and frequency-weighted accumulated sound exposure levels (SEL; $L_{E,24h}$) for impulsive and non-impulsive (both continuous and intermittent) from Finneran et al. (2017) for the onset of PTS and TTS in turtles.
- Sea turtle behavioural response threshold of 166 dB re 1 µPa (SPL; L_p) (McCauley et al. 2000), along with a sound level associated with behavioural disturbance of 175 dB re 1 µPa (SPL; L_p) (McCauley et al. 2000). These apply to impulsive sources only.

Additional material is provided on the potential impact to benthic invertebrates in Section 4.1, however there is not currently sufficient material to determine robust criteria for which an assessment can be conducted. A qualitative discussion is provided in Section 4.1.

Table 1. Acoustic effects of impulsive noise on marine mammals: Unweighted SPL, SEL_{24h}, and PK thresholds.

Hearing group	NMFS (2024)			
	TTS onset thresholds* (received level)		PTS onset thresholds* (received level)	
	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 (LF) cetaceans	168	216	183	222
High–frequency (HF) cetaceans	178	224	193	230
Very High–frequency (VHF) cetaceans	144	196	159	202
Otariid Seals	170	224	185	230

* Dual metric acoustic thresholds for impulsive sounds: Use whichever results in the largest isopleth for calculating TTS or PTS onset.

L_{pk} denotes peak sound pressure is flat weighted or unweighted and has a reference value of 1 μPa.

$L_{E,24h}$ denotes cumulative sound exposure over a 24 h period and has a reference value of 1 $\mu Pa^2 s$.

Table 2. Criteria for effects of non–impulsive noise exposure, including vessel noise, for marine mammals: unweighted SPL and weighted SEL_{24h} thresholds.

Hearing group	NMFS (2024)	
	TTS onset thresholds (received level)	PTS onset thresholds (received level)
	Weighted SEL_{24h} ($L_{E,24h}$; dB re 1 μPa²·s)	Weighted SEL_{24h} ($L_{E,24h}$; dB re 1 μPa²·s)
Low–frequency (LF) cetaceans	177	197
High–frequency (HF) cetaceans	181	201
Very High–frequency (VHF) cetaceans	161	181
Otariid seals	179	199

L_E denotes cumulative sound exposure over a 24 h period and has a reference value of 1 $\mu Pa^{2} \cdot s$.

Table 3. Unweighted SPL, behavioural response threshold criteria for marine mammals.

Sound source characteristics	NOAA (2024), NMFS (2023) SPL (L_p; dB re 1 μPa)
Impulsive	160
Intermittent	160
Continuous	120

L_p - denotes sound pressure level period and has a reference value of 1 μPa.

2. Estimating Sound Exposure from Side Scan Sonar Surveys

Side Scan Sonar (SSS) is a marine geophysical survey technique that is used to produce an image of the seafloor to identify obstructions or features. This type of survey comprises transducers mounted on either side of a vehicle towed above the seabed (e.g. towfish). SSS transducers may also be mounted on Autonomous Underwater Vehicle (AUV) systems, vessel hulls or ROVs.

Side scan sonar is highly directional in the horizontal plane, with sound levels outside the beam significantly less than those within the beam. However, a swath of beam energy is output in the vertical plane perpendicular to the tow direction (Figure 1). SSS towfish are typically towed 10-20 m above the seabed, thus the beam is typically restricted to a swath close to the seabed by design. SSSs can produce acoustic signals over a variety of narrow band frequencies, but typically between 70 kHz and 400 kHz.

