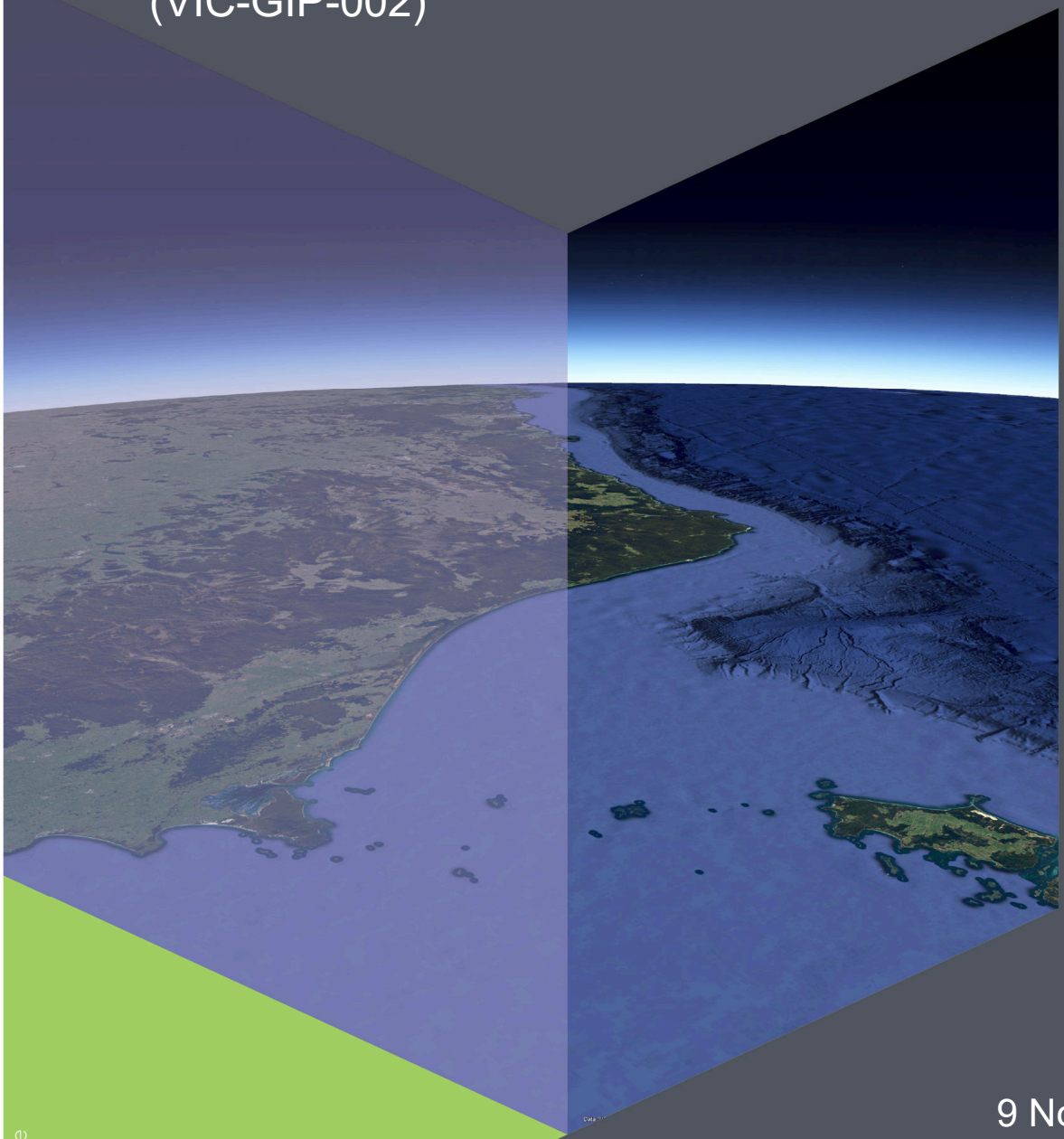
CarbonNet Project

Geophysical and Geotechnical Investigations Environment Plan Summary (VIC-GIP-002)



Rev 0
9 November 2018

Australian Government
Department of Industry, Innovation and Science

VICTORIA State Government
Economic Development, Jobs, Transport and Resources

DOCUMENT ACCEPTANCE and RELEASE NOTICE

This is Revision 0 of the CarbonNet Project's Geophysical and Geotechnical Investigations Environment Plan (EP) Summary. This is a managed document. Changes will only be issued as a complete replacement document. Recipients should remove superseded versions from circulation.

PREPARED FOR ACCEPTANCE DATE: 9/11/2018

Giulio Pinzone, Environmental Specialist, AGR.

APPROVED FOR RELEASE DATE: 9/11/2018

Ross McGowan, Executive Director, Earth Resources Economic Development, Department of Economic Development, Jobs, Transport and Resources

BUILD STATUS

Rev	Date	Author	Purpose	Reviewers
0	09/11/2018	G. Pinzone	Issued to NOPSEMA	IF, VMDC
A	08/11/2018	G. Pinzone	Draft for review	IF, VMDC

TABLE OF CONTENTS

Acronyms

Acronym	Definition
2D	Two-dimensional
3D	Three-dimensional
ABS	Australian Bureau of Statistics
AFMA	Australian Fisheries Management Authority
AHO	Australian Hydrographic Office
AIS	Automatic Identification System
ALARP	As Low As Reasonably Practicable
AMSA	Australian Maritime Safety Authority
AMP	Australian Marine Park
APPEA	Australian Petroleum Production and Exploration Association
AS/NZS	Australian Standard/New Zealand Standard
ASBTIA	Australian Southern Bluefin Tuna Industry Association
BACI	Before-After-Control-Impact
BIA	Biologically Important Area
BOD	Biological Oxygen Demand
BOEM	Bureau of Ocean Energy Management
BPEM	Best Practice Environmental Management
BRUV	Baited Remote Underwater Video
BWMC	Ballast Water Management Certificate
BWMP	Ballast Water Management Plan
BWR	Ballast Water Report
CCS	Carbon Capture and Storage
CFA	Commonwealth Fisheries Association
CHARM	Chemical Hazard and Risk Management
CITES	Convention on International Trade in Endangered Species of Wild Fauna and Flora
CMID	Common Marine Inspection Document
CO_2	Carbon Dioxide
CoEP	Code of Environmental Practice
CPUE	Catch Per Unit Effort
CSIRO	Commonwealth Scientific and Industrial Research Organisation
CTD	Conductivity, Temperature and Depth
DAWR	Department of Agriculture and Water Resources (Cth)
DEDJTR	Victorian Department of Economic Development, Jobs, Transport and Resources (Vic)
DELWP	Department of Environment, Land, Water and Planning (Vic)

Acronym	Definition
DGPS	Differential Global Positioning System
DIIS	Department of Industry, Innovation and Science (Cth)
DoD	Department of Defence (Cth)
DoE	Department of the Environment (Cth) (*former*)
DoEE	Department of Environment and Energy (Cth)
DP	Dynamic Positioning
DSEWPC	Department of Sustainability, Environment, Water, Population and Communities (Cth) (*former*)
EARPL	Esso Australia Resources Pty Ltd
EEZ	Exclusive Economic Zone
EIA	Environmental Impact Assessment
EIAPP	Engine International Air Pollution Prevention
EMBA	Environment that May Be Affected
EMD	Emergency Management Division (of DEDJTR)
EMS	Environmental Management System
EP	Environment Plan
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999* (Cth)
EPO	Environmental Performance Outcome
EPS	Environmental Performance Standard
ERA	Environmental Risk Assessment
ERC	Emergency Response Coordinator
ERP	Emergency Response Plan
ERR	Earth Resources Regulation (division of DEDJTR)
ESD	Environmentally Sustainable Development
FFG Act	*Flora and Fauna Guarantee Act 1988* (Vic)
GA	Geoscience Australia
GDP	Gross Domestic Product
GHG	Greenhouse Gas
GIS	Geographic Information System
GMDSS	Global Maritime Distress Safety System
GMEM	Gippsland Marine Environmental Monitoring
GMP	Garbage Management Plan
GPS	Global Positioning System
HFC	High Frequency Cetacean
HSE	Health, Safety and Environment
HSSE	Health, Safety, Security and Environment
IAGC	International Association of Geophysical Contractors
IAP	Incident Action Plan

Acronym	Definition
IAP2	International Association for Public Participation
IAPP	International Air Pollution Prevention
ICC	Incident Control Centre
IEE	International Energy Efficiency
ILUA	Indigenous Land Use Agreements
IMCA	International Marine Contractors Association
IMO	International Maritime Organisation
IMS	Invasive Marine Species
IMT	Incident Management Team
IOGP	International Oil & Gas Producers Association
IOPP	International Oil Pollution Prevention
IPP	International Pollution Prevention
ISPP	International Sewage Pollution Prevention
IUCN	International Union for the Conservation of Nature
LEFCOL	Lakes Entrance Fisherman's Cooperative
LFC	Low Frequency Cetacean
LiDAR	Light Detection and Ranging
MARPOL	International Convention for the Prevention of Pollution from Ships 1973, as modified by the Protocol of 1978
MARS	Maritime Arrivals Reporting System
MFC	Mid Frequency Cetacean
MMO	Marine Mammal Observer
MNES	Matter/s of National Environmental Significance
MNP	Marine National Park
MoC	Management of Change
MoU	Memorandum of Understanding
MSV	Maritime Safety Victoria
NEBA	Net Environmental Benefit Analysis
NGOs	Non-Government Organisation
NNTT	National Native Title Tribunal
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NOPTA	National Offshore Petroleum Titles Authority
OCNS	Offshore Chemical Notification Scheme
ODS	Ozone-Depleting Substance
OHS	Occupational Health and Safety
OIW	Oil-in-Water
OPEP	Oil Pollution Emergency Plan

Acronym	Definition
OPGGS Act	*Offshore Petroleum and Greenhouse Gas Storage Act* (Cth & Vic)
OPGGS	Offshore Petroleum and Greenhouse Gas Storage
OSMP	Oil Spill Monitoring Program
OSPAR	Oslo-Paris Conventions
OSRA	Oil Spill Response Atlas
OWR	Oiled Wildlife Response
OWS	Oily Water Separator
PMM	Project Management Manual
PMS	Planned Maintenance System
PTS	Permanent Threshold Shift
RAMSAR	Convention on Wetlands of International Importance especially as Waterfowl Habitat
RO	Reverse Osmosis
ROS	Regional Outfall Sewer
ROV	Remotely Operated (underwater) Vehicle
SCAT	Shoreline Clean-up and Assessment Technique
SEEMP	Ship Energy Efficiency Management Plan
SEP	Stakeholder Engagement Plan
SESS	Southern and Eastern Scalefish and Shark
SETFIA	South-East Trawl Fishing Industry Association
SHS	Scalefish Hook Sector
SIMOPS	Simultaneous Operations
SIV	Seafood Industry Victoria
SMPEP	Shipboard Marine Pollution Emergency Plan
SOLAS	International Convention for the Safety of Life at Sea
SOP	Standard Operating Procedure
SORF	Soil and Organic Recycling Facility
SRT	State Response Team
SSFAssn	Sustainable Shark Fishing Association
SSIA	Southern Shark Industry Alliance
STP	Sewage Treatment Plant
SWOP	Saline Wastewater Outfall Pipeline
TEC	Threatened Ecological Community
TSV	Transport Safety Victoria
TTS	Temporary Threshold Shift
VADA	Victorian Abalone Divers Association
VBA	Victorian Biodiversity Atlas
VFA	Victorian Fisheries Authority

Acronym	Definition
VGRMF	Victorian Government Risk Management Framework
VHF	Very High Frequency
VRLA	Victorian Rock Lobster Association
VSFA	Victorian Scallop Fisherman's Association
WA	Western Australia/n

Units of Measurement

°C	Degrees Celsius
bbl	Barrel
cui	Cubic Inches
dB	Decibel/s
grt	Gross Registered Tonnes
Hz	Hertz
kHz	Kilohertz
km	Kilometre/s
km/hr	Kilometres per hour
m	Metre/s
MMbbl	Million barrels
MMscf	Million Standard Cubic Feet
nm	Nautical mile/s
PK	Peak
PK-PK	Peak-to-Peak
psi	Pounds per Square Inch
RMS	Root Mean Square
SEL	Sound Exposure Level
SEL_{24h}	Sound Exposure Level over 24 hours
SPL	Sound Pressure Level
t	Tonne/s

1. Introduction

1.1. Background

The CarbonNet Project ('CarbonNet') is investigating the potential for establishing a commercial scale carbon capture and storage (CCS) network in Gippsland. The network would bring together multiple carbon dioxide (CO_2) capture projects in Victoria's Latrobe Valley, transporting CO_2 via a shared pipeline and injecting it into deep underground, offshore storage sites in Bass Strait.

It is envisaged that the Project will capture and store between 1 and 5 million tonnes of CO_2 per annum and have the potential to expand to 20 million tonnes per annum (tpa) or more.

1.2. Purpose

The Crown in right of Victoria is proposing to conduct geotechnical and geophysical (G&G) investigations (hereafter referred to as 'the activity') at and around the site of a future drilling location in the Gippsland Basin off eastern Victoria, in Greenhouse Gas Assessment Permit VIC-GIP-002, in Commonwealth waters (Figure 1.1). The purpose of the investigation is to assess and characterise the seabed to support a jack-up Mobile Offshore Drilling Unit (MODU) that will be used to drill an Offshore Appraisal Well (OAW). The OAW drilling activities will be the subject of a separate EP submission.

The activity area is 19.4 square kilometres (km^2) in size, ranging in water depths from 21 metres (m) to 33 m Lowest Astronomical Tide (LAT). The activity is estimated to take up to 14 days between late 2018 and the end of the June 2019. The exact timing of the activity is contingent on the receipt of environmental approvals, vessel availability and fair sea state conditions suitable for G&G investigations. The geophysical and geotechnical site investigations will be conducted separately using different vessels, with the geophysical investigations conducted first to provide information for the geotechnical investigations.

The activity will be conducted entirely within Commonwealth waters in accordance with the *Offshore Petroleum and Greenhouse Gas Storage Act 2006* (OPGGS Act 2006) (Cth).

1.3. Proponent

CarbonNet was established in 2009 by the Victorian Government to investigate the potential for a large-scale CCS network in the Gippsland region, and was awarded Commonwealth CCS Flagship status in 2012. Since this time, CarbonNet has conducted a thorough evaluation of the Gippsland nearshore region to identify and assess possible CO_2 storage formations.

CarbonNet is managed by a project team within the Victorian Department of Economic Development, Jobs, Transport and Resources (DEDJTR) (Resources Division, Earth Resources Economic Development). CarbonNet has been developed using a stage-gated approach and is currently in Stage 3 (Project Development and Commercial Establishment).

CarbonNet manages a number of greenhouse gas (GHG) assessment permits on behalf of the Crown in right of Victoria to investigate their potential for GHG storage. CarbonNet has identified three contingent CO_2 storage formations that it wishes to investigate further as part of a portfolio approach to CCS in the Gippsland region. CarbonNet's preferred contingent storage formation, Pelican, is located in the VIC-GIP-002 and GGAP006386(V) GHG assessment permits.

The VIC-GIP-002 GHG assessment permit was granted on 15 May 2015. As part of its Stage 3 appraisal activities, CarbonNet has already completed the Pelican 3-dimensional (3D) marine seismic survey (MSS) in February 2018 (a large portion of which was within the VIC-GIP-002 permit) and intends on drilling an OAW within VIC-GIP-002.

1.4. Titleholder and Liaison Person Details

The Titleholder's nominated liaison contact details are provided below:

Ian Filby
CarbonNet Project Director
DEDJTR, Resources Division, Earth Resources Economic Development
Telephone: +61 476 858 620
Email: carbonnet.info@ecodev.vic.gov.au

1.5. Scope of this Plan

The activity will be conducted in accordance with all applicable legislation and regulations, and specifically to meet the requirements of the OPGGS Act 2006 (Cth), and its associated Regulations.

The activity (as defined in Regulation 6 of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009, hereafter referred to as OPGGS(E)), is defined as:

> *The physical collection of geophysical and geotechnical data, from the time that the vessel first deploys equipment within the activity area, until the time the vessel retrieves the equipment and departs the activity area for the last time.*

CarbonNet submitted the Environment Plan (EP) to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) for assessment on the 14th of September 2018, and it was subsequently accepted on the 1st of November 2018.

This document provides a summary of the full EP accepted by NOPSEMA in accordance with Regulation 13(E)(4) of the OPGGS(E).

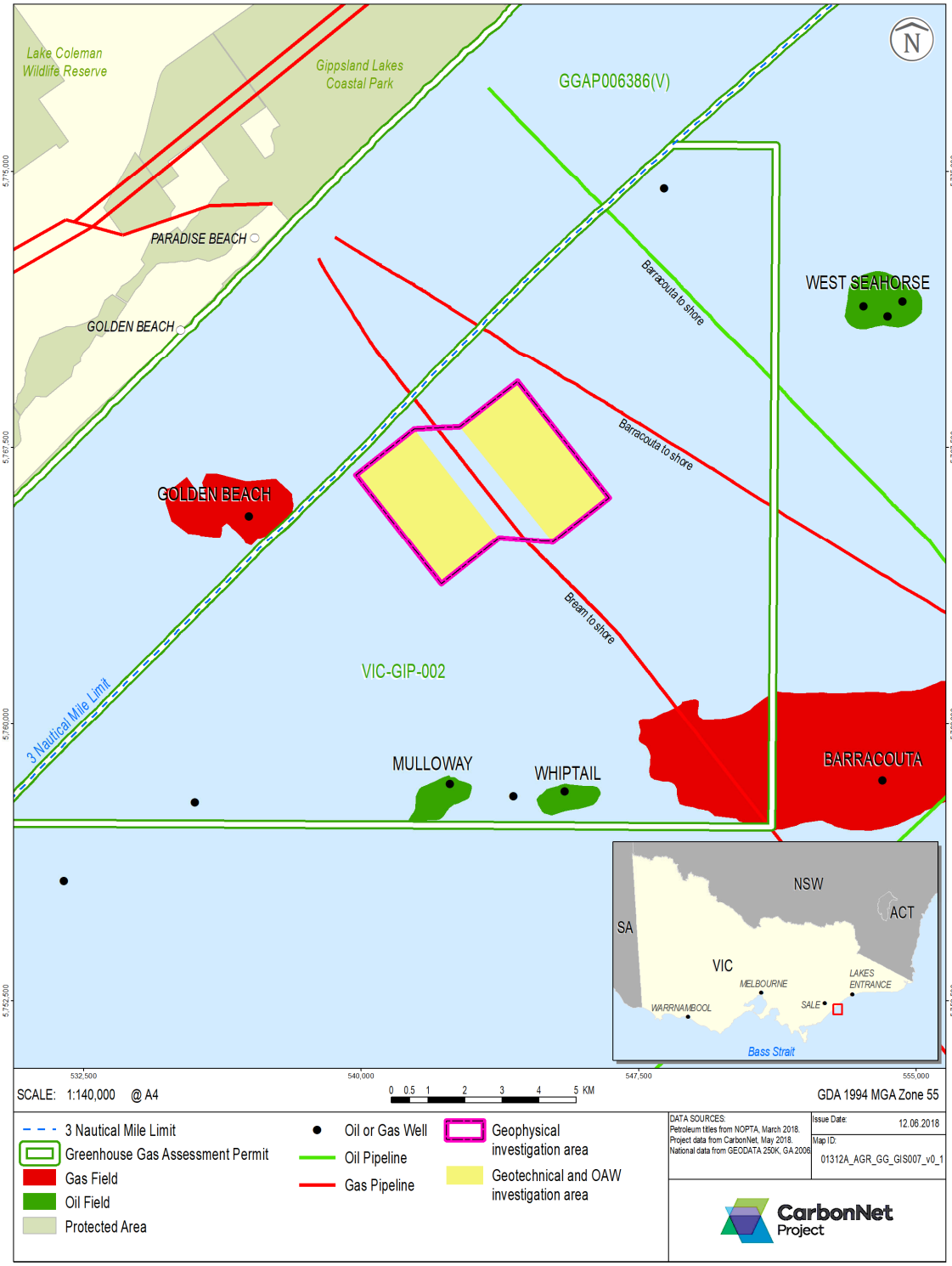


Figure 1.1 Location of the proposed G&G investigations activity area

2. Activity Description

This chapter provides a description of the proposed activity.

2.1. Activity Location

The VIC-GIP-002 GHG assessment permit is located in Commonwealth waters (adjacent to and contiguous with the GGAP006386(V) permit), covering an area of 223 km^2 in water depths ranging between 22 m and 40 m LAT.

The activity area lies entirely within VIC-GIP-002 and is divided into two parts (Figure 2.1), as follows:

- Geophysical investigation area – is defined as the polygon bounded by points A to F in Figure 2.1 (see also the coordinates in Table 2.1). The geophysical area extends over the Bream-A gas pipeline, operated by Esso Australia Resources Pty Ltd (EARPL). This polygon has an area of 19.4 km^2 (or 5.6 nm^2). This investigation will be conducted first.
- Geotechnical investigation area – is a subset of the geophysical investigation area, which includes a 500-m offset either side of the Bream-A pipeline to ensure that there is no geotechnical activity in close proximity to the pipeline. The geotechnical investigation area is defined as the polygon bounded by points A, B, G and H and the polygon bounded by points C, D, E and F in Figure 2.1. The western polygon has an area of 7.5 km^2 (or 2.2 nm^2) and the eastern polygon has an area of 7.9 km^2 (or 2.3 nm^2) (combined at 15.4 km^2, or 4.5 nm^2). The geotechnical investigation will follow the geophysical investigation.

The activity area encompasses the largest polygon, being that for the geophysical investigation. It occurs in water depths ranging from 21 m to 33 m LAT and extends 5 kilometres (km) (east to west) and 4 km (north to south) (see Figure 2.1).

At its closest point, the activity area is located 6.1 km southeast offshore of the township of Golden Beach, midway along the Ninety Mile Beach between Loch Sport and Seaspray in south Gippsland. The coordinates of the activity area are provided in Table 2.1 and distances from the activity area to nearby features are provided in Table 2.2.

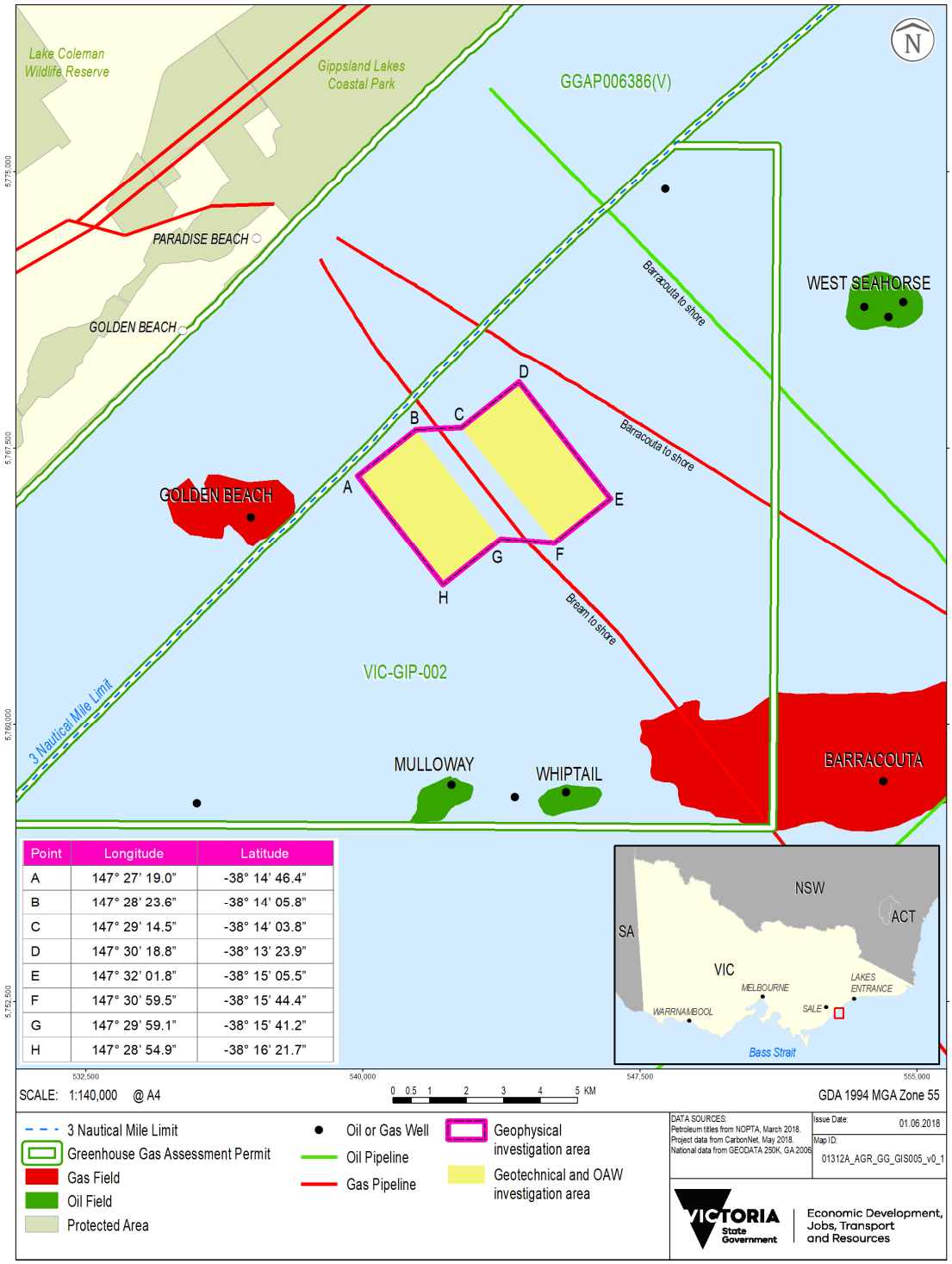


Figure 2.1. The activity area

Table 2.1. Coordinates of the activity area

Point	Longitude	Latitude
A	147° 27’ 19.0”	-38° 14’ 46.4”
B	147° 28’ 23.6”	-38° 14’ 05.8”
C	147° 29’ 14.5”	-38° 14’ 03.8”
D	147° 30’ 18.8”	-38° 13’ 23.9”
E	147° 32’ 01.8”	-38° 15’ 05.5”
F	147° 30’ 59.5”	-38° 15’ 44.4”
G	147° 29’ 59.1”	-38° 15’ 41.2”
H	147° 28’ 54.9”	-38° 16’ 21.7”

GDA 94, MGA Zone 55

Table 2.2 Distance to key features from the activity area

Feature	Distance and direction from the nearest point of the activity area to the nearest point of the feature
Towns	
Golden Beach	6.1 km northwest
Paradise Beach	6.4 km northwest
Loch Sport	19 km northeast
Seaspray	26 km southwest
Lakes Entrance	56 km northeast
Infrastructure	
Bream to shore pipeline: Vic/PL32 & Vic/PL32(V) (gas)	Overlapped by geophysical investigation
Barracouta to shore pipeline: Vic/PL1 & Vic/PL1(V) (gas)	750 m east
Barracouta to shore pipeline: Vic/PL4 & Vic/PL4(V) (oil & condensate)	5.2 km east
Seahorse subsea wells (nearest) (oil)	9 km northeast
Tasmanian gas pipeline	26 km southwest
Regional Outfall Sewer (ROS) (Delray Beach)	6.7 km northwest
Basslink electricity interconnector cable	46 km southwest
Australian Marine Parks	
Beagle	98 km southwest
Victorian marine parks	
Ninety Mile Beach Marine National Park	28 km southwest
Nooramunga Marine and Coastal Park	60 km southwest
Corner Inlet Marine Park	107 km southwest

Feature	Distance and direction from the nearest point of the activity area to the nearest point of the feature
Natural features	
Lakes Entrance (channel)	55 km northeast
Hogan Island group	111 km south-southwest
Beware Reef (off Cape Conran)	120 km northeast
Wilsons Promontory (southern tip)	132 km southwest

2.2. Timing

The activity is scheduled to commence between late 2018 and the end of the June 2019, contingent on the availability of suitable vessels and the receipt of environmental approvals. The activity is estimated to take up to 14 days to complete, although this is dependent on the exact technologies used and sea state conditions during the activity execution phase.

There is the potential that some aspects of the geophysical investigation (e.g., side-scan sonar (SSS)) may need to be undertaken again immediately prior to the MODU mobilisation. The purpose of this additional site clearance survey would be to re-confirm the absence of seabed hazards and meet the warranty requirements of the MODU owner. If this additional site clearance survey is required before the end of June 2019, it is included in the scope of this EP. Should an additional site clearance survey be required after June 2019 (due to delays with the mobilisation of the MODU), that site clearance survey will be addressed in the OAW EP.

It is proposed that one vessel will undertake the geophysical investigation (likely to be a small, locally-based vessel), while a larger specialist vessel will undertake the geotechnical investigation.

2.3. Objective of the Activity

The objective of the activity is to identify constraints and hazards that may affect the drilling of an OAW. The risk to a MODU's integrity through loss of seabed support makes intrusive G&G investigations critical (IOGP, 2017). As the proposed OAW location is not finalised, the activity area has been designed to consider the full positional uncertainty of the final surface location of the well.

2.4. Project Management Arrangements

AGR Australia Pty Ltd (AGR) is the Drilling Management Contractor (DMC) appointed to this project by CarbonNet. AGR is responsible for providing project management and well delivery services for the G&G investigations and OAW, including the preparation of all documents required for regulatory approvals 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 (HSE) incidents. In Australia, AGR has drilled over 40 offshore wells in all the major basins in water depths ranging from 40 m to 360 m.

2.5. Geophysical Investigations

The geophysical investigations will involve the investigations described in Table 2.3. These investigations are designed to support jack-up MODU leg penetration calculations and detect hazards on or below the seabed so that they can be avoided when determining the placement of the MODU.

A simplified pictorial representation of geophysical investigation techniques is provided in Figure 2.4.

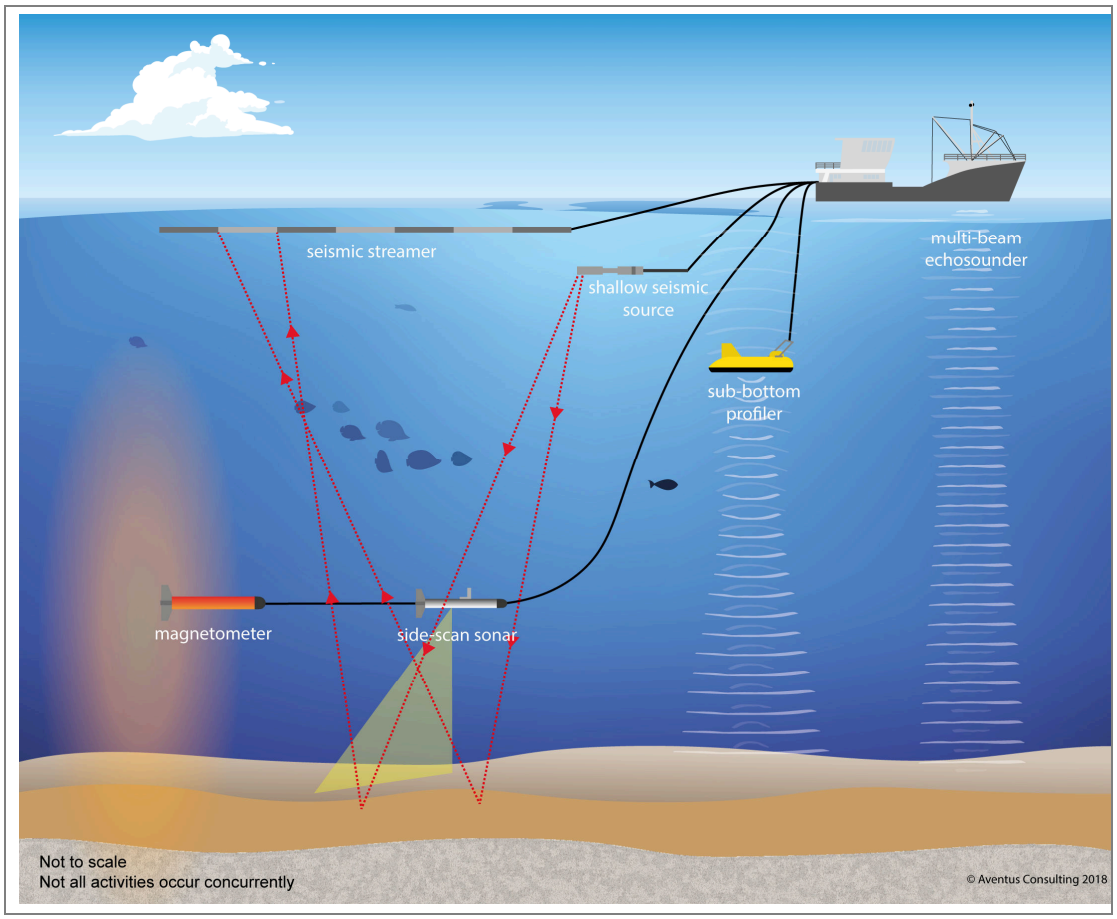


Figure 2.4. Simplified representation of geophysical investigation techniques

Table 2.3. Description of geophysical investigation techniques

Purpose/function	Method
Multi-beam echo sounder (MBES)	
The purpose of the MBES investigation is to undertake detailed measurements of water depth (bathymetry) in the activity area.	A MBES mounted on the vessel hull is highly 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. MBES systems are available for all water depths between 1 m and 12,000 m. A MBES transmits a broad acoustic pulse from a transducer over a swath across 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 (2D) geo-referenced bathymetric maps of the seabed. The MBES equipment is generally operated at tow speeds of 3-4 knots (5.5–7.4 km/hr). Given the size of the activity area and its shallow waters, the activity would take about 4 days to complete and typically be undertaken as follows: • 100 m spaced primary lines (~50 lines, 5 km long, east to west). • 500 m spaced secondary lines (cross lines or tie lines, ~8 lines, 4 km long, north to south). • Total of 282 line kilometres. MBES operate over a range of frequencies, with a typical shallow water MBES operating between 200–700 kHz (classified as high frequency). The maximum source levels are about 236–242 dB re 1 µPa @ 1 m (DoC, 2016).
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 oblique 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 tow-fish 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 similar to MBES but operates at a wider fan angle. The acoustic energy received by the SSS tow vehicle (backscatter) provides information as to the general distribution and characteristics of the surficial sediment and outcropping strata, as for MBES. 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 SSS towfish is constructed of stainless steel and is a cylindrical torpedo-like device and is typically towed 10-15 m above the seabed depending on water depth and the frequency range. The SSS is towed and operated at the same time as the MBES and is likely to be undertaken in two passes in conjunction with the MBES. The tow-fish SSS systems typically operate at dual frequencies; • A low frequency of about 100 –120 kHz (with a swath range of 150-200 m); and

Purpose/function	Method
	• A high frequency mostly of 400 kHz to 500 kHz is utilised (with a swath range of 50-100 m). The maximum source levels are about 210–220 dB re 1 µPa @ 1 m (DoC, 2016).
Sub-bottom profiler (SBP)	
A SBP is used to investigate the layering and thickness of the uppermost seabed sediments (shallow geology).	There are three different types of SBP, which exhibit a trade-off between resolution and depth of penetration based on the frequency of the acoustic signal: 1. Very high frequency systems including pingers, parametric echo sounding and Compressed High-Intensity Radar Pulse (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 in to the seabed and provide the best resolution, but lowest penetration of all three options. A CHIRP is normally hull-mounted when used for shallow water operations, but may also be towed in a similar fashion to the SSS. This system utilises an FM signal across a full range of frequencies, typically either 2-16 kHz or 4-24 kHz. The maximum source levels of a CHIRP are about 200–205 dB re 1 µPa @ 1 m (DoC, 2016). 2. High-frequency boomers – consist of a circular piston moved by electro-magnetic force (comprising an insulated electrical coil adjacent to a metal plate). The high voltage energy that excites the boomer plate is stored in a capacitor bank. A shipboard power supply generates an electrical pulse that is discharged to the electrical coil causing a magnetic field to repel a metal plate. This energetic motion generates a broadband, high amplitude impulsive acoustic signal in the water column that is directed vertically downward. A boomer system offers a penetration depth of up to 100 m below the seabed. Boomers are mostly surface towed, but may also be towed below the surface to avoid sea surface wave noise and movement. The typical frequency spectrum of boomer systems ranges between 0.2 and 10 kHz. The sound source level can vary from 100 to 220 dB re 1 µPa @ 1 m. 3. Medium-frequency sparkers – are seismic sources that create an electric arc between electrodes with a high voltage energy pulse. The arc momentarily vaporises water in a localised volume and the vapour expands, generating a pressure wave. Sparkers provide low-resolution data to a much greater penetration depth below the seabed (~100 m). Sparkers are surface towed. The generated frequencies are generally between 50 Hz (0.05 kHz) and 4 kHz. The sound source level is typically between 215 and 225 dB re 1 µPa @ 1 m. The SBP must be able to provide imagery that penetrates to a minimum depth of at least 30 m below the mud line or to the anticipated penetration of the MODU legs plus 1.5 times the spud can diameter. The receiver for the sparker or boomer system is usually a hydrophone or hydrophone array consisting of a string of individual hydrophone elements located within a neutrally buoyant synthetic hydrocarbon filled tubing. They typically contain 8 to 12 hydrophone elements evenly spaced in a tube that is 2.5 to 4.5 m in length and 25 mm in diameter.

Purpose/function	Method
	The SBP system is towed and operated at the same time as the MBES and SSS. The survey is likely to be undertaken in two passes in conjunction with the MBES and SSS.
Magnetometer	
This equipment detects large and small metallic objects on or below the seabed (e.g., buried pipelines, petroleum wellheads, shipwreck debris and dropped objects such as unexploded ordinance, cables, anchors, chains) that may not be identified by acoustic means.	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. A magnetometer measures the ambient magnetic field using nuclear magnetic resonance technology, applied specifically to hydrogen nuclei. No sound pulses are emitted from a magnetometer. The magnetometer survey will be conducted simultaneously with the MBES, SSS and SBP, as it can be powered using the same tow cable and power supply. The magnetometer towfish is constructed of stainless steel and is a cylindrical torpedo-like type device. A magnetometer is capable of a sampling rate of at least 1 Hz with a sensitivity of at least 1 nanotesla (nT).
Shallow Seismic	
Provides near-surface geological structural information and detects geohazards such as shallow gas.	The equipment deployed for shallow seismic surveys must be able to provide information to a depth of at least 30 m below the seabed (and generally down to a few hundred metres below the seabed). Shallow seismic investigations typically use a mini air-gun. The deeper data acquired through shallow seismic surveying supplements the MBES, SSS and SBP data. A single receiver streamer is used, typically 150-1,500 m long, depending on the quality of data required, and is towed at a depth of 1-3 m below sea level. Given the size of the activity area and its shallow waters, the shallow seismic activity would be undertaken separately to the MBES/SSS/SBP and magnetometer investigation, would take about one additional day to complete and typically be undertaken as follows: • 100 m primary and secondary line spacing. • Survey of 1 x 1 km grid centred on the drill centre. • Total of ~22 line kilometres. Shallow seismic technology typically operates in a frequency range of 20 Hz to 500 kHz. The sound source is a small compressed air unit ranging between 6 and 160 cubic inches (cui), or a delta sparker sound source, depending on local geology. The activation interval ranges from 3.125 m to 12.5 m. The source level is typically 226 dB re 1 µPa @ 1 m.