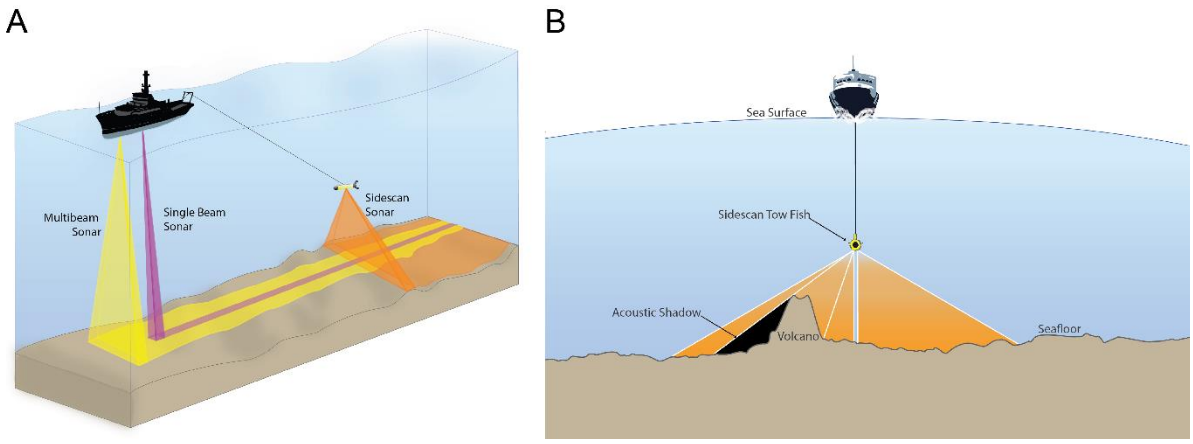

Figure 1. Graphical illustration of the differences between multi-beam, single beam, and side scan sonar. B) Graphical illustration of the side scan towfish swath coverage of the seafloor. Illustrations by Vicki Gazzola. https://ecce.esri.ca/wp-content/uploads/2022/01/Towfish.png

Representative SSS systems include those from EdgeTech, such as the 4200 SSS model. The 4200 SSS produces signals at 120 and 410 kHz when operated in 100 and 400 kHz modes, respectively. Some models may contain additional operational modes; however, measurements exist for the two frequency regimes of the EdgeTech 4200, and they are different enough to represent the different operational regimes of other SSSs. The EdgeTech 4200 SSS model only generates high frequency signals, and in this case, will only be relevant for fauna with sensitivity to signals of approximately 100 kHz or higher. Marine mammal frequency weighting functions are presented in Appendix B.

Sound emissions that exceed 100 kHz would not be heard by low-frequency cetaceans, fish, and turtles, which are most sensitive to signals well below 110 kHz. The frequencies of sound produced by the SSS unit considered here will only be relevant to fauna sensitive to higher frequencies that may be impacted by accumulated SEL (i.e. high-frequency cetaceans and very-high-frequency cetaceans).

Measurements of an EdgeTech 4200 were reported in Crocker and Fratantonio (2016) for 100 and 400 kHz modes, with a maximum per-pulse source level of 176 dB re 1 μPa^2s m (SEL) and 205 dB re 1 μPa m (SPL) respectively. Table 4 provides nominal, but upper bound values for the EdgeTech 4200 SSS, which have been written in units to align with the updated ANSI and ISO standards for acoustic terminology, ANSI S1.1 (2013) and ISO 18405:2017 (2017). The repetition rate was nominally selected as 10 Hz; however, repetition rates can vary depending on the speed of a SSS survey.

Table 4. Side scan sonar source specifications, adapted from Crocker and Fratantonio (2016)

Equipment	Operational Mode (kHz)	Source Level (dB re 1 μPa m)	Peak Source Level (dB re 1 μPa m)	Energy source level (dB re 1 μPa^2s m^2)	Beam Width[a] (°)	Pulse Duration (ms)	Repetition Rate (Hz)
EdgeTech 4200	400	205	210	176	178	1.3	10[a]
	100	201	206	179	178	7.2	

[a] SSS nominal repetition rate estimated from manufacture specifications which stating that repetition rate is selected to ensure three pings incident on a 1 m^3 target volume at range of 100 m for a given vessel survey speed in accordance with hydrographic standards (NOAA 2016).

For the 100 and 400 kHz operational modes and the specifications in Table 4, Table 5 presents the frequency weighted SEL PTS and TTS horizontal impact distance estimates for a nominal side scan sonar survey considering a spreading loss calculation described in Appendix A, weighting curves can be found in Appendix B.

Table 5. Horizontal distances (m) to frequency-weighted SEL_{24h} based PTS and TTS marine mammal thresholds from NMFS (2024) for a nominal side scan sonar survey. An N/A indicates that the operational model produces the majority of its acoustic energy outside the hearing group sensitivity range.

Hearing group	Threshold for SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²·s)	Nominal estimated horizontal distance (m) to SEL threshold	
		400 kHz Mode	100 kHz Mode
PTS			
High-frequency (HF) cetaceans	201	N/A	*
Very High-frequency (VHF) cetaceans	181	*	7
Otariid seals	199	*	*
TTS			
High-frequency (HF) cetaceans	181	N/A	5
Very High-frequency (VHF) cetaceans	161	7	139
Otariid seals	219	*	*

An asterisk indicates that the sound level threshold will likely not be reached.

Austin et al. (2013) also measured the EdgeTech 4200 system during an operational program, focusing on the 120 kHz signals (100 kHz mode). They reported the distance from in-beam pulses to an SPL of 120 dB re 1 µPa to be 1400 m. The measurements conducted in Austin et al. (2013) therefore indicate that the marine mammal behavioural response criteria could be exceeded up to 1400 m from SSS equipment for high-frequency and very-high-frequency cetaceans; however, these ranges were extrapolated based on curves fitted to data and may not be fully constrained at longer ranges, and thus should be considered conservative. As a comparative example, the spreading loss calculation presented here predicts maximum horizontal distances between 340 – 705 m to the marine mammal behavioural response criteria for non-impulsive continuous sound sources of 120 dB re 1 µPa (SPL; L_p) for high-frequency and very-high-frequency cetaceans.

Sound emissions that exceed 100 kHz would not be heard by low-frequency cetaceans, fish, and turtles, which are most sensitive to signals well below 110 kHz. The frequencies of sound produced by the SSS units considered here will only be relevant to fauna sensitive to higher frequencies that may be impacted by accumulated SEL (i.e. high-frequency cetaceans and very-high-frequency cetaceans). Therefore no effects are predicted, for low-frequency cetaceans, fish and sea turtles, from the considered SSS equipment.

3. Estimating Sound Exposure from Sub-Bottom Profilers

Sub-bottom profilers (SBPs) are marine geophysical survey equipment that are used to generate cross-sectional images of shallow geological structure below the seafloor. There are a variety of SBP instrument types including, but not limited to, boomers, sparkers, airguns and transducer (Chirp) type systems. We understand that transducer type systems are likely to be used for geographical and geophysical subsea infrastructure investigations for the Emperor Energy's offshore developments Fields, but that boomers might also be included.

3.1. Transducer Type Sub-Bottom Profilers

Transducer type SBP systems typically produce a swept-frequency signal, i.e. the signal is emitted over time and over a specific frequency range. The pulse length, frequency bandwidth, and phase/amplitude characteristics of a pulse are generally selectable. The transducer that transmits a signal also receives the signal reflected from the seafloor. These types of SBPs operate at medium to high frequencies (~1 kHz – 25 kHz); a given instrument and processing systems specifications define the bandwidth of the signal and characteristics, which can vary by SBP system and manufacturer.

JASCO have previously modelled an EdgeTech X-Star SBP (manufactured by EdgeTech) mounted on SBP-216 tow-fish (McPherson and Wood 2017). In that modelling study, the operational frequency range was 2 kHz to 16 kHz. Sound levels associated with the marine mammal behavioural response criterion of 160 dB re 1 µPa (SPL; L_p) for impulsive sound sources were not exceeded beyond a horizontal distance of less than 2 m from the SBP.

Crocker and Fratantonio (2016) reported source levels for several different SBPs. Table 6 provides nominal, but upper bound values for the three transducer SBPs extracted from Crocker and Fratantonio (2016). Units have been written to align with the updated ANSI and ISO standards for acoustic terminology, ANSI S1.1 (2013) and ISO 18405:2017 (2017).