2.6. Geotechnical Investigations

Geotechnical investigation methods collect detailed information on the properties of the seabed and the underlying shallow sediments to build up a picture of the local geology of the activity area. The collected sediments are photographed, described and tested to determine the load bearing properties of the seabed at potential MODU spud can locations and also validate the results of the geophysical investigations. The geotechnical investigations will take place after the geophysical investigations.

A description of the proposed geotechnical investigation is outlined in Table 2.4. A simplified pictorial representation of geotechnical investigation techniques is provided in Figure 2.5.

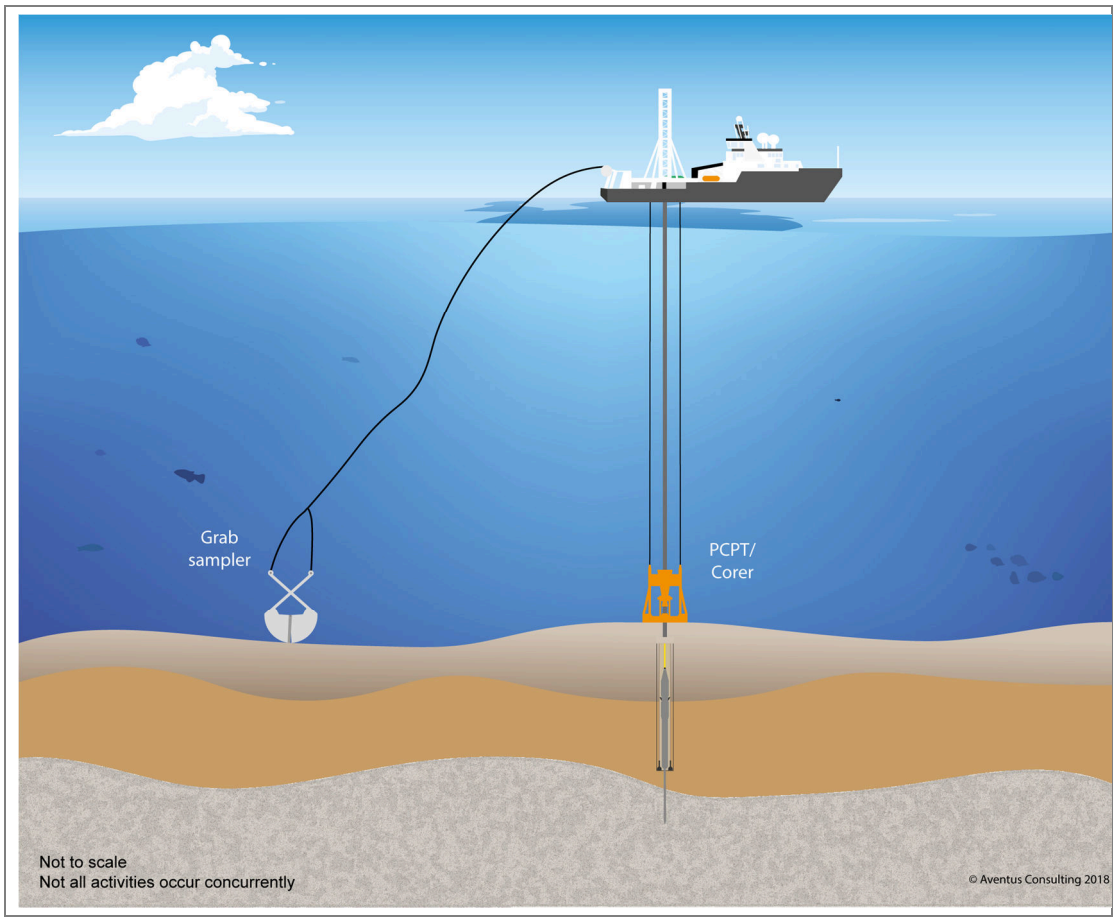


Figure 2.5. Simplified representation of geotechnical investigation techniques

Table 2.4. Description of geotechnical investigations techniques

Purpose/function	Method
Seabed grab sampling	
Seabed grab sampling provides samples for undertaking geological analysis of unconsolidated seabed sediments (e.g., sands, silts and clays).	Grab sampling is a process of collecting small samples of surface sediments from the seafloor. Only surface sediments are collected and the sampler has no ability to penetrate to depth. Grab samples typically use a Van Veen grab sampler, which is a light-weight sampler designed to take large samples in soft seabed sediments. It has long lever arms and sharp cutting edges on the bottom of the scoops, much like a set of jaws, which enable it to cut into the seabed. The weighted jaws, chain suspension, and doors and screens allow flow-through during lowering to the seabed (using a winch) and assure vertical descent where strong underwater currents exist. When the lowering cable is taut the grabs 'arms' are locked open. Then, when the grab touches the seabed, the cable becomes slack, which releases catches and, on recovery, the cables attached at the top of the arms exert tension on the arms extending from the jaws, causing them to lift, and cause the jaws to dip deeper into the sediment, and trap material as they tightly close. Also, when the grab settles on the seabed, the flaps fall back and cover the screens completely, helping to prevent any loss of sediment during retrieval. 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]). Other samples may be obtained at areas of geological change or interest that have been identified by the SSS and SBP data. The grab sample can leave a hole 30–40 cm in diameter and about 10–20 cm deep.
Coring	
The various types of coring (vibro, box and piston) provide samples for undertaking geological analysis of formations below the seabed. One or more of these types of coring may be employed for this activity, so each is described here. 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.	**Vibrocoring** Vibrocoring is a technique for collecting core samples in unconsolidated sediments by using a vibrating device (generally referred to as 'vibrohead') to drive a coring tube into the seabed. Typically, two large electrical motors power two concentric weights, which produce the necessary vibration. Once the unit is on the sea floor, the high power vibrator motors are engaged and drive the core barrel with PVC liner into the seabed. The corers are lowered by winching a cable wire from the vessel at approximately 1-2 m/s, so the duration of lowering and recovery operations in the activity area will be short (20-30 seconds at each site). Sampling itself is of a very short duration at each location (typically 5 to 10 minutes) and given the small activity area, may only take a few hours in total. Vibrocorers typically core to a depth of up to 12 m.
	Box coring Box corers are designed to take 'undisturbed' samples from the top of the seabed and are suitable for almost every type of sediment. The box core relies on its own weight for penetration of the seafloor and has a single swing arm that closes after being triggered to retain the sample on retrieval. Operation is simple and straightforward; when the frame touches the seafloor, a gimbal suspension combined with the weight of the core box ensures the box is always in the vertical position. When the weight is taken off the hoist cable, the trigger mechanism releases the cylinder-shaped core box. This can penetrate the seabed to

Purpose/function	Method
No drilling muds are required in the coring process and no drill cuttings are generated.	depths ranging between 5 cm and 1 m using the weight of the box corer to push it into the sediment. The driving force can be adjusted by adding or removing lead weights. Both top and bottom of the core box are now automatically closed, and the seabed sample is collected. The box is then removed from the corer enabling unrestricted access to the sample surface and sides. Sampling itself is of a very short duration at each location and given the small activity area, may only take a few hours in total.
	Piston (or gravity) coring A piston corer is normally used on soft, unconsolidated sediments. The coring unit is deployed from the side of the vessel using a dedicated coring deployment system with different length cores ranging from 3 m to 24 m (typically no greater than 6 m). A piston corer is lowered by wire rope to the seabed. It has a trigger device that hits the seabed before the core barrel and releases the corer allowing it to freefall. As the barrel enters the sediment, a special internal piston creates a vacuum and helps to draw the core into the barrel. Core catchers prevent the sediment from coming out of the coring tube. This suction reduces compaction of the sample in the inner sleeve. Sampling itself is of a very short duration at each location and given the small activity area, this testing may only take a few hours in total.
Piezo Cone Penetrometer Test (PCPT)	
PCPT determines soil strength and helps to delineate soil stratigraphy. 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]). This ground-truths the geophysical data and provides soil strength data that can be used for geotechnical analysis.	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). The PCPT unit consists of a rod up to 25 m long (or discrete rod sections to make up a total of 25 m) that has a small cone at its base (with typical cone tips having a cross-sectional area of 2, 5, 10 or 15 cm^2). The PCPT measures resistance to the push and these measurements allow high quality interpretation of ground conditions and pore pressure dissipation testing. A seabed frame is lowered to the seabed with the PCPT unit integrated into it and operated remotely. A PCPT typically takes 2-2.5 hours to complete. Given the small activity area, PCPT sampling may only take a few hours in total. 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.
Borehole sampling	
Borehole sampling gathers geotechnical soil data to a minimum depth of the jack-up MODU spud can penetration plus 1.5 x the spud can diameter.	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

Purpose/function	Method
	penetrate the seabed to the desired depth, PCPT's measurements may also be obtained in a separate borehole. The actual depth of penetration is dependent on the soil conditions. For borehole coring, wireline-deployed hydraulically-operated push or piston samplers may be used to recover high quality samples as a result of the fixed piston that rests on the bottom of the borehole. Drilling fluid will be used during the borehole sampling and PCPT process to lubricate the drill bit, transport cuttings out of the borehole to keep the borehole clean and to prevent the borehole from collapsing during the coring process. For a borehole 80 m deep, the volume of drilling fluid would be in the order of 30 m^3. Seawater is the primary constituent of geotechnical drilling fluids. Inert drilling fluid additives may be added to the seawater to form a water-based mud (WBM) if challenging boring conditions are encountered. Common WBM additives that may be used during the coring process include guar, bentonite and barite. CarbonNet will specify that all drilling fluid additives are of low eco-toxicity, with only 'Gold'/'Silver' (CHARM) or 'D'/'E' (non-CHARM) OCNS-rated chemicals to be used. Cuttings are discharged directly to the seabed during borehole sampling. Drill cuttings are inert pieces of rock, sand and other particles removed from the borehole during the sampling process. Cuttings range in size from very coarse to very fine particles. Up to 3.2 m^3 of cuttings per hole may be generated (12.8 m^3 in total).

2.7. Associated Non-invasive Investigations

A conductivity, temperature and depth (CTD) probe and drop camera may be deployed within the water column to provide visual and physico-chemical information about the activity area. These devices are static non-invasive survey techniques that do not interact with the seabed and do not generate acoustic sound or other emissions.

2.8. Investigation Vessels

The geophysical and geotechnical contractors are yet to be appointed. Vessels have also yet to be selected. It is likely that different vessels will be used, as follows:

- Geophysical investigations – a small, locally-based vessel (e.g., from Lakes Entrance) capable of towing light-weight equipment; and
- Geotechnical investigations – a larger, specialist vessel, with a large deck area and drilling derrick. This is likely to be mobilised from outside Victoria, either from elsewhere in Australia or from a global pool of suitable vessels.

Initial mobilisation of crew to the vessels will be via port call. Given the short duration of the activity, crew changes will not be required. No helicopter transfers are planned.

The vessels will hold station using DP or propellers; anchoring will not be necessary, unless in the event of an emergency (and not in the activity area due to the presence of subsea pipelines). The use of support vessels will not be required.

Given the short duration of the activity, the vessels will not require refuelling on location in order to complete the investigations. The vessels will bunker with marine diesel only while in port.

2.9. Activity Summary

Table 2.5 summarises the proposed activity parameters.

Table 2.5. Summary of the activity parameters

Parameter	Details		
Timing	Commencing between late 2018 and the end of the June 2019		
Duration of activity	Estimated at up to 14 days, split into two campaigns		
Water depths	21 – 33 m LAT		
Activity area	19.4 km^2		
Activity area dimensions	5 km (east-west) x 4 km (north-south)		
Geophysical investigation	Duration (estimate)	Sound frequency range (kHz)	Sound source levels (dB re 1 µPa @ 1 m)
MBES	4 days (undertaken concurrently)	200–700	236–242
SSS		100-120 and up to 1,600	210–220
SBP		2–16 or 4–24 0.05–4 0.2–10	200–205 215–225 100–220
Magnetometer		N/A	N/A
Shallow seismic	1 day, undertaken separately to above	0.3-5	~226
Geotechnical investigation	Duration (estimate)	Depth of penetration (m)	Number of investigation sites
Grab sampling	Several hours	0.1–0.2	Up to four sites per MODU location investigated
Coring	Several hours	Up to 24	
PCPT	Several hours	Up to 25	
Borehole sampling	5-7 days	Up to 80	

3. Stakeholder Consultation

CarbonNet has a strategic and systematic approach to stakeholder engagement.

CarbonNet has opened the channels of communication with stakeholders (definition provided in Section 4.2.1) to provide an opportunity for open and honest communication that promotes integration of stakeholder values into its decision-making process. This provides the means for CarbonNet to identify individuals and groups as well as their needs, ideas, values and issues of concern regarding the environmental and/or social impacts of the activity.

In keeping with DEDJTR's Environment Policy (see Section 3.1), CarbonNet is also committed to open, ongoing and effective engagement with the communities in which it operates and providing information that is clear, relevant and easily understandable.

This section of the EP defines the:

- Objectives of stakeholder consultation;
- Regulatory requirements for stakeholder consultation;
- Who needs to be considered in decision-making;
- When decisions must be completed; and
- The ongoing consultation schedule.

3.1. Stakeholder Consultation Objectives

CarbonNet's Stakeholder Engagement Plan (SEP) for this activity provides a structured approach to engagement activities in line with current best practice. CarbonNet has incorporated key learnings from its recent Pelican 3DMSS into the SEP.

The key objectives of the SEP are to:

- Provide stakeholders with access to clear, up-to-date and timely information, and a point of contact for the project;
- Provide an opportunity for a two-way information exchange and meaningful stakeholder consultation;
- Build on the stakeholder engagement that CarbonNet has already undertaken in the Gippsland region;
- Demonstrate integrity and transparency in CarbonNet's approach to stakeholder engagement; and
- Meet the stakeholder consultation requirements for EPs (see Section 4.2).

3.2. Regulatory Requirements

Stakeholder consultation is required under the OPGGS(E), as summarised in this section.

Section 460 (*Interference with other rights*) of the OPGGS Act states that a person carrying out activities in an offshore GHG assessment permit should not interfere with other users of the offshore area to a greater extent than is necessary for the reasonable exercise of the rights and performance of the duties of the first person. In order to determine what activities are being carried out, and whether exploration or production activities may interfere with existing users, consultation is required.

In relation to the content of an EP, more specific requirements are defined in the OPGGS(E) Regulation 11A. This regulation requires that a Titleholder consult with 'relevant persons' in the preparation of an EP. A 'relevant person' is defined in Regulation 11A as:

1. Each Department or agency of the Commonwealth to which the activities to be carried out under the EP, or the revision of the EP, may be relevant;
2. Each Department or agency of a State or the Northern Territory to which the activities to be carried out under the EP, or the revision of the EP, may be relevant;
3. The Department of the responsible State Minister, or the responsible Northern Territory Minister;
4. A person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the EP, or the revision of the EP; and
5. Any other person or organisation that the Titleholder considers relevant.

Further guidance regarding the definition of functions, interests or activities is provided in NOPSEMA's *Environment Plan decision making guideline (GL1721, Rev 5, June 2018)*, as follows:

- Functions – a person or organisation's power, duty, authority or responsibilities;
- Activities – a thing or things that a person or group does or has done; and
- Interests – a person or organisation's rights, advantages, duties and liabilities; or a group or organisation having a common concern.

Regulation 14(9) of the OPGGS(E) also defines a requirement for consultation in relation to the Implementation Strategy defined in the EP. In addition, Regulation 16(b) of the OPGGS(E) requires that the EP contain a summary and full text of this consultation.

3.3. Stakeholder Identification

CarbonNet has used a number of methods to determine the key stakeholders for this activity. This includes project team knowledge (especially leveraged from the recently completed Pelican 3DMSS), information from consultants and contractors that CarbonNet has engaged, discussions with oil and gas participants, regulators and peak bodies, internet research, existing networks and Summary EPs published by NOPSEMA for activities undertaken in the Gippsland region.

CarbonNet has identified a range of relevant persons, as defined in Regulation 11A of the OPGGS(E) (listed in Table 3.1), with whom it has consulted. The stakeholders are grouped into five categories of relevant persons as outlined by the OPGGS(E) (as listed in Section 3.2).

The stakeholder list has been and will continue to be reviewed, as required, throughout the consultation process. Meetings with stakeholders may identify other relevant parties that CarbonNet may consult.

Stakeholders identified for this activity, divided into the categories defined under Regulation 11A of the OPGGS(E), are listed in Table 3.1.

Table 3.1. Stakeholders identified for the activity

Category 1 - Department or agency of the Commonwealth to which the activities to be carried out under the EP may be relevant	
National Offshore Petroleum Titles Administrator (NOPTA)	Australian Maritime Safety Authority (AMSA) - Nautical and Regulation Section
Department of Immigration and Border Protection - Maritime Border Command	Department of Defence (DoD) – Defence Support Group
Australian Fisheries Management Authority (AFMA)	Department of Agriculture and Water Resources (DAWR)
Australian Hydrographic Office (AHO)	Department of Infrastructure and Regional Development (DIRD)
NOPSEMA	
Category 2 - Each Department or agency of a State to which the activities to be carried out under the EP may be relevant	
Environment Protection Authority (EPA)	Department of Environment, Land, Water and Planning (DELWP) - Oiled Wildlife Response team
Parks Victoria	
Maritime Safety Victoria	
Category 3 - The Department of the responsible State Minister	
DEDJTR - Earth Resources Regulation (ERR)	Victorian Fisheries Authority (VFA)
Category 4 - A person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the EP	
Fisheries	
Commonwealth Fisheries Association (CFA)	Seafood Industry Victoria (SIV)
South-East Trawl Fishing Industry Association (SETFIA)	Eastern Zone Abalone Industry Association
Lakes Entrance Fisherman's Cooperative (LEFCOL)	Victorian Abalone Divers Association (VADA)
Victorian Scallop Fisherman's Association (VSFA)	Sustainable Shark Fishing Association (SSFAssn)
Southern Shark Industry Alliance (SSIA)	VRFish
Lakes Entrance Scallop Fishing Industry Association	Small Pelagic Fishery Industry Association
Victorian Bays and Inlets Fisheries Association	Victorian Rock Lobster Association (VRLA)
Australian Southern Bluefin Tuna Industry Association (ASBTIA)	Tuna Australia (ETBF Industry Association)

Eastern Rock Lobster Industry Association	
Adjacent/overlapping petroleum Titleholders	
GB Energy (Vic) Pty Ltd (previously Cape Energy) – VIC/RL1(V)	ExxonMobil (Esso Australia Resources Pty Ltd, EARPL) – VIC/RL1
3D Oil (VIC/P57)	Carnarvon Hibiscus Pty Ltd – VIC/P57
Lakes Oil	
Oil spill preparedness and response agencies	
DEDJTR – Emergency Management Division (EMD)	AMSA – Marine Environmental Pollution Response
Gippsland Ports	Gippsland Water
Lakes Entrance Coastguard	Gippsland Emergency Management Planning Committee(s)
East Gippsland Catchment Management Authority (EGCMA)	
Other local interests	
Gippsland Water Police	Paynesville Water Police
Category 5 - Any other person or organisation that the Titleholder considers relevant	
Local Government Authorities	
Wellington Shire Council	

CarbonNet (and AGR as the DMC) have engaged with onshore stakeholders, such as the Golden Beach and Paradise Beach communities, which have a strong interest in the CarbonNet Project more broadly.

CarbonNet also has an ongoing engagement program for the broader project with a number of other organisations, which are kept informed via community mail outs, e-Newsletters, the project website and meetings.

It should be noted that consultation with contractors to AGR (and CarbonNet) who will assist with the execution of the activity is not addressed in this section of the EP. This includes organisations that AGR (and CarbonNet) have a contract, agreement or MoU with for assistance in the event of oil spill response or operational and scientific monitoring. Discussions held with these organisations that are not directly linked to the impact and risk assessment in this EP are not included in the summary of stakeholder consultation in Section 3.5.

Where discussions with these organisations have assisted in the development or refinement of oil spill response strategies described in the OPEP, then these have been incorporated (e.g., EMD). The 'functions, interests or activities' of these organisations are only triggered in an emergency response. Consultation with these contractors and organisations is undertaken in accordance with Regulation 14(5) of the OPGGS(E), which requires measures to ensure that each employee or contractor working on, or in connection with the activity, is aware of his or her responsibilities in relation to this EP and has the appropriate competencies and training.

CarbonNet recognises that the relevance of stakeholders identified in this EP may change in the event of an emergency. Every effort has been made to identify stakeholders that may be impacted by a non-routine event or emergency, the most significant of which is considered to be a Level 2 or 3 marine diesel oil spill from the vessels.

CarbonNet acknowledges that other stakeholders not identified in this EP may be affected, and that these may only become known to CarbonNet in such an event.

3.4. Engagement Method and Approach

3.4.1. Engagement Approach

Consultation has been broadly undertaken in line with the International Association for Public Participation (IAP2) spectrum, which is considered best practice for stakeholder engagement. In order of increasing level of public impact, the elements of the spectrum and their goals are as follows:

- Inform – to provide the public with balanced and objective information to assist them in understanding the problems, alternatives and/or solutions.
- Consult – to obtain public feedback on analysis, alternatives and/or decisions.
- Involve – to work directly with stakeholders throughout the process to ensure that public concerns and aspirations are consistently understood and considered.
- Collaborate – to partner with the public in each aspect of the decisions, including the development of alternatives and the identification of the preferred solution.
- Empower – to place final decision-making in the hands of the stakeholders.

The manner in which CarbonNet has informed, consulted and involved stakeholders is outlined throughout this section. Attempts to collaborate with stakeholders, including the commercial fishing industry, have been made and discussions on these proposals are ongoing.

Under the regulatory regime for the approval of EPs, the decision maker is the regulator. This being the case, the final step in the IAP2 spectrum, 'Empower', has not been adopted.

CarbonNet has a strategic and systematic approach to stakeholder engagement, which aims to foster an environment where two-way communication and ongoing, open dialogue is encouraged to build positive relationships. Key principles that guide CarbonNet in its stakeholder engagement activities include:

- Timely engagement;
- Transparency;
- Providing accurate and objective information;
- Monitoring stakeholder interests;
- Ongoing active consideration of stakeholder feedback; and
- Tailoring appropriate communications to meet audience needs.

CarbonNet has applied these principles to its stakeholder engagement since its inception in 2009, and has methodically recorded its engagement activities in the project's consultation database, Consultation Manager™ (see Section 3.4.3).

CarbonNet has engaged with key stakeholders including the Latrobe Valley and Gippsland communities, local councils, community groups, industry bodies and potential partners, government sponsors, regulators, research partners, and international organisations supporting the development of CCS (such as the Global Carbon Capture and Storage Institute). Examples include the 2011 airborne gravity

survey, 2012 soil hydrocarbon survey and 2018 Pelican 3DMSS, for which activity-specific SEPs were developed and implemented with the assistance of highly competent industry experts.

This activity includes four phases of stakeholder engagement, these being:

1. Planning and conducting engagement activities, until the EP is accepted by NOPSEMA;
2. Pre-mobilisation communications;
3. Communications during the activity; and
4. Communications after the activity is completed.

Additional periods of engagement and communications activities may be required, depending on the needs of the activity and feedback from consultation.

3.4.2. Engagement Methodology

A range of stakeholder engagement and communications methods and tools have been used throughout the engagement process, including (but not limited to) the following:

- Emails;
- Letters;
- Fact sheet;
- Diagrams;
- Face-to-face meetings;
- Outgoing phone calls;
- Incoming project phone line;
- Community drop-in information sessions;
- CarbonNet e-newsletter; and
- Up-to-date information on the CarbonNet website (http://earthresources.vic.gov.au/carbonnet).

Overall, contact has been made with over 62 individual stakeholders from 45 organisations. The communications and stakeholder engagement for this activity is led by AGR's Stakeholder Engagement Coordinator (SEC) and assisted by the CarbonNet's SEC and project team subject matter experts. In undertaking this consultation, CarbonNet has considered the consultation guidelines (Table 3.2) released by various Commonwealth and Victorian government agencies and industry associations in response to the consultation requirements of the OPGGS(E).

Fact Sheet and Invite to Comment to Stakeholders

An initial overview of the proposed activities was provided to relevant stakeholders (including key fishing associations) on the 17th of July 2018. This overview consisted of an email with an attached 3-page information sheet and invited feedback to formally seek stakeholder views and provide an opportunity to ask questions. The email was then followed by a phone call to confirm receipt of the original email, or a follow-up email should a phone number not be available. Additional information, including graphics and descriptions of equipment to be used during the activity, was also provided if requested. Consultation with stakeholders for this activity was conducted over a five-week period, with consultation in this EP documented up to the

28th of August 2018. CarbonNet and AGR will continue to consult with stakeholders as required.

As part of preparing the SEP, CarbonNet consulted with the Victorian fishery regulator (the Victorian Fisheries Authority, VFA) to assist with stakeholder identification and to understand the status of fisheries in the activity area and diesel spill EMBA. This was followed by engagement with fishing industry associations.

Consultation with relevant fisheries began in July 2018. Key fisheries engaged include Seafood Industry Victoria (SIV), the South East Trawl Fishing Industry Association (SETFIA), the Lakes Entrance Fishermen's Cooperative (LEFCOL), Sustainable Shark Fishing Association (SSFAssn) and the Victorian Scallop Fishermen's Association (VSFA).

CarbonNet is mindful of the need to co-exist with other tenement holders. CarbonNet manages five GHG assessment permits on behalf of the State of Victoria, which are adjacent to or overlap existing petroleum tenement holders. CarbonNet has pre-existing and ongoing engagement with these tenement holders to provide them updates on the work program activities. Overlapping and adjacent tenement holders received an overview of proposed activities during workshops conducted in April and May 2018 and were contacted individually after the information flyer was distributed. Each of these tenement holders responded with letters of no objection to this activity.

Invite to Comment to Local Community

In addition to engaging relevant stakeholders, a letter was sent to Golden Beach and Paradise Beach property owners introducing the activity and inviting residents to attend an information session in Golden Beach on the 18th of July 2018. The direct mail out (682 letters in total) was chosen to reach the greatest number of Golden Beach and Paradise Beach community members as a result of feedback received during the Pelican 3DMSS. The letter was distributed by Wellington Shire Council on behalf of CarbonNet (i.e., CarbonNet is not privy to residents' names and addresses). Of the 682 letters posted to community members, CarbonNet received 8 emails asking questions about the activity (or CarbonNet Project in general) and planned consultation (representing a 1% response rate).

An advertisement regarding the activity was placed in the Gippsland Times & Maffra Spectator on the 31st of July 2018.

Community Drop-in Sessions

Two community drop-in information sessions were held for this activity.

First Session

The first information drop-in session for the activity was held in Golden Beach from 4–6 pm on Wednesday 1st of August 2018. This was delivered by AGR and supported by CarbonNet. This session was attended by approximately 30 people. Attendees were provided fact sheets and access to subject matter experts with supporting visual material. The session was hosted by CarbonNet and AGR.

Second Session

The second information session for the activity was held in Sale from 11:30–2 pm and in Golden Beach from 4–6 pm on Friday 17th of August 2018, as an official Science Week event. The Sale session was attended by 5 people and the Golden Beach session was attended by 18 people. The session was hosted by CarbonNet and AGR, with additional subject matter experts from the CO2CRC and CSIRO in attendance.

Table 3.2. Stakeholder consultation guidance required by industry-related agencies

Agency	Published guidance	Requirements	CarbonNet action
NOPSEMA	*Decision-making guideline – Criterion 10A(g) Consultation Requirements* (N-04750-GL1629, Rev 1, November 2016)	This guideline describes NOPSEMA's consideration of consultation requirements when assessing EPs and identifies NOPSEMA's position on key regulatory requirements. It also describes the five categories of relevant persons outlined in the OPGGS(E).	CarbonNet has used the descriptions of the five categories of relevant persons to categorise stakeholders for this project, and also provided information specified in the guideline within this chapter.
AMSA	Advisory Note for the Offshore Petroleum Industry Consultation with Respect to Oil Spill Contingency Plans and Environmental Plans (no date)	To assist offshore petroleum Titleholders, address their oil spill preparedness and response requirements, AMSA invites them to enter into a Memorandum of Understanding ('MoU') with AMSA. This MoU sets out an understanding of respective roles and responsibilities when responding to ship-sourced and non-ship-sourced marine pollution incidents. The MoU is the sole method through which AMSA consults on Titleholder's EPs.	Based on the consultation undertaken, CarbonNet is of the view that it does not need to enter into an MoU with AMSA to provide support for oil spill preparedness and response.
Department of Industry, Innovation and Science (DIIS)	Offshore Petroleum and Greenhouse Gas Activities: Consultation with Australian Government agencies with responsibilities in the Commonwealth Marine Area (September 2017).	The Australian Government has developed guidance for Titleholders to assist in determining which agencies may be relevant for consultation purposes in developing or revising EP submissions. It outlines the interests of DoEE, Director of National Parks, DAWR, AFMA, AMSA, DoD and the Department of Foreign Affairs and Trade.	CarbonNet has reviewed this guidance (released after the initial EP submission) and is satisfied that all relevant agencies have been consulted.

Further Sessions

As part of ongoing consultation efforts with the Golden Beach and Paradise Beach communities, information sessions were held on 1 August, 17 August (during National Science Week), 22 September and 20 October 2018.

3.4.3. Record of Stakeholder Engagement

A record of all consultation is recorded in CarbonNet's consultation database, Consultation Manager™, including any objections and claims about possible adverse impacts of the activity raised by relevant persons. This includes meeting summaries, phone call summaries, logs of emails and letters.

Individual emails and letters are saved on DEDJTR's document management system known as TRIM.

3.4.4. Consultation with Fisheries Associations

CarbonNet has consulted with all relevant fishing industry groups who may be present in the area during the activity.

CarbonNet understands that several commercial and recreational fishing representative groups, including SIV, SETFIA, SSIA, VR Fish and Tuna Australia, have consulted their membership and networks on the proposed activity.

CarbonNet will liaise closely with all fishing representative groups to notify their membership of when the activity will take place. To date, SETFIA has offered to provide a complimentary text message service to its membership on behalf of CarbonNet to inform its membership of the exact timing of the activity.

3.4.5. Dedicated Project Email and Hotline

A project-specific email address (carbonnet.drilling@agr.com) and free call telephone number (1800 312 966) were established to facilitate stakeholder consultation. These details are provided in all stakeholder consultation material.

The email inbox is managed by AGR's SEC, with data provided to CarbonNet on a regular basis. Enquiries are answered with the assistance of a Frequently Asked Questions (FAQ) document or referred to subject matter experts to provide further information.

All correspondence is recorded in Consultation Manager™.

3.4.6. CarbonNet Website

Information on the activity is available on the CarbonNet website (http://earthresources.vic.gov.au/carbonnet). This website is updated regularly and promoted in all stakeholder and community communications. Flyers prepared for future project milestones (see Section 4.7) are also available on the website.

3.4.7. CarbonNet Email Distribution List

CarbonNet has established a project e-newsletter to assist in ongoing community and stakeholder consultation. Throughout consultation for this activity, community and stakeholders have been encouraged to subscribe to the e-newsletter via the project website.

3.5. Summary of Stakeholder Consultation

Stakeholder consultation has involved extensive consultation with a broad range of stakeholders, as listed in Table 3.1. Key themes during consultation for this activity include:

- Objection to the project generally;
- Potential impacts to the marine environment, mostly as a result of using shallow seismic equipment; and
- Consultation process.

Table 3.3 summarises the key themes and outcomes from this, and Table 3.4 summarises the key themes and outcomes from the community information sessions undertaken in Golden Beach.

A summary of key stakeholder consultation undertaken to date, together with CarbonNet's responses and assessment of merit is included in Table 3.5. This table focuses on stakeholders who have been identified as 'relevant persons' whose functions, interests or actives may be affected by the activity. It also includes key stakeholders with whom engagement has taken place to enable CarbonNet to determine whether they are 'relevant persons' for the survey.

Table 3.3. Key themes and outcomes from stakeholder consultation

Theme	Key stakeholders	Issues and outcomes
Objections to the CarbonNet Project broadly	LEFCOL, VSFA	• A desire from some stakeholders to not progress with the activity, or the project in general. • Additional information and briefings were offered to stakeholders but not taken up.
Impact of shallow seismic equipment on marine environment	SSFAssn, Tuna Australia, VSFA and VRFish	• Concern over the potential use of shallow seismic equipment and what impacts this might have on the marine environment. • Stakeholders raised concerns about a separate large-scale MSS planned in the Gippsland Basin in late 2018 by CGG. • SSFAssn and Tuna Australia were interested in what modelling had been conducted for the shallow seismic component of the activity and plans for post-activity monitoring to assess the impact to marine life. • CarbonNet has carefully considered and applied all relevant studies to the impact and risk assessment for this activity. The potential impacts to fisheries have been assessed by CarbonNet as insignificant. • Due to the scale and low impacts and impacts of the activity, CarbonNet is not planning to undertake Before-After-Control-Impact (BACI) monitoring.
Consultation fatigue by fishing stakeholders	VRLA, SETFIA, SIV	• Concurrent consultation with titleholders has led to fishing representative groups and their membership experiencing consultation fatigue. • CarbonNet acknowledges the circumstances and has adapted its communication strategy to mitigate this, including providing information sessions at Golden

Theme	Key stakeholders	Issues and outcomes
		Beach and making phone calls instead of sending emails where appropriate. • CarbonNet will use text messaging services offered by SETFIA and Notices to Mariners to reach local fishers prior to conducting the activity.

Table 3.4. Key themes and outcomes from community information sessions

Theme	Issues and outcomes
Objections to the CarbonNet Project broadly	• Concern that the use of shallow seismic equipment during the activity will result in noise and vibration felt onshore, similar to that reported during the MSS. • CarbonNet provided additional information that explained the differences between the potential shallow seismic activity and the Pelican 3DMSS. • CarbonNet responded to individual community member concerns via email and during the community drop-in sessions.
Location of the OAW	• Community members wanted to know why the Pelican site was chosen as the site for CarbonNet. • During the second information session, the presence of independent research organisations CSIRO and CO2CRC were helpful in explaining the geological conditions that make the Pelican site well-suited to CCS.
HSE risks of CCS	• During both community sessions, there was interest in how potential leaks from a future injection well and pipeline would be monitored and responded to.

3.6. Ongoing Consultation

CarbonNet defined a 'reasonable period' (as specified in Regulation 11A(3) of the OPGGS(E)) as 30 business days for stakeholders to provide comments. This is in line with the NOPSEMA guidelines for stakeholder consultation and long-standing and well-established industry practice. Key milestones that will trigger further consultation for this activity include:

- Phase 2:
  - Confirmation of activity timing.
  - Future optimisation activities (e.g., changes to the project area); EP acceptance and the availability of the EP Summary on the NOPSEMA website.
  - Operational planning aspects.
- Phase 3:
  - Any significant incidents (e.g., large hydrocarbon spill).
- Phase 4:
  - Completion of the activity.

Any claims or objections from stakeholders will be assessed and the EP then modified if required. If this relates to the identification of a new or significantly increased risk, the revised EP will be submitted to NOPSEMA for assessment.

Consultation Manager™ remains a live database and is updated regularly.

As detailed in the SEP, CarbonNet has planned ongoing consultation with the Golden Beach and Paradise Beach communities independent of the regulatory approvals process. This involves hosting monthly community information sessions and providing additional communication materials at these sessions and through the CarbonNet website and e-newsletter.

Table 3.5. Summary of stakeholder consultation undertaken

Stakeholder	Functions, interests and/or activities	Date	Concerns, impacts or claims raised by stakeholder	CarbonNet's assessment of merit to claims or objections
Category 1 - Department or agency of the Commonwealth to which the activities to be carried out under the EP may be relevant				
Australian Maritime Safety Authority (AMSA)	Key regulator for marine safety, advises on shipping lanes and safety in Commonwealth waters	17/7/18	CarbonNet emailed AMSA (Senior Advisor Nautical and Hydrographic) with a letter that invited comment, fact sheet and contact details.	N/A
		19/7/18	CarbonNet telephoned AMSA and spoke with the Senior Advisor Nautical and Hydrographic – System Safety Standards, who advised: • AMSA had received the email; • The activity appears straight forward from an AMSA perspective; and • AMSA is preparing a response.	N/A
		20/7/18	CarbonNet received email from AMSA (Senior Advisor Nautical and Hydrographic) providing assessment of the proposed activity: • AMSA noted that the proposed activity area sits outside major shipping routes, however, it is likely smaller vessels will be encountered during the activity. • AMSA provided a plot of Automatic Identification System (AIS) data collected between April and June 2018. • AMSA recommended CarbonNet liaise with NOPSEMA to meet regulatory requirements for operating in Commonwealth waters. • AMSA recommended that the survey vessel notify AMSA's Joint Rescue Coordination Centre (JRCC) 24 to 48 hours prior to the activity commencing. • AMSA recommended that CarbonNet contact the Australia Hydrographic Office (AHO) no less than four weeks prior to survey operations commencing.	This information was shared with the CarbonNet team. The regulatory reporting requirements provided by AMSA are included in Section 7.12 and Section 8.8 of the EP.

		10/8/18	CarbonNet advised AMSA (Senior Advisor Nautical and Hydrographic) that an EP is being prepared and will be submitted to NOPSEMA for approval in September 2018. CarbonNet acknowledged AMSA (Senior Advisor Nautical and Hydrographic) recommendations and advised AMSA that it would notify JRCC and AHO once operations had been scheduled.	As above.
AMSA – Marine Environment-al Pollution Response	Key regulator for responding to vessel-based oil spill in Commonwealth waters	17/7/18	CarbonNet emailed AMSA (Manager Environment Pollution Response) with a letter that invited comment, fact sheet and contact details.	N/A
		15/8/18	CarbonNet HSE Manager emailed AMSA (Manager Environment Pollution) with details of the planned activity. It was explained that an EP and OPEP are being prepared and these are in final stages of consultation. As part of the OPEP there has been Oil Spill Trajectory Modelling (OSTM) conducted for a marine diesel spill scenario from the largest vessel involved in the activity. The results indicate impacts would be predominantly in state waters. A copy of the draft OPEP was provided in the email for AMSA to review. Contact details were provided and CarbonNet invited contact if there were any questions.	N/A
		22/8/18	CarbonNet called AMSA (Manager Environment Pollution). The stakeholder confirmed he had received the email and briefly reviewed the draft OPEP. He did not foresee any immediate issues with it and noted that, as explained in the OPEP, based on the OSTM the response control agency would be DEDJTR EMD State Response Team (SRT) and AMSA would support as required. The stakeholder was satisfied with the process flow chart.	N/A
Australian Fisheries Management Authority (AFMA)	Manage Commonwealth Fisheries	17/7/18	CarbonNet emailed AFMA with a letter that invited comment, fact sheet and contact details.	N/A
		20/7/18	CarbonNet called AFMA (Manager, Environment, Research & Bycatch Section) and was informed that stakeholder had resigned.	CarbonNet forward original message to the new recipient.

			An alternative contact was provided (Manager, Environment Fisheries Branch).	
		30/07/18	CarbonNet received email response from AFMA (Manager, Environment Fisheries Branch) requesting that CarbonNet ensure the information provided in the letter and fact sheet be shared with the Commonwealth Fisheries Association and that consultation is undertaken with local fishers.	CarbonNet has undertaken consultation with several fishing associations, including Commonwealth Fisheries Association, and local fishers.
		31/7/18	CarbonNet responded confirming that consultation was being undertaken with all relevant stakeholders, including local fishers.	N/A
Australian Hydrographic Office (AHO)	Issue Notice to Mariners	17/7/18	CarbonNet emailed AHO with a letter that invited comment, fact sheet and contact details.	N/A
		19/7/18	CarbonNet spoke with AHO who advised that there were no major concerns about the planned activity. AHO requested that CarbonNet notify them once the EP had been approved and the activity was scheduled.	CarbonNet will notify AHO once operations are scheduled. The regulatory reporting requirements are included in Section 8.8 of the EP.
Department of Agriculture and Water Resources (DAWR) - Biosecurity	Provide quarantine clearance for foreign vessels entering Australian waters	17/7/18	CarbonNet emailed DAWR - Biosecurity with a letter that invited comment, fact sheet and contact details.	N/A
		20/7/18	CarbonNet called DAWR and left voicemail requesting call back if they have any questions about the proposed G&G investigations.	N/A
		22/8/18	CarbonNet received email from DAWR requesting further information on: • Which port will be used for the activity; • Whether there would be interaction between the vessels and overseas vessels; • Whether vessels used for the activity would move in and out of Australian waters; • Equipment used during investigations from overseas; • Nationality of crew members; and • Waste management on vessels.	CarbonNet has addressed biosecurity requirements and control measures in Section 7.11 of the EP.

			DAWR suggested CarbonNet refer to the DAWR website for biosecurity requirements.	
		23/8/18	CarbonNet emailed DAWR and responded to each point raised in the email. Since CarbonNet was unable to provide specific details on the vessels and crew prior to contracts for the activity being awarded, CarbonNet offered to provide more information once the contracts had been awarded.	N/A
		24/8/18	DAWR thanked CarbonNet for the response. DAWR referred CarbonNet to the weblink in the email to lodge a biosecurity form if the vessel is from overseas and more details of the process online. CarbonNet explained that it is likely the vessels will be sourced from within Australia. Explained that if the vessel comes from overseas then DAWR Biosecurity will give the vessel a rating. Stakeholder will follow up colleagues to check they had no further questions.	CarbonNet will inform DAWR Biosecurity if vessels are sourced from overseas.
Department of Defence (DoD) - Defence Support Group	Manage all Australian defence activities. The DoD has operations in Sale, Gippsland.	17/7/18	CarbonNet emailed DoD with a letter that invited comment, fact sheet and contact details.	N/A
		8/8/18	CarbonNet sent email to DoD with original letter, fact sheet and contact details attached inviting comment.	N/A
		8/8/18	DoD sent email to CarbonNet confirming they had received the email and would send a response. To date, no response has been provided.	Defence activities are addressed in Section 5.6.8 of the EP and CarbonNet believes further consultation is not required.
Department of Infrastructure and Regional Development (DIRD)	Potential for overlapping projects and/or activities	17/7/18	CarbonNet emailed DIRD (Director, Maritime Safety and Environment) with a letter that invited comment, fact sheet and contact details.	N/A
		19/7/18	CarbonNet spoke with DIRD team member and was advised they had not received the email. The Director (Maritime Safety and Environment) had resigned and contact details for the new contact were provided.	N/A

		8/8/18	CarbonNet re-issued original letter with fact sheet and contact details inviting comments. Referred to phone conversation on 19/7/18.	N/A
		8/8/18	DIRD sent email to CarbonNet advising they do not have any questions at this stage. They wish to be kept informed as the activity progresses.	CarbonNet will inform DIRD when key milestones are reached regarding the activity. DIRD will be engaged during the CarbonNet OAW EP consultation process.
Maritime Border Control (MBC)	Security and customs stakeholder within Commonwealth waters	17/7/18	CarbonNet emailed MBC with a letter that invited comment, fact sheet and contact details.	N/A
		19/7/18	CarbonNet called MBC but there was no answer or opportunity to leave a message.	N/A
		23/7/18	CarbonNet emailed MBC advising that the consultation period for the activity was nearing completion, encouraging them to email or call if they wished to provide comment on the activity. Fact sheet and contact details were provided.	CarbonNet does not believe follow up is required as there will be no conflict between the activity and MBC operations in Bass Strait.
Category 2 - Each Department or agency of a State to which the activities to be carried out under the EP may be relevant				
Department of Environment, Land, Water and Planning (DELWP) – Oiled Wildlife Response	Manage the foreshore adjacent to the activity area and is responsible for oiled wildlife in Victorian jurisdiction response in the event of a hydrocarbon spill.	17/7/18	CarbonNet emailed DELWP (Oiled Wildlife Response branch) with a letter that invited comment, fact sheet and contact details.	N/A
		17/7/18	Stakeholder replied to initial project email with a query about their relevance in the consultation process and the expected date they would receive the EP for review. Stakeholder recommended CarbonNet consult DEDJTR EMD regarding the potential for marine pollution events.	N/A
		18/7/18	CarbonNet replied to DELWP (Oiled Wildlife Response): • DEDJTR EMD has been consulted as part of this consultation process; • DELWP Oiled Wildlife Response was identified as a relevant stakeholder in the case of a diesel spill; and • EP is under development and will be submitted to NOPSEMA for review because the activity is Commonwealth Waters.	N/A

Parks Victoria – Central Gippsland	Manage Gippsland Lakes Coastal Park, including Golden Beach Foreshore	17/7/18	CarbonNet emailed Parks Victoria Central Gippsland with a letter that invited comment, fact sheet and contact details.	N/A
		19/7/18	CarbonNet called Parks Victoria Central Gippsland. Stakeholder commented that since the activity is offshore in Commonwealth waters they do not have any issues with the activity.	N/A
Maritime Safety Victoria – Waterway Safety	Victorian government agency responsible for maritime safety	17/7/18	CarbonNet emailed Maritime Safety Victoria (Waterway Safety) with a letter that invited comment, fact sheet and contact details.	N/A
		19/7/18	CarbonNet called Maritime Safety Victoria (Waterway Safety). Stakeholder said that because activity is within Commonwealth Waters they have no issues with the activity. Stakeholder offered to send information about operations to maritime stakeholders on their database to reach more stakeholders.	CarbonNet will consider using Maritime Safety Victoria database to distribute information about the activity to inform mariners prior to commencing operations.
Environment Protection Authority (EPA)	Victorian government agency responsible for environment management	17/7/18	CarbonNet emailed EPA with a letter that invited comment, fact sheet and contact details.	N/A
		19/7/18	CarbonNet called stakeholder and left message requesting call back if they had any comments regarding the original email.	The EPA has a role in reviewing the OPEP via a review committee formed by the DEDJTR Emergency Management Division (EMD), along with the EPA and ERR. Accordingly, no additional consultation with the EPA is required as their functions are not affected by routine aspects of this activity.
Category 3 - The Department of the responsible State Minister				
DEDJTR – EMD	Control agency for marine pollution emergency in State waters	28/6/18	CarbonNet emailed DEDJTR EMD (Manager Marine Pollution) requesting to present the OSTM and draft OPEP to relevant stakeholders within DEDJTR EMD. Stakeholder on maternity leave until July 2019.	N/A
		29/6/18	CarbonNet and DEDJTR EMD (Senior Project Officer) exchanged emails to confirm suitable meeting time.	N/A

		10/7/18	AGR's HSE Manager presented to DEDJTR EMD:: • An overview of G&G and OAW activities; • OTSM results; • Key environmental receptors; and • Proposed oil spill response strategies.	EMD's Marine Pollution Manager advised that a review committee (comprising EMD, EPA, DELWP and ERR) is established to review OPEPs. Accordingly, CarbonNet does not need to consult with these agencies separate to this process.
		17/7/18	CarbonNet emailed DEDJTR EMD (Senior Project Officer) with a letter that invited comment, fact sheet and contact details.	N/A
		9/8/18	CarbonNet issued draft OPEP and OSMP for the activity and requested that EMD's Senior Project Officer contact CarbonNet with any questions.	N/A
		15/8/18	CarbonNet called to discuss draft OPEP. CarbonNet provided a summary of the OPEP and they key sections, and DEDJTR EMD said it sounded acceptable based on the summary. DEDJTR EMD confirmed they had forwarded the OPEP to DELWP and EPA for consideration and will send to Gippsland Ports.	N/A
		28/8/18	CarbonNet emailed EMD to ask if there were any comments on the OPEP.	N/A
		29/8/18	EMD responded and said there were no comments at this stage, but that DELWP and EPA would be chased up.	N/A
		5/9/18	Email received from EMD (Manager Marine Pollution) with suggestions for changes to draft OPEP, including TSV comments.	CarbonNet incorporated comments into a revised draft of the OPEP.
		6/9/18	CarbonNet emailed EMD (Manager Marine Pollution) with the updated OPEP addressing the supplied comments.	N/A
		6/9/18	EMD (Manager Marine Pollution) emailed CarbonNet clarifying comments around equipment availability and requesting CarbonNet advise EMD of when desktop oil spill response exercise is to occur.	N/A
		6/9/18	CarbonNet emailed the final version of the OPEP to EMD and advised that CarbonNet will liaise with EMD on the proposed desktop exercise date.	CarbonNet will continue to liaise with the EMD as the mobilisation phase of the activity approaches.

DEDJTR EMD – Prepared-ness and Recovery Coordination	Control agency for marine pollution emergency in State waters	17/7/18	CarbonNet emailed DEDJTR EMD (Director, Preparedness & Recovery Coordination) with a letter that invited comment, fact sheet and contact details.	N/A
		19/7/18	CarbonNet called DEDJTR EMD (Director, Preparedness & Recovery Coordination) to confirm receipt of email and offer opportunity for comment and questions. Stakeholder had not read email but said they would be in touch if they had any comments.	N/A
		21/8/18	CarbonNet emailed DEDJTR EMD (Director, Preparedness & Recovery Coordination) to seek final comment on the activity before the close out of consultation. To date, there has been no response.	CarbonNet has been working directly with the EMD Marine Pollution Manager on the OPEP review and no further involvement at Director level is required.
DEDJTR EMD – Ports, Shipping and Maritime Emergencies	Victorian government agency that manages ports and emergencies in Victorian waters	17/7/18	CarbonNet emailed DEDJTR EMD (Manager Ports, Shipping and Maritime Emergencies) with a letter that invited comment, fact sheet and contact details.	N/A
		19/7/18	CarbonNet called DEDJTR EMD (Manager Ports, Shipping and Maritime Emergencies) and left message requesting call back if stakeholder had any input or questions	CarbonNet does not believe follow up is required as another function within EMD has reviewed the OPEP.
DEDJTR - Earth Resources Regulation (ERR)	Regulator for petroleum and GHG activities in Victorian state waters, immediately adjacent to the activity area	23/7/18	CarbonNet emailed DEDJTR ERR (Principal Environmental Scientist) with a letter that invited comment, fact sheet and contact details.	N/A
		27/7/18	CarbonNet called DEDJTR ERR (Principal Environmental Scientist) to confirm receipt of email and invite comment and input. Stakeholder had not read the email but requested more detail on when DEDJTR ERR should expect to receive the EP for review.	N/A
		31/7/18	CarbonNet responded by email to explain that CarbonNet will not submit the EP for review to ERR as the activity is completely within Commonwealth waters.	The EMD Marine Pollution Manager has been liaising with the ERR on the OPEP review and no further involvement at the Principal Environmental Scientist level is required.

Victorian Fisheries Authority (VFA)	Victorian fisheries and individual fishers	4/5/18	CarbonNet emailed the VFA to request information on what fisheries operate in the activity area.	N/A
		4/5/18	VFA (Principal Policy Analyst) responded by email stating that data could be provided for the two cells intersected by the activity area.	N/A
		31/5/18	CarbonNet emailed the VFA requesting confirmation of the fisheries that operate in the area intersected by the oil spill EMBA.	N/A
		22/6/18	The VFA emailed data for the fishing catch and effort cells requested. Much of the data was not able to be provided due to confidentiality reasons, but it provided information on what fisheries operate in the area.	The information provided by the VFA has been incorporated in to Section 5.6.3 of the EP.
		17/7/18	CarbonNet emailed VFA (Acting CEO) with a letter that invited comment, fact sheet and contact details.	N/A
		20/7/18	CarbonNet called VFA (Acting CEO) to confirm email had been received and if they wished to provide comment. Stakeholder confirmed they had received email but had not read it. This stakeholder stated that his main concern was whether the fact sheet had been sent to commercial fisheries.	CarbonNet confirmed that the email had been sent to commercial fisheries associations and they are being engaged as part of the consultation process.
Category 4 - A person or organisation whose functions, interests or activities may be affected by the activities to be carried out under the EP				
Adjacent/overlapping petroleum Titleholders				
GB Energy (Vic) Pty Ltd	Adjacent titleholder (Vic/RL1(V)) in Victorian state waters	9/5/18	CarbonNet held a risk assessment workshop with GB Energy to understand if there would be any risks that this activity may have on their current and future operations in their permit. Following the workshop, they issued correspondence to CarbonNet stating that they have no objections to CarbonNet undertaking the activity as planned. There was general correspondence in the lead up to and following this event (not included in Appendix 3 for confidentiality reasons).	CarbonNet is satisfied that this activity will not have any impacts or risks on this stakeholder's activities.
		17/7/18	CarbonNet emailed GB Energy with a letter that invited comment, fact sheet and contact details.	N/A

		2/8/18	CarbonNet emailed GB Energy to follow up on the original email and invited questions and feedback.	N/A
Esso Australia Resources Pty Ltd	Overlapping titleholder for VIC/RL1	17/4/18	CarbonNet held a risk assessment workshop with EARPL to understand if there would be any risks that this activity may have on their current and future operations in their tenements. Following the workshop, they issued correspondence to CarbonNet stating that they have no objections to CarbonNet undertaking the activity as planned. There was general correspondence in the lead up to and following this event (not included in Appendix 3 for confidentiality reasons).	CarbonNet is satisfied that this activity will not have any impacts or risks on this stakeholder's activities.
		17/7/18	CarbonNet emailed EARPL with a letter that invited comment, fact sheet and contact details.	N/A
		19/7/18	EARPL advised CarbonNet of a new contact for future consultation.	N/A
		19/7/18	CarbonNet emailed original email to new contact at EARPL with a letter that invited comment, fact sheet and contact details.	N/A
3D Oil Ltd	Nearby titleholder	17/7/18	CarbonNet emailed 3D Oil (Managing Director) with a letter that invited comment, fact sheet and contact details.	N/A
		19/7/18	CarbonNet spoke to 3D Oil (Petroleum Systems Analyst) who confirmed there was no crossover with their titles and CarbonNet since 3D Oil had relinquished 50% of their titles. 3D oil wishes to be kept informed of this activity and the OAW.	CarbonNet will continue to engage 3D Oil for this activity and future activities such as the OAW.
Carnarvon Hibiscus	Nearby titleholder (VIC/L31)	2/5/18	CarbonNet held a risk assessment workshop with Carnarvon Hibiscus to understand if there would be any risks that this activity may have on their current and future operations in their permit. Following the workshop, they issued correspondence to CarbonNet stating that they have no objections to CarbonNet undertaking the activity as planned. There was general correspondence in the lead up to and following this event (not included in Appendix 3 for confidentiality reasons).	CarbonNet is satisfied that this activity will not have any impacts or risks on this stakeholder's activities.

		17/7/18	CarbonNet emailed Hibiscus Petroleum (Australian Assets) with a letter that invited comment, fact sheet and contact details.	N/A
		8/8/18	CarbonNet emailed Hibiscus Petroleum (Australia Assets) to follow up on the original email and invite questions and feedback. To date, there has been no response.	CarbonNet does not believe follow up is required as the activity will not have any impacts on their permit areas.
Lakes Oil	Nearby titleholder (Vic/P43(V) and Vic/P44(V))	17/7/18	CarbonNet emailed Hibiscus Petroleum with a letter that invited comment, fact sheet and contact details.	N/A
		19/7/18	CarbonNet spoke to Lakes Oil who said they had no issues with the activity and that there is not overlap in their titles. Stakeholder questioned when OAW drilling was planned. Lakes Oil expressed an interest in being informed once the drill rig had been procured.	CarbonNet advised Lakes Oil that OAW drilling was planning for late 2019/early 2020 and that further information would be provided in late 2018 as part of the OAW consultation process.
Other local interests				
Gippsland Water Police	Search and rescue, law enforcement	17/7/18	CarbonNet emailed Gippsland Water Police with a letter that invited comment, fact sheet and contact details. An email bounce-back was received.	N/A
		20/7/18	CarbonNet called the stakeholder following the bounce-back, and the stakeholder provided an updated email address.	N/A
		10/8/18	CarbonNet re-issued original email and invited comment. To date, there has been no response.	CarbonNet does not believe follow up is required at this stage as contact will be made closer to the time of the activity.
Paynesville Water Police	Search and rescue, law enforcement	17/7/18	CarbonNet emailed Paynesville Water Police with a letter that invited comment, fact sheet and contact details. To date, there has been no response.	CarbonNet does not believe follow up is required at this stage as contact will be made closer to the time of the activity.
Oil spill preparedness and response agencies				

Gippsland Water	Water and wastewater management in Gippsland	17/7/18	CarbonNet emailed Gippsland Water with a letter that invited comment, fact sheet and contact details.	N/A
		20/7/18	CarbonNet called Gippsland Water. Stakeholder said they did not believe they had received the email and requested the email be re-issued.	N/A
		8/8/18	CarbonNet re-issued original email to Gippsland Water and received a bounce-back.	N/A
		10/8/18	CarbonNet called Gippsland Water. No answer so left voicemail explaining that a second bounce-back had been received and requesting a call back.	CarbonNet does not believe follow up is required as the activity will not have any impacts on Gippsland Waters outfall operations.
Gippsland Ports	Local authority responsible for managing ports and waterways in Gippsland	17/7/18	CarbonNet emailed Gippsland Ports with a letter that invited comment, fact sheet and contact details.	N/A
		19/7/18	CarbonNet called Gippsland Ports. Stakeholder confirmed that the email had been discussed internally with the management and marine operations group. They do not have any major concerns and are generally happy with what CarbonNet are doing. Their main area of concern is a pollution event. Gippsland Ports would be interested in attending upcoming community sessions in Golden Beach. They asked to be kept informed of when these sessions are scheduled.	CarbonNet will provide Gippsland Ports with further information on community sessions.
		10/8/18	CarbonNet emailed Gippsland Ports providing details of two community sessions planned for 17/8/18 in Sale and Golden Beach. CarbonNet provided the link for Gippsland Ports to subscribe the general CarbonNet project emails to be notified of upcoming community events.	N/A
East Gippsland	Waterways, catchment and	17/7/18	CarbonNet emailed East Gippsland CMA with a letter that invited comment, fact sheet and contact details.	N/A

Catchment Management Authority (CMA)	flood management	20/7/18	CarbonNet called East Gippsland CMA to follow up on email. Spoke with personal assistant and left message for stakeholder to call back if they had not received email or had any feedback. To date, there has been no response.	CarbonNet does not believe follow up is required as the activity will not have any impacts on the CMA's onshore activities.
VF18 Lakes Entrance Coast Guard	Maritime safety	17/7/18	CarbonNet emailed Lakes Entrance Coast Guard with a letter that invited comment, fact sheet and contact details.	N/A
		8/8/18	CarbonNet email Lakes Entrance Coast Guard to follow up on the original email and invite any input. To date, there has been no response.	CarbonNet does not believe follow up is required at this stage as contact will be made closer to the time of the activity.
Gippsland Coastal Board	This board no longer functions.	17/7/18	CarbonNet emailed Gippsland Coastal Board with a letter that invited comment, fact sheet and contact details.	N/A
		17/7/18	CarbonNet received an automatic reply stating that Gippsland Coastal Board closed on 30 June 2018 under Victoria's marine and coastal reforms.	N/A
		23/7/18	CarbonNet received an email response confirming that the Gippsland Coastal Board could be removed from the consultation register.	CarbonNet has removed this stakeholder from the consultation register as requested.
Gippsland Emergency Management Planning Committee	Emergency response planning.	17/7/18	CarbonNet emailed Gippsland Emergency Management Planning Committee with a letter that invited comment, fact sheet and contact details.	N/A
		20/7/18	CarbonNet called the Gippsland Emergency Management Planning Committee. Stakeholder said they were unsure why they needed to be included in consultation and did not have any concerns with the planned activity. Stakeholder informed CarbonNet that they are retiring on 30 November 2018 and provided a new contact for future consultation.	CarbonNet will continue to engage Gippsland Emergency Management Planning Committee to ensure preparedness in the case of an emergency. CarbonNet has updated the stakeholder register with the new contact details.
Fisheries				

Common-wealth Fisheries Association (CFA)	Peak body representing commercial fishers in Commonwealth waters	17/7/18	CarbonNet emailed the CFA with a letter that invited comment, fact sheet and contact details.	N/A
		31/7/18	CarbonNet called the CFA and left message with reception requesting a call back. To date, there has been no response.	CarbonNet does not believe follow up is required as all relevant Commonwealth-managed fisheries are being consulted.
		28/8/18	CarbonNet emailed the CFA to provide notification that formal consultation for this activity is being closed out. CarbonNet reiterated that it will remain in contact with the CFA as the consultation for the OAW phase commences.	CarbonNet will continue consulting with this stakeholder as required.
Australian Southern Bluefin Tuna Industry Association (ASBTIA)	Peak body representing bluefin tuna fishers	17/7/18	CarbonNet emailed the ASBTIA with a letter that invited comment, fact sheet and contact details.	N/A
		31/7/18	CarbonNet called the ASBTIA. The stakeholder explained they had been on leave and requested the email be re-issued. CarbonNet re-issued email to stakeholder and thanked the stakeholder for time on the phone earlier. CarbonNet provided a brief summary of the activity and invited the stakeholder to get in touch if they would like to discuss further.	N/A
Eastern Zone Abalone Industry Association	Peak body representing Victorian abalone fishers	17/7/18	CarbonNet emailed Eastern Zone Abalone Industry Association (CEO) with a letter that invited comment, fact sheet and contact details.	N/A
		31/7/18	CarbonNet called stakeholder. No answer. CarbonNet left a message requesting a call back.	N/A
		14/7/18	CarbonNet spoke to stakeholder and provided overview of activity. The stakeholder had no questions or concerns about the proposed activity.	N/A
Lakes Entrance	Cooperative of commercial	17/7/18	CarbonNet emailed LEFCOL (General Manager) with a letter that invited comment, fact sheet and contact details.	N/A

Fisherman's Co-operative Ltd (LEFCOL)	fishers in Lakes Entrance that fish in or around the activity area	31/7/18	CarbonNet made follow up phone call to LEFCOL (General Manager). LEFCOL worker answered and CarbonNet left message requesting that the General Manager call back.	N/A
		14/7/18	CarbonNet made a follow up phone call to the LEFCOL General Manager. CarbonNet left message with reception.	N/A
		14/7/18	LEFCOL General Manager returned phone call. Stakeholder advised that he didn't have any questions or comments other than wanting CarbonNet not to undertake the activity. He stated that CarbonNet and other operators were ruining fishing habitats and he didn't have any option to contest the plans. CarbonNet advised that all consultation with stakeholders is recorded and captured in the EP process and encouraged LEFCOL to provide specific comments or concerns. Stakeholder said he had done it beforehand and that it was a waste of time so he wouldn't be doing it again. CarbonNet once again encouraged him to provide comment for capture in EP. Stakeholder advised that his consultation is done via SETFIA and that he speaks to SETFIA's CEO on a regular basis so is happy for SETFIA to represent his interests and concerns.	CarbonNet thanked stakeholder for his time and encouraged him to express concerns so they could be captured in the EP development process.
Seafood Industry Victoria (SIV)	Peak industry body for Victorian Fisheries	17/7/18	CarbonNet emailed SIV (Executive Director) with a letter that invited comment, fact sheet and contact details.	N/A
		19/7/18	CarbonNet called SIV (Executive Director). No answer. Left voicemail requesting a call back.	N/A
		31/7/18	CarbonNet called SIV (Executive Director). Advised that he was not available in the office. Called mobile and left voicemail requesting a call back.	N/A
		31/7/18	Stakeholder returned phone call and was keen to understand planned consultation, timing, planned equipment and whether an EP would be required for the work.	N/A

		6/8/18	CarbonNet sent follow up email to SIV (Executive Director) following phone conversation with information responding to questions. Re-issued fact sheet. Encourage stakeholder to get in touch if he had any questions.	N/A
		7/8/18	SIV Executive Director sent email response to CarbonNet email requesting more information regarding: 1. What process was being followed for consultation. Stakeholder attached a copy of SIV/TSIC best-practice consultation policy 2. More information on the Pelican 3DMSS activity, the size and capacity of the shallow seismic airguns, the expected sound spread and how the cumulative sound would be measured. 3. The results of the 3DMSS. 4. Whether there had been an area deemed suitable for the CCS and how this had been determined. 5. Whether there was any insight collected during the MSS that was of valuable in sharing with the fishing industry.	CarbonNet's response is provided two rows down (14 August).
		8/8/18	CarbonNet replied to email from SIV Executive Director. Acknowledged the email had been received and that CarbonNet would be in touch with a response shortly.	N/A
		14/8/18	CarbonNet emailed the SIV Executive Director with a response to each point raised in his email, as follows: 1. CarbonNet endeavours to engage stakeholders in meaningful way to ensure that any objections or claims of an environmental, social or economic nature are considered and addressed. Consulting methods include the initial release of information (such as the information sheet), followed up by phone calls, email and meetings, as requested by stakeholders. Additional information is available on the CarbonNet website. CarbonNet also acknowledged SIV's consultation policy for reference purposes.	N/A

			2. The data acquired during the Pelican 3DMSS is still undergoing processing and interpretation. Initial analysis has confirmed the data to be of significantly higher quality than previous surveys over the area. 3. Confirmed that as part of this activity, there may be the need for a shallow seismic survey. It was explained that if required, the sound source will likely be 4 x 40 cubic inches, if not less. The scale and duration of the survey will be far less, and the source will be far lower than that of the Pelican 3DMSS carried out in February 2018. More detail on the potential shallow seismic activity was provided including the depth of interest, sound source, survey area and duration of activity. 4. Monitoring undertaken for similar investigations to the proposed activity demonstrate that sound intensity attenuated rapidly from the source to levels below that which would cause harm to marine fauna. Habitat assessments carried out for the Pelican 3DMSS found no sensitive receptors in the near vicinity of the proposed activity area. 5. CarbonNet already has a high degree of confidence in the site for CCS, as it has undertaken an extensive geoscience evaluation programme, which includes independent scientific peer reviews and external certification. These external and independent assurance reviews of the geoscience will continue. 6. A wide range of information was collected as part of the Pelican 3DMSS. CarbonNet recommend that SIV raise this request through the fisheries advisory panel established for the Pelican 3DMSS upon which SIV sits.	
		28/8/18	CarbonNet emailed SIV to provide notification that formal consultation for this activity is being closed out. CarbonNet reiterated that it will remain in contact with SIV as the consultation for the OAW phase commences.	CarbonNet will continue consulting with this stakeholder as required.

South East Trawl Fishing Industry Association (SETFIA)	Peak industry body representing trawl fishers in southeast Australia	17/7/18	CarbonNet emailed SETFIA generic inbox with a letter that invited comment, fact sheet and contact details.	N/A
		17/7/18	CarbonNet emailed SETFIA (Executive Director) with a letter that invited comment, fact sheet and contact details.	N/A
		17/7/18	Stakeholder sent email requesting a call back. Explained that SETFIA represents most of the fishing effort in industry.	N/A
		18/7/18	CarbonNet called stakeholder. The stakeholder was particularly interested in what exclusion zones will apply to fishers during the activity. Stakeholder offered a text messaging service to notify local fishers of activity. He requested that future emails be addressed to him personally, rather than referring to him as 'Stakeholder'.	CarbonNet has taken up the offer to use SETFIA's text messaging service to notify fishers when the activity commences. CarbonNet has adopted personalised emails for future consultation.
		18/7/18	Stakeholder sent follow up email to CarbonNet following the phone conversation on the same day (copied to LEFCOL and AFMA). Stakeholder explained SETFIA's involvement in conducting a study of fishing effort prior to the Pelican 3DMSS. Stakeholder expressed concern that there is consultation fatigue amongst the fishing community with the significant level of offshore activity occurring in the Gippsland Basin. Stakeholder complemented CarbonNet's planning and stated that they did not believe further investigations were required to understand fishing activity in the area. Stakeholder requested clarification of what involvement CarbonNet desired from the fishing industry, including exclusion zones, and suggested SETFIA's SMS service as a way to communicate these expectations prior to operations for a fee.	As above.
		27/7/18	CarbonNet emailed SETFIA (and those copied in to their original response), addressing queries and taking up the offer of complimentary text messages.	N/A

			CarbonNet confirmed that the SETFIA report that was prepared for CarbonNet in 2017 has been considered throughout the delivery of consultation and in preparation of the EP. CarbonNet confirmed that an exclusion zone will be in place around the activity vessels during operations.	
		8/8/18	Stakeholder emailed CarbonNet requesting a phone call.	N/A
		8/8/18	CarbonNet confirmed that they would be happy to talk over the phone. The CarbonNet SEC suggested that if the stakeholder would like more detailed operational or environmental information, they can organise for a subject matter expert to be part of the conversation.	N/A
		8/8/18	SETFIA responded by emailed stating that they are not concerned with the operational and environmental aspects and wished to discuss how to communicate to fishers.	N/A
		10/8/18	CarbonNet emailed stakeholder to thank them for the clarification and confirm time of call.	N/A
		13/8/18	CarbonNet called SETFIA as agreed. CarbonNet provided a summary of the activity and proposed timing. SETFIA reiterated that they are not concerned about the nature or scale of the activity, but is more interested in timing and giving fishers as much notice as possible given high levels of activity in area. SETFIA asked that as soon as CarbonNet has an update on the timing of the works to please get in touch with them. SETFIA will then communicate this to its network. CarbonNet confirmed that they would inform SETFIA of the timing. SETFIA has trawl net and gill net meetings next week and will be providing an update to those fishers then.	N/A
		13/8/18	CarbonNet emailed the fact sheet to SETFIA again following the phone call.	N/A

		13/8/18	SETFIA replied to CarbonNet's email stating that the project was the least of their concerns but that it would be good to have notice prior to the activity.	N/A
		13/8/18	CarbonNet responded by thanking SETFIA for their time and said that CarbonNet would be in touch closer to the activity to communicate to fishers.	N/A
Small Pelagic Fishery Industry Association (SPFIA)	Peak industry body representing pelagic fishers	17/7/18	CarbonNet emailed the SPFIA with a letter that invited comment, fact sheet and contact details.	N/A
		31/7/18	CarbonNet called the SPFIA. There was no answer. A message was left on voicemail requesting a call back.	N/A
		14/8/18	CarbonNet called the SPFIA. There was no answer. A message was left on voicemail requesting a call back.	CarbonNet does not believe follow up is required as the fishing effort in and around the activity area is well known (described in Section 5.6.3) and there is little pelagic fishing.
Southern Shark Industry Alliance	Shark fisheries representative	17/7/18	CarbonNet emailed Southern Shark Industry Alliance with a letter that invited comment, fact sheet and contact details.	N/A
		31/7/18	CarbonNet called stakeholder. There was no answer. A message was left on voicemail requesting a call back.	N/A
		14/8/18	CarbonNet called stakeholder. Stakeholder advised he had received fact sheet and had circulated to his network to gather feedback, and advised he would come back to CarbonNet once he had questions from that group. CarbonNet advised that consultation for the activity would be closing at the end of August and it would be ideal to get feedback before then. Stakeholder acknowledged schedule and said they would send feedback once it had been received. To date, there has been no additional feedback.	CarbonNet does not believe follow up is required as the fishing effort in and around the activity area is well known (described in Section 5.6.3) and impacts to sharks are assessed to be insignificant.

Sustainable Shark Fishing Association (SSFAssn)	Peak industry body for shark gillnetters	17/7/18	CarbonNet emailed the SSFAssn with a letter that invited comment, fact sheet and contact details.	N/A
		31/7/18	CarbonNet called stakeholder. There was no answer. A message was left on voicemail requesting a call back.	N/A
		7/8/18	CarbonNet sent email to stakeholder inviting feedback.	N/A
		14/8/18	CarbonNet called stakeholder. There was no answer. A message was left on voicemail requesting a call back.	N/A
		14/8/18	Stakeholder returned CarbonNet's phone call. Stakeholder had one question regarding whether any underwater sound modelling had been done for this activity. Stakeholder advised that if there had been modelling done then they would be satisfied that monitoring would not be required during the shallow seismic activity.	CarbonNet responded to the stakeholder advising that a response would be forthcoming.
		24/8/18	CarbonNet replied stating that BACI monitoring was undertaken for the Pelican 3DMSS, which has provided good baseline data about the marine environment in the area. Given the lower intensity sound sources to be used for the G&G investigations (and subsequent very low impacts to marine fauna), CarbonNet is therefore not proposing to undertake additional BACI monitoring for this activity.	As part of the activity's impact assessment process, the shallow seismic survey was deemed to have insignificant impacts. The planning for this element of the activity has looked at ways to reduce the sound volume to ALARP.
		28/8/18	CarbonNet emailed SSFAssn to provide notification that formal consultation for this activity is being closed out. CarbonNet reiterated that it will remain in contact with SSFAssn as the consultation for the OAW phase commences.	CarbonNet will continue consulting with this stakeholder as required.
Tuna Australia (ETBF Industry Association)	Peak industry body for tuna fishers in the eastern tuna billfish fishery	17/7/18	CarbonNet emailed ETBF Industry Association with a letter that invited comment, fact sheet and contact details.	N/A
		31/7/18	CarbonNet called stakeholder to follow up on email. There was no answer.	N/A
		7/8/18	CarbonNet sent a follow up email with fact sheet re-issued.	N/A

		7/8/18	Stakeholder emailed saying that they did not receive the original email. Stakeholder confirmed that they would send information to industry and seek input.	
		8/8/18	CarbonNet replied to stakeholder explaining that the email should have been received on 17 July 2018. CarbonNet thanked stakeholder for seeking feedback from their members and for their prompt reply.	N/A
		8/8/18	Stakeholder responded to email confirming that they did not receive anything from CarbonNet in July. Stakeholder notified CarbonNet that they would come back next week with any input form industry.	N/A
		17/8/18	Stakeholder emailed CarbonNet. They did not receive any responses from their membership after circulating CarbonNet's fact sheet. Stakeholder's individual concern is the immediate impact on marine life and that appropriate follow up surveys are undertaken to monitor the impact on marine life (using BACI monitoring).	It has been deemed that BACI monitoring is not necessary for this activity due to the short timeframe, restricted activity area and small sound sources.
		21/8/18	CarbonNet replied to stakeholder explaining that BACI monitoring will not be undertaken for this activity due to its short term and low impact nature. It was explained that CarbonNet is in the process of preparing an EP for the activity. The EP will include information on the expected impact of the shallow seismic activity, however, CarbonNet is confident the proposed activities pose little to no risk to the environment. CarbonNet conducted BACI monitoring during the Pelican 3DMSS, which has provided CarbonNet with a good understanding of the marine habitat in the proposed activity area.	Potential impacts of the activity, including shallow seismic, on marine fauna are included in Section 7.1 of the EP.
		28/8/18	CarbonNet emailed Tuna Australia to provide notification that formal consultation for this activity is being closed out. CarbonNet reiterated that it will remain in contact with Tuna Australia as the consultation for the OAW phase commences.	CarbonNet will continue consulting with this stakeholder as required.

Victorian Abalone Divers Association (VADA)	Peak industry body for abalone divers	17/7/18	CarbonNet emailed VADA with a letter that invited comment, fact sheet and contact details.	N/A
		24/7/18	CarbonNet called VADA. There was no answer.	N/A
		31/7/18	CarbonNet called VADA. There was no answer.	N/A
		14/8/18	CarbonNet called VADA and spoke to stakeholder. Stakeholder had not received email but confirmed the email listed was correct.	N/A
		14/8/18	CarbonNet re-issued email (including fact sheet) to VADA after phone conversation. To date, there has been no response.	CarbonNet does not believe follow up is required as it is known that abalone fishing does not take place within the EMBA.
Victorian Bays and Inlets Fisheries Association	Peak industry body for fishers working in bays and inlets along the Victorian coast	17/7/18	CarbonNet emailed Victorian Bays and Inlets Fisheries Association with a letter that invited comment, fact sheet and contact details.	N/A
		31/7/18	CarbonNet called stakeholder. There was no answer. A message was left on voicemail requesting a call back.	N/A
		7/8/18	CarbonNet sent follow up email with fact sheet requesting stakeholder get in touch if they had any questions.	CarbonNet does not believe follow up is required as the activity will not have any impacts to bays and inlets.
Victorian Rock Lobster Association (VRLA)	Peak industry body for rock lobster fishers	17/7/18	CarbonNet emailed the VRLA (President and Secretary) with a letter that invited comment, fact sheet and contact details.	N/A
		18/7/18	Both stakeholders responded to email explaining that they had consultation fatigue, requesting that consultation be conducted via SIV.	The stakeholder database was updated to note that no future correspondence should be issued to the VRLA.
		18/7/18	CarbonNet acknowledged the stakeholder's request to undertake consultation via SIV.	See also SIV consultation records.