Table 6. Sub-bottom profiler source specifications, adapted from Crocker and Fratantonio (2016)

Equipment	Operational Mode	Frequency Bandwidth (kHz)	Source Level (dB re 1 µPa m)	Peak Source Level (dB re 1 µPa m)	Energy source level (dB re 1 $\mu Pa^2 s\ m^2$)	Beam Width (°)	Pulse Duration (ms)	Repetition Rate (Hz)[1]
EdgeTech 424	100% Power	8.5-12.4	178	184	154	71	3.5	
EdgeTech 512	100% Power	5.7-9	179	184	159	51	9.1	5
Knudsen 3202	Power Setting 4	3.3-5.7	209	214	193	78	21.4	

[1] Repetition rate proposed in considering specification documents and previous public information (Vineyard Wind and JASCO Applied Sciences 2020). These are nominal and depend on usage.

In a similar procedure to the other source types considered in this report, a simple spreading loss model was used to calculate estimates of sound propagation and to provide distances estimates to noise effect criteria for marine fauna. Received levels have been calculated based on an assumption of spherical spreading with absorption loss; the method is described in Appendix A . For the SBPs listed in Table 6, the considered frequencies are sufficiently high enough, and the corresponding wavelengths are sufficiently short enough, such that a simple spreading loss model is an applicable tool to provide distance estimates to impact criteria. The application of this method may not hold for all SPB systems and per-case, per-system considerations are required. Table 7 presents the frequency weighted SEL PTS and TTS horizontal impact distance estimates for a nominal sub-bottom survey (refer to Appendix A for calculation details and weighting curves can be found in Appendix B).

Table 7. Horizontal distances (m) for frequency-weighted SEL_{24h} based PTS and TTS marine mammal thresholds from NMFS (2024) for a nominal sub-bottom profiling survey. An N/A indicates that the operational model produces the majority of the acoustic energy outside the hearing group sensitivity range.

Hearing group	Threshold for SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²·s)	Nominal estimated horizontal distance (m) to SEL threshold		
		EdgeTech 424	EdgeTech 512	Knudsen 3202
PTS				
Low-Frequency (LF) cetaceans	183	*	*	28
High-frequency (HF) cetaceans	193	*	*	*
Very High-frequency (VHF) cetaceans	159	*	*	250
Otariid seals	185	*	*	19
TTS				
Low-Frequency (LF) cetaceans	168	*	*	808
High-frequency (HF) cetaceans	178	*	*	11
Very High-frequency (VHF) cetaceans	144	8	7	3974
Otariid seals	170	*	*	563

An asterisk indicates that the sound level threshold may not be reached.

In considering the sound levels from SBPs above, the per-pulse peak pressure source levels are close to most of the PK noise effect criteria thresholds (outlined in Section 1), and in some cases the reported sources levels are below PK criteria thresholds. Therefore, PK noise effect criteria thresholds may be exceeded but only within very close proximity to SBP sources. Indeed, the simple spreading loss model suggests that PK criteria for all marine mammal groups may be exceeded at very short horizontal distances from the considered SPB sources, ~2m and ~5 m for PTS and TTS, respectively. The spreading loss calculation predicts a maximum horizontal distance between 4 – 180 m for the marine mammal behavioural response criterion of 160 dB re 1 µPa (SPL; L_p).

The spreading loss distance estimates for the two EdgeTech SBPs in Table 7 are similar to those reported in McPherson and Wood 2017. However, for the higher-powered Knudsen 3202 system, the range estimates are larger than were reported in McPherson and Wood 2017. These results indicate the importance of considering the equipment and system specifications, as well as the way the equipment will be used operationally, in determining impact distances. Refer to Section 4 for additional context on fish and turtles.

3.2. Boomer Type Sub-bottom Profiler

As the boomer source had not been decided at the time of this assessment, a commonly-used representative system was considered, with levels derived from a previous JASCO field measurement campaign. JASCO previously modelled a AP3000 triple-plate boomer (manufactured by Subsea Systems, Inc.) for a confidential client in the Gippsland region, and the modelling approach and results have been used to inform this assessment.

In that modelling study, the source was represented by scaling JASCO's measurement results from a source verification study on an AP3000 system Martin et al. (2012) from a double-plate configuration to a triple-plate configuration. This resulted in a source level of the AP3000 triple-plated boomer operating at 1800 J per pulse energy was calculated to be 169.0 dB 1 μPa^{2}m^{2}s.