Victorian Scallop Fisherman's Association (VSFA)	Scallop Fisheries representative	17/7/18	CarbonNet emailed the VSFA (CEO) with a letter that invited comment, fact sheet and contact details.	N/A
		31/7/18	CarbonNet phoned stakeholder. There was no answer. A message was left on voicemail requesting a call back.	N/A
		7/8/18	CarbonNet sent a follow up email to stakeholder with fact sheet attached requesting stakeholder get in touch if they had any questions on the activity.	N/A
		8/8/18	Stakeholder responded stating that the contact details for VSFA were incorrect and requested that CarbonNet contact VFA for future consultation.	N/A
		8/8/18	CarbonNet replied to stakeholder thanking them for the information and confirming this would be updated for future consultation.	CarbonNet emailed VFA via website explaining that it had been recently advised that Alecia Basset-Albert is no longer the contact for the VSFA. Alecia advised that the VFA would have the best contact for this industry body. A request was made for a new contact for VSFA. The flyer was re-issued to this contact.
		14/8/18	CarbonNet telephoned stakeholder to follow up on original email. Stakeholder advised he hadn't read fact sheet and asked CarbonNet to re-issue it. The stakeholder advised that he thought seismic surveys killed all the fish in the area and that it didn't matter what he said about it. CarbonNet advised that it was keen to hear his questions and concerns so they could be addressed and encouraged the stakeholder to email or call with any questions.	N/A
		14/8/18	CarbonNet re-issued email to stakeholder's newly provided email address and encouraged him to get in touch if he has any questions.	N/A

VRFish	Victorian recreational fisheries representative	17/7/18	CarbonNet emailed VRFish with a letter that invited comment, fact sheet and contact details.	N/A
		31/7/18	CarbonNet called stakeholder to follow up on email. There was no answer. A message was left on voicemail requesting a call back.	N/A
		7/8/18	CarbonNet sent follow up email to stakeholder requesting they get in touch with any questions.	N/A
		9/8/18	The Executive Officer replied to CarbonNet's email. VRFish's main concern is about MSS and potential adverse effects to fish stocks. With the Pelican 3DMSS now completed, they are less concerned about this particular activity. The stakeholder commented that the fact sheet does not provide any specific details about the activity and he requested more information about the: • Level of noise generated by taking shallow core samples. • Potential impact to fish of core samples. • Impact to fishing quality in area after taking samples. • What steps are taken to avoid creating a plume of sediment away from the site. • What steps are being taken to notify fishers of activity. • What the next phase of the project involves. This stakeholder commented that the planned time of the activity coincides with peak fishing season. He said he will be in the Golden Beach area next weekend and will reach out if other issues are raised by local fishers.	See following row.
		20/8/18	CarbonNet responded to this stakeholder specifically addressing his concerns about the potential sound levels generated by the geophysical investigations, impacts on fish, seabed turbidity and the plans for future consultation with fishers.	The information provided to VRFish is included throughout the EP.

		28/8/18	CarbonNet emailed VRFish to provide notification that formal consultation for this activity is being closed out. CarbonNet reiterated that it will remain in contact with VRFish as the consultation for the OAW phase commences.	CarbonNet will continue consulting with this stakeholder as required.
Local fisher	Scallop fisher	17/7/18	CarbonNet emailed stakeholder with a letter that invited comment, fact sheet and contact details.	N/A
		7/8/18	CarbonNet sent follow up email to stakeholder with fact sheet reattached requesting stakeholder get in touch if they had any questions.	N/A
		14/8/18	CarbonNet sent follow up email to stakeholder to check whether stakeholder had any questions.	N/A
Local fisher	Owner, Mitchelson Fisheries	17/7/18	CarbonNet emailed stakeholder with a letter that invited comment, fact sheet and contact details.	N/A
		7/8/18	CarbonNet sent follow up email to stakeholder requesting stakeholder get in touch if they had any questions.	N/A
		14/8/18	CarbonNet called stakeholder. There was no answer. A message was left on voicemail requesting a call back.	N/A
Category 5 - Any other person or organisation that the Titleholder considers relevant				
Wellington Shire Council	Council in closest proximity to the activity, which includes the towns of Golden Beach and Paradise Beach	17/7/18	CarbonNet emailed Wellington Shire Council (Manager Business Development) with a letter that invited comment, fact sheet and contact details.	N/A
		20/7/18	CarbonNet called Wellington Shire Council (Manager Business Development). Stakeholder had not read email but said that they would circulate the email internally and revert if they had any questions. Stakeholder was aware of ongoing consultation between CarbonNet and Wellington Shire Council.	N/A

		23/7/18	Wellington Shire Council assisted with a mail out to 682 property owners in Golden Beach and Paradise Beach using their property database. The letter advised of the 1 August information session at Golden Beach, the G&G investigations and the upcoming OAW.	N/A
		7/8/2018	CarbonNet briefed several Wellington Shire Council staff and councillors (project update including the G&G investigations).	N/A
Golden Beach and Paradise Beach community members				
Community member	Impact on sea life and local community	25/7/18	Stakeholder emailed CarbonNet requesting further information about the activity, including: 1. What are the investigations expected to achieve if the area has already been deemed as suitable for CCS. 2. What impact will the investigations have on local residents while they are taking place. 3. What impact will the investigations have on marine life while they are taking place. 4. Why are the investigations being carried out during the peak summer period when more people are around.	CarbonNet provided a detailed response to the questions, as outlined in the following row.
		27/7/18	CarbonNet emailed a response to the stakeholder addressing each of the queries, as follows: 1. The investigations will provide detailed data and imaging of seabed conditions to inform the location of the proposed OAW and confirm the location is suitable for the drill rig. The investigations are another step in the planning process to further ascertain the suitability of the location. 2. The investigations will take place entirely offshore (approximately 6-11 km from shore) and will not have any impact on residents. CarbonNet will continue to inform the community on the timing of the investigations in the lead-up to the activity taking place in late 2018/early 2019. 3. The investigations will have minimal impact on marine life. An outline of the equipment to be used during the activity	N/A

			was provided, along with a description of potential impacts to marine fauna and the seabed. 4. The investigations need to be undertaken over the summer period because that if when sea state is most suitable. Interruptions to Golden Beach residents or visitors are not anticipated. CarbonNet is also working with fishing stakeholders to minimise any disruptions over the course of the activity.	
Community member	Consultation process	26/7/18	Stakeholder emailed CarbonNet stating that community sessions should be held on weekends so all ratepayers could attend.	CarbonNet considered feedback into planning for upcoming consultation.
		27/7/18	CarbonNet responded thanking the stakeholder for the feedback. CarbonNet explained that it's in the process of finalising dates for future community information sessions and that days and times that suit different members of the community is being taken into consideration. The stakeholder was advised that future dates would be released shortly.	Community information sessions planned for late September and late October 2018 will be held on Saturdays in Golden Beach to enable more locals to attend when they're not working.
Community member	Consultation process	26/7/18	Stakeholder emailed CarbonNet requesting all community meetings be run on weekends. Stakeholder also stated that they would prefer future communications not be sent through the Ratepayers Association. Stakeholder wanted the whole community to have its say.	As above.
		27/7/18	CarbonNet responded to the stakeholder thanking them for their email, explaining that the mail out to stakeholders was assisted by Wellington Shire Council and was issued to all Golden Beach and Paradise Beach residents (682 in total). CarbonNet stated that it is in the process of finalising the dates for future information sessions in Golden Beach and that these would be published via the e-newsletter.	N/A
		27/8/18	The stakeholder responded, reiterating that they had no trust in the ratepayer's association or the action group against carbon storage, which is why they would appreciate CarbonNet engaging the community directly so community members receive all the information.	CarbonNet considered feedback into planning for upcoming consultation.

Community member	Consultation process	27/7/18	Stakeholder emailed CarbonNet expressing that the time of the first community session at Golden Beach (Wednesday 4 to 6 pm) is not suitable for the demographics of the rate payers. The stakeholder requested future meetings be held on weekends or filmed.	Community information sessions planned for late September and late October 2018 will be held on Saturdays in Golden Beach to enable more locals to attend when they're not working.
		27/7/18	CarbonNet replied, explaining that the mail out was conducted with the assistance of Wellington Shire Council and that CarbonNet is scheduling further meetings over the coming months, with the days and times being considered to suit community members. The stakeholder was referred to the e-newsletter to keep informed of future community sessions.	N/A
Community member	Impacts to whales and dolphins	2/8/18	CarbonNet emailed the stakeholder following a conversation at the first community session in Golden Beach with regard to controls adopted during geophysical investigations to minimise harm to cetaceans. CarbonNet provided web links to further information as discussed during the community session, including the: • Summary EP for the Pelican 3DMSS. • Page references in the Pelican 3DMSS Summary EP for discussion on Burrunan dolphin and cetacean migration patterns. • Link to the EPBC Act Policy 2.1.	N/A
Community member	Onshore sound and vibration	30/7/18	Stakeholder emailed CarbonNet requesting more information on the G&G investigations and whether there will be any onshore impacts felt by residents.	N/A
		31/7/18	CarbonNet responded to the stakeholder with a summary of the different investigations proposed to be undertaken. CarbonNet advised the stakeholder that no impacts will be felt onshore during these investigations. The stakeholder was provided a link to the CarbonNet website for further information on the activity.	N/A
Community member	Consultation process	26/7/18	Stakeholder emailed CarbonNet requesting to be kept informed of future project updates.	N/A

		26/7/18	CarbonNet responded to the stakeholder confirming that CarbonNet will continue to keep the Golden Beach and Paradise Beach communities informed about upcoming activities. CarbonNet suggested the stakeholder signs up to the e-newsletter to receive updates and information on upcoming community sessions.	N/A

4. Existing Environment

The 'environment that may be affected' (EMBA) by the activity is described in this section, together with its values and sensitivities. While each environmental aspect for the activity has its own unique EMBA, the most significant one has been chosen for this chapter, which is that relating to a diesel spill.

This diesel spill EMBA has been established through hydrocarbon spill modelling and is based upon the area that could be affected by the largest credible vessel spill. The EMBA (Figure 4.1) is therefore defined as:

> *The extent of low level hydrocarbon exposure to the sea surface (1 µm) and contact to shorelines (>10-100 g/m^2) as a result of the loss of 155 m^3 of marine diesel oil over 6 hours from a project vessel within the proposed activity area using annualised metocean conditions.*

Where appropriate, descriptions of the regional environment are provided for context. The 'environment' is defined in the OPGGS(E) as:

- Ecosystems and their constituent parts, including people and communities;
- Natural and physical resources;
- The qualities and characteristics of locations, places and areas;
- The heritage value of places; and
- The social, economic and cultural features of these matters.

The key sources of information utilised in developing this chapter include the:

- EPBC Act Protected Matters Search Tool (PMST) database (DoEE, 2018a);
- Victorian Biodiversity Atlas, VBA (DELWP, 2018);
- South-east Marine Region Profile (DoE, 2015a);
- South-east Bioregional Plan (CoA, 2015);
- Marine Natural Areas Values Study Vol 2: Marine Protected Areas of the Flinders and Twofold Shelf Bioregions (Barton *et al*., 2012);
- National Conservation Values Atlas (DoEE, 2018b);
- Victorian Oil Spill Response Atlas (OSRA) (DEDJTR, 2017a);
- Pelican MSS Habitat Survey (Advisian, 2017);
- Pelican MSS Habitat Assessment (Advisian, 2018);
- Eastern Victorian Ocean Scallop Fishery 2017-18 Abundance Survey (Fishwell Consulting/VFA, 2018); and
- Pelican 3-D Seismic Survey Sound Source Characterisation (Jasco Applied Sciences, 2018).

Table 4.1 summarises the presence or absence of receptors and sensitivities within the proposed activity area.

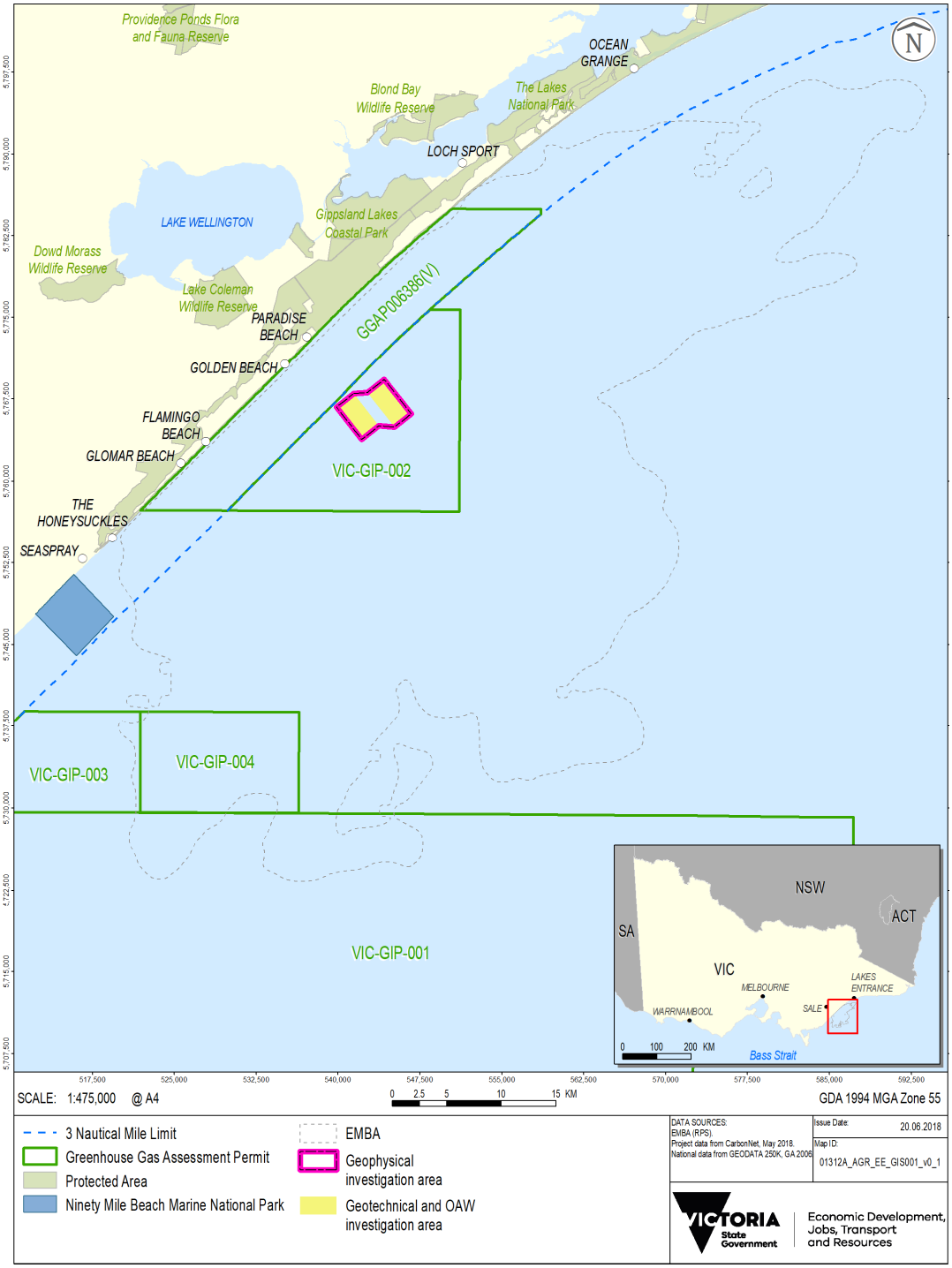


Figure 4.1 The EMBA for the activity

Table 4.1. Presence of receptors within the activity area and EMBA

Receptor	Activity area	EMBA
Physical		
Low profile rocky reef	Patchy	Patchy
Sponge garden	Patchy	Likely
Conservation values		
Australian Marine Parks (AMPs)	No	No
World Heritage-listed properties	No	No
National Heritage-listed properties	No	No
Threatened Ecological Communities (TECs)	No	No
Key Ecological Features (KEFs)	No	Upwelling East of Eden
Nationally Important Wetlands	No	No
Victorian marine protected areas	No	No
Onshore protected areas	No	No
Biological environment		
Plankton		
Benthic species:		
- commercial scallops	Isolated individuals	No beds that are commercially viable
- rock lobsters	No	
Seagrass beds	Isolated & sparse	
Fish:		
- Biologically Important Area (BIA) for great white shark		
Cetaceans:		
- BIA for pygmy blue whale		
- BIA for southern right whale	No	State waters only
- BIA for humpback whale	No	No
Pinnipeds	Foraging only	Foraging only
Reptiles	Vagrants only	Vagrants only
Seabirds		
Shorebirds	No	
Marine pests	Possible	Possible
Cultural Heritage Values		
Shipwrecks	No	No
Indigenous heritage	No	No
Socio-economic Environment		
Native Title	No	No
Tourism	Possible game fishing	

Receptor	Activity area	EMBA
Petroleum infrastructure	One gas pipeline	
Commercial fishing	Shark gillnet/hook (Cth) Ocean access (Vic) Ocean purse seine (Vic)	Shark gillnet/hook (Cth) Trawl (Cth) Rock lobster (Vic) Ocean access (Vic) Ocean purse seine (Vic) Inshore trawl (Vic)
Recreational fishing	Possible game fishing	
Commercial shipping		

Green shading denotes presence.

4.1. Regional Context

The activity area is located within the Southeast Shelf Transition provincial bioregion within the South-east marine region (DoE, 2015a). This region extends from east of Wilson's Promontory to north of Tathra (NSW).

The coastline adjacent to the bioregions (as classified at the Commonwealth and state scales) is exposed, with long sandy beaches broken by rocky headlands and numerous coastal lagoons.

4.1.1. Climate

The region's climate is moist cool temperate (Barton *et al.*, 2012), with cool wet winters and cool summers. It is influenced by rain bearing cold fronts that move from south-west to north-east across the region, producing strong winds from the west, north-west and south-west.

Bass Strait is located on the northern edge of the westerly wind belt known as the Roaring Forties. Occasionally, intense meso-scale low-pressure systems occur in the region, bringing very strong winds, heavy rain and high seas. These events are unpredictable in occurrence, intensity and behaviour, but are most common between September and February (McInnes and Hubbert, 2003). Winds from the west dominate the September to April period.

4.1.2. Physical Environment

The activity area overlaps the seafloor 'slope' geomorphic unit as classified in the South-east Marine Region Profile (DoE, 2015a).

The gradient of the activity area is a very flat 0.2°, with the seabed depth difference being 12 m over a distance of 4.8 km perpendicular to the coast.

Intermittent and very narrow areas of low-profile reefs (about 0.5 m to 1.5 m in height above the surrounding seabed) running parallel to the coast are scattered through the nearshore sandy sediments along the Ninety Mile Beach. These reefs comprise calcarenite and occur immediately behind the surf zone, in water depths ranging from 7 to 25 m (Burton *et al.*, 2012), and are likely to be often covered by mobile sand. These occur shoreward of the activity area.

A marine habitat assessment (using a non-intrusive towed camera) was commissioned by CarbonNet and conducted in early April 2017 by Advisian, to provide information for the MSS EP. The primary aim of the assessment, among others, was to determine broad seabed substrate types. Of the 71 sites sampled in the MSS acquisition area, seven sites occur within the activity area (numbers 28, 36, 37, 38, 39, 46 and 47). The results of this sampling indicate that fine sand is the dominant substrate of the activity area. Sampling locations are presented in Figure 4.2.

4.1.1. Oceanography

The activity area is located in shallow water depths ranging from 21 to 33 m in the Gippsland Basin. The bathymetry contours run consistently parallel to the coast across the activity area.

Water Currents

Currents within Bass Strait are primarily driven by tides, winds and density-driven flows (RPS APASA, 2018). The region is oceanographically complex, with sub-tropical influences from the north and sub-polar influences from the south (DoE, 2015a). There is a slow easterly flow of waters in Bass Strait and a large anti-clockwise circulation (DoE, 2015a).

Surface currents in the area flow in the northeast to southwest axis parallel with the coastline. The average monthly surface current speed is 0.30 metres per second (m/s), with the maximum surface current speeds ranging between 1.0 and 1.5 m/s.

Sea Temperature

The shallowness of Bass Strait means that its waters more rapidly warm in summer and cool in winter than waters of other nearby regions (DoE, 2015a).

Waters of eastern Bass Strait are generally well mixed, but surface warming sometimes causes weak stratification in calm summer conditions. Sea surface temperature in the region varies annually from a minimum of 13°C (August/September) to a maximum of 19°C (March). The average annual sea surface temperature is 16°C.

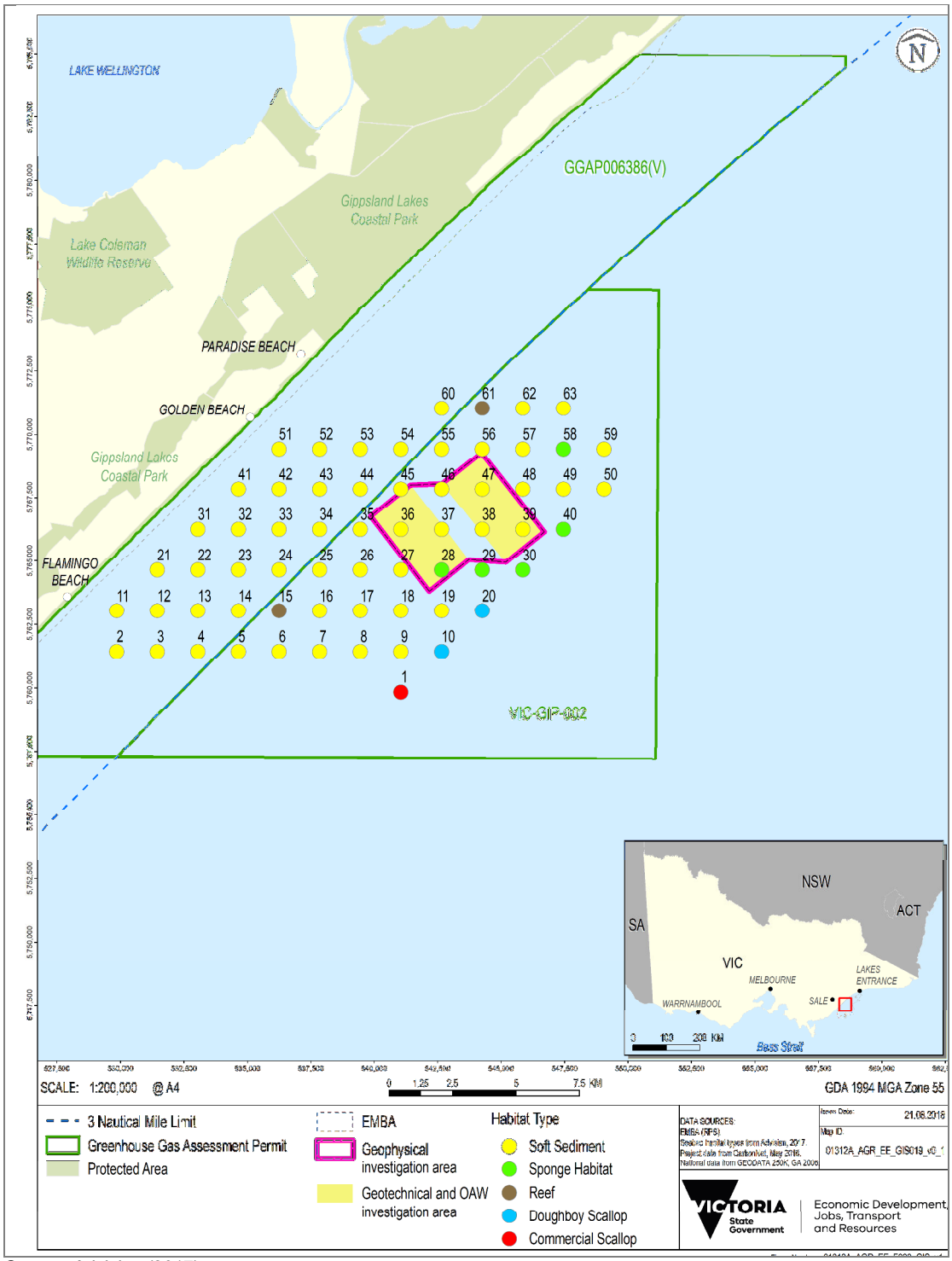
Tides

Tidal currents run parallel to the coast and follow a semi-diurnal pattern (Barton *et al*., 2012), with some diurnal inequalities (Jones and Padman, 1983) and speeds generally ranging from 0.1 to 2.5 m/s (Fandry, 1983). However, Barton et al (2012) report that strong tidal currents (2 to 2.5 knots, or 1-1.3 m/s) are characteristic of the area. Tidal variation is 0.9 m for spring tides and 0.6 m for neap tides (Barton *et al*., 2012).

The main tidal components in Bass Strait vary in phase by about three to four hours from east to west. Most of this phase change occurs between Lakes Entrance and Wilson's Promontory. Tidal flows in Bass Strait come in from the east and west during a rising (flood) tide and flow out to the east and west during a falling (ebb) tide.

Waves

Bass Strait is a high-energy environment exposed to frequent storms and significant wave heights (Jones, 1980), though Barton et al (2012) report wave energy in the Twofold Shelf Bioregion as relatively low.



Source: Advisian (2017).

Figure 4.2. Sampling locations for the Pelican 3DMSS marine environmental assessment, indicating seabed types and habitat, in relation to the activity area

4.1.2. Ambient Ocean Sound

Physical and biological processes contribute to natural background sound. Physical processes include that of wind, waves, rain and earthquakes, whilst biological noise sources include vocalisations of marine mammals and other marine species.

Ambient underwater sound characterisation of the Pelican 3DMSS acquisition area was undertaken immediately prior to the MSS taking place in February 2018. Jasco Applied Sciences (Jasco) conducted this work on behalf of CarbonNet in late January and early February 2018.

The study involved four deployment locations (Figure 4.3), with sites 2 and 3 being the closest to the activity area (about 750 m to the west in water depths of 26 m and 27 m, respectively).

Autonomous Multi-channel Acoustic Recorders (AMAR) were used for this study, which recorded on two channels simultaneously. The AMARs were fitted with up to three different hydrophones (out of four hydrophone models used overall) (Jasco, 2018).

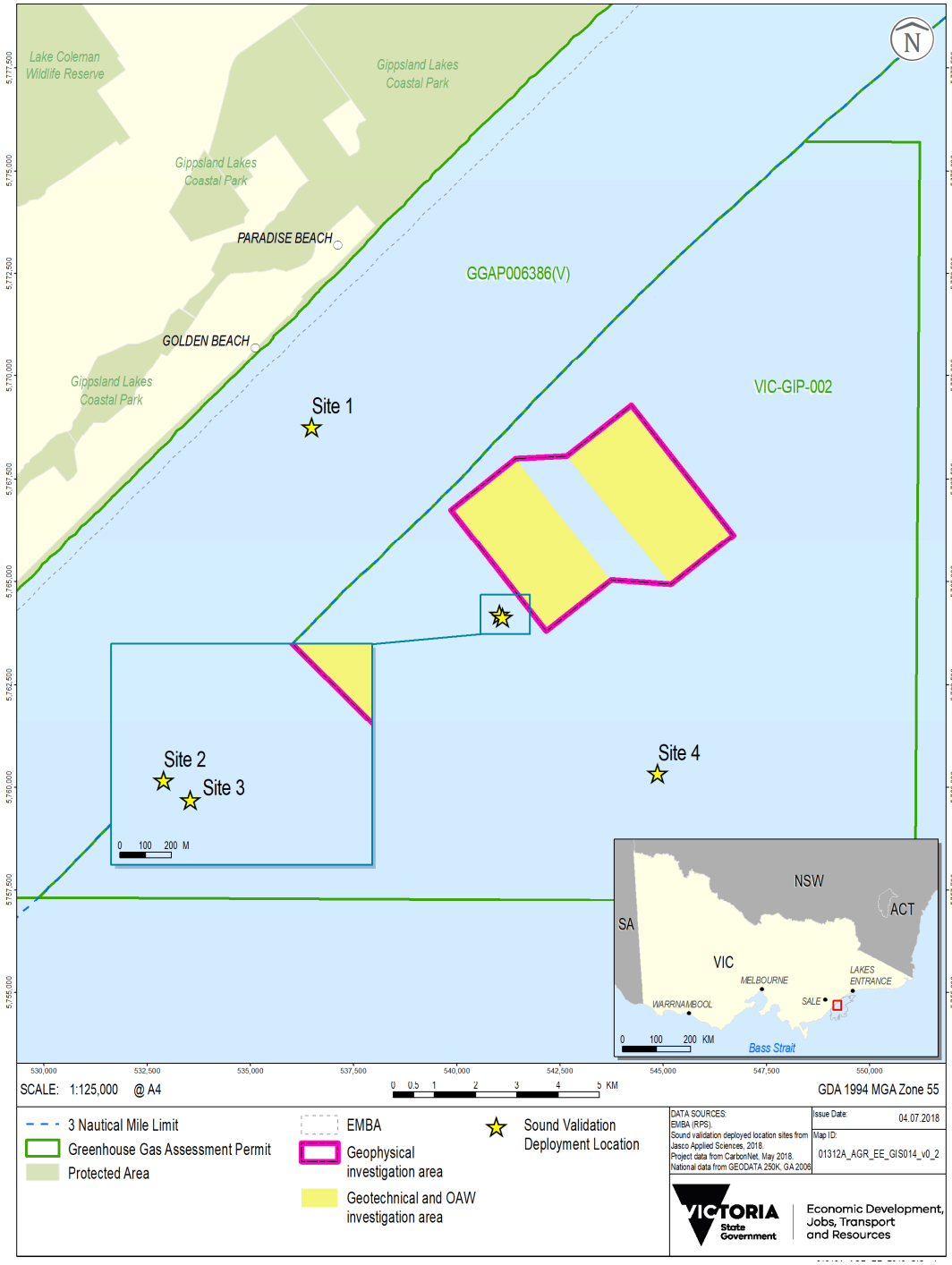
The ambient soundscape of the Golden Beach region prior to the MSS was contributed to strongly by weather events (wind and wave noise correlated with tidal state), with low levels of shipping and biological sound. Both Stations 3 and 4 show the presence of snapping shrimp, with elevated power spectral density levels above 1.5 kHz due to their contributions at night. Biological sources are primarily evident in recordings from Station 3 in the 1-10 kHz and 10-32 kHz bands as elevated night time levels, which are likely linked to increased biological activity at the nearshore reef, as they are not evident at Station 4. Increased noise levels in the 10-100 Hz band (primarily at Station 3) occur on a 6-hourly cycle, aligning with the tidal cycle. The highest levels occur as the tide rises from low to high at night early in the week, with similar noise levels for all tidal cycles at the end of the week as the moon approached the last-quarter on the 8th of February 2018. The tidal cycles are more noticeable at Station 3 as it is in shallower water than Station 4, and also because it is closer to the coast, and the sound levels are more influenced by wave action on the beach.

The daily sound exposure level (SEL) values for the pre-MSS period varied between a minimum of 162.5 and maximum of 163.7 at Station 3, and a minimum of 158.3 and a maximum of 163.6 at Station 4.

4.2. Conservation Values and Sensitivities

The conservation values and sensitivities in and around the activity area particularly, but also within the EMBA, are described in this section.

- Australian Marine Parks – The Beagle Australian Marine Park (AMP) and East Gippsland AMP are located 98 km southwest and 206 km east of the activity area, respectively. Neither of these AMPs are located within the EMBA.
- World Heritage Listed-properties – are examples of sites that represent the best examples of the world's cultural and heritage values, of which Australia has 19 properties (DoEE, 2018c). No properties on the World Heritage List occur within the EMBA.



Source: JASCO Applied Sciences (2018).

Figure 4.3. Location of the four underwater sound measurement stations in relation to the activity area

- The National Heritage List is Australia's list of natural, historic and Indigenous places of outstanding significance to the nation (DoEE, 2018d). There are no National Heritage-listed places in Bass Strait.

- Wetlands of international importance ('Ramsar wetlands') – are representative, rare or unique wetlands, or are important for conserving biological diversity, and are included on the List of Wetlands of International

Importance developed under the Ramsar Convention. There are no Ramsar wetlands in the EMBA.

- Threatened Ecological Communities (TECs) – provide wildlife corridors and/or habitat refuges for many plant and animal species, and listing a TEC provides a form of landscape or systems-level conservation (including threatened species). The nearest TEC to the activity area is the *Giant Kelp Marine Forests of South East Australia*, mapped as possibly occurring within the nearshore parts of eastern Gippsland, and is protected as a matter of NES under the EPBC Act. Mapping indicates that this TEC does not occur within the activity area or the EMBA (with the nearest occurrence being east of the mouth of the Snowy River, 111 km northeast of the activity area and 56 km northeast of the nearest boundary of the EMBA).
- Commonwealth Heritage-listed places are natural, indigenous and historic heritage places owned or controlled by the Commonwealth (DoEE, 2018f). No properties on the Commonwealth Heritage List occur within the EMBA.
- Nationally important wetlands – are considered significant for a variety of reasons, including their importance for maintaining ecological and hydrological roles in wetland systems, providing important habitat for animals at a vulnerable stage in their life cycle, supporting 1% or more of the national population of any native plant or animal taxa or for its outstanding historical or cultural significance (DoEE, 2018h). Several nationally important wetlands occur along the Victorian coast, although none of these occur within the EMBA.

4.2.1. Key Ecological Features

Key Ecological Features (KEFs) are elements of the Commonwealth marine environment that, based on current scientific understanding, are considered to be of regional importance for either the region's biodiversity or ecosystem function and integrity. KEFs have no legal status in decision-making under the EPBC Act, but may be considered as part of the Commonwealth marine area (DoEE, 2018g).

The National Conservation Values Atlas indicates that the EMBA intersects the western-most portion (~12 km) of the 'Upwelling East of Eden' KEF, located 44 km to the northeast of the activity area (Figure 4.4).

Upwelling East of Eden

Dynamic eddies of the EAC cause episodic productivity events when they interact with the continental shelf and headlands. The episodic mixing and nutrient enrichment events drive phytoplankton blooms that are the basis of productive food chains including zooplankton, copepods, krill and small pelagic fish (DoE, 2015a). Therefore, the key value of the KEF is its high productivity and aggregations of marine life.

The upwelling maintains regionally high primary productivity that supports fisheries and biodiversity, including 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. The area is also important for seals, other cetaceans, sharks and seabirds (DoE, 2015a).

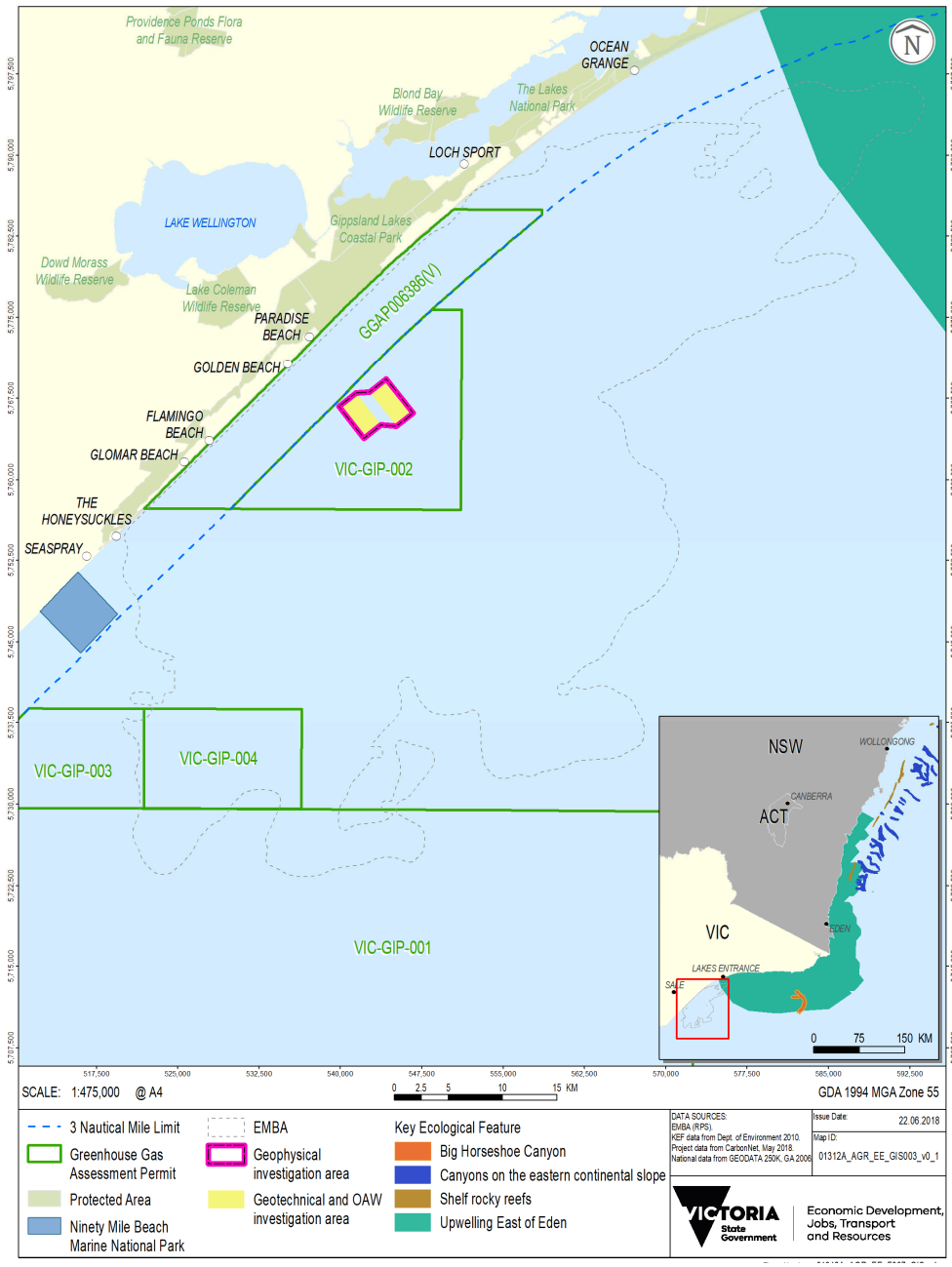


Figure 4.4. The 'Upwelling East of Eden' KEF

4.2.2. Victorian Marine Protected Areas

Victoria has 24 marine national parks and sanctuaries that are protected and managed under the *National Parks Act 1982* (Vic) by Parks Victoria.

There are no marine protected areas located in the EMBA, with the nearest being the Ninety Mile Beach Marine National Park (MNP), 28 km southwest of the activity area (and 2 km from the nearest point of the EMBA) (see Figure 4.1). Given its close proximity to the EMBA, the marine park is described below.

Ninety Mile Marine National Park

The Ninety Mile Beach MNP covers an area of 2,750 ha and extends along approximately 5 km of coastline and offshore for 5 km from the high-water mark

(ParksVic, 2006). The park protects an internationally significant sandy environment, recognised for its exceptionally high diversity of marine invertebrates.

The park's key natural values are listed as:

- Very high diversity of marine invertebrates, including the large endemic southern Australian seastar (*Coscinasterias muricata*) and the soft coral *Pseudogorgia godeffroyi*;
- Scattered low calcarenite reefs providing habitat for a distinctive marine invertebrate fauna, especially sponges, with sparse flora communities of small red algae; and
- Important habitat for threatened shorebird species such as the threatened hooded plover (*Thinornis rubricollis*) and other species listed under international migratory bird agreements.

The waters of the park have aggregations of juvenile white shark (*Carcharodon carcharias*), snapper (*Pagrus auratus*), Australian salmon (*Arripis* spp.), long-finned pike (*Dinolestes lewini*) and short-finned pike (*Sphyaena novaehollandiae*). The southern right whale, Australian fur seals and New Zealand fur-seals are known to frequent the park.

The Ninety Mile Beach is a potentially important area for the endangered hooded plover (listed as vulnerable in Victoria). However, their numbers between McLoughlins Point and Seaspray on biannual counts between 2000 and 2006 declined markedly from 40 to three, with none observed during the 2004 and 2006 survey. The loss of roosting and nesting areas due to beach erosion may be a major factor. The area is also used by other threatened shorebirds, including crested terns, Caspian terns, pied oystercatchers and sanderlings (ParksVic, 2006).

4.3. Coastal Environment

The physical coastal environment described in this section is defined by the extent of the EMBA, which stretches for 50 km from The Honeysuckles in the west to Loch Sport in the east.

The environmental features of the coast immediately adjacent to the activity area are dominated by sandy sediment with sparse reef (low-profile carbonate reef). This section of the coastline is entirely sandy beach, which provides important nesting habitat for the hooded plover.

The western part of the coastline within the EMBA is dominated by the Ninety Mile Beach, a 90-mile (145 km) long stretch of sandy beach on the seaward side of a narrow, tall, vegetated sand dune system. These sand dunes provide important habitat for hooded plovers and roosting sites for other shorebird species.

There are no estuaries along the coastline of the EMBA, with the nearest being Merriman Creek (at Seaspray). This is only intermittently open. There are also no offshore islands in the EMBA.

Sand is the dominant intertidal substrate within the EMBA.

4.4. Biological Environment

The results of the PMST and VBA database searches provide the key means by which species are identified for the area and are discussed in this section.

Additionally, BIAs are identified for those species that may occur within the survey area and EMBA. BIAs are spatially defined areas, defined by the DoEE based on expert scientific knowledge, where aggregations of individuals of a species are known to display biologically important behaviour such as breeding, foraging, resting or migration (DoEE, 2018i). The BIAs do not represent a species' full distribution range.

4.4.1. Benthic Assemblages

Regional knowledge

The seascape of the region is composed of a series of massive sediment flats, interspersed with small patches of reef, bedrock and consolidated sediment (Wilson and Poore, 1987).

The sediment flats are generally devoid of emergent fauna but benthic invertebrates such as polychaetes, bivalves, molluscs and echinoderms are present (Wilson and Poore, 1987). There are also a number of burrowing species that inhabit the soft seabed, including tubeworms, small crustaceans, nematodes, nemerteans and seapens (PBEES, 2001).

Bass Strait

Surveys of benthic invertebrates in Bass Strait (Poore *et al*., 1985; Wilson and Poore, 1987) have shown:

- Crustaceans and polychaetes dominate the infaunal communities, many of which are unknown species.
- The high diversity of a wide range of invertebrate groups has been a recurrent observation of all surveys in Bass Strait and diversity is high compared with equivalent areas of the northern hemisphere.
- Many species are widely distributed across the Strait, suggesting heterogeneous sediments and many microhabitats.
- Some invertebrate groups are allied with fauna from Antarctic seas. In winter, when the east coast of Tasmania is supplied with water from the sub-Antarctic, the overlap with the EAC contributes to the high diversity.

Barton et al (2012) report that in the Ninety Mile Beach Marine National Park (28 km west-southwest of the activity area at their nearest points), reefs are dominated by invertebrates (70% coverage), including sponges, ascidians (sea squirts) and smaller bryozoans (resembling coral) and hydroids (colonies of tiny jellies attached to a feather-like base).

Activity area

A marine habitat assessment (using a non-intrusive towed camera) was commissioned by CarbonNet and conducted in early April 2017 by Advisian. Of the 71 sites sampled in the MSS acquisition area, seven sites occur within this activity area. The results of this sampling indicate that, in general, the seabed is dominated by fine sand with biota that varies from very little epibiota to a sparse cover of sponges.

In the wider area of the habitat assessment (which occurs within the EMBA), the following benthic assemblages were found:

- Isolated and sparse seagrass beds (sampling sites 4, 13, 16, 44 and 60);
- Isolated occurrences of sponge gardens (sampling sites 28-30, 40, 58, 69).

- Isolated occurrences of *Pseudogorgia godeffroyi* (sampling sites 27, 32, 34, 50 and 51), an unusual soft coral found only in Victoria between McGaurans Beach and Delray Beach (ECC, 2000).
- A small patch of unmapped, flat low-profile offshore reef with no ledges or crevices, immediately seaward of the 30 m isobath and on the western side of Esso's Bream to shore gas pipeline. This reef is dominated by sponges and ascidians (such as stalked ascidian *Pyura spinifera*) and smaller bryozoans, hydroids and the odd clump of red algae, with the occasional *Chlamys* scallop attached to the reef (not commercial scallops). The offshore reefs at sites 61, 66 and 68 are described as being less than 50 cm in height above the surrounding seabed, while the inshore reefs at sites 64, 65 and 67 are described as being about 0.5 m to 1.5 m in height above the surrounding seabed.
- Live commercial scallops (*Pecten fumatus*) were noted in low abundance at site 1 (32 m water depth) with dead scallops observed at site 62 (23 m water depth).

Of the 71 sites sampled in the marine habitat assessment, 58 of them (82%) are classified as soft sediment (fine to coarse sand and gravels/shell) (Advisian, 2017), so it is reasonable to conclude that the majority of the activity area has a sandy seabed.

Scallops

Commercial scallops (*Pecten fumatus*) are present throughout Bass Strait, with a distribution along the southeast Australian coast from central NSW, Victoria, SA and Tasmania. They are found partially buried in soft sediment ranging from mud to coarse sand. Scallops aggregate into beds, with healthy scallops recessing their convex right valve beneath the sediment such that the flat left valve is level or slightly below the sediment surface (AFMA, 2017a; Przeslawski *et al*., 2016b). Commercial scallops are mainly found at depths of 10-20 m, but may also occur at depths of up to 120 m. While mainly sedentary, scallops can swim by rapidly opening and closing their shells, usually when disturbed by predators (AFMA, 2017a). Scallops feed on prey and detritus, while they are prey for starfish, whelks and octopus (AFMA, 2017a).

Scallops reach reproductive maturity after one year but do not spawn until the second year. Commercial scallops usually have a life span of less than 7 years, but wild populations have been known to die off rapidly after 3-5 years (AFMA, 2017a). Adult scallops normally spawn over an extended period between June and November (a sudden increase in water temperature is thought to trigger spawning), with individuals producing up to one million eggs (AFMA, 2017a). In Victoria, a spawning peak appears to take place in spring (September, October and November) (DPI, 2005). Information provided by SIV indicates spawning occurs from September to December. Larval scallops drift as plankton for up to six weeks before first settlement, with peak settlement occurring in mid-late September (AFMA, 2017a; Przeslawski *et al*., 2016b). They attach to a hard surface such as seaweed or mussel and oyster shells, and remain attached until reaching around 6 mm in length. The small scallops then detach themselves, settle into sediments and bury in so that only the top flat shell is visible. The juvenile scallops grow quickly and reach marketable size within 18 months (VFA, 2017). Scallop settlement is highly variable both temporally and spatially (VFA, 2017).

Natural mortality for commercial scallops is variable, with a study from Port Phillip Bay indicating an annual mortality rate of 40%, with other studies in the 1980s indicating a mortality rate of 11-51% (DPI, 2005).

The VFA has advised CarbonNet that very little commercial fishing for scallops has been undertaken in the activity area in the last five years (see Section 5.6.3), with SIV indicating that no scallop harvesting has occurred over the last 7-8 years.

While the dominance of sandy sediments throughout the activity area provides abundant suitable scallop habitat and makes it possible that scallops could occur, recent surveys indicate that the presence of commercial scallops is nil to low and commercially viable scallop beds are not present:

- The CarbonNet-commissioned marine habitat assessment observed only one location within the former Pelican 3DMSS acquisition area where commercial scallops were present (outside of this activity area) (Advisian, 2017; 2018) (see Figure 4.5), but in very low abundance that would not be considered a commercial bed for fishing purposes.

- The VFA undertook a scallop stock assessment survey in December 2017 and January 2018 (extending from the shoreline out to 20 nm and between Wilsons Promontory in the east and Point Hicks in the west, with a total area of 4,859 km^2) (Koopman *et al*., 2018). Of the 148 survey tows in this area, 17 tows were undertaken within the former Pelican 3DMSS acquisition area. There was zero scallop catch reported. The tow area referred to as LE3 was undertaken within the proposed G&G investigations area and caught no scallops (Koopman *et al*., 2018) (Figure 4.5). Of the nine potential scallop beds identified in the former Pelican 3DMSS area, only one was considered worthy of additional survey (being 'LE1', 16.5 km^2 in area), located immediately to the east of the Pelican 3DMSS area (and 3.6 km east-southeast of the activity area). Twenty-five (25) random tows were undertaken in this area, with a mean density of 27.7 kg/1,000 m^2 from all tows, or 0.51 individuals per square metre based on non-zero tows, with an estimated total biomass of 456 tonnes.
- A pre-Pelican 3DMSS marine habitat assessment (using a non-intrusive towed camera) was commissioned by CarbonNet and conducted in mid-January 2018 by Advisian to provide additional information on the presence or absence of commercial scallops from the acquisition area. Sixty (60) transects were run (including four within the activity area) (Figure 4.6). Commercial scallops were only detected in only six sites; one of these sites is located in the activity area and found two commercial scallops. No beds of commercial scallops were observed.

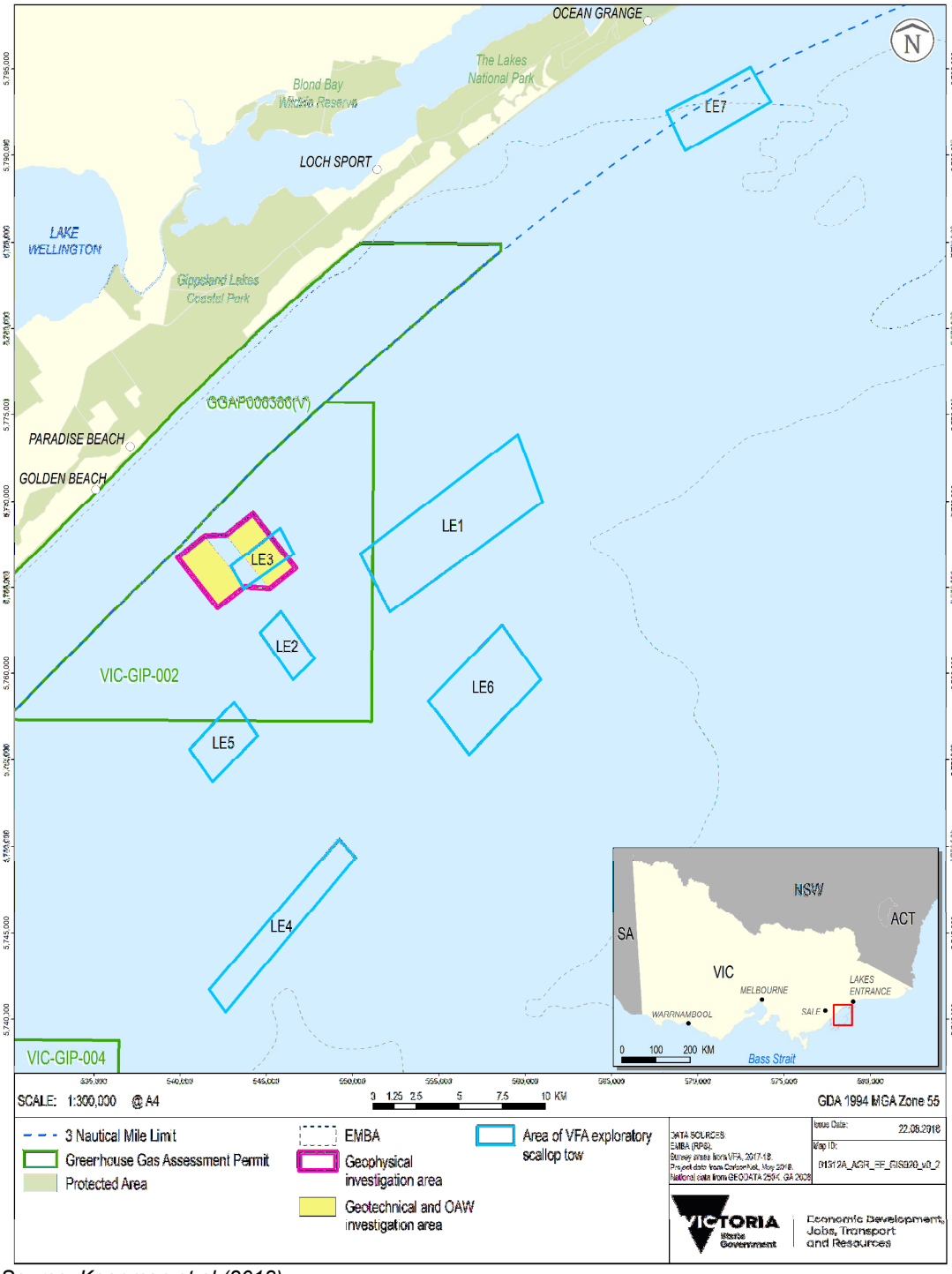
Southern rock lobster

The southern rock lobster (*Jasus edwardsii*) is found on coastal reefs from the south-west coast of WA to the south coast of NSW, including Tasmania and the New Zealand coastline. Southern rock lobsters are found to depths of 150 m (DPI, 2009). In the Gippsland region, southern rock lobster habitat occurs as patchy, discontinuous low-profile reef running parallel to the coast.

The life cycle of the rock lobster is complex. After mating in autumn, fertilised eggs are carried under the tail of the female for approximately three months before being released, typically between September and November. Once released, rock lobster larvae, or phyllosoma, live in the plankton and undergo eleven developmental stages over a period of one to two years while being carried by ocean currents. During metamorphosis, juvenile rock lobster shift from a planktonic to a benthic existence (DPI, 2009).

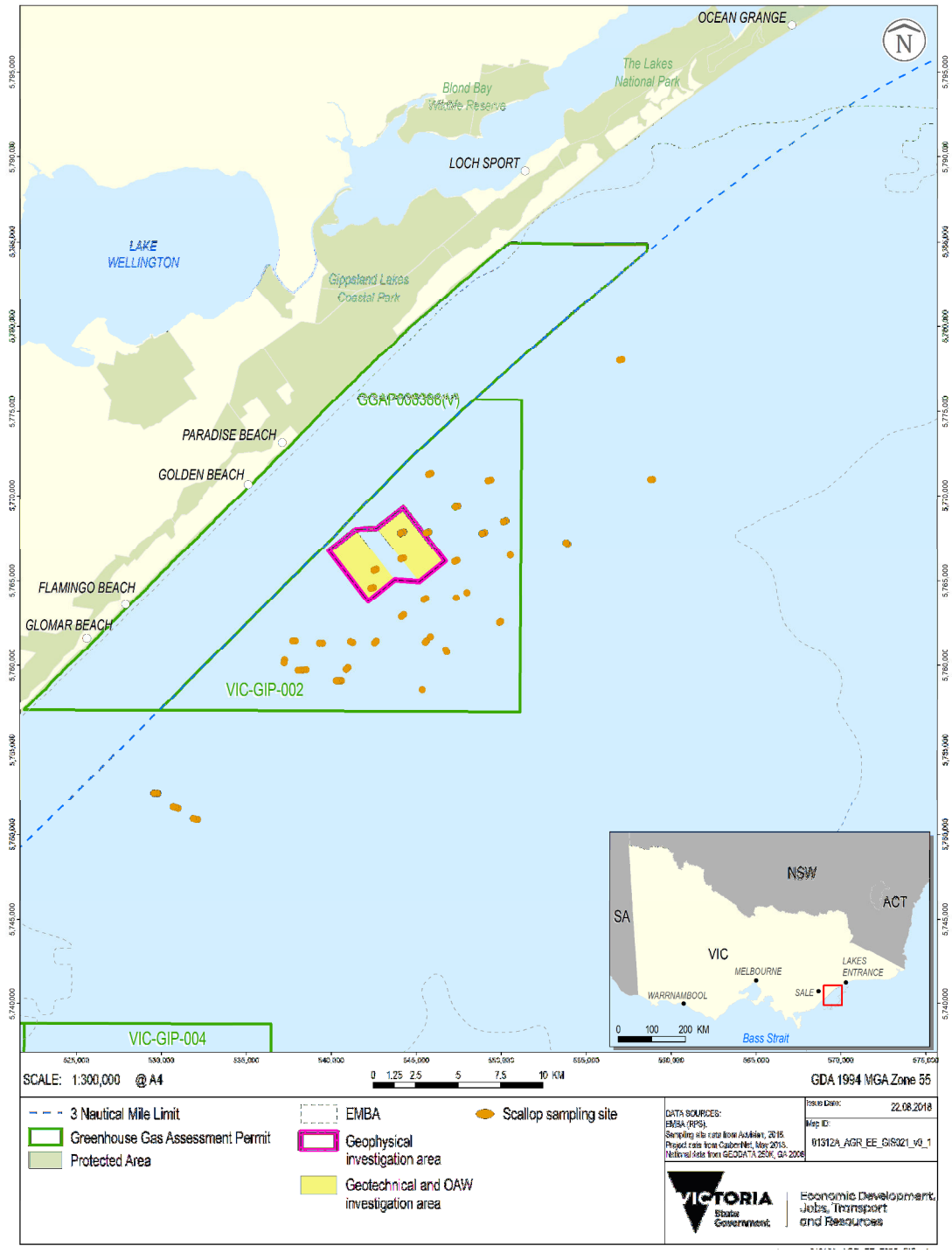
Rock lobsters grow by moulting or shedding their exoskeleton. The frequency of the moulting cycle declines with age from five moults a year for newly settled juveniles to once a year for mature adults. Males grow faster and larger than females, reaching 160 mm in carapace length after ten years. Females generally reach 120 mm in the same period. Growth rates also vary spatially, with growth faster in the east than in the west (DPI, 2009).

Adult rock lobsters are carnivorous and feed mostly at night on a variety of bottom dwelling invertebrates such as molluscs, crustaceans and echinoderms. Major predators include octopus and various large fish and sharks. In Victoria, the abundance of rock lobster decreases from west to east reflecting a decreasing area of suitable rocky reef habitat (DPI, 2009). Rocky reef is present as scattered patches shoreward off the activity area in waters less than 20 m deep.



Source: Koopman et al (2018).

Figure 4.5. Location of VFA scallop investigation sites in relation to the activity area



Source: Advisian (2018).

Figure 4.6. Location of scallop sampling sites in relation to the activity area

4.4.2. Flora

Literature searches indicate that marine flora, such as seagrasses and kelp, are generally not abundant in the extensive areas of subtidal sand flats in the nearshore waters of the EMBA. This is likely to be due to the high-energy nature of the Gippsland coastline and the mobile nature of sands, which prevents many species being able to anchor themselves.

Of the 71 sites sampled in the MSS acquisition area during the CarbonNet-commissioned marine habitat assessment, the seven sites located within the activity area did not encounter any vegetation. However, outside the activity area, some isolated and sparse seagrass beds were noted at five sites and large brown algae (*Ecklonia radiata* and *Sargassum*) was noted at the inshore reef area.

4.4.3. Plankton

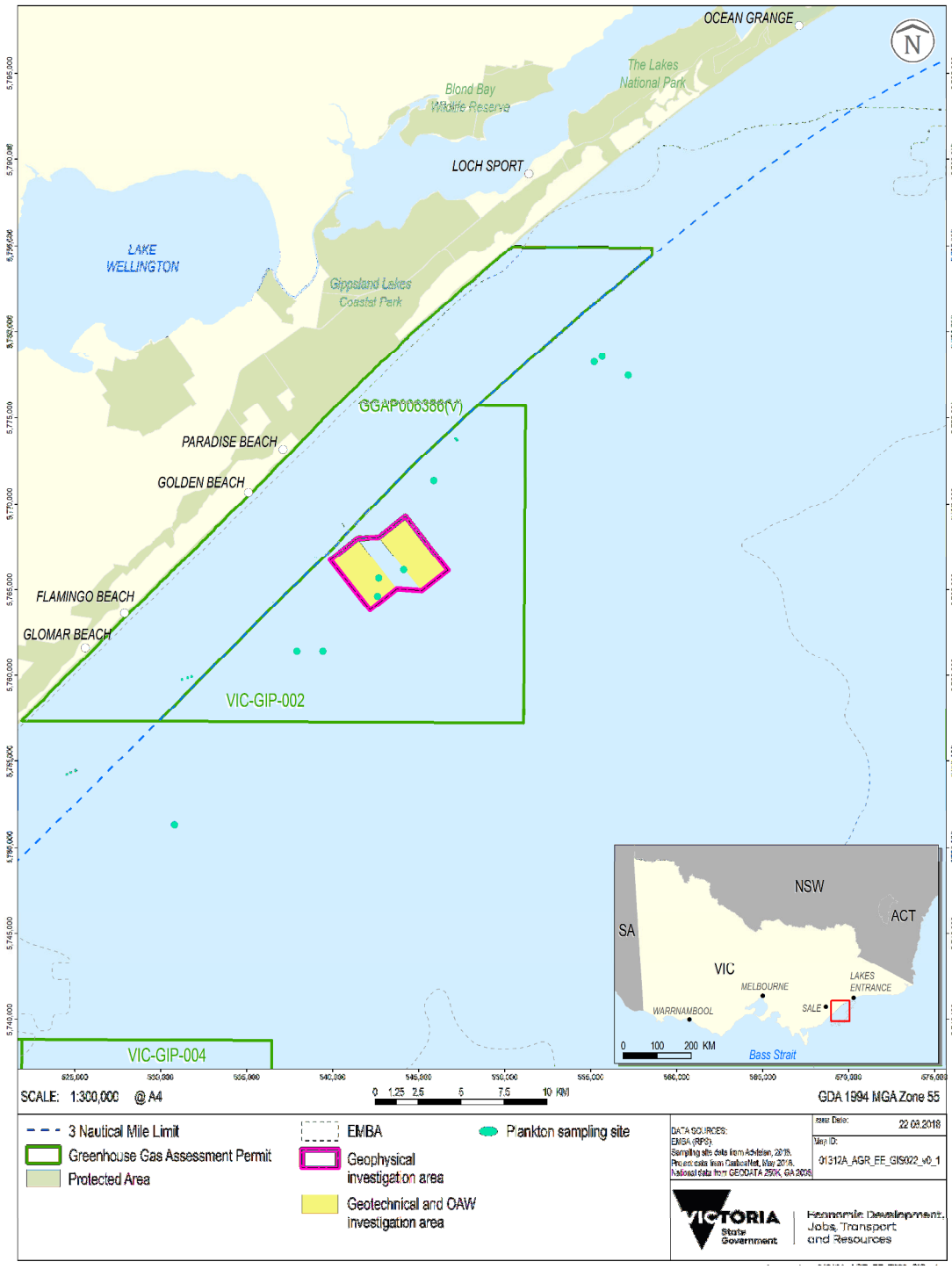
Plankton is a key component in oceanic food chains and comprises two elements; phytoplankton and zooplankton, as described herein.

Phytoplankton (photosynthetic microalgae) comprise 13 divisions of mainly microscopic algae, including diatoms, dinoflagellates, gold-brown flagellates, green flagellates and cyanobacteria and prochlorophytes (McLeay *et al.*, 2003). Phytoplankton drift with the currents, although some species have the ability to migrate short distances through the water column using ciliary hairs. Phytoplankton biomass is greatest at the extremities of Bass Strait (particularly in the northeast) where water is shallow and nutrient levels are high.

Zooplankton is the faunal component of plankton, comprising small crustaceans (such as krill) and fish larvae that feed on zooplankton. Zooplankton includes species that drift with the currents and also those that are motile. More than 170 species of zooplankton have been recorded in eastern and central Bass Strait, with copepods making up approximately half of the species encountered (Watson & Chaloupka, 1982).

In order to determine the composition of zooplankton in the Pelican 3DMSS operational area, CarbonNet commissioned Advisian to undertaken pre- and post-MSS plankton sampling. Six sites were sampled within the Pelican 3DMSS acquisition area and three reference sites were sampled to the northeast in late January 2018 (Figure 4.8 shows all locations in relation to the activity area). The results of this work found that:

- The composition of zooplankton was a typical healthy example of those expected for temperate coastal waters;
- Copepods were the dominant group, with varying proportions of appendicularians, cladocerans and doliolids. Numerous other groups occurred in small numbers, including siphonophores, fish larvae, fish eggs, polychaetes, ghost shrimps and cnidarians (jellies); and
- No southern rock lobster or scallop larvae were present.



Source: Advisian (2018).

Figure 4.7. Plankton sampling sites in relation to the activity area

4.4.4. Fish

It is estimated that there are over 500 species of fish found in the waters of Bass Strait, including a number of species of importance to commercial and recreational fisheries (LCC, 1993). Fish species commercially fished in and around the activity area are listed in Section 5.6.2.

There are 32 fish species (28 of which are seahorses and pipefish) recorded in the EPBC Act PMST (DoEE, 2018a) as potentially occurring in the activity area, with an

additional two fish species recorded within the EMBA (as marked with an asterisk in Table 4.2. The key threatened and migratory species are described in this section.

Table 4.2. EPBC Act-listed fish that may occur in the EMBA

Scientific name	Common name	EPBC Act status			BIA within the EMBA?	Recovery Plan in place?
		Listed threatened species	Listed migratory species	Listed marine species		
Freshwater						
*Galaxiella pusilla**	Dwarf galaxias	V	-	-	-	AS
Prototroctes maraena	Australian grayling	V	-	-	-	RP, AS
Oceanic						
Carcharodon carcharias	Great white shark	V	Yes	-	B/N	RP, AS
*Isurus oxyrinchus**	Shortfin mako	-	Yes	-	-	-
Lamna nasus	Porbeagle	-	Yes	-	-	-
Rhincodon typus	Whale shark	V	Yes	-	-	Expired
Pipefish, seahorses and seadragons						
Heraldia nocturna	Upside-down pipefish	-	-	Yes	-	-
Hippocampus abdominalis	Big-belly seahorse	-	-	Yes	-	-
Hippocampus breviceps	Short-head seahorse	-	-	Yes	-	-
Hippocampus minotaur	Bullneck seahorse	-	-	Yes	-	-
Hippocampus whitei	White's seahorse	-	-	Yes	-	-
Histiogamphelus briggsii	Crested pipefish	-	-	Yes	-	-
Histiogamphelus cristatus	Rhino pipefish	-	-	Yes	-	-
Hypselognathus rostratus	Knifesnout pipefish	-	-	Yes	-	-
Kaupus costatus	Deepbody pipefish	-	-	Yes	-	-
Kimblaeus bassensis	Trawl pipefish	-	-	Yes	-	-
Leptoichthys fistularius	Brushtail pipefish	-	-	Yes	-	-

Scientific name	Common name	EPBC Act status			BIA within the EMBA?	Recovery Plan in place?
		Listed threatened species	Listed migratory species	Listed marine species		
Lissocampus runa	Javelin pipefish	-	-	Yes	-	-
Maroubra perserrata	Sawtooth pipefish	-	-	Yes	-	-
Mitotichthys semistriatus	Halfbanded pipefish	-	-	Yes	-	-
Mitotichthys tuckeri	Tucker's Pipefish	-	-	Yes	-	-
Notiocampus ruber	Red pipefish	-	-	Yes	-	-
Phyllopteryx taeniolatus	Common seadragon	-	-	Yes	-	-
Solegnathus robustus	Robust pipehorse	-	-	Yes	-	-
Solegnathus spinosissimus	Spiny pipehorse	-	-	Yes	-	-
Stigmatopora argus	Spotted pipefish	-	-	Yes	-	-
Stigmatopora nigra	Widebody pipefish	-	-	Yes	-	-
Stigmatopora olivacea	A pipefish	-	-	Yes	-	-
Stipecampus cristatus	Ringback pipefish	-	-	Yes	-	-
Syngnathoides biaculeatus	Double-end pipehorse	-	-	Yes	-	-
Urocampus carinirostris	Hairy pipefish	-	-	Yes	-	-
Vanacampus margaritifer	Mother-of-pearl pipefish	-	-	Yes	-	-
Vanacampus phillipi	Port Phillip pipefish	-	-	Yes	-	-
Vanacampus poecilolaemus	Longsnout pipefish	-	-	Yes	-	-

* *Listed only from the EMBA.*

Definitions

Listed threatened species:	A native species listed in Section 178 of the *EPBC Act* as either extinct, extinct in the wild, critically endangered, endangered, and vulnerable or conservation dependent.

Listed migratory species:	A native species that from time to time is included in the appendices to the Bonn Convention and the annexes of JAMBA, CAMBA and ROKAMBA, as listed in Section 209 of the *EPBC Act*.
Listed marine species:	As listed in Section 248 of the *EPBC Act*.

Key

EPBC status (@ June 2018)	V	Vulnerable
	E	Endangered
	CE	Critically endangered
BIA	A	Aggregation
	D	Distribution (i.e., presence only)
	F	Foraging
	M	Migration
Recovery plans	CA	Conservation Advice
(under the EPBC Act 1999)	CMP	Conservation Management Plan
	RP	Recovery Plan
(under the FFG Act 1988)	AS	Action Statement

Great white shark (*Carcharodon carcharias*)

The great white shark is widely distributed and located throughout temperate and sub-tropical waters, with their known range in Australian waters including all coastal areas except the Northern Territory (DSEWPaC, 2013).

Studies of great white sharks indicate that they are usually solitary animals, largely transient and only temporarily resident (e.g., days to weeks) in areas it inhabits (DSE, 2003b; DSEWPaC, 2013). However, individuals are known to return to feeding grounds on a seasonal basis (Klimley & Anderson, 1996). The species moves seasonally along the south and east Australian coasts, moving northerly along the coast during autumn and winter and returning to southern Australian waters by early summer.

Observations of adult sharks are more frequent around fur seal and sea lion colonies, including Wilsons Promontory (approximately 123 km southwest of the activity area) and the Skerries (approximately 185 km northeast of the activity area) (DSE, 2003b).

Juveniles are known to congregate in certain key areas including the Ninety Mile Beach area (including Corner Inlet and Lakes Entrance), where a BIA for breeding is overlapped by the activity area (Figure 4.9). A BIA (distribution only) for the great white shark covers the entire southeast marine region, with the nearest feeding BIA being around Kangaroo Island in South Australia (875 km to the west-northwest).

Given their transitory nature and the proximity of known congregation areas, great white sharks may occur within the activity area and EMBA, and they may have a seasonal overlap if the activity is conducted during early summer.

Shortfin mako shark (*Isurus oxyrinchus*)

The shortfin mako shark is a pelagic species with a circum-global, wide-ranging oceanic distribution in tropical and temperate seas (Mollet *et al*., 2000), though the timing of occurrence is not reported. It is widespread in Australian waters, commonly found in water with temperatures greater than 16°C (Museums Victoria, 2017).

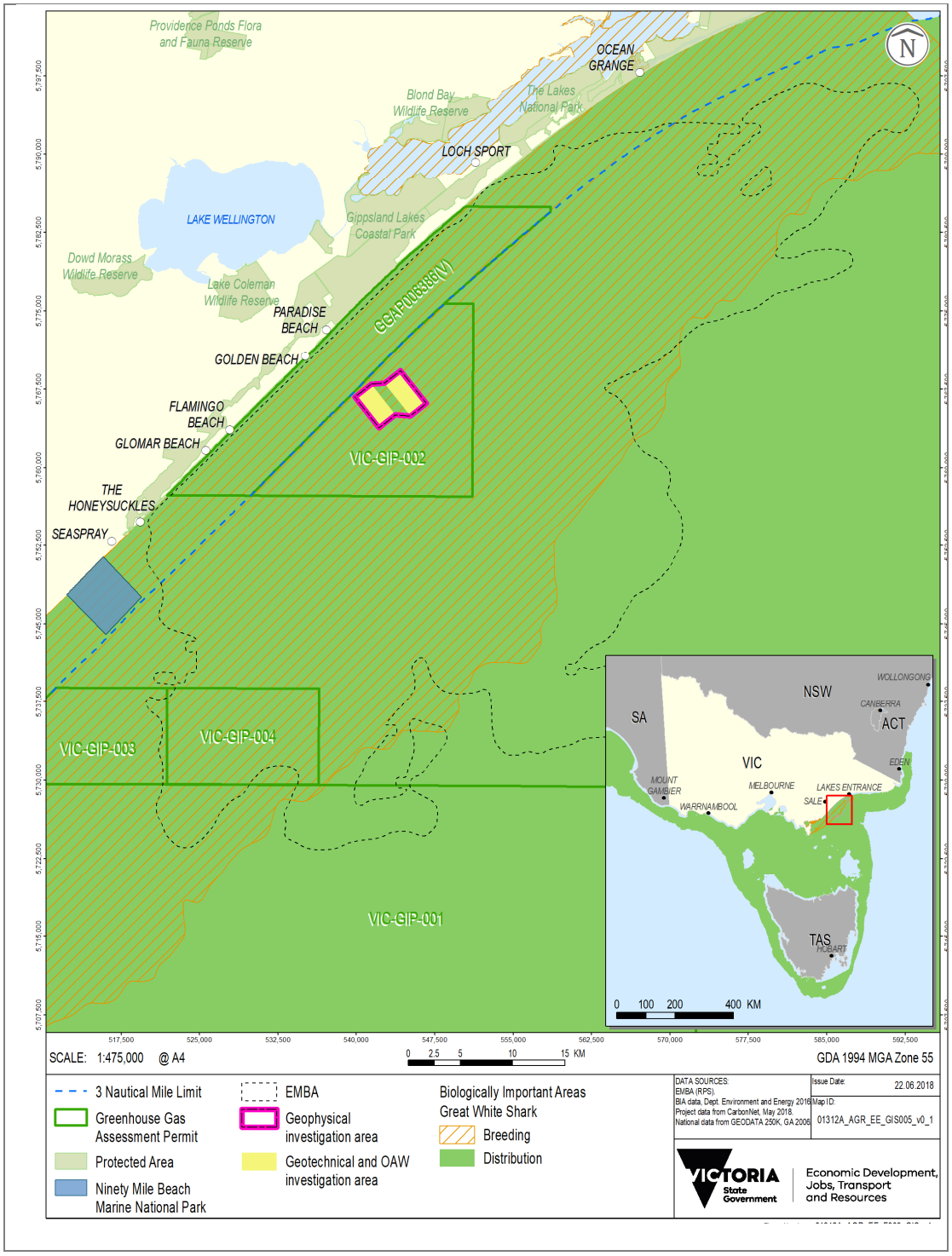


Figure 4.8. BIA for the great white shark

Due to their widespread distribution in Australian waters, shortfin mako sharks may be encountered in the activity area and EMBA, albeit in low numbers.

Sygnathids (EPBC Act: Listed marine species, FFG Act: Not listed)

Twenty-eight of the 34 marine ray-finned fish species identified in the EPBC Act PMST (82%) are sygnathiformes, which includes seahorses, seadragon, pipehorse and pipefish. The majority of these fish species are associated with seagrass meadows, macroalgal seabed habitats, rocky reefs and sponge gardens located in

shallow, inshore waters (e.g., protected coastal bays, harbours and jetties) less than 50 m deep (Museums Victoria, 2017).

The PMST species profile and threats profiles indicate that the sygnathiforme species listed for the EMBA are widely distributed throughout southern, south-eastern and south-western Australian waters. The diverse range of ecological niches afforded by the shallow waters shoreward of the activity area would be expected to provide suitable habitat for these listed species, whereas the absence of reef and seagrass habitat observed within the activity area would suggest the diversity and abundance of these species would be far less in the activity area.

4.4.5. Cetaceans

The PMST (DoEE, 2018a) indicates that five whale species and seven dolphin species may reside within or migrate through the activity area, with an additional three whale species recorded within the EMBA (as marked with an asterisk [*] in Table 4.3). A description of species listed in Table 4.3 is focused on threatened and migratory species known to occur in the nearshore Gippsland region.

Table 4.3. EPBC Act-listed cetaceans that may occur in the EMBA

Scientific name	Common name	EPBC Act status			FFG Act status	BIA within the EMBA?	Recovery Plan in place?
		Listed threatened species	Listed migratory species	Listed marine species			
Whales							
Balaenoptera acutorostrata	Minke whale	-	-	Yes	-	-	-
*Balaenoptera borealis**	Sei whale	V	Yes	Yes	-	-	CA
Balaenoptera musculus	Blue whale (pygmy)	E	Yes	Yes	T	F	RP, AS
*Balaenoptera physalus**	Fin whale	V	Yes	Yes	-	-	CA
Caperea marginata	Pygmy right whale	-	Yes	Yes	-	F	-
Eubalaena australis	Southern right whale	E	Yes	Yes	T	M/R	CMP, AS
Megaptera novaeangliae	Humpback whale	V	Yes	Yes	T	-	CA, AS
*Pseudorca crassidens**	False killer whale	-	-	Yes	-	-	-
Dolphins							
Delphinus delphis	Common dolphin	-	-	Yes	-	-	-
Grampus griseus	Risso's dolphin	-	-	Yes	-	-	-

Scientific name	Common name	EPBC Act status			FFG Act status	BIA within the EMBA ?	Recovery Plan in place?
		Listed threatened species	Listed migratory species	Listed marine species			
Lagenorhyn-chus obscurus	Dusky dolphin	-	Yes	Yes	-	-	-
Orcinus orca	Killer whale	-	-	Yes	-	-	-
Tursiops aduncus	Indian Ocean bottlenose dolphin	-	-	Yes	-	-	-
Tursiops truncatus	Bottlenose dolphin	-	-	Yes	-	-	-

* *Listed only from the EMBA.*

Legend as per Table 2, with the exception that 'T' in the FFG Act column is 'threatened' under the *FFG Act 1988* (Vic).