In the modelling study a conservative sound speed profile that would be most supportive of sound propagation conditions for the period of the investigations was defined and applied, and single-impulse sound fields were predicted at a single location, and accumulated sound exposure fields were predicted for likely scenarios of geophysical investigations 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; $L_{pk\text{-}pk}$), and either single-impulse (i.e., per-pulse) or accumulated sound exposure levels (SEL, L_E) as appropriate for different noise effect criteria. The analysis considered the distances away from the source or survey lines at which several effects criteria or relevant sound levels were reached.

Sound levels associated with the considered behavioural effect criteria are not reached beyond a distance of less than 10 m for the boomer, and no criteria associated with injury are reached.

The likelihood of fish being close enough to the sound source for physiological impacts to occur is considered remote (McPherson and Wood 2017). Behavioural impacts to fish from survey equipment noise will be limited to behavioural responses within metres of the noise source.

Crocker and Fratantonio (2016) reported source levels for several different SBPs. Table 8 provides nominal, but upper bound values for a triple plate boomer SBP extracted from Crocker and Fratantonio (2016). Units have been written to align with the updated ANSI and ISO standards for acoustic terminology, ANSI S1.1 (2013) and ISO 18405:2017 (2017).

Table 8. Sub-bottom profiler boomer source specifications, adapted from Crocker and Fratantonio (2016)

Equipment	Operational Mode	Frequency Bandwidth (kHz)	Source Level (dB re 1 μPa m)	Peak Source Level (dB re 1 μPa m)	Energy source level (dB re 1 μPa^{2}s m^2)	Beam Width (°)	Pulse Duration (ms)	Repetition Rate (Hz)[1]
Applied Acoustics S-Boom	700 J (three plates)	0.2-6.2	205	211	172	61	0.6	5

[1] Repetition rate proposed in considering specification documents and previous public information (Vineyard Wind and JASCO Applied Sciences 2020). These are nominal and depend on usage.

To compare with the discussion points in cited literature, in a similar procedure to estimate received levels and determine threshold exceedance ranges has been conducted. Like, the other source types considered in this report, received levels have been calculated based on an assumption of spherical spreading with absorption loss. The method is described in Appendix A. Table 9 presents the frequency weighted SEL PTS and TTS horizontal impact distance estimates for a nominal boomer sub-bottom survey (refer to Appendix A for calculation details and weighting curves can be found in Appendix B).

Table 9. Horizontal distances (m) for frequency-weighted SEL_{24h} based PTS and TTS marine mammal thresholds from NMFS (2024) for a nominal sub-bottom profiling survey. An N/A indicates that the operational model produces the majority of the acoustic energy outside the hearing group sensitivity range.

Hearing group	Threshold for SEL_{24h} ($L_{E,24h}$; dB re 1 µPa²·s)	Nominal estimated horizontal distance (m) to SEL threshold
		S-Boom (Triple Plate)
PTS		
Low-Frequency (LF) cetaceans	183	*
High-frequency (HF) cetaceans	193	*
Very High-frequency (VHF) cetaceans	159	2
Otariid seals	185	*
TTS		
Low-Frequency (LF) cetaceans	168	7
High-frequency (HF) cetaceans	178	*
Very High-frequency (VHF) cetaceans	144	36
Otariid seals	170	*

An asterisk indicates that the sound level threshold may not be reached.

The per-pulse peak pressure source levels are close to most of the PK noise effect criteria thresholds (outlined in Section 1). Therefore, PK noise effect criteria thresholds may be exceeded but only within very close proximity to SBP sources, if at all. The simple spreading loss model suggests that PK criteria for all marine mammal groups may be exceeded at very short horizontal distances from the considered SPB sources, ~1 m and ~3 m for PTS and TTS, respectively. The spreading loss calculation predicts a maximum horizontal distance of 90 m to the marine mammal behavioural response criterion of 160 dB re 1 µPa (SPL; L_p).

The spreading loss distance estimates for the Boomer SBP in Table 9 are similar to those reported in McPherson and Wood 2017, with the notable difference of the maximum horizontal distance to the marine mammal behavioural response estimated to be 90 m from the spreading loss model. These results reflect a slightly more conservative source parameterisation used with the spreading loss model. This results in slightly larger distances compared to those reported in the provided studies. Refer to Section 4 for additional context on fish and turtles.

4. Additional Results

Acoustic masking occurs when a sound impedes an animal’s ability to perceive biologically relevant signals. Due to the context-specific nature of masking, there are not currently any noise effect criteria to assess against. Nonetheless, all of the considered survey equipment has the potential to cause masking of cetacean vocalisations due to their overlap with the frequency range produced by geophysical survey signals. Masking is most likely to affect high-frequency and very-high-frequency cetaceans due to the overlap with their hearing sensitivities (refer to Appendix B) and sound emissions. However, due to the limited propagation range of the geophysical survey signals (high frequencies attenuate rapidly), in most cases the range at which the impact could occur will be small, typically within hundreds of meters.

Sound from HRG survey equipment would not result in physiological impacts to turtles located within metres of the sources considered above. This is because the sounds produced by the considered geophysical survey equipment are outside of the hearing frequency range for turtles, which for green and loggerhead turtles is approximately 50 – 2,000 Hz (Finneran et al. 2017), with highest sensitivity to sounds between 200 and 400 Hz (Ridgway et al. 1969, Ketten and Bartol 2005, Bartol and Ketten 2006, Bartol 2008, Yudhana et al. 2010, Piniak et al. 2011, Lavender et al. 2012, 2014).

Based on available criteria from Popper et al (2014), potential impacts of equipment on fish have been considered. Sound from HRG survey equipment could result in physiological impacts to fish located within metres of the sources considered above. However, the likelihood of fish being close enough to the sound source for physiological impacts to occur is considered remote.

4.1. Benthic Invertebrates

Research is ongoing into the relationship between sound and its effects on benthic invertebrates, 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. 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, 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 levels of particle motion may lead to a behavioural response, or mortality. Therefore, at this stage, we cannot propose authoritative thresholds to inform the impact assessment.

In consideration of the evolving research, for crustaceans a PK-PK sound level of 202 dB re 1 μPa (Payne et al. 2008) is considered to be associated with no effect. Additionally for context related to different levels of potential impairment, the PK-PK sound levels of 209-212 dB re 1 μPa determined by Day et al. (2016b) as applied to crustaceans, and 213 dB re 1 μPa from Day et al. (2019), 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) and Day et al. (2017).

The while not reported here per-pulse peak to peak pressure source levels for the sources referenced in Crocker and Fratantonio (2016) are close to most of the PK-PK noise effect criteria thresholds and in some cases the reported sources levels are below PK-PK criteria thresholds. Therefore, PK-PK noise effect criteria thresholds for benthic invertebrates may be exceeded but only within very close proximity to HRG sources. Moreover, for hull mounted HRG equipment where the source is several tens or metres from the seabed it is unlikely for these types of HRG equipment to exceed the PK-PK criteria thresholds at the seafloor.

5. Summary

This technical summary should be used to provide context to potential impacts from geophysical surveying equipment that generally operate at high frequencies; here we consider side scan sonars

(SSSs) and sub-bottom profilers (SBPs). Estimates of horizontal effect distances are nominal and depend on what equipment is used and how it is configured.

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Appendix A. Calculation Methods

A.1. Empirical Spreading Loss Calculations

The general method specified in the Interim Recommendation for Sound Source Level and Propagation Analysis for High Resolution Geophysical (HRG) Sources (NOAA September 9, 2019) was followed to perform loss calculations. We note that there are an updated set of interim recommendations (Guan 2020) from the author of the 2019 guidance document. This updated method provides adjusted calculation methods to consider water depth in the prediction of the horizontal impact distance, the method described herein is equivalent to the case where the water depth is greater than the vertical component of the slant distance (see Figure 2 for a diagram). We have not considered water depth in the prediction of the horizontal impact distance, to allow for operational flexibility.