Pygmy blue whale (*Balaenoptera musculus*)

Blue whales are the largest living animals on earth, growing to a length of over 30 m, weighing up to 180 tonnes and living up to 90 years (DoE, 2015b). The Tasman-Pacific pygmy blue whale (*B. musculus. brevicauda*) is the sub-species that migrates through Bass Strait, found in waters north of 55°S (DSEWPC, 2012b). Blue whales are a highly mobile species that feed on krill (euphausids, *Nyctiphane australis*).

A BIA for 'likely foraging' for the pygmy blue whale covers most of Bass Strait, including the activity area, with known foraging areas (abundant food source/annual high use area) occurring off the southwest Victorian coast (Figure 4.10).

The time and location of the appearance of blue whales in the South-east Marine Region generally coincides with the upwelling of cold water in summer and autumn along the southeast South Australian and southwest Victoria coast (the Bonney Upwelling) and the associated aggregations of krill that they feed on (DoE, 2015b; Gill and Morrice, 2003). This is a key feeding area for the species.

Blue whale migration patterns are thought to be similar to those of the humpback whale, with the species feeding in mid-to high-latitudes (south of Australia) during the summer months and moving to temperate/tropical waters in the winter for breeding and calving. Pygmy blue whale migration is oceanic and no specific migration routes have been identified in the Australasian region (DoE, 2015b).

Given the intersection of the foraging BIA with the activity area, it is possible that pygmy blue whales may occur in the activity area and the EMBA, though this possibility is low, and sightings would be most likely to occur during autumn.

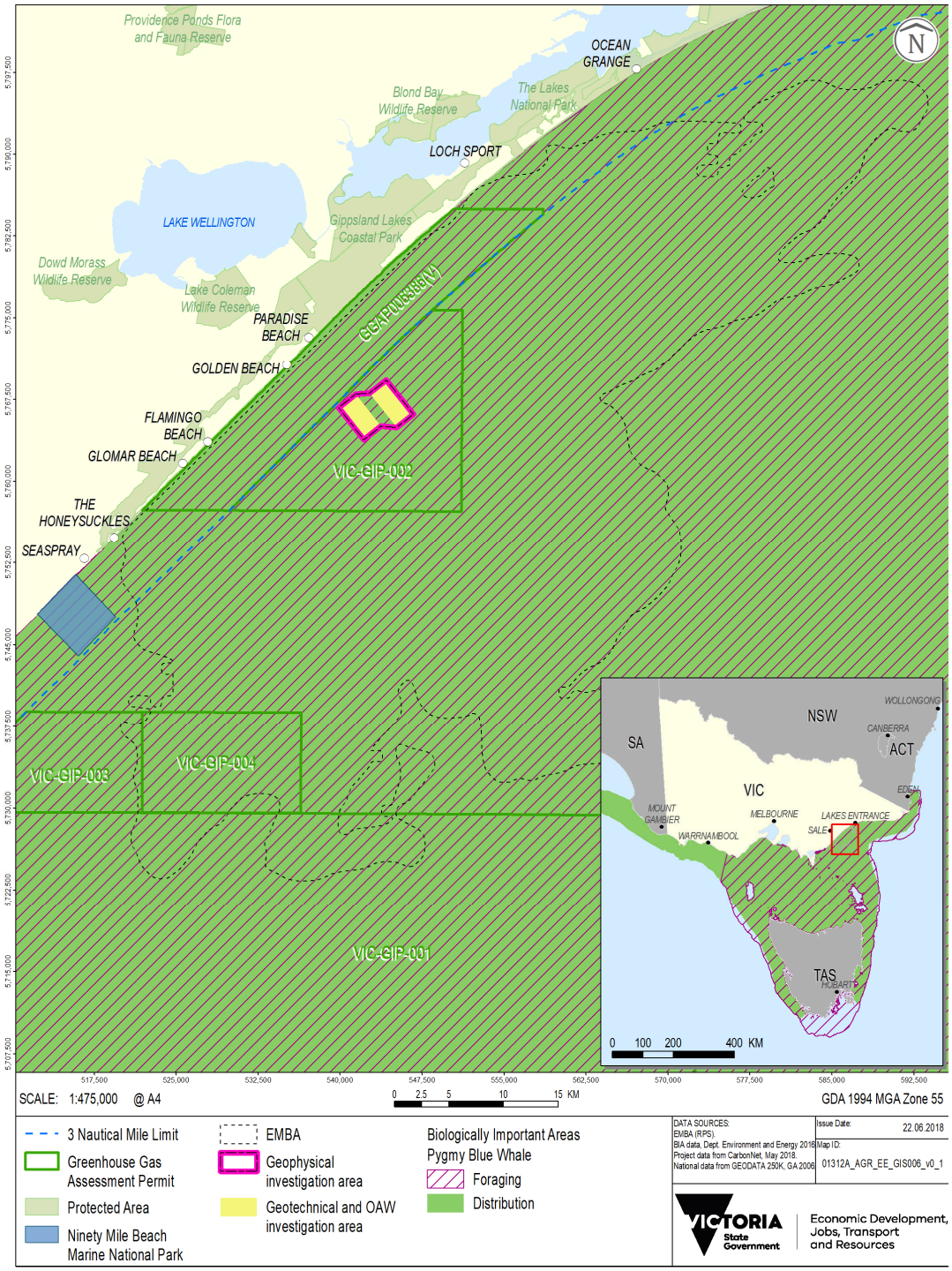


Figure 4.9. Pygmy blue whale BIA

Fin whale (*Balaenoptera physalus*)

The fin whale is the second-largest whale species after the blue whale, growing up to 27 m long and weighing up to 70 tonnes (TSSC, 2015d). It is a cosmopolitan species

and is found from polar to tropical waters (more commonly in temperate waters) (TSSC, 2015d).

They are considered rare in Australian waters (Bannister *et al*., 1996), with available information suggesting they are more common in deeper water (TSSC, 2015d). They show well-defined long annual migrations between higher latitude feeding grounds in summer to lower latitude breeding ground in winter (TSSC, 2015d). Migratory movements are essentially north–south with little longitudinal dispersion.

Based upon the species preference for offshore waters, the absence of a BIA in Australian waters and the nearshore location of the activity area, it is considered unlikely that this species occurs within the activity area or the EMBA.

Southern right whale (*Eubalaena australis*)

Southern right whales are medium to large black (or less commonly grey-brown) baleen whales (DSEWPC, 2012b). They reach a maximum length of approximately 17.5 m and a weight of around 80 tonnes, with mature females slightly larger than males (DSEWPC, 2012b). The Australian population is estimated at 3,500 individuals (Charlton *et al*., 2014).

The southern right whale is present off the Australian coast between May and October (sometimes as early as April and as late as November) (DSEWPC, 2012b) (Figure 4.11).

Small but growing numbers of non-calving whales regularly aggregate for short periods of time in coastal waters off Peterborough, Port Campbell, Port Fairy and Portland in Victoria, located more than 400 km west of the activity area, with waters less than 10 m deep preferred (DSEWPC, 2012b).

The closest known calving/nursery grounds to the activity area occurs at Logan's Beach off the coast of Warrnambool in southwest Victoria (approximately 432 km west of the activity area) (DSEWPAC, 2012).

The BIA for migration/resting on migration for the southern right whale occurs through all Victorian state waters, including those around the activity area, as they are known to generally occur within 2 km of shorelines (DSEWPC, 2012b). However, a defined near-shore coastal migration corridor is considered unlikely given the absence of any predictable directional movement for the species (DSEWPC, 2012b).

Due to the uncertainties associated with the exact migratory paths in eastern Bass Strait, there is a low potential that southern right whales may be encountered through the activity area and EMBA between May and October (likely outside of the proposed G&G investigations).

Humpback whale (*Megaptera novaeangliae*)

The humpback whale is a moderately large (15-18 m long) baleen whale that has a worldwide distribution but geographic segregation. Humpback whales are found in Australian offshore and Antarctic waters, feeding primarily on krill in Antarctic waters. The eastern Australian population of humpback whales is referred to as Group E1 by the International Whaling Commission, one of seven distinct breeding stocks in the southern hemisphere (TSSC, 2015e).

Bass Strait represents part of the core range of the E1 Group, but feeding, resting or calving is not known to occur in Bass Strait (TSSC, 2015e), though migration through Bass Strait may occur. The nearest area that humpback whales are known to congregate (forage) is at the southern-most part of NSW (near the eastern border of Victoria), approximately 232 km northeast of the activity area. Twofold Bay (Eden) off the NSW south coast is the nearest known feeding area (a BIA) for humpback whales, located 250 km northeast of the activity area.

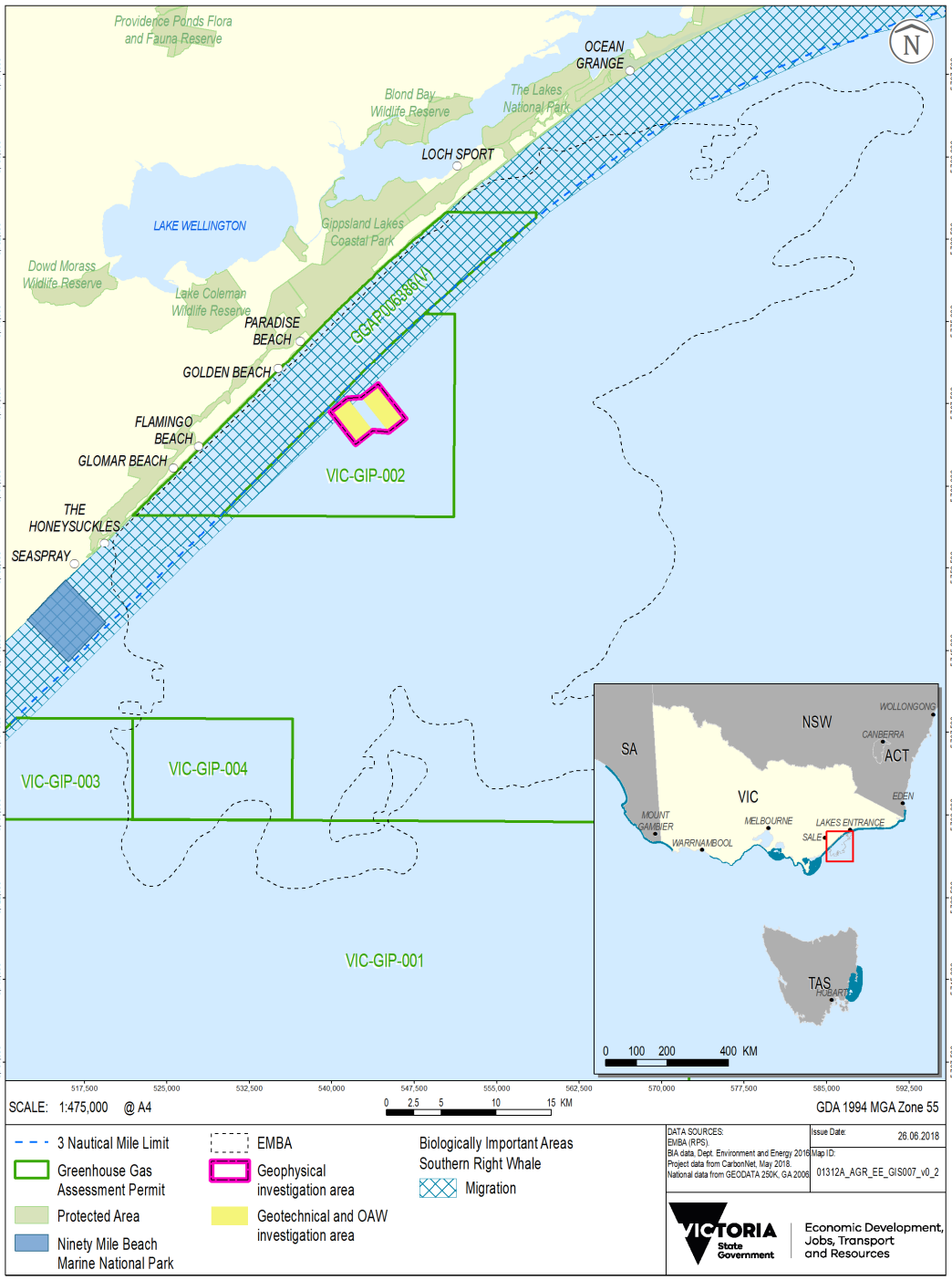


Figure 4.10. Southern right whale BIA

Humpback whales undertake annual migrations between their summer feeding grounds in Antarctic waters to their breeding and calving grounds in sub-tropical and tropical inshore waters, migrating up the Australian east coast (TSSC, 2015e). The northern migration off the southeast coast starts in April and May, with the southern migration occurring from November to December. This migration tends to occur close to the coast, along the continental shelf boundary in waters about 200 m deep (TSSC, 2015e).

As the activity area and the EMBA represent a core range for humpback whales, there is a likelihood that they may be encountered, particularly during April, May, November and December, though this likelihood is considered low due to their preference for migrating along the edge of the continental shelf.

Dolphins

None of the six dolphin species listed in the PMST are listed as threatened under the EPBC Act or FFG Act. Many dolphins are cosmopolitan species that are generally restricted to continental shelf environments. The common dolphin (*Delphinus delphis*) and the bottlenose dolphin (*Tursiops truncatus*) are the two most common dolphin species in the region, and are present throughout southern Australia.

The Burrunan dolphin (*Tursiops australis*) is a species of bottlenose dolphin only recognised as a separate species in 2011 that is present in the Gippsland Lakes (not listed in the EPBC PMST or the VBA for the EMBA). This species is listed as threatened under the FFG Act. Only two resident populations of Burrunan dolphin are known to occur, comprising about 50 individuals in the Gippsland Lakes and 100 individuals in Port Phillip Bay (Charlton-Robb *et al*., 2011). It is unclear whether migration occurs between these sites, though researchers from the Marine Mammal Foundation released information in mid-2017 indicating that there are genetic similarities between the dolphins in the Gippsland Lakes and around Tasmania's Freycinet Peninsula (ABC, 2017). The Marine Mammal Foundation believes a transient group of male dolphins swim between Gippsland and eastern Tasmania to breed with two different populations of female dolphins. The taxonomic validity of this new species has been questioned by the Committee for Taxonomy for the International Society for Marine Mammology (DRI, 2016).

4.4.6. Pinnipeds

There are two pinniped species recorded under the EPBC Act PMST as potentially occurring within the activity area and EMBA (DoEE, 2018a), these being the New Zealand fur-seal (*Arctocephalus forsteri*) and Australian fur-seal (*Arctocephalus pusillus*). These species are not listed as threatened under the FFG Act. There are no breeding or haul-out sites in the activity area or EMBA for both species, though the area may provide year-round foraging habitat. There is no BIA for these species in the EMBA. Australian fur-seals are regularly seen resting and foraging on and around the petroleum production platforms in the region.

4.4.7. Reptiles

Three species of marine turtle are listed under the EPBC Act as potentially occurring in the activity area and EMBA, these being the loggerhead turtle (*Caretta caretta*), leatherback turtle (*Dermochelys coriacea*) and green turtle (*Chelonia mydas*). The two former species are listed as endangered, and the latter listed as vulnerable under the EPBC Act. All three species are listed as migratory and marine species under the Act.

No BIAs for turtles occur within Bass Strait, with turtles in Victorian waters considered to be rare vagrants outside their usual range (EA, 2003) of tropical and sub-tropical waters.

4.4.8. Avifauna

Forty-nine (49) bird species (seabirds and shorebirds) are listed under the EPBC Act as potentially occurring in the activity area, with an additional 19 species recorded within the EMBA (as marked with an asterisk [*] in Table 4.4) (DoEE, 2018a). The majority of these are listed as migratory and marine species.

Table 4.4. EPBC Act-listed bird species that may occur in the EMBA

Scientific Name	Common Name	EPBC Act status			FFG Act status	BIA within the EMBA?	Recovery Plan in place?
		Listed threatened species	Listed migratory species	Listed marine species			
True seabirds (27 species)							
Albatross							
Diomedea antipodensis	Antipodean albatross	V	Yes	Yes	-	Foraging	Generic RP in place for all albatross in Australia, + AS for all albatross
Diomedea gibsoni	Gibson's albatross	V	Yes	Yes	-	-	
Diomedea epomophora (sensu stricto)	Southern royal albatross	V	Yes	Yes	T	-	
Diomedea exulans (sensu lato)	Wandering albatross	V	Yes	Yes	T	Foraging	
Diomedea sanfordi	Northern royal albatross	E	Yes	Yes	-	-	
Phoebetria fusca	Sooty albatross	V	Yes	Yes	T	-	
Thalassarche bulleri	Buller's albatross	V	Yes	Yes	T	Foraging	
Thalassarche bulleri platei	Northern Buller's albatross	V	-	-	-	Foraging	
Thalassarche cauta	Shy albatross	V	Yes	Yes	T	Foraging	
Thalassarche cauta steadi	White-capped albatross	V	Yes	Yes	-	-	
Thalassarche chrysostoma	Grey-headed albatross	E	Yes	Yes	T	-	
*Thalassarche eremita**	Chatham albatross	E	Yes	Yes	-	-	
Thalassarche impavida	Campbell albatross	V	Yes	Yes	-	Foraging	
Thalassarche melanophris	Black-browed albatross	V	Yes	Yes	-	Foraging	
Thalassarche salvini	Salvin's albatross	V	Yes	Yes	-	-	
Thalassarche sp. nov.	Pacific albatross	V	Yes	Yes	-	-	

Scientific Name	Common Name	EPBC Act status			FFG Act status	BIA within the EMBA?	Recovery Plan in place?
		Listed threatened species	Listed migratory species	Listed marine species			
Thalassarche steadi	White-capped albatross	V	Yes	Yes	-	-	
Petrels							
Fregetta grallaria grallaria	White-bellied storm-petrel	V	-	-	-	-	-
Halobaena caerulea	Blue petrel	V	-	Yes	-	-	-
Macronectes giganteus	Southern giant petrel	E	Yes	Yes	T	-	Generic RP and AS for giant petrels
Macronectes halli	Northern giant petrel	V	Yes	Yes	T	-	
Pterodroma leucoptera leucoptera	Gould's petrel	E	-	-	-	-	RP
Other seabirds							
Ardenna carneipes	Flesh-footed shearwater	-	Yes	Yes	-	-	-
Catharacta skua	Great skua	-	-	Yes	-	-	-
*Haliaeetus leucogaster**	White-bellied sea-eagle	-	-	Yes	T	-	-
Pachyptila turtur subantarctica	Fairy prion (southern)	V	-	-	-	-	CA
Pandion haliaetus	Osprey	-	Yes	Yes	-	-	-
True shorebirds (41 species)							
Actitis hypoleucos	Common sandpiper	-	Yes	Yes	-	-	-
Ardea alba	Great egret	-	-	Yes	-	-	-
*Ardea ibis**	Cattle egret	-	-	Yes	-	-	AS
Arenaria interpres	Ruddy turnstone	-	Yes	Yes	-	-	-
*Botaurus poiciloptilus**	Australian bittern	E	-	-	T	-	CA
Calidris acuminata	Sharp-tailed sandpiper	-	Yes	Yes	-	-	-
Calidris canutus	Red knot	E	Yes	Yes	-	-	
Calidris ferruginea	Curlew sandpiper	CE	Yes	Yes	T	-	-

Scientific Name	Common Name	EPBC Act status			FFG Act status	BIA within the EMBA?	Recovery Plan in place?
		Listed threatened species	Listed migratory species	Listed marine species			
Calidris melanotos	Pectoral sandpiper	-	Yes	Yes	Yes	-	-
*Calidris ruficolis**	Red-necked stint	-	Yes	Yes	-	-	-
Charadrius bicinctus	Double-banded plover	-	-	Yes	-		
Charadrius leschenaultii	Greater sand plover	V	Yes	Yes	-	-	CA
Charadrius mongolus	Lesser sand plover	E	Yes	Yes	-	-	CA
*Charadrius ruficapillus**	Red-capped plover	-	-	Yes	-	-	-
*Gallinago hardwickii**	Latham's snipe	-	Yes	Yes	-	-	-
*Gallinago megala**	Swinhoe's snipe	-	Yes	Yes	-	-	-
*Gallinago stenura**	Pin-tailed snipe	-	Yes	Yes	-	-	-
Heteroscelus brevipes	Grey-tattler	-	Yes	Yes	T	-	-
*Himantopus himantopus**	Black-winged stilt	-	-	Yes	-	-	-
Hirundapus caudacutus	White-throated needletail	-	-	Yes	-	-	-
*Lathamus discolour**	Swift parrot	CE	-	Yes	-	-	AS
*Limosa lapponica bauera**	Bar-tailed godwit	V	Yes	Yes	-	-	-
*Limosa lapponica menzbieri**	Northern Siberian bar-tailed godwit	CE	Yes	Yes	-	-	-
Limosa limosa	Black-tailed godwit	-	Yes	Yes	-	-	-
*Neophema chrysogaster**	Orange-bellied parrot	CE	-	Yes	T	-	RP, AS
Numenius madagascariensis	Eastern curlew	CE	Yes	Yes	T	-	CA
*Numenius minutus**	Little curlew	-	Yes	Yes	-	-	-
Numenius phaeopus	Whimbrel	-	Yes	Yes	-	-	-

Scientific Name	Common Name	EPBC Act status			FFG Act status	BIA within the EMBA?	Recovery Plan in place?
		Listed threatened species	Listed migratory species	Listed marine species			
Philomachus pugnax	Ruff (Reeve)	-	Yes	Yes	-	-	-
Pluvialis fulva	Pacific golden plover	-	Yes	Yes	-	-	-
Pluvialis squatarola	Grey plover	-	Yes	Yes	-	-	-
Recurvirostra novaehollandiae	Red-necked avocet	-	-	Yes	-	-	-
*Rostratula australis**	Australian painted snipe	E	-	Yes	T	-	CA
*Sterna (Sternula) albifrons**	Little tern	-	Yes	Yes	T	-	AS
Sterna (Sternula) fuscuta	Sooty tern	-	-	Yes	-	-	-
Sterna (Sternula) nereis nereis	Australian fairy tern	V	-	-	T	-	CA
*Thinornis rubricollis rubricollis**	Hooded plover (eastern)	V	-	Yes	T	-	AS
Tringa glareola	Wood sandpiper	-	Yes	Yes	-	-	-
*Tringa nebularia**	Common greenshank	-	Yes	Yes	-	-	-
Tringa stagnatilis	Marsh sandpiper	-	Yes	Yes	-	-	-
Xenus cinereus	Terek sandpiper	-	Yes	Yes	T	-	-

Exclusively Seabirds

Albatrosses (and giant-petrels) are among the most dispersive and oceanic of all birds, spending more than 95% of their time foraging at sea in search of prey and usually only returning to land (remote islands) to breed (EA, 2001). These species breed in remote islands of Antarctica and the Southern Ocean.

All Australian waters can be considered foraging habitat for albatross and petrels, with the most important habitat considered to be south of 25°S (DSEWPC, 2011), which includes the activity area. Given these species' ability to cover vast ocean distances while foraging, it is possible they may overfly and forage in the vicinity of the activity area.

The albatross and petrel species listed have a widespread distribution throughout the southern hemisphere.

BIAs for foraging exist within various parts of the EMBA for six of the albatross species (black-browed, Buller's, Campbell, Indian yellow-nose, shy and wandering albatross), with foraging taking place throughout all of Bass Strait.

Other seabirds listed in the PMST may occur within the activity area and EMBA as their ecological niches dictate.

Shorebirds and Coastal Species

The plovers, terns, sandpipers, snipes, godwits and other shorebird species feed on a range of molluscs, worms, crustaceans and insects along the shoreline or the wetlands behind the coastal dunes, some breeding overseas before returning to Australia, while others breed in Australia and nest along the sandy beaches of the Ninety Mile Beach.

4.4.9. Marine Pests

Marine pests known to occur in South Gippsland, according to ParksVic (2015) and Butler et al (2012) include:

- Pacific oyster (*Crassostrea gigas*) – small number of this oyster species are reported to occur in Western Port Bay and at Tidal River in the Wilsons Promontory National Park (DELWP, 2015).
- Northern pacific seastar (*Asterias amurensis*) – prefer soft sediment habitat, but also use artificial structures and rocky reefs, living in water depths usually less than 25 m (but up to 200 m water depths)..
- New Zealand screw shell (*Maoricolpus roseus*) – lies on or partially buried in sand, mud or gravel in waters up to 130 m deep. It can densely blanket the sea floor with live and dead shells and compete with native scallops and other shellfish for food. This species is present in eastern Bass Strait, forming extensive and dense beds on sandy seabeds (Patil *et al*., 2004).
- European shore crab (*Carcinus maenas*) – prefers intertidal areas, bays, estuaries, mudflats and subtidal seagrass beds, but occurs in waters up to 60 m deep. It is presumed to occur on the intertidal reefs of all the marine national parks in Gippsland, except the Ninety Mile Beach MNP (which has no intertidal reef).

The Pacific oyster and European shore crab are known to occur in the Gippsland Lakes (Hirst & Bott, 2016).

4.5. Cultural Heritage Values

4.5.1. Aboriginal Heritage

The coastline adjacent to the activity area is occupied by the *Gunaikurnai* language group. The Gippsland coastline is of significant Aboriginal cultural heritage significance. There are numerous areas containing Aboriginal shell middens (i.e., the remains of shellfish eaten by Aboriginal people) along the sand dunes of the coast. Coastal shell middens are found as layers of shell exposed in the side of dunes, banks or cliff tops or as scatters of shell exposed on eroded surfaces.

4.5.2. Maritime Archaeological Heritage

Shipwrecks (together with their associated relics) over 75 years old are protected within Commonwealth waters under the Historic *Shipwrecks Act 1976* (Cth) and in Victorian waters under the *Victorian Heritage Act 1995* (Vic).

Shipwrecks

There are no shipwrecks mapped as occurring in the activity area or the marine portion of the EMBA. The Australian National Shipwreck and Relic Database (DoEE, 2017j) lists four shipwrecks occurring nearby but outside the EMBA.

Shipwreck Protection Zones

Of the 650 shipwrecks in Victoria, nine have been placed within protected zones (a no-entry zone of 500-m radius [78.5 ha] around a particularly significant and/or fragile shipwreck) (DELWP, 2017). None of these are located within the activity area or EMBA.

4.6. Socio-economic Environment

This section describes the social and economic environment of the activity area and the EMBA.

4.6.1. Coastal Settlements

The coastline adjacent to the activity area is sparsely populated, with the adjoining townships of Golden Beach and Paradise Beach being the closest. These towns are located within the Wellington Shire Council.

The populations for Golden Beach and Paradise Beach are 293 and 160, respectively. In Golden Beach, 68% of the 461 private dwellings are unoccupied, while 72% of the 308 private dwellings in Paradise Beach are unoccupied.

Camping among the sand dunes is also available along this section of coastline. Golden Beach has a small group of retail shops, a community hall, church, caravan park, football oval, bowling green and 9-hole golf course.

4.6.2. Native Title

The National Native Title Tribunal (NNTT) database identifies that there is Native Title Determination registered over much of the coastline adjacent to the activity area, this being for the Gunai/Kurnai People (VCD2010/001).

There are no Native Title Claims over the activity area or adjacent coastline (NNTT, 2017). There are no Indigenous Land Use Agreements (ILUA) registered by the NNTT along the coastline adjacent to the activity area (NNTT, 2017).

4.6.3. Commercial Fishing

Several Commonwealth and Victorian commercial fisheries are licensed to operate in and around the activity area and the EMBA.

Commonwealth-managed Fisheries

Commonwealth fisheries are managed by the AFMA under the *Fisheries Management Act 1991* (Cth). Their jurisdiction covers the area of ocean from 3 nm from the coast out to the 200 nm limit (the extent of the AFZ). Commonwealth commercial fisheries with jurisdictions to fish the EMBA are the:

- Bass Strait Central Zone Scallop Fishery;

- Eastern Tune and Billfish Fishery;
- Eastern Skipjack Tuna Fishery;
- Southern Bluefin Tuna Fishery;
- Small Pelagic Fishery (eastern sub-area);
- Southern Squid Jig Fishery; and
- Southern and Eastern Scalefish and Shark (SESS), incorporating;
    - Gillnet and Shark Hook sector.
    - South East Trawl sector.
    - Scalefish Hook sector.

The only Commonwealth-managed fishery currently operating in the activity area is the SESS Fishery.

Victorian-managed Fisheries

Victorian-managed commercial fisheries with access licences that authorise harvest in the waters of the activity area and the EMBA include the following (noting that not all actually operate in the area):

- Ocean Scallop;
- Rock Lobster (Eastern zone);
- Ocean Access (general, all species);
- Ocean Purse Seine (noted by VFA as being the most active fishery in the region);
- Trawl (inshore);
- Abalone (central zone) (does not operate in the activity area);
- Wrasse (does not operate in the activity area); and
- Banded Morwong (by permit) (does not operate in the activity area).

The activity area intersects small portions of the VFA catch and effort grid cells E39 and E40. These grid cells are based on divisions of 10' latitude (approximately 10 nm) and 12.1' longitude (approximately 12.1 nm).

Table 4.5 provides a presence/absence of fishing activity for catch and effort grid cells E39 and E40 for the last five financial years (2012-13 to 2016/17, inclusive). This data indicates that the ocean scallop fishery has not been active in the activity area and immediate surrounds for the last two financial years, and that the inshore trawl has not operated for a number of years.

Table 4.6 summarises the key facts for each for the Commonwealth and Victorian fisheries that actively fishes in the activity area and/or the EMBA.

Table 4.5. Fisheries catch data from the activity area (grid cells E39 & E40)

Year	Catch (tonnes)	Fisheries fished				
		Ocean scallop	Rock lobster	Ocean access	Ocean purse seine	Inshore trawl
2012/13	ID	1 day		25 days		
2013/14	ID	31 days				
2014/15	ID	1 day	6 days			
2015/16	ID		19 days			
2016/17	ID		3 days	5 days		

ID = Insufficient data to report (where there are fewer than 5 licence holders in a fishing grid cell, VFA policy is that data is not publicly released in order to protect confidentiality).

Green cells denotes fishing activity.

Table 4.6. Commercial fisheries that fish within the activity area and/or EMBA

Fishery	Target species	Geographic extent fishery	Fishing season	Fishing methods, vessels and licences	Catch data and other information
Commonwealth-managed fisheries					
Shark Gillnet and Shark Hook Sector	Gummy shark (*Mustelus antarcticus*) is the key target species, with bycatch of elephant fish (*Callorhinchus milii*), sawshark (*Pristiophorus cirratus, P. nudipinnis*), and school shark (*Galeorhinus galeus*).	Waters from the NSW/Victorian border westward to the SA/WA border, including the waters around Tasmania, from the low water mark to the extent of the AFZ. Most fishing occurs in waters adjacent to the coastline in Bass Strait, with a low to medium fishing intensity over the activity area. *Activity area intersects 0.0014% of the fishery and the EMBA intersects 0.165% of the fishery.*	12-month season, beginning 1st May.	Demersal gillnet and a variety of line methods. 2016-17 – 74 permits and 62 active vessels. 2015-16 – 74 permits and 61 active vessels. 2014-15 – 74 permits and 69 active vessels. Landing ports in Victoria are Lakes Entrance, San Remo and Port Welshpool.	2016-17 – 2,118 tonnes worth $18.3 million. 2015-16 – 2,233 tonnes worth $18.4 million. 2014-15 – 2,005 tonnes worth $16.9 million. In 2015-16, the SESS Fishery is the largest Commonwealth fishery in terms of volume produced (there is no 2016-17 data available).

Fishery	Target species	Geographic extent fishery	Fishing season	Fishing methods, vessels and licences	Catch data and other information
Commonwealth Trawl Sector (CTS)	Key species targeted are eastern school whiting (*Sillago flindersi*), flathead (*Platycephalus richardsoni*) and gummy shark (*Mustelus antarcticus*).	Covers the area of the AFZ extending southward from Barrenjoey Point (north of Sydney) around the New South Wales, Victorian and Tasmanian coastlines to Cape Jervis in South Australia. Effort increasingly concentrated on the continental shelf, rather than historical areas of the slope. *Activity area intersects 0.0017% of the fishery and the EMBA intersects 0.20% of the fishery.*	12-month season, beginning 1st May. Highest catches from September to April.	Multi-gear fishery, but predominantly demersal otter trawl and Danish-seine methods. 2016-17 – 57 trawl fishing rights with 50 active trawl and Danish-seine vessels. 2015-16 – 57 trawl fishing rights with 51 active trawl and Danish-seine vessels. 2014-15 – 57 trawl fishing rights with 50 active trawl and Danish-seine vessels. In the activity area, between 7 and 13 vessels have operated since 2007. Primary landing ports are in NSW, and Lakes Entrance and Portland in Victoria.	2016-17 – 8,691 tonnes, with no value assigned. 2015-16 – 9,025 tonnes, worth $41.5 million. 2014-15 – 8,264 tonnes worth $37.7 million. Logbook catches have been gradually declining since 2001. Danish seine activity is the key method in Gippsland, with low fishing intensity in the activity area in the last few years.

Fishery	Target species	Geographic extent fishery	Fishing season	Fishing methods, vessels and licences	Catch data and other information
Victorian					
Bass Strait Scallop Fishery (Victorian zone)	Commercial scallop (*Pecten fumatus*). The 2017-18 VFA stock assessment found no scallops within the activity area or EMBA in commercial quantities, so it is unlikely that the EMBA will be fished for many years.	Extends 20 nm from the high tide water mark of the entire Victorian coastline (excluding bays and inlets where commercial scallop fishing is prohibited). Management of the Bass Strait Scallop fishery was split between the Commonwealth, Victoria and Tasmania in 1986 under an Offshore Constitutional Settlement, whereby Commonwealth central, Victorian and Tasmanian zones were created. *Activity area intersects 0.0552% of the fishery and the EMBA intersects 0.089% of the fishery.*	12-month season, beginning 1st of April. Fishing usually occurs during the winter months, but can occur from May to the end of November. The 2017/18 scallop stock assessment found that they are present in much lower numbers than historically, with a total biomass of about 5,107 t (from Wilson's Promontory to the Victoria/NSW border). Scallops have highly variable levels of natural mortality, with an historical 'boom' or 'bust' nature. Fishing activity in the area is currently low.	Towed scallop dredges (typically 4.5 m wide) that target dense aggregations ('beds') of scallop. A tooth-bar on the bottom of the mouth of the dredge lifts scallops from the seabed and into the dredge basket. As of September 2017, there are 90 fishery access licences available. Only a few vessels fishing these licenses operate in any one year (generally between 12 and 20). Vessels are typically based out of Lakes Entrance or Port Welshpool, although licence holders may fish the entire coastline. Some licence holders also have entitlements to fish the Commonwealth scallop fishery, inshore trawl, Commonwealth SESS fishery and the southern squid jig fishery. The fishery operates to its own Scallop Management Plan (i.e., not one developed by the VFA).	There has been no catch in the activity area during 2016/17 and 2015/16, with little effort prior to this and very low catches (less than 1 tonne over the period 2011-16). Zero quotas were in place for the 2010/11, 2011/12 and 2012/13 seasons due to a lack of commercial scallop quantities. The TACC has been set at 135 tonnes for the 2013/14, 2014/15, 2015/16, 2016/17 and 2017/18 fishing seasons, and is likely to remain at this level for the foreseeable future. Scallop spawning normally occurs from late winter to early spring, with larvae drifting as plankton for up to six weeks before first settlement. Juvenile scallops reach marketable size within 18 months.

Fishery	Target species	Geographic extent fishery	Fishing season	Fishing methods, vessels and licences	Catch data and other information
Rock Lobster Fishery (eastern zone; Lakes Entrance region) (Figure 5.45)	Southern rock lobster (*Jasus edwardsii*). Very small bycatch of species including southern rock cod (*Lotella* and *Pseudophycis* spp), hermit crab (family Paguroidea), leatherjacket (*Monacanthidae* spp) and octopus (*Octopus* spp). SETFIA has stated that octopus is now being sighted in the area for the first time since the 1990s and that Moreton Bay bugs (*Thenus orientalis*) are spawning near the Ninety Mile Beach MNP, though it is not clear whether these are fished.	The eastern zone stretches from Apollo Bay in southwest Victoria to the Victorian/NSW border. Rock lobster abundance decreases moving from western Victoria to eastern Victoria. Larval release occurs across the southern continental shelf, which is a high-current area, facilitating dispersal. The pelagic phyllosoma larval phase lasts around 12–18 months. *Activity area intersects 0.03% of the fishery (eastern zone) and the EMBA intersects 3.97% of the fishery (eastern zone).*	Closed season for: • Female lobsters – 1 June to 15 November to protect females in berry during spawning period. • Male lobsters – 15 September to 15 November to protect males during their moulting period when soft shells increase their vulnerability. Catches are generally highest from August to January.	Fished from coastal rocky reefs in waters up to 150 m depth, with most of the catch coming from inshore waters less than 100 m deep. Baited pots are generally set and retrieved each day, marked with a surface buoy. As of September 2017, there were 36 fishery access licences in the eastern zone. Only one lobster fisher operates in the EMBA (shoreward of the activity area), fishing a small section of mapped reef in water depths between 15-20 m.	In the eastern zone, catches for the last five seasons were: • 2015/16 – 58 t valued at $5.1 million. • 2014/15 – 59 t valued at $5 million. • 2013/14 – 51 t valued at $3.6 million. • 2012/13 – 48 t valued at $2.7 million. • 2011/12 – 65 t valued at $3.9 million.
Multi-species Ocean Fishery					

Fishery	Target species	Geographic extent fishery	Fishing season	Fishing methods, vessels and licences	Catch data and other information
Ocean Access (or Ocean General) Fishery	Gummy shark (*Mustelus antarcticus*), school shark (*Galeorhinus galeus*), Australian salmon (*Arripis trutta*), snapper (*Pagrus auratus*). Small bycatch of flathead (*Platycephalidae* spp).	Entire Victorian coastline, excluding marine reserves, bays and inlets.	Year-round. Most fishing undertaken off Lakes Entrance occurs between April and July.	Utilises mainly longlines (200 hook limit), but also haul seine nets (maximum length of 460 m) and mesh nets (maximum length of 2,500 m per licence). As of September 2017, there are 171 fishery access licences. Fishing usually conducted as day trips from small vessels (<10 m in length).	There is insufficient catch data (catch data is combined with other fisheries and therefore unable to be distinguished on a stand-alone basis).
Ocean Purse Seine Fishery	Australian sardine (*Sardinops sagax*), Australian salmon (*Arripis trutta*) and sandy sprat (*Hyperlophus vittatus*) are the main species. Southern anchovy (*Engraulis australis*) caught in some years.	Entire Victorian coastline, excluding marine reserves, bays and inlets.	Year-round.	Purse seine, which is generally a highly selective method that targets one species at a time, thereby minimising bycatch. Purse seines do not touch the seabed. A lampara net may also be used. Only one licence is active in Victorian waters (based out of Lakes Entrance), with fishing focused close to shore and during the day. This licence is held by Mitchelson Fisheries Pty Ltd, a family business that catches primarily sardines, salmon, mackeral, sandy sprat, anchovy and white bait using the *Maasbanker* purse seine vessel.	