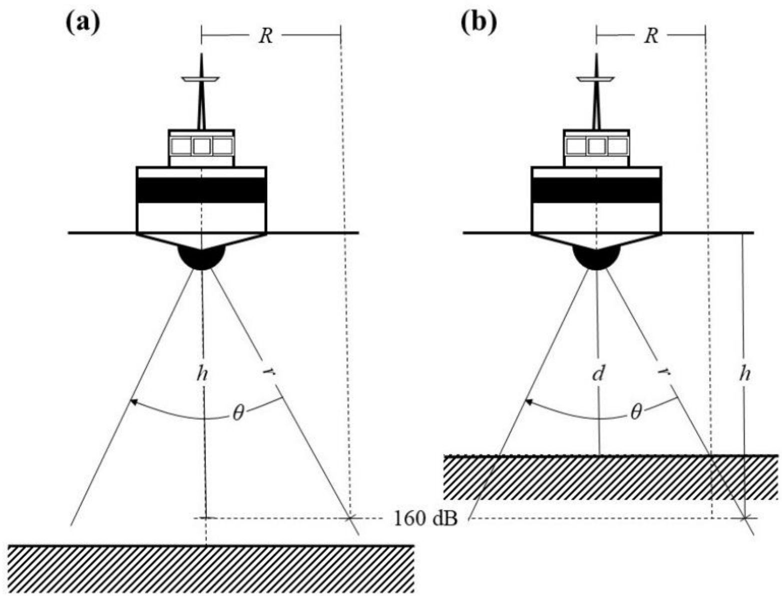

Figure 2. Excerpt from Guan (2020). The calculation methods described herein is equivalent to the left diagram labelled (a).

The calculation method is described as follows.

The sonar equation is used to calculate the received level:

$$RL(r) = SL - PL(r), \tag{1}$$

where RL is a generalised the pressure level (dB re 1 μPa or dB re 1 μPa^{2}s) and applies to PK, SPL and SEL calculations, r is the distance from the source (m), SL is the source level (dB re 1 μPa m or dB re 1 μPa^{2}s m), and PL is the propagation loss as a function of distance. Propagation loss is calculated using:

$$PL(r) = 20\log_{10}\left(\frac{r}{1\text{ m}}\right)\text{ dB} + \alpha(f) \cdot r/1000, \tag{2}$$

where $\alpha(f)$ is the absorption coefficient (dB/km) and f is frequency (kHz). The absorption coefficient is approximated by discarding the boric acid term from Ainslie (2010; p29; eq 2.2):

$$\alpha(f) \approx 0.000339f^2 + 48.5f^2/(75.6^2 + f^2)\,. \tag{3}$$

When a range of frequencies is produced by a source, the lowest frequency for determining the absorption coefficient was used.

A.2. Estimating Range to Thresholds Levels

Distances to PK thresholds and SPL criteria were calculated using the PK or SPL source level and applying propagation loss from Equation 2. The PK and SPL calculations were performed at radial distances *r*, which varied between 1 m and 10 km to determine when levels cross a threshold or exceed a criterion. For a downwards-pointing source with a beamwidth less than 180°, the horizontal impact distance (*R*) is calculated from the in-beam range using:

$$R = r \cdot \sin\left(\frac{\delta\theta}{2}\right), \tag{4}$$

where $\delta\theta$ is the beamwidth.

For the weighted SEL thresholds, the following steps were performed:

- Modelled propagation loss as a function of oblique range using Equation 2.
- Modelled per-pulse SEL for a stationary receiver at a fixed distance off a straight survey line, using a vessel transit speed and source-specific pulse length and repetition rate. The calculation considered, a vessel transit speed of 3.5 knot (~5 m/s) and a 20 km straight survey line track. The off-line distance is referred to as the closest point of approach (CPA) and was performed for CPA distances between 1 m and 10 km. The survey line length was modelled as 10 km long (analysis showed longer survey lines increased SEL by a negligible amount). SEL is calculated as $SPL + 10\log_{10}\frac{T}{1\,\mathrm{s}}\ \mathrm{dB}$, where T is the pulse duration. A flat spectrum between the source minimum and maximum frequency is assumed, which was weighted according to the marine mammal hearing group weighting function (NMFS (2024)) and summed across frequency.
- Calculated the SEL for each survey line to produce curves of weighted SEL as a function of CPA distance.
- Used the curves from Step 4 to estimate the CPA distance to the threshold.
- This method accounts for the hearing sensitivity of the marine mammal group and seawater absorption for downwards-facing transducers.