Sources: Agriculture Victoria (Fisheries) (2017); FRDC (2017), SETFIA and Fishwell Consulting (2017), VFA (2018), Sen (2011) and consultation with VFA.

4.6.4. Recreational Fishing

Recreational fishing along the Gippsland coast typically targets snapper, King George whiting, flathead, bream, sharks, tuna, calamari, and Australian salmon.

Recreational fishing and boating is largely confined to the Gippsland Lakes and nearshore coastal waters. As Bass Strait is relatively shallow, the water currents through the Bass Strait can create unpredictable seas, reducing the numbers of recreational boats from venturing long distances into the Bass Strait from shore. Small boats are likely to fish around the nearshore reef area, while larger game fishing boats are likely to fish further out to sea and use nearby ports and boat ramps for launching. There are no boat ramps adjacent to the activity area.

The Golden Beach Surf Fishing Competition takes place over the weekend nearest Australia Day and during the Easter long weekend (midnight Good Friday to midnight Easter Sunday) each year between Seaspray and Loch Sport. The period of time between Christmas and Australia Day weekend are generally the busiest for recreational fishing.

4.6.5. Tourism

Marine-based tourism and recreation in the Bass Strait is primarily associated with recreational fishing and boating (see previous section).

The Gippsland Lakes (comprising Lake Victoria, Lake King, and Lake Wellington, together with other smaller lakes, marshes and lagoons) are the primary tourist attraction in the region. The communities adjacent to this network of lakes are popular tourist towns for their boating and fishing activities, along with bushwalking, bird watching and other nature-focused activities.

The beaches adjacent to the activity area are not patrolled and the Golden Beach Surf Life Saving Club is not active, with swimmers encouraged to go to Seaspray where there is a patrol. There is no surf break, although some surfing is observed from time to time.

4.6.6. Petroleum and GHG Infrastructure, Exploration and Production

In 2016, Victoria accounted for 20% of Australia's petroleum liquids production. Victoria accounted for 17% of Australia's conventional gas production in 2016, much of which is from the Gippsland Basin (APPEA, 2017).

The Gippsland Basin has 24 offshore production licenses, 5 exploration permits and 5 retention leases (NOPTA, 2018) and a total of 22 offshore petroleum production platforms have been installed in Bass Strait since first production was established (excluding subsea production wells) (Figure 4.12).

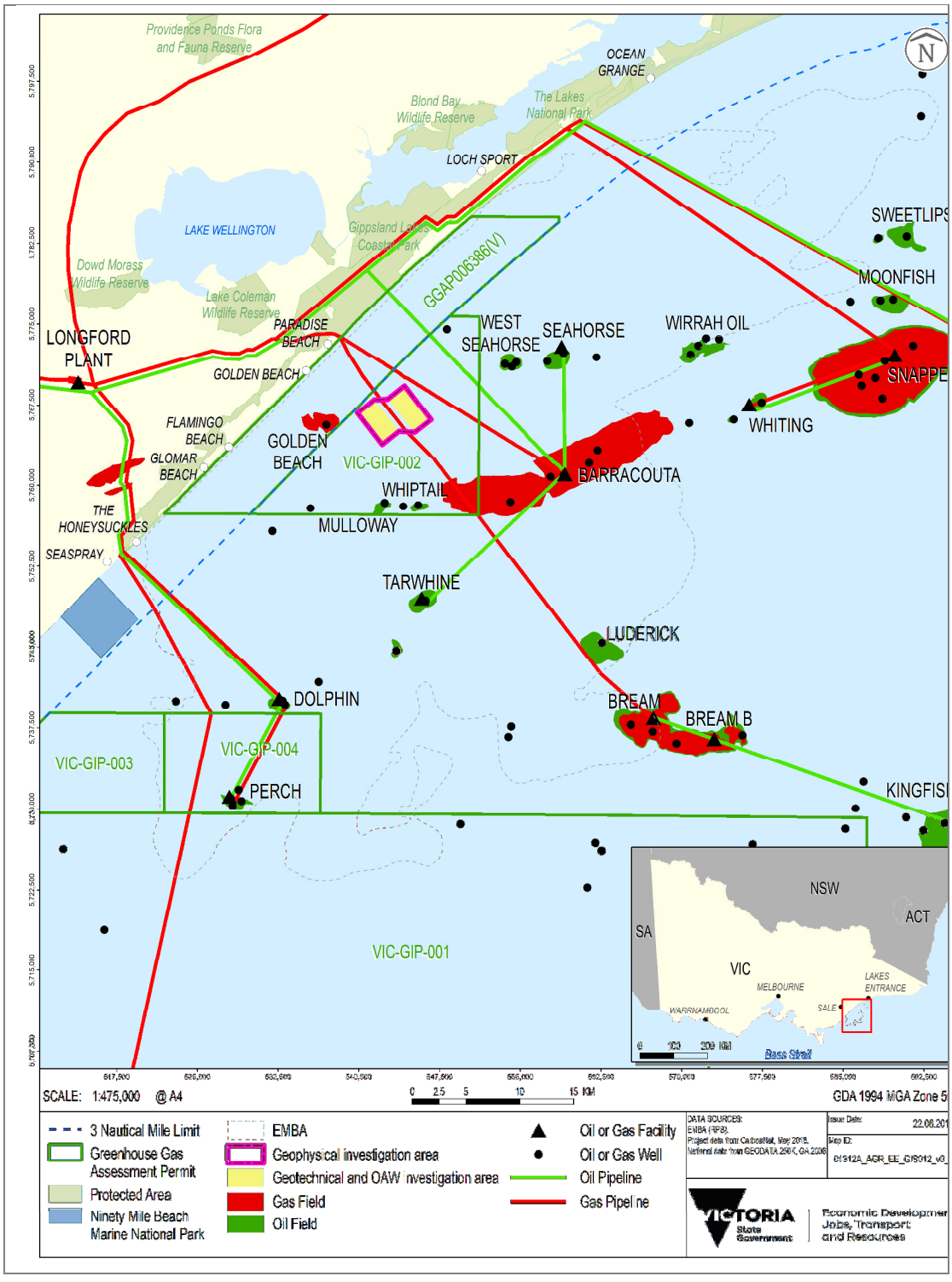


Figure 4.11. Petroleum reservoirs and infrastructure in the Gippsland region

The activity area overlaps one gas pipeline (Bream A to shore) operated by Esso Australia Resources Pty Ltd (EARPL) and is located in close proximity to two other EARPL pipelines located to the east of the activity area.

There are no wells within the activity area. The nearest well is Golden Beach-1 (dry hole), located 3.1 km to the west, which has been suspended (with the wellhead remaining). The wellhead for the associated Golden Beach-1A well (gas show) also remains.

4.6.7. Commercial Shipping

The South-east Marine Region (which includes Bass Strait) is one of the busiest shipping regions in Australia (DoE, 2015a). Lakes Entrance is an important fishing port for the region (DoE, 2015a).

The activity area is located entirely within the Bass Strait 'Area to be Avoided' (ATBA). This area is a routing measure that ships in excess of 200 gross tonnes should avoid due to the high concentration of offshore petroleum infrastructure (oil and gas platforms and pipelines, as described in Section 4.6.6) that can provide a navigational hazard. Operators of vessels greater than 200 gross tonnes must apply to NOPSEMA to enter and be present within the ATBA (Australian Border Force, 2017).

Very light shipping activity occurs through the activity area, with higher traffic volume shipping areas located to the south of the activity area and immediately south of the ATBA.

4.6.8. Defence Activities

There are no defence training areas within the EMBA (DoE, 2015a). The activity area is located beneath Defence Restricted Airspace R258D.

4.6.9. Other Infrastructure

Other infrastructure present within the EMBA includes the ocean outfalls for Regional Outfall Sewer (ROS) at Delray Beach (6.7 km northwest of the activity area) and the Saline Wastewater Outfall Pipeline (SWOP) at McGaurans Beach (46 km southwest of the activity area). These outfalls dispose large volumes of highly saline treated wastewater.

There are no submarine cable protection zones in the vicinity of the activity area.

5. Impact and Risk Assessment Methodology

While 'impacts' and 'risks' are acknowledged as having different definitions, the term 'risk' is used throughout this chapter when describing the overall methodology of assessing impacts and risks given that AS/NZS 31000:2009 uses the term 'risk' (but is intended to also describe the approach to assessing impacts).

5.1. Risk Assessment Approach

The Victorian Government requires that all Departments approach to risk management be compliant with the Australian New Zealand Risk Management Standard ISO31000:2009 (Risk management-Principles and guidelines), the directions issued under the *Financial Management Act 1994* (Vic) and the Victorian Government Risk Management Framework (VGRMF) (Department of Treasury and Finance, 2015).

The Department's policy recognises that the approach to implementation of some requirements may need to be varied, to reflect different structures and staffing arrangements within the different business areas within the Department. The CarbonNet Project: Project Risk Management Strategy (Version 4.0) outlines this approach.

5.2. CarbonNet Risk Management Process

The CarbonNet risk management process (CNRMF) is based on a 7-step risk management process as shown in Figure 5.1, which is consistent with ISO AS/ANZ 31000:2009, the VGRMF and DEDJTR RMF.

5.3. Risk Identification

In order to identify the environmental risks associated with this activity (together with recommendations for their control), CarbonNet held an environmental risk assessment workshop, which identified the impacts and risks of the activity and associated control measures involving people from various disciplines. The outcomes of these workshops were recorded in a risk register, which has been used as the basis for the impact and risk assessment.

5.4. Risk Analysis

The OPGGS(E) require that the environmental impacts and risks of an activity are evaluated and documented in an EP. Definitions of impacts and risks according to regulations and relevant risk management guidelines are:

- Impact - Any change to the environment, whether adverse or beneficial, that wholly or partially results from an activity.
- Risk - The effect of uncertainty.

The key process used for analysing risk is to determine the likelihood and the consequence of the risk occurring.

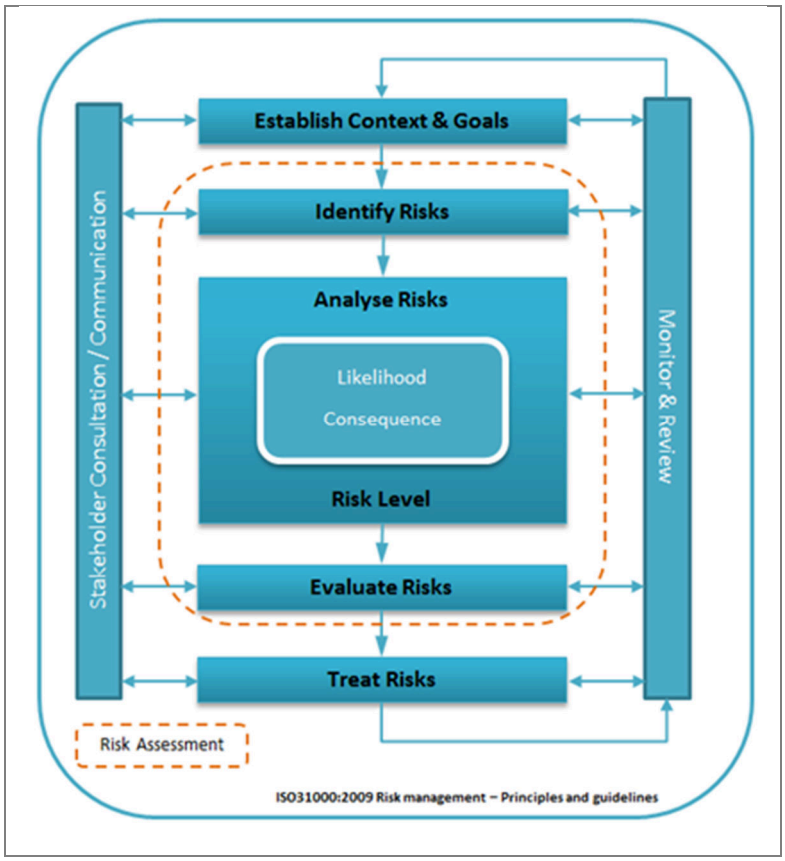


Figure 5.1. Risk management process

5.4.1. Determining Likelihood of Risk

Likelihood is defined as: *the chance of something happening*.

Existing controls (what is in place now to deal with this event if it does happen) must be considered when the level of likelihood is selected. The likelihood is selected as per Table 5.1.

Table 5.1. DEDJTR environmental risk framework – likelihood of occurrence

Rating	Description	Probability
Almost certain	Is expected to occur in most circumstances.	>95-99%
Likely	Will probably occur in most circumstances.	>60-95%
Possible	Might occur at some time.	>40-60%
Unlikely	Could occur at some time.	>5-40%
Rare	May occur only in exceptional circumstances.	<5%

** The probability column assigns a general percentage likelihood of the hazard occurring as a general guide to accompany the description of likelihood.*

5.4.2. Determining Consequence of Risk

Consequence is defined as:

> *the possible impact and the extent the risk/event would have in nine categories, these being strategic, safety, environment, service delivery, reputation, financial, people cultural & wellbeing, social, and legal & legislative*.

The effectiveness of existing controls and likelihood (data available) must be taken into consideration when assessing the extent of the consequences. The consequence is selected as per Table 5.2 (with the environment category highlighted for ease of reference). Chapter 6 presents the residual consequence (assuming the successful implementation of controls).

DEDJTR's risk framework considers existing controls when determining risk (i.e., normally 'inherent' risk is not considered). However, for this EP, 'inherent' risk and/or consequence has been presented to provide an indication of what the risk and/or consequence would be in the event that the controls fail.

A minimum of one category must be selected (in the case of the EP, this will be 'environment'). If more than one category is assessed, there are likely to be a number of different consequence ratings. The *overall* consequence rating is that which is the highest consequence in any of the categories assessed.

Table 5.2. DEDJTR consequence scale

Risk Focus	**Insignificant** Can be managed with no change in operations or additional resources	**Minor** Can be managed with no change in operations, but may need resources and priorities to be reallocated	**Moderate** Changes in operations may be required, additional resources needed, and priorities reallocated	**Major** Changes in operations and additional resources may be greater than those available to the Group / Division	**Critical** Changes in operations impacts the wider Department, resources required may exceed the Department's resource capability
Strategic Risk event impacts on the ability of the Project to deliver financial & non-financial outcomes	• Failure to meet up to 1% of stated financial or non-financial outcomes.	• Failure to meet 1-5% of stated financial or non-financial outcomes.	• Failure to meet 5-10% of stated financial or non-financial outcomes.	• Failure to meet 10-20% of stated financial or non-financial outcomes.	• Failure to meet greater than 20% of stated financial or non-financial outcomes.
Safety Risk event impacts the safety and wellbeing (injuries, illness, death, displacement, resilience) of DEDJTR staff, visitors, contractors or the public	• Slight health effect/injury not effecting work performance or causing disability to work (including first aid case and medical treatment case).	• Minor health effect/injury affecting work performance such as restriction to activities or a need to take a few days to recover (up to 10 days off). • Offsite medical treatment or Lost Time Injury (LTI).	• Major health effect/injury effecting work performance in the longer term such as a prolonged absence from work (up to 30 days off). • More than 1 LTI.	• Extensive and/. or permanent total disability in the work force. • Industrial Relations challenges and costs. • Work cover claims/sanctions. • Insurance Premium penalties.	• Single or Multiple fatalities or multiple permanent disability or illness. • Department prosecuted under OHS legislation.
Financial Risk event impacts the financial position/budget of the Project	• Project expenditure, or budget impacted by up to 1%. • Insignificant financial loss to industry/ environmental stakeholder.	• Project expenditure, or budget impacted by 1-5%. • Minor financial loss to local economy/industry/ environmental stakeholder.	• Project expenditure, or budget impacted by 5-10%. • Moderate financial loss to region/industry/ environmental stakeholder.	• Project expenditure, or budget impacted by 10-20%. • Major financial loss to region/industry/environmental stakeholder.	• Project expenditure, or budget impacted by more than 20%. • Critical financial loss to primary/ industry/ environmental stakeholder or the broader state.

Risk Focus	**Insignificant** Can be managed with no change in operations or additional resources	**Minor** Can be managed with no change in operations, but may need resources and priorities to be reallocated	**Moderate** Changes in operations may be required, additional resources needed, and priorities reallocated	**Major** Changes in operations and additional resources may be greater than those available to the Group / Division	**Critical** Changes in operations impacts the wider Department, resources required may exceed the Department's resource capability
Environment Risk event impacts the natural environment or infrastructure	• Effect is highly localised (e.g., individual or small number of plants or animals, or up to tens of square metres). • No threatened species are affected. • There is no damage at the habitat or ecosystem level. • Environmental impact is reversible/ negligible and/or under 1 year. • No active rehabilitation is required. • A spill of hydrocarbons that requires no active clean up.	• Localised effects on the environment (e.g., several plants or animals, or up to one square kilometre). • No threatened species are affected. • There is minor damage at the habitat level, but no damage at the ecosystem level. • Environmental impact is reversible and recovery is possible in 1-5 years. • Minimal active rehabilitation may be required (e.g., days or weeks). • A spill of hydrocarbons that may require active clean up.	• Moderate effects on the environment (e.g., small to large group of plants and/or animals, up to 10 square kilometres). • Threatened species or habitat suffer injury. • There is moderate damage at the habitat or ecosystem level. • Environmental impact is reversible, with recovery possible over the medium-term (5 to 10 years). • Active rehabilitation is required over months. • A spill of hydrocarbons that requires active clean up (days to weeks).	• Major effects on the environment (e.g., large group of plants and/or animals, 10 to hundreds of square kilometres). • Threatened species or habitats suffer mortality. • There is major damage at the habitat or ecosystem level. • Environmental damage is wholly or partially reversible, with recovery possible over a period of 10-20 years. • Active rehabilitation is required over months. • A spill of hydrocarbons that requires active clean up (weeks to months).	• Very serious effects on the environment (e.g., hundreds of square kilometres/ landscape level scale). • Threatened species population or habitat/s suffer mortality. • There is extensive damage at the habitat or ecosystem level. • Environmental damage is long-term (>20 years) or permanent, with recovery unlikely to be successful. • Active rehabilitation is required over years but may not be successful. • A spill of hydrocarbons that requires active clean up (months to years).
Service Delivery Risk event impacts ability to deliver the day-to-day operations of the Project	• Insignificant impact to the Department's ability to deliver its services/functions. • No inconvenience to customers/ stakeholders.	• Minor short-term temporary impact to the department's capability in providing its services/functions. • Customers/stakeholders slightly inconvenienced.	• Moderate impact to the department's capability in providing its services/functions. • Customers/stakeholders inconvenienced.	• Continuing difficulties in delivering the department's critical services/ functions. • Major impact on customers/ stakeholder.	• Long-term detrimental effect on the department's capability in providing critical services/functions. • Serious impact to customers/stakeholders.

Risk Focus	**Insignificant** Can be managed with no change in operations or additional resources	**Minor** Can be managed with no change in operations, but may need resources and priorities to be reallocated	**Moderate** Changes in operations may be required, additional resources needed, and priorities reallocated	**Major** Changes in operations and additional resources may be greater than those available to the Group / Division	**Critical** Changes in operations impacts the wider Department, resources required may exceed the Department's resource capability
	• Effect on systems and processes minimal and contained to one Business Unit. • Impact may be confined to a single business area. • Minimal management resources required to address event over days.	• Effect on systems and processes contained to one Division. • Impact may be confined to a single Division. • Some management resources required to address event over days.	• Inability to deliver services for up to one week in at least one Division or Group. • Impact may be confined to a single Division or Group. • Some management resources required to address event over several weeks.	• Inability to deliver services for between 1-3 weeks across the Department. • May impact on multiple Division or Group &/or single locations. • Significant management resources required to address event over several weeks or months.	• Inability to deliver services for more than 3 weeks across the Department. • May impact on multiple Division or Group, whole Department &/or multiple regions. • Complete suspension of normal management activities for several weeks or months in order to address event.
Reputation Risk event has a sustained impact on the reputation of the Department (or of specific Group, Divisions or Programs within the Department) either within Government or external stakeholders.	• Very limited public or political interest. • Minimal adverse local attention (1 day only). • Relationship with central agency remediated promptly. • Complaint from one stakeholder. • Complaint or public criticism resolved promptly by day-to-day management processes.	• Adverse localised public or political interest. • Limited attention on a single issue in local media over a short period (up to 1 week). • Relationship with central agency requires some management attention. • Complaint or public criticism resolved promptly by day-to-day management processes.	• Adverse localised negative public or political interest. • Short-term local media attention (up to 2 months). • Relationship with central agency requires specific management attention. • Local community concern on a single issue over a sustained period (up to 2 months). • Short-term (1-2 week) loss of confidence in the Department.	• Serious adverse public attention at State/National level (6-12 months). • Serious adverse State/National media on one or more issues over a prolonged period (6-12 months). • Media attention escalates, calls for public enquiry and Ministerial accountability. • Medium-term negative public interest. • Medium-term loss of Government or central agency confidence in the Department.	• Very serious public outcry at State/National level (longer than 1 year). • Negative State/National media over a prolonged period (greater than 1 year). • Ministerial enquiry / Royal Commission. • Long-term loss of Government or central agency trust in the Department.

Risk Focus	Insignificant Can be managed with no change in operations or additional resources	Minor Can be managed with no change in operations, but may need resources and priorities to be reallocated	Moderate Changes in operations may be required, additional resources needed, and priorities reallocated	Major Changes in operations and additional resources may be greater than those available to the Group / Division	Critical Changes in operations impacts the wider Department, resources required may exceed the Department's resource capability
People, Culture and Wellbeing Risk event impacts the Department's people and culture or their mental well being	• Minor non-compliance with code of conduct. • Lack of consistency in some practices by staff across department.	• Complaints, passively upset, and uncooperative. • Some staff do not engage and collaborate vertically within a group. • Minimal staff turnover with minimal loss of skills, knowledge and expertise.	• Low morale, disengagement, increased absenteeism and workplace conflict. • Some staff are not engaged and there is only partial collaboration vertically within a group and horizontally across groups/divisions. • Minimal turnover of key staff with skills, knowledge and expertise.	• Major morale issues and high absenteeism. • Most staff are not engaged and there is no collaboration vertically within a group and horizontally across groups/ divisions. • Resignations of key staff with skills, knowledge and expertise. • Staff are not up skilled to meet Business Plan priorities and commitments.	• Department wide morale issues and mass absenteeism. • Staff are not engaged and there is no collaboration vertically within a group and horizontally across the Department. • Resignations of large numbers of key management level staff with skills, knowledge and expertise. • Staff are not up skilled to meet department corporate objectives and key strategic priorities.
Social Risk event reduces the community's: • Ability to function normally (social fabric, cultural values and heritage, resourcing). • Environmental values of interest (recreational	• Community disruption, reprioritisation or relocation of resources. Minor damage to objects of identified significance. • Minor delay to major community event. • Inconsequential damage to	• Community damage, requiring external resources to return to normal function. • Localised parts of the community affected. • Delay or reduced scope of major community event. • Minor damage to environmental values of interest.	• Isolated cases of displaced people. • The community requires significant external resources to return to normal function. • Widespread inconveniences to affected community. • Significant damage to environmental values of interest.	• Large numbers of people displaced. • Adverse coronial findings linking the department action to death or injury. • Significant loss/damage to objects of cultural significance, impacts emotional & psychological capacity in large parts of the community. • Temporary cancellation/ significant delay to major event.	• Displacement of people beyond ability to cope. • Irreparable damage to whole community, impacts beyond social and psychological capacity and relying on external support. • Permanent cancellation of major event. • Permanent destruction of environmental interests.

Risk Focus	Insignificant Can be managed with no change in operations or additional resources	Minor Can be managed with no change in operations, but may need resources and priorities to be reallocated	Moderate Changes in operations may be required, additional resources needed, and priorities reallocated	Major Changes in operations and additional resources may be greater than those available to the Group / Division	Critical Changes in operations impacts the wider Department, resources required may exceed the Department's resource capability
facilities, local art gallery, events).	environmental values of interest.			• Severe damage to environmental interests.	
Legal & Legislation Risk event results in legal consequences	• Non-compliance with legislation, identified internally and resulting in internal acknowledgement and process review. • Minor breach of internal policies and procedures with minimal management resources required. • Breach of contract with minimal management resources required. • Issue resolved internally with no further escalation.	• Internal investigation. • Prosecution or civil action involving exposure to minor compensation, and/or minor negative precedent. • Regulatory or contract breach requiring some management resources to address event over days.	• External investigation or report to responsible authority (of moderate level). • Prosecution or civil action, with one of moderate level of compensation or moderate level. • Regulatory or contract breach requiring some management resources to address event over several weeks.	• External investigation or report to responsible authority (of major level). • Public enquiry (i.e. Royal Commission/ Parliamentary Committee). • Prosecution or civil action with high-level compensation and high-level negative precedent. • Sanctions imposed by external regulator. • Regulatory or contract breach leading to financial penalties of 10-20% total Department revenue.	• Prosecution or civil action leading to imprisonment of an officer. • Public enquiry (i.e. Royal Commission/Parliamentary Committee). • Un-insured compensation payments. • Negative precedent requiring very serious impact and major reform to the Department. • Severe sanctions imposed by external regulator. • Major prosecution or litigation with potential financial penalties of greater than 20% total Department revenue.

Consequence scale current as at September 2018.

5.4.3. Determining Risk Rating

The risk is determined by 'multiplying' likelihood and consequence, as per Table 5.3. The recommended form of action, escalation and monitoring for each risk level is provided in Table 5.4. Chapter 6 presents the residual risk rating (with controls adopted) for each risk (unplanned events).

Table 5.3. Risk matrix

Consequence	Likelihood				
	Rare	Unlikely	Possible	Likely	Almost certain
5 – Critical	Medium	Significant	High	High	High
4 – Major	Medium	Medium	Significant	High	High
3 – Moderate	Low	Medium	Medium	Significant	High
2 – Minor	Low	Low	Medium	Medium	Significant
1 – Insignificant	Low	Low	Low	Medium	Medium

Table 5.4. Recommended actions and reporting requirements for each risk level

Rating level	Recommended action	Reporting requirements
High	Highest priority in research, planning, decision-making, allocation of resources, treating and monitoring. Immediate action required by the Executive Manager. Active Management response required.	The Governing Body (i.e., Steering Committee or Board) must review all high-rated risks. Consideration should be given by Programs/Projects for the inclusion of all high-rated risks in the Division's risk register.
Significant	High priority in planning, allocation of resources, treatment plans and monitoring. Action required by the Executive Manager. Regular monitoring response required.	The Governing Body (i.e., Steering Committee or Board) must review all significant-rated risks.
Medium	Existing controls, treatment plans and monitoring can be managed within existing operational routines. Action required by the relevant Executive Manager and the Manager of the risk. Periodic monitoring required.	The Project will review all medium-rated risks and determine appropriate treatment plans to lower the target risk rating.
Low	It is expected that the existing controls are effective with minor additional action required. Routine day-to-day management required by the Manager of the risk.	The Project will review all low-rated risks and determine appropriate controls and monitoring frequency.

5.5. Risk Evaluation

Table 5.5 outlines the appropriate management response and the activities required based upon the risk levels identified in Table 5.4.

Table 5.5. Appropriate management responses for each risk level

Appropriate management response	Activities required
HIGH Active Management	• A risk treatment plan(s) must be established and implemented. • These risks should be embedded in the CarbonNet Project Steering Committees. • The risk should be entered on Periscope. • A treatment can be entered on Periscope stating that the risk is being monitored. Progress reports should be entered on Periscope. • Risks should be reported to the DEDJTR Risk and Audit Committee.
SIGNIFICANT Regular Monitoring	• Existing good treatments should be maintained. • Additional risk treatments as required should be established and implemented. • These risks should be embedded in the CarbonNet Project Steering Committees. • The risk should be entered on Periscope. • A treatment can be entered on Periscope stating that the risk is being monitored. Progress reports should be entered on Periscope. • Risks should be reported to the DEDJTR Risk and Audit Committee.
MEDIUM Periodic Monitoring	• Risks should be monitored over a quarterly period to ascertain as to whether there are any incidents that could increase the severity of the risk. • A treatment plan should be generated in the project risk register. Once treatment plan actions are closed, risk is to be re-evaluated.
LOW No major concern	• Risks should be reviewed quarterly to ascertain whether the severity of the risk has changed.

The difference between environmental impact assessment (EIA) and environmental risk assessment (ERA) is that EIA is concerned with events that are reasonably *certain* to occur (such as planned discharges to the air or water), while ERA is concerned with events that *may* possibly occur (such as hydrocarbon spills, introductions of marine pests, loss of waste overboard).

For this activity, CarbonNet has determined that impacts and risks are defined as follows:

- **Impacts** result from activities that are an inherent part of the activity and will result in a change to the environment or a component of the environment, whether adverse or beneficial. For example, acoustic discharges from the geophysical investigations and disturbance to seabed sediments are impacts

on the marine environment that cannot be avoided for the activity to achieve its aims.

- **Risks** result from activities where a change to the environment or component of the environment *may* occur as a result of an event associated with the activity (i.e., there may be impacts if the event actually occurs). Risk is a combination of the consequences of an event and the associated likelihood of the event occurring. For example, a hydrocarbon spill may occur if a vessel's fuel tank is punctured by a collision during the activity. The risk of this event is determined by assessing the consequence of the impact (using factors such as the type and volume of fuel and the nature of the receiving environment) and the likelihood of this event happening (which may be determined qualitatively or quantitatively).

5.6. Risk Treatment

Each of the impacts and risks identified and evaluated in Chapter 6 have associated control measures. The manner in which ALARP and acceptability for each impact and risk is described in this section.

5.6.1. Demonstration of ALARP

All impacts and risks need some form of management. Factors to be considered when determining treatment options include:

- The cost of implementing risk treatment options against the potential benefits – this may take the form of a cost-benefit analysis.
- Legal, legislative compliance and social responsibility – these may override cost, especially with regard to occupational health and safety requirements.
- Availability and suitability of ways to eliminate or reduce the hazard – the availability of resources such as infrastructure, equipment and capability need to be considered in light of State policies, procedures, values and behaviours.

The ALARP Principle states that it must be possible to demonstrate that the cost involved in reducing the risk further would be grossly disproportionate to the benefit gained. The ALARP Principle arises from the fact that infinite time, effort and money could be spent attempting to reduce a risk or impact to zero.

There is no universally accepted guidance to applying the ALARP principle to environmental assessments. For this EP, the guidance provided in NOPSEMA's *Environment Plan decision making* guideline has been applied and augmented where deemed necessary.

The level of ALARP assessment is dependent upon the:

1. Residual impact and risk level (high versus low); and
2. The degree of uncertainty associated with the assessed impact or risk.

Impacts and risks are considered to be lower-order and ALARP when, using the CarbonNet risk matrix (see Table 5.3 and Table 5.4), the impact consequence is rated as 'insignificant' or 'minor' or risks are rated as 'low' or 'medium'. In these cases, applying 'good industry practice' is sufficient to manage the risk and ALARP does not need to be demonstrated.

When an impact consequence is rated as ‘moderate’, ‘major’ or ‘critical’, or when the risk is rated as ‘significant’ or ‘high’, ALARP must be demonstrated. Doing so must consider:

- Alternative controls – potentially more effective control measures are adopted as a replacement;
- Additional control measures – that add to the suite of control measures to reduce the environmental impact; and
- Improved control measures – evaluated for improvements they could bring to the effectiveness of the adopted control measures in terms of functionality, availability, reliability, survivability, independence and compatibility.

As none of the impacts for this activity are rated above ‘insignificant’ and none of the risks are rated above ‘medium’, a detailed demonstration of ALARP does not need to be addressed. As such, this process is not described here.

5.6.1. Demonstration of Acceptability

CarbonNet has considered a range of factors to demonstrate the acceptability of the environmental impacts and risks associated with this activity. This evaluation considers several factors, with the impacts or risks considered to be at an acceptable level if the following questions are answered affirmatively:

- Policy conformance – is the proposed management of the risk or impact aligned with the DEDJTR Environmental Policy?
- Management system conformance – is the proposed management of the risk or impact aligned with DEDJTR’s environmental management system and associated procedures?
- Stakeholder engagement – have stakeholders raised any concerns about activity impacts or risks. For concerns of merit, are measures in place to avoid, mitigate for or manage these?
- Legislative context – is the impact or risk being managed in accordance with existing Australian or international laws or standards such as MARPOL, AMSA Marine Orders, etc?
- Industry practice – is the impact or risk being managed in line with industry best practice environmental management (BPEM), such as the Australian and international guidelines and codes of practice?
- Environmental context – is the impact or risk being managed pursuant to the nature of the receiving environment (e.g., sensitive or unique environmental features generally require more management measures to protect them than environments widely represented in a region)?
- Ecologically Sustainable Development (ESD) principles – does the impact or risk comply with the APPEA Principles of Conduct (APPEA, 2008), which includes that ESD principles be integrated into company decision-making?

6. Environmental Impact and Risk Assessment

This chapter presents the EIA and ERA for the environmental impacts and risks identified for the project using the methodology described in Chapter 5.

A summary of the residual impact and risk ratings for each impact and risk identified in this chapter is presented in Table 6.1.

Table 6.1. Summary of geophysical and geotechnical environmental impact and risk ratings

Known hazards (impacts)		Residual consequence
1	Underwater sound – impacts to biological receptors	
	– plankton	Insignificant
	– fish (with swim bladders)	Insignificant
	– fish (without swim bladders)	Insignificant
	– cetaceans	Insignificant
	– pinnipeds	Insignificant
	– avifauna	Insignificant
	– benthic invertebrates	Insignificant
	– turtles	Insignificant
2	Underwater sound – disruption to commercial fisheries	
	– ocean access (Vic)	Insignificant
	– ocean purse seine (Vic)	Insignificant
	– SESS, gillnet and shark hook (Cth)	Insignificant
3	Seabed disturbance	Insignificant
4	Atmospheric emissions	Insignificant
5	Light emissions	Insignificant
6	Sewage and grey water discharges	Insignificant
7	Cooling and brine water discharges	Insignificant
8	Putrescible waste discharges	Insignificant
9	Deck and bilge water discharges	Insignificant
Potential hazards (risks)		**Residual risk**
10	Accidental overboard disposal of waste – environmental	Low
	– social	Low
11	Introduction of IMS – environmental	Low
	– social	Low

12	Displacement of or interference with third-party vessels (*using financial consequence*) – displacement	Low
	– interference	Low
13	Damage to Bream-A gas pipeline (*using financial consequence*) – damage to pipeline	Medium
	– loss of field production	Medium
14	Vessel strike or entanglement with megafauna – individuals	Low
	– population	Low
15	Diesel spill	Low
Hydrocarbon spill response activities (risks)		Residual risk
16	Surveillance and tracking	Low
17	Protection and deflection – nearshore habitat	Low
	– shoreline habitat	Low
	– fauna disturbance	Low
18	Shoreline assessment and clean-up – shoreline habitat	Medium
	– recreational users	Medium
	– cultural heritage	Low
19	Oiled wildlife response – fauna injury	Low
	– fauna death	Low

Table 6.2 presents a summary of the environmental hazards associated with the activity, the impacts and risks of these hazards, the impact and risk ratings and the environmental performance standards (EPS) required to manage the identified impacts and risks. An EPS is defined as a *statement of the performance required of a control measure*.