Appendix B. 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).

B.1.1. Marine Mammal Frequency Weighting Functions

In 2015, a US 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:

$$G(f) = K + 10\log_{10}\left[\left(\frac{(f/f_{lo})^{2a}}{\left[1+(f/f_{lo})^2\right]^a\left[1+(f/f_{hi})^2\right]^b}\right)\right] \quad \text{(B–1)}$$

Finneran (2015) proposed five functional hearing groups for marine mammals in water: low–, mid– and high–frequency cetaceans (LF, MF, and HF cetaceans, respectively), 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 acoustic impacts on marine mammals (NMFS 2018), and in the latest guidance by NMFS (2024). The updates did not affect the content related to either the definitions of frequency–weighting functions or the threshold values, however, the terminology for mid– and high–frequency cetaceans was changed to high– and very high–frequency cetaceans (VHF cetaceans). Table B–1. lists the frequency–weighting parameters for each hearing group relevant to this assessment, and Figure B–1 shows the resulting frequency–weighting curves.

Table B–1. Parameters for the auditory weighting functions used in this project as recommended by NMFS (2024).

Functional hearing group	NMFS (2024)				
	a	b	f_1 (Hz)	f_2 (Hz)	K[1] (dB)
Low-frequency cetaceans	0.99	5	168	26,600	0.12
High-frequency cetaceans	1.55	5	1,730	129,000	0.32
Very high-frequency cetaceans	2.23	5	5,930	186,000	0.91
Otariid pinnipeds underwater	1.58	5	2530	43,800	1.37

[1] In NMFS (2018) and NMFS (2024), this constant is symbolized by C.

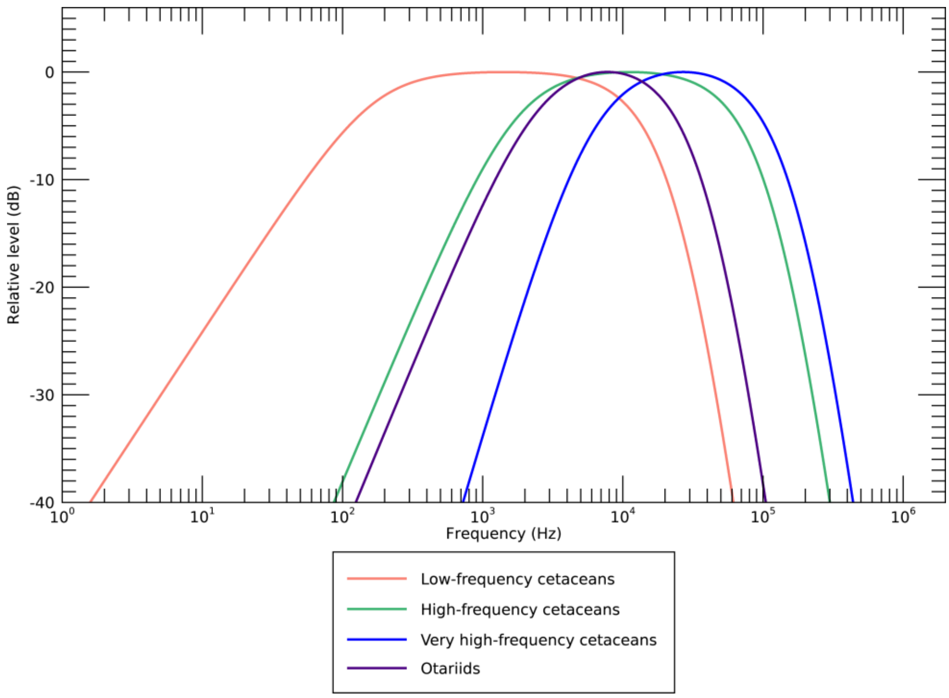

Figure B–1. Auditory weighting functions for functional marine mammal hearing groups used in this project as recommended by NMFS (2024).