Table 6.1. Environmental impact and risk assessment for the geophysical and geotechnical investigations

Hazard	Potential impacts & risks	Avoidance, management and mitigation measures (environmental performance standards)	Residual impact or risk
Known hazards (impacts)			Residual consequence rating

Generation of underwater sound from geophysical activities and vessels	Temporary and localised physiological or pathological impacts to local populations of marine fauna, including plankton, fish, cetaceans, pinnipeds, avifauna, benthic invertebrates and turtles.
	Potential onshore impacts:
	CarbonNet's acoustic consultant has advised that the shallow seismic source and the SBP operate at significantly lower source levels than a commercial seismic array, and thus the resulting sound levels are proportionally lower at comparable distances. Neither source has the energy to generate vibration in the seafloor that will be perceived by humans on land given the distance of the activity from land (a minimum distance of 6.2 km).
		• The EPBC Act Policy Statement 2.1 (Part A, Standard Management Procedures, Section A.3) will be implemented during the geophysical investigations. This includes:
		  ○ Pre-start visual observations out to 3 km for 30 minutes.
		  ○ Soft-starts over a 30-minute period.
		  ○ Reducing power if cetaceans are observed within the 'low power zone' (within 2 km of the sound source).
		  ○ Shutting down the sound source if a cetacean is observed within the shutdown zone (within 500 m of the sound source).
		  ○ Having a Marine Mammal Observer (MMO) onboard the vessel undertaking geophysical investigations to implement the EPBC Act Policy Statement.
		  ○ The SBP and shallow seismic source will not be operated at night-time if there have been three or more shutdowns in the proceeding 24 hours.
		• All crew aboard the vessels are inducted into the EPBC Act Policy 2.1 requirements.
		• Cetacean strategy is discussed in the vessel's daily operations meetings during geophysical investigations.
		• Cetacean sightings are reported to the DoEE.
		• Vessel engines and thrusters are well maintained.
			Insignificant

Hazard	Potential impacts & risks	Avoidance, management and mitigation measures (environmental performance standards)	Residual impact or risk
Potential disruption to fisheries from underwater sound (indirect impact)	Temporary and localised disruption to the sustainability of commercial and recreational fisheries.	• The location and timing of the activity will be communicated to local marine users, through notifications via AMSA, the Australian Hydrographic Service and via direct communications from CarbonNet. • The vessels used for the activity will be readily identifiable to other vessels.	Insignificant
Seabed disturbance from geotechnical activities.	Localised turbidity of the water column at the seabed, smothering of seabed habitat by borehole cuttings, seabed damage and displacement of a small area of seabed habitat.	• Physical damage to reef habitat will be avoided by specifying that the vessels do not anchor (they will remain on station using dynamic positioning). • Only low toxicity, readily biodegradable and non-bioaccumulating water-based muds and additives will be used during the coring process. • Avoid the loss of towed equipment through using the contractors' quality control/assurance procedures. • Avoid objects being dropped overboard by securely fastening equipment to the vessel decks and ensuring that crane operators are trained and competent in the crane/A-frame handling and transfer procedure.	Insignificant

Atmospheric emissions from the vessels	Decrease in air quality due to gaseous emissions and particulates from diesel combustion and contribution to the incremental build-up of GHG in the atmosphere (influencing climate change).	• Combustion systems operate in accordance with MARPOL Annex VI (Prevention of Air Pollution from Ships) requirements.
		  ○ Vessels greater than 400 gross tonnes will have in place a current International Air Pollution Prevention (IAPP) certificate and Ship Energy Efficiency Management Plan (SEEMP).
		  ○ Only marine-grade low sulphur (no greater than 3.5% m/m) diesel will be used.
		  ○ Vessels >400 gross tonnes must ensure that firefighting and refrigeration systems are managed to minimise Ozone Depleting Substances (ODS).
		• Only a MARPOL VI-approved incinerator is used to incinerate solid combustible waste (e.g., non-putrescible food waste, timber, rags, etc).
		• All fuel-burning equipment will be maintained in accordance with planned maintenance systems.
		• Fuel use will be measured, recorded and reported for abnormal consumption so that corrective action can be taken in the event of abnormal (i.e., higher than required) fuel use.
			Insignificant

Hazard	Potential impacts & risks	Avoidance, management and mitigation measures (environmental performance standards)	Residual impact or risk

Light glow from the vessels	Attractant to fauna, temporary and localised increase in predation rates on fauna attracted to lights.	• Light glow is minimised by managing external vessel lighting in accordance with:
		  ○ AMSA Marine Orders Part 30 (Prevention of Collisions).
		  ○ AMSA Marine Orders Part 59 (Offshore Support Vessel Operations).
			Insignificant

Discharge of treated sewage and grey water from the vessels	Temporary and localised reduction in water quality (up to 50 m horizontally and 10 m vertically from the discharge point).	• Treated sewage and grey water will only be discharged in Commonwealth waters (>3 nm from shore). • Sewage and grey water will be treated in a MARPOL Annex IV-compliance sewage treatment plant prior to discharge. • In the event of a sewage treatment plan malfunction, untreated sewage and grey water will only be discharged when > 12 nm from shore (in accordance with MARPOL Annex IV).	Insignificant
Discharge of cooling water and reverse osmosis (brine) from the vessels	Temporary and localised elevation in sea surface water temperature and salinity levels (up to 50 m horizontally and 10 m vertically from the discharge point).	• Engines and associated equipment that require cooling by water will be maintained in accordance with the vessel maintenance system so that they are operating within accepted parameters. • Only low-toxicity chemicals are used in the cooling and brine water systems.	Insignificant

Discharge of putrescible waste from the vessels	Temporary and localised increase in nutrient content of surface and near-surface water quality (up to 100 m horizontally and 10 m vertically from the discharge point).
	Temporary increase in scavenging behaviour of pelagic fish and seabirds.
		• Putrescible waste discharges will comply with MARPOL Annex V requirements:
		  ○ A Garbage Management Plan is in place (for vessels >100 gross tonnes or certified to carry 15 persons or more) that sets out the procedures for minimising, collecting, storing, processing and discharging garbage.
		  ○ Food waste will be macerated to <25 mm prior to discharge.
		  ○ Macerated putrescible waste will only be discharged in Commonwealth waters (>3 nm from shore).
		  ○ In the event of macerator malfunction, un-macerated putrescible waste will be discharged when >12 nm from shore.
		  ○ Non-putrescible galley waste will either be incinerated or returned to shore for disposal.
			Insignificant

Hazard	Potential impacts & risks	Avoidance, management and mitigation measures (environmental performance standards)	Residual impact or risk		

Discharge of bilge water and deck drainage from the vessels	Temporary and localised reduction in water quality (up to 100 m horizontally and 10 m vertically from the discharge point).	• Bilge water discharges comply with MARPOL Annex I requirements:
		  ○ Vessels greater than 400 gross tonnes will have in place a MARPOL Annex I-compliant oily water separator (OWS) set to limit oil-in-water content to <15 ppm prior to discharge.
		  ○ The OWS is maintained in accordance with the vessel planned maintenance system (PMS).
		  ○ The OWS is calibrated in accordance with the PMS to ensure the 15 ppm limit is met.
		• No whole residual bilge oil is discharged overboard (residual oil from the oily water separator is pumped to tanks and disposed of onshore).
		• Chemical storage areas will be bunded and drain to the bilge tank.
		• Portable bunds and/or drip trays are used to collect spills or leaks from equipment that is not contained within a permanently bunded area (non-process areas).
		• Deck cleaning detergents will be biodegradable.
		Incident response:
		• The vessel crew is competent (i.e., trained) in spill response.
		• Spill response kits (fully stocked) and scupper plugs or equivalent drainage control measures are readily available to the deck crew and used in the event of a spill to deck to prevent or minimise discharge overboard.
		• Spills to deck will be cleaned immediately in accordance with the vessel-specific Shipboard Marine Pollution Emergency Plans (SMPEP).
			Insignificant		

Potential hazards (risks)			Residual risk assessment		
			C	L	RR

Accidental overboard release of hazardous and/or non-hazardous waste from the vessels	Marine pollution (litter and a temporary and localised reduction in water quality).
	Injury and entanglement of individual animals (such as seabirds and seals) and smothering or
		• Vessels >100 gross tonnes or certified to carry more than 15 people vessel will have in place and implement a vessel-specific Garbage Management Plan, including measures such as:
		  ○ Solid wastes will be bagged and sent ashore for disposal.
		  ○ All waste bins will be secured and covered.
		  ○ Waste streams will be sorted onboard to enable correct onshore disposal and recycling.
		• Vessel crew and visitors will be inducted into the waste management procedures.
			Envtl
			Insignif-icant
			
			Social
			Insignif-icant
				Rare
				
				Rare
					Low
					
					Low

Hazard	Potential impacts & risks	Avoidance, management and mitigation measures (environmental performance standards)	Residual impact or risk		
	pollution of benthic habitats.	• A waste manifest will be maintained. • Solid waste that is accidentally discharged overboard is recovered if reasonably practicable.			

Introduction of invasive marine species from the vessel hulls and/or ballast water	Reduction in native marine species diversity and abundance.
	Displacement of native marine species.
	Socio-economic impacts on commercial fisheries.
	Reduction of conservation values of protected areas.
		• A vessel contractor pre-qualification is undertaken to ensure vessel biofouling and ballast water controls meet these EP requirements.
		• Vessels are managed in accordance with the National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (AQIS, 2009). This means:
		  ○ Conducting in-water inspection by divers or inspection in drydock if deemed necessary.
		  ○ Biofouling risk will be assessed, with cleaning of hull and internal seawater systems undertaken if deemed necessary.
		  ○ Anti-fouling coating status taken into account, with antifouling renewal undertaken if deemed necessary.
		• Any vessel >400 gross tonnes carries a current International Anti-fouling System (IAFS) Certificates and is complaint with and Marine Order Part 98 (Anti-fouling Systems).
		• The Western Australian Department of Fisheries Biofouling Risk Assessment Tool will be completed to calculate a vessel risk status (in the absence of an equivalent [and as a proxy for] Commonwealth- or Victorian-waters risk assessment tool). Only vessels with a low risk ranking will be permitted to work on the activity.
		• Towed/submersible equipment will be cleaned (e.g., fouling is removed) prior to initial use in the activity area.
		• Vessels will fulfil the requirements of the Australian Ballast Water Management Requirements (DAWR, 2017, v7). This includes requirements to:
		  ○ Carry a valid Ballast Water Management Plan.
		  ○ Submit a Ballast Water Report (BWR) through the Maritime Arrivals Reporting System (MARS).
		  ▪ If intending to discharge internationally-sourced ballast water, submit BWR through MARS at least 12 hours prior to arrival.
		  ▪ If intending to discharge Australian-sourced ballast water, seek a low-risk exemption through MARS.
		  ○ Hold a Ballast Water Management Certificate.
			Envt
			Moderate
			
			Social
			Moderate
				Rare
				
				Rare
					Low
					
					Low

Hazard	Potential impacts & risks	Avoidance, management and mitigation measures (environmental performance standards)	Residual impact or risk		
		○ Ensure all ballast water exchange operations are recorded in a Ballast Water Record System.			
Displacement of or interference with third-party vessels	Presence of vessel/s (and towed equipment), damage to or loss of fishing equipment and loss of commercial fish catches.	• CarbonNet has undertaken consultation with relevant marine stakeholders to understand the current level of on-water activities. • The AHO will be notified of the activity no less than four weeks prior to the activity commencing to enable the promulgation of Notice to Mariners and AusCoast navigational warnings. • The activity vessels are readily identifiable to third-party vessels. • Visual and radar watch is maintained on the bridge of the vessels at all times. • The Vessel Master and deck officers have a valid SCTW certificate in accordance with AMSA Marine Order 70 (seafarer certification) (or equivalent) to operate radio equipment to warn of potential third-party spatial conflicts. • The Vessel Masters issue warnings (e.g., radio warning, flares, lights/horns) to third-party vessels approaching the safety exclusion zone in order to prevent a collision with the vessel/s or equipment. • The tail buoys on the shallow seismic streamers will have flashing lights and radar reflectors so they are visible to other marine users. • The vessels will display the appropriate lights and day shapes for a vessel with restricted ability to manoeuvre during operations when geophysical and geotechnical equipment is deployed. • CarbonNet will apply to NOPSEMA to enter and work within the Bass Strait ATBA if the vessels are >200 gross tonnes. • The Vessel Master will sound the general alarm, manoeuvre the vessel to minimise the effects of the collision and implement all other measures as outlined in the vessel or structure collision procedure (or equivalent). • Vessel collisions will be reported to AMSA if that collision has or is likely to affect the safety, operation or seaworthiness of the vessel or involves serious injury to personnel.	*Displace* Insignif-icant *Interfere* Moderate	Rare Rare	Low Low
Damage to the Bream-A subsea pipeline due to geophysical sound pulses	Loss of pipeline integrity and disruption to commercial petroleum production.	• CarbonNet has undertaken thorough consultation with EARPL to understand the implications of simultaneous operations (SIMOPs). • CarbonNet and EARPL will undertake a joint SIMOPs workshop prior to the activity commencing to ensure that all hazards to both parties are understood and communicated between the parties.	*Damage* Critical *Product loss* Critical	Rare Rare	Medium Medium

Hazard	Potential impacts & risks	Avoidance, management and mitigation measures (environmental performance standards)	Residual impact or risk		
or because geotechnical equipment is placed over the pipeline		• CarbonNet will advise EARPL of the activity commencement dates and maintain ongoing communications during the investigations. • The geophysical investigations will be undertaken prior to the geotechnical investigations in order to accurately determine the position of the Bream-A pipeline, which will then be used to accurately inform the 500-m exclusion zone for the geotechnical investigations. • CarbonNet will ensure that the geotechnical contractor has the coordinates of the Bream-A pipeline (obtained from the geophysical investigation) marked in the vessel's navigation displays to ensure that no geotechnical work is conducted within 500-m of the pipeline. *Incident response:* • CarbonNet will report damage to the pipeline to EARPL as soon as possible after becoming aware of the incident. • CarbonNet will report damage to NOPSEMA within 2 hours of becoming aware of the incident.			

Vessel strike or entanglement with megafauna (e.g., whales, dolphins, seals)	Injury or death of individual animals.	• The Australian Guidelines for Whale and Dolphin Watching (DEWHA, 2005) for sea-faring activities will be implemented, which means:
		  ○ Caution zone (300 m either side of whales and 150 m either side of dolphins) – vessels must operate at no wake speed in this zone.
		  ○ No approach zone (100 m either side of whales and 50 m either side of dolphins) – vessels should not enter this zone and should not wait in front of the direction of travel or an animal or pod/group.
		  ○ Do not encourage bow riding.
		  ○ If animals are bow riding, do not change course or speed suddenly.
		  ○ If there is a need to stop, reduce speed gradually.
		• The MMO onboard the geophysical physical will implement the above-listed guidelines (while crew will implement it on the geotechnical vessel).
		• Vessel crew will complete an environmental induction covering the above-listed requirements for vessel and megafauna interactions.
		Incident response:
		• Vessel strike causing injury to or death of a cetacean is reported via the online National Ship Strike Database within 72 hours of the incident.
			Individual
			Insignif-icant
			
			Population
			Minor
				Unlikely
				
				Rare
					Low
					
					Low

Hazard	Potential impacts & risks	Avoidance, management and mitigation measures (environmental performance standards)	Residual impact or risk		
		• Entanglement of megafauna in survey streamers is reported to the Whale and Dolphin Emergency Hotline as soon as possible. No attempts to disentangle megafauna should be made by project personnel.			
Diesel release due to a vessel-to-vessel collision	Temporary and localised reduction in water quality. Tainting of commercial fisheries species. Injury and death of species such as seabirds and turtles. Pathological effects on fish larvae and plankton.	• As per 'displacement of or interference with third-party vessels', plus: *Preparedness:* • No refuelling will take place on location. • The vessel has an approved SMPEP (or equivalent appropriate to class) that is implemented in the event of a fuel tank rupture and spill. • Vessel crew will be trained in spill response techniques in accordance with the SMPEP and vessel training matrix. • Within 4 weeks prior to each vessel contractor commencing the activity, a desktop oil spill response exercise will be conducted to test interfaces between the SMPEP, OPEP, NatPlan and VicPlan. *Reporting:* • CarbonNet will report the spill to regulatory authorities within 2 hours of becoming aware of the spill. *Response:* • The Vessel Master will authorise actions in accordance with the vessel-specific SMPEP (or equivalent according to class) and the activity-specific OPEP to limit the release of MDO. • CarbonNet will undertake operational and scientific monitoring in accordance with the OSMP.	Minor	Rare	Low
Hydrocarbon spill response activities (risks)					
Diesel spill response activities	Spill surveillance and tracking – disturbance to marine and coastal fauna from increased vessel and aerial activity.	*Preparedness:* • Access to operational response capabilities is maintained through the Maritime Emergencies NSR Plan. • DEDJTR undertakes regular desktop drills to test response capability. • DEDJTR ensures that regular inspection and testing is undertaken for its oil spill response equipment.	Insignif-icant	Possible	Low
	Protection and deflection booming – disturbance to marine and coastal fauna and habitats and to		Insignif-icant	Possible	Low

Hazard	Potential impacts & risks	Avoidance, management and mitigation measures (environmental performance standards)	Residual impact or risk		
	coastal Aboriginal heritage.	• An oil spill-tracking buoy is available and maintained in operational condition on each of the contracted vessels. *Response* • An Incident Action Plan (IAP) is prepared by the IMT Planning Officer within the first 24 hours after the spill starts, which is used to guide response activities. • Visual observations from aircraft are initiated within 12 hours of request (subject to daylight hours). • Surveillance aircraft will ensure buffer distances of 500 m (helicopters) and 300 m (fixed wing) are maintained around cetaceans in accordance with EPBC Regulations 2000 (Part 8). • An operational NEBA is prepared to determine the net benefits of each response strategy. • Personnel and equipment resources are deployed to site to undertake responses activities within timeframes outlined in the IAP.			
	<u>Shoreline assessment and clean-up</u> – disturbance to coastal fauna and habitats, Aboriginal cultural heritage, temporary exclusion of the public from beaches, secondary contamination.		*Shoreline habitat* Minor	Possible	Medium
			Recr. users Minor	Likely	Medium
			Cultural heritage Minor	Unlikely	Low
	<u>Oiled wildlife response</u> – distress, injury or death of fauna through inappropriate		Insignif-icant	Rare	Low

7. Implementation Strategy

The Crown in right of Victoria 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 Chapter 6 are adequately implemented.

AGR is responsible to CarbonNet who has overall responsibility for the management of the activity to ensure that design and execution of the activities is in accordance with industry best practice and legislated standards, that contractors have appropriate equipment to undertake the investigations and that the the day-to-day direction of work and the monitoring and auditing of work by contractors is undertaken in accordance with the accepted EP.

The vessel contractors will have the day-to-day control and management of the vessels through the respective Vessel Masters. The Vessel Master has over-riding authority and responsibility to make decisions with respect to environment protection and pollution prevention and to request assistance as may be necessary.

As the Titleholder, the Crown in right of Victoria (via CarbonNet) has entered into an agreement with AGR to use its Integrated Management System (IMS) (i.e., health, safety and environment) and support (resource) services and incident management capabilities associated with this activity.

7.1. Environmental Management Systems

7.1.1. DEDJTR

The DEDJTR has in place an Environmental Management System (EMS) that is aligned with ISO 14001:2004 (*Environmental Management Systems – requirements with guidance for use*). The EMS is outlined in the department's EMS Manual (Version 1, July 2015).

The EMS is a program for identifying, managing and reducing the department's impact on the environment, based on the principle of continual improvement and the 'plan-do-check-act' cycle in line with ISO14001. The EMS is subject to biennial audits.

7.1.2. AGR

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 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 Well Delivery Process (WDP). The AGR WDP is a central component of the AGR Management System and is being used by CarbonNet for this activity.

7.2. Legislative Framework

The activity is located entirely within Commonwealth waters, and as such is guided by Commonwealth legislation.

7.2.1. DEDJTR Environment Policy

The DEDJTR's Environment Policy provides a public statement of the Department's commitment to minimise adverse effects on the environment (Box 8.1).

The CarbonNet Project operates under DEDJTR's Environmental Management System (EMS), which aims to minimise and manage the impacts on employees, contractors, the environment and the communities in which the project operates. The EMS has been developed in line with Australian/New Zealand Standard ISO 14001:2004 Environmental Management Systems (described further in Chapter 8).

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's Health, Safety, Environment and Quality (HSEQ) Policy is provided in Box 8.2.

7.2.1. Environmental Approvals Process

Offshore Petroleum and Greenhouse Gas Storage Act 2006

The OPGGS Act 2006 (Cth) addresses all licensing, health, safety and environmental issues for offshore GHG activities in Commonwealth waters (generally between the 3 nm mark and the 200 nm limit of Australian seas).

The OPGGS(E) requires the preparation of an EP prior to conducting a GHG activity for acceptance by NOPSEMA.

Environment Protection and Biodiversity Conservation Act 1999

The *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) is the key legislation regulating projects that may have an impact on a Matter of National Environmental Significance (MNES).

In February 2014, NOPSEMA became the sole designated assessor of petroleum and GHG activities in Commonwealth waters in accordance with the Minister for the Environment's endorsement of NOPSEMA's environmental authorisation process under Part 10, section 146 of the EPBC Act. Under the streamlined arrangements, impacts on the Commonwealth marine area by petroleum and GHG activities are assessed solely through NOPSEMA.

DEDJTR ENVIRONMENT POLICY

Introduction
This policy aims to reduce both current and future environmental impacts of the Department of Economic Development, Jobs, Transport and Resources (DEDJTR) through both staff behavioural change and infrastructure improvements.

Scope
This policy is applicable to all operations and services of the department at all locations. Agencies linked to the department are expected to comply with the spirit of this policy in the context of the organisation in which they work.

Policy Statement
The Environment Policy has been developed to increase awareness of the environmental impacts that the organisation faces and to demonstrate commitment to further reducing these impacts over time. DEDJTR has responsibility for 70 sites across Victoria. Staff are required to familiarise themselves and act in accordance with the Environment Policy.

Procedures
Staff are expected to save energy, utilise smarter travel, utilise greener procurement, save water, utilise waste and recycling systems and save paper.

Environment representatives are expected to:

- Communicate environmental information to staff.
- Encourage staff to behave in an environmentally responsible manner and participate in environmental initiatives.
- Ensure new staff members are informed of their environmental responsibilities.
- Act as a point of contact for staff and report issues/concerns to the Environment Manager.
- There should be at least one environment representative for each floor/location occupied by the department (where practical).

The Environment Manager is expected to:

- Maintain the Environmental Management System (EMS) and related documentation.
- Provide quarterly and annual report information to senior management.
- Organise and implement environmental staff behaviour change campaigns.
- Provide environmental support and guidance to all staff when required.
- Monitor, measure and publicly report environmental performance.
- Identify risks to DEDJTR's environmental performance.
- Set annual targets to further reduce all environmental impacts.
- Ensure new capital works programs incorporate comprehensive environmental sustainability principles.
- Ensure operational activities comply with environmental legislation, government policy and relevant departmental environmental procedures and guidelines

Managers are expected to:

- Provide feedback to the Environment Manager on quarterly and annual reports.
- Ensure this policy appropriately articulates the department's commitments.
- Support the implementation of the EMS.
- Identify opportunities to embed environmental sustainability throughout the department's activities.

Policy owner/branch: Environment Manager, People and Workplace Services.
Approved by: DEDJTR Executive Board (19 August 2015).
Next review: September 2018.
Version No. DOC/15/242170 (April 2018).

Box 8.1. The DEDJTR Environment Policy

HSEQ policy

AGR is a learning organisation that builds on ethical principles where business results are directly connected to a responsible health, safety, environmental and social performance.

WE work in a knowledge based company, delivering Services to our Clients in the oil and gas industry.

WE strive to identify and manage any risk in all our activities and constantly work to avoid:

- Personal injuries
- Work-related illness
- Negative environmental impact
- Reputational and Economical loss

WE resolutely believe that no deadline is so important that a task cannot be carried out safely. Where there is doubt regarding safety, the task will be halted immediately. If we see a hazardous situation, we shall intervene.

WE are committed to identifying significant environmental aspects and reducing any environmental impact AGR may create.

WE are continually working to improve and, as such, realise that AGR's health, safety, environmental and social performance are essential for the continued success of our organisation, the wellbeing of our employees and further good relations with the communities in which we are based.

WE meet our Clients expectations, and use their feedback for continuous improvement.

WE shall continuously measure the performance of our business by use of HSEQ objectives and targets. The subsequent results will be communicated to all employees.

WE shall perform regular internal control activities to ensure compliance with the AGR Management System and relevant legislative requirements within the areas and countries in which we operate.

WE shall regularly review our Management System to ensure continuous improvement and that an adequate and effective system is in place.

WE are responsible for our own and each others' health and safety, as well as for the environment. Overall accountability, however, lies with management.

Date: 27.01.2017

Svein Sollund
CEO AGR

AGR-HSEQ-S-01

Box 8.2. The AGR HSEQ Policy

7.3. Training and Awareness

7.3.1. Recruitment and Training

During its contractor selection process, AGR will conduct a due diligence review to ensure that the chosen contractors have 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.

7.3.2. Environmental Induction

An activity-specific HSE induction for all personnel working on the activity will be undertaken prior its commencement. The vessel contractors will conduct their own company and vessel-specific inductions independently of the activity-specific HSE induction.

7.3.3. Oil Spill Response Training

Quarterly training of vessel crews in SMPEP procedures is a MARPOL requirement for vessels over 400 GRT (Annex 1, Regulation 37). During its contractor audit process, AGR will assess the vessel contractors' implementation of their SMPEPs (or equivalent, relevant to class).

An office-based desktop spill response exercise of the activity-specific OPEP will be conducted by CarbonNet, DEDJTR EMD and AGR prior to the activity commencing.

7.3.4. Marine Mammal Observers

Only an appropriately qualified and experienced MMO will be hired from the large pool of MMOs available through various consultancies. The MMO will provide an information session to the geophysical vessel crew at the start of the geophysical investigations regarding their MMO duties and the communication protocols required to ensure their duties are undertaken efficiently.

7.3.5. 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), in daily operations meetings and weekly HSE meetings.

7.3.6. Communications

The Vessel Masters and AGR/CarbonNet Onboard Representative are jointly responsible for keeping the vessel crews informed about HSE issues, acting as a focal point for personnel to raise issues and concerns. A number of meetings, involving various project personnel, will take place onshore and offshore during the activity.

7.4. Environmental Emergencies and Preparedness

In the event of an emergency of any type, the Vessel Master will assume overall onsite command and act as the Emergency Response Coordinator (ERC). All persons aboard the vessels will be required to act under the ERC's directions. The AGR/CarbonNet Onboard Representative will maintain communications with DEDJTR EMD in the event of an emergency involving an oil spill. Oil spill emergency

response support will be provided by DEDJTR EMD. Overall emergency management will be via AGR's IMT based in CarbonNet's office during program execution.

7.4.1. Adverse Weather Protocols

It is the duty of the Vessel Master to act as the focal point for all actions and communications with regards to any emergency, including response to adverse weather or sea state, to safeguard his vessel, all personnel onboard and environment. During adverse weather, the Vessel Master is responsible, among other things, for ensuring the safety of all personnel onboard and to monitor all available weather forecasts and predictions.

7.4.2. Vessel Emergencies and Oil Spills

Activity-specific emergency response procedures will be included in the vessel contractors' Emergency Response Plan (ERP). The ERP will contain instructions for vessel emergency, medical emergency, search and rescue, reportable incidents, incident notification and emergency contact information.

The activity-specific OPEP will be implemented (and supplements the vessel-specific SMPEP) in the event of a Level 2 or Level 3 hydrocarbon spill that requires response resources beyond those immediately available to the vessels. The activity-specific OPEP details the response actions aimed at minimising the impacts of an MDO spill on sensitive resources.

7.4.3. Emergency Response Training

The readiness and competency of DEDJTR EMD, CarbonNet, AGR and the vessel contractors to respond to incidents and emergencies will be tested by conducting a desktop emergency response exercise within four (4) weeks prior to each vessel contractor commencing the activity.

7.5. Oil Spill Preparedness and Response

Project-specific oil spill preparedness and response plans have been prepared, as outlined herein.

7.5.1. OPEP

The OPEP outlines details the oil spill response arrangements to be undertaken in the event of a Level 2 or 3 MDO spill from any of the vessels associated with the activity. It outlines the reporting arrangements and response structure, and essentially bridges to the Victorian Government's State Maritime Emergencies (non-search and rescue) Plan (EMV, 2016).

The responses outlined in the OPEP are:

- Source control – the responsible Vessel Master will ensure that the impacted fuel tank/s are managed so as to minimise the volume of MDO lost to sea (as per the SMPEP).
- Surveillance and tracking – vessel-based and aerial monitoring will be undertaken to determine the trajectory of the spill in order to ascertain receptors that may be at risk.

- Protection and deflection – relates to booming estuaries that may be open in order to protect their values.
- Shoreline assessment and clean-up – involves undertaking a survey of shoreline impacts and allocating resources to clean up stranded diesel oil, where possible.
- Oiled wildlife response – the DELWP is the agency responsible for responding to oiled wildlife. CarbonNet would work with DELWP to provide resources as necessary.
- Decontamination and waste management – this process involves responsibly decontaminating oiled equipment used in the spill response, and disposing of waste to suitable facilities.

7.5.2. SMPEP

The vessel will have in place a SMPEP (or equivalent, according to class). This document is required under MARPOL Annex 1, Regulation 37. This plan outlines reporting procedures and the steps that should be undertaken to control the discharge. This document does not outline on-water or shoreline oil spill response actions; the OPEP fills this void.

7.5.3. OSMP

An Operational and Scientific Monitoring Program (OSMP) has been prepared for the activity, which is designed to provide a framework for operational and scientific monitoring in the event of a Level 2 or 3 hydrocarbon release. Such a program aims to assess the impacts of a hydrocarbon spill. The OSMP is divided into a description of operational and scientific studies, as follows:

<u>Operational monitoring (or Type 1 monitoring, response phase) studies</u>

1. Predictive oil spill trajectory modelling.
2. Surveillance and reconnaissance to detect hydrocarbons and resources at risk.
3. Detecting and monitoring for the presence and properties of hydrocarbons.
4. Monitoring of contaminated resources.

<u>Scientific Monitoring (or Type 2, recovery Phase) studies</u>

1. Assessment of the presence, quantity and character of hydrocarbons in marine waters.
2. Assessment of the presence, quantity and character of hydrocarbons in seabed sediments.
3. Assessment of impacts and recovery of subtidal and intertidal benthos.
4. Assessment of impacts and recovery of seabird and shorebird populations.
5. Assessment of impacts and recovery of pinniped populations.
6. Desktop assessment of impacts to marine megafauna.
7. Assessment of impacts and recovery of marine fish.
8. Assessment of physiological impacts to commercially important fisheries species (fish health and seafood quality/safety) and recovery.

Consultancies and government organisations suitable to undertake this monitoring work, and the resources required, are presented in the OSMP Framework and associated OSMP Implementation Plan.

7.6. Incident Recording and Reporting

Regulation 4 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.

CarbonNet interprets 'moderate to significant' environmental damage as being those hazards identified through the impact and risk assessment process 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 are:

- Accidental overboard disposal of waste;
- The introduction of IMS;
- Displacement of or interference with third-party vessels;
- Damage to the Bream-A gas pipeline; and
- Shoreline assessment and clean-up.

As such, incidents relating to these matters are defined as reportable incidents. CarbonNet has a comprehensive list of stakeholders that will be notified promptly in the event of a reportable incident.

7.7. Management of Change

CarbonNet's Project Management Manual (version 1.5) (PMM) will be used as the overarching document that will guide the Management of Change (MoC) process for the activity.

AGR will utilise the AGR Management of Risk and Control of Change for all activity changes that may impact on environmental performance. 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 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.

7.8. Monitoring

7.8.1. Field Environmental Monitoring

CarbonNet will maintain a quantitative record of emissions and discharges, and other environmental matters generated on location during the activity.

The vessel contractor is responsible for collecting this data and reporting it to AGR. This is facilitated by completing a daily environmental monitoring register that will be provided by AGR to the contractor. These results will be reported in the end-of-activity EP performance report submitted to NOPSEMA.

- Underwater sound – MMO megafauna visual observations.
- Atmospheric emissions – fuel consumption.
- Bilge water – volume of bilge water discharged.
- Muds used for borehole sampling – chemicals and volumes used in the mud system.
- Waste disposal – weight/volume of waste sent ashore.
- Displacement of or interaction with third-party vessels – continuous bridge watch for (and communications with, as necessary), third-party vessels.
- Interference or damage to shipwrecks - Ongoing surveillance and reporting of disturbance to shipwrecks within the activity area.
- Introduction of invasive marine species - Volume and location of ballast water discharges.
- Vessel strike or entanglement with cetaceans - MMO continuous megafauna observations during geophysical investigations.
- Diesel spill (in the event of) – operational monitoring in line with the OPEP.

7.8.2. Auditing, Assurance and Inspections

Environmental performance of the activity will be reviewed by undertaking HSE due diligence pre-activity audits of the selected vessels and undertaking ongoing internal operations inspections during the activity.
A summary of the EP commitments for the activity will be distributed aboard the vessels, and implementation will be monitored by AGR.

8. References

ABC News. 2014. 'Clean-up underway after tar balls wash up on Ninety Mile Beach.' ABC News Online. Article posted 18 March 2014.

ABC. 2000. Kiwi shellfish smother Australian seabeds. A WWW article accessed at http://www.abc.net.au/science/articles/2000/11/06/207775.htm. ABC Science. 6 November 2000.

ABC. 2017. Dolphins migrate across Bass Strait to double dip in the gene pool. A WWW article accessed at http://www.abc.net.au/news/2017-07-27/dolphins-migrating-to-mate-in-tasmania-and-victoria/8742292. Australian Broadcasting Corporation.

ABS. 2017. Wellington Shire. A WWW database accessed at http://www.abs.gov.au/ausstats/abs@nrp.nsf/781eb7868cee03e9ca2571800082bece/6a140d6630b90557ca25793b00095ade!OpenDocument.

Addison, R.F., Brodie,P.F., Edwards, A. and Sadler, M.C. 1986. Mixed function oxidase activity in the harbour seal (*Phoca vitulina*) from Sable Is., N.S. Comp. Biochem. Physiol. 85C (1):121-124.

Advisian. 2018a. Marine Seismic Survey, Offshore Habitat Assessment. Report prepared by Advisian and CEE for CarbonNet. August 2018 (Report 301010-01596).

Advisian. 2018b. Zooplankton Survey, Pre and Post Seismic Assessment. Report prepared by Advisian and CEE for CarbonNet. May 2018 (Report 301010-01598).

AFMA. 2015. School Shark (*Galeorhincus galeus*) Stock Rebuilding Strategy. Revised 2015. A WWW document accessed at http://www.afma.gov.au/wp-content/uploads/2014/12/School-Shark-Rebuilding-Strategy.pdf. Australian Fisheries Management Authority. Canberra.

AFMA. 2017a. Species profiles. A WWW database accessed at http://www.afma.gov.au. Australian Fisheries Management Authority. Canberra.

AFMA. 2017b. Bass Strait Central Zone Scallop Fishery Resource Assessment Group (ScallopRAG) Meeting 29. Meeting Minutes. Date: 14 June 2017. A WWW document accessed at http://www.afma.gov.au/wp-content/uploads/2017/08/ScallopRAG-mintues-29.pdf. Australian Fisheries Management Authority. Canberra.

AMSA. 1998. The Effects of Maritime Oil Spills on Wildlife Including Non-Avian Marine Life. Australian Maritime Safety Authority. Canberra.

AMSA. 2003. Oil Spill Monitoring. Background Paper. Australian Maritime Safety Authority.

AMSA. 2012. Advisory Note for Offshore Petroleum Industry Consultation with Respect of Oil Spill Contingency Plans. A WWW document downloaded from https://www.amsa.gov.au/navigation/shipping-management/offshore-activities/documents/guidance-to-offshore-industry-oscp.pdf Australian Maritime Safety Authority.

AMSA. 2013 Rescuing Oiled wildlife – What can you do! Accessed at https://www.amsa.gov.au/environment/maritime-environmental-

emergencies/nationalplan/General-Information/oiled-wildlife/rescuing-wildlife/index.asp. Australian Maritime Safety Authority. Canberra.

AMSA. 2014. National Plan for Maritime Environmental Emergencies. Australian Maritime Safety Authority. Canberra.

AMSA. 2014. On Scene. Newsletter for the National Plan for Maritime Environmental Emergencies. Issue 26, October 2014. Australian Maritime Safety Authority. Canberra.

AMSA. 2015. Technical Guideline for the Preparation of Marine Pollution Contingency Plans for Marine and Coastal Facilities. Australian Maritime Safety Authority. Canberra.

AMSIS. 2017. Australian Marine Spatial Information System. A WWW database accessed at http://www.ga.gov.au/scientific-topics/marine/jurisdiction/amsis. Geoscience Australia. Canberra.

ANZECC and ARMCANZ. 2000. Australian and New Zealand Guidelines for Fresh and Marine Water Quality. Volume 2. Aquatic Ecosystems – Rationale and Background Information. Australian and New Zealand Environment and Conservation Council and Agriculture and Resource Management Council of Australia and New Zealand.

APASA. 2012. Marine diesel fuel oil spills and weathering. Memorandum from Trevor Gilbert, Director Maritime, Environment and Chemical Services at APASA, to Phil Harrick, HSEQ Manager, AGR Petroleum Services. 24th June 2012.

APPEA. 2008. Code of Environmental Practice. Australian Petroleum Production and Exploration Association.

APPEA. 2017. Key Statistics 2016. A WWW document accessed at http://www.appea.com.au/wp-content/uploads/2016/06/Key-Stats_2016.pdf. Australian Petroleum Production and Exploration Association. Canberra.

AQIS. 2011. Australian Ballast Water Management Requirements. Version 5. Australian Quarantine Inspection Service, Department of Agriculture, Fisheries and Forestry. Canberra.

Au, W.W.L., A.N. Popper, and R.R. Fay. 2000. Hearing by Whales and Dolphins. Springer New York.

Backhouse, G., Jackson, J. and O'Connor, J. 2008. National Recovery Plan for the Australian Grayling *Prototroctes maraena*. Department of Sustainability and Environment. Melbourne.

Baker, A. 1985. Pygmy right whale *Caperea marginata* (Gray, 1846). In: Ridgway, S H and Harrison, R. (eds.) Handbook of Marine Mammals Vol. 3: The Sirenians and Baleen Whales. Academic Press, London.

Bannister, J.L., Kemper, C.M. and Warnecke R.M. 1996. The Action Plan for Australian Cetaceans. The Director of National Parks and Wildlife Biodiversity Group. Environment Australia. Canberra.

Barkaszi, M.J., M. Butler, R. Compton, A. Unietis, and B. Bennet. 2012. Seismic survey mitigation measures and marine mammal observer reports. U.S. Dept. of the Interior, Bureau of Ocean Energy Management, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study BOEM 2012-015.

Barry, S. B., Cucknell, A. C. and Clark, N. 2012. 'A direct comparison of bottlenose dolphin and common dolphin behaviour during seismic surveys when air guns are and air not being utilised.' In: The effects of noise on aquatic life. Edited by A. N. Popper and A. Hawkins.

Bartol, S.M. and Ketten, D.R. 2006. Turtle and tuna hearing. In: Swimmer, Y. and Brill, R (eds). December 2006. NOAA Technical Memorandum NMFS-PIFSC-7. 98-103.

Bartol, S.M., Musick, J.A. and Lenhardt, M.L. 1999. Auditory evoked potentials of the loggerhead sea turtle (Caretta caretta). *Copeia*: 836-840.

Barton, J., Pope, A. and Howe, S. 2012. Marine Natural Values Study Vol 2: Marine Protected Areas of the Flinders and Twofold Shelf Bioregions. Parks Victoria Technical Series. Number 79. Parks Victoria. Melbourne.

Basslink. 2001. Basslink Draft Integrated Impact Assessment Statement. Main Report. Prepared by NSR Environmental Consultants Pty Ltd for Basslink Pty Ltd.

Bell, B., Spotila, J.R. and Congdon, J. 2006. High Incidence of Deformity in Aquatic Turtles in the John Heinz National Wildlife Refuge. *Env Poll*. 142(3): 457– 465.

Bik, H.M, Halanych, K.H., Sharma, J. and Thomas, W.K. 2012. Dramatic shifts in benthic microbial eukaryote communities following the Deepwater Horizon oil spill.

Birdlife Australia. 2016. Species fact sheets. A WWW database accessed in August 2016 at http://birdlife.org.au/.

Black, K.P., Brand, G.W., Grynberg, H., Gwyther, D., Hammond, L.S., Mourtikas, S., Richardson, B.J., and Wardrop, J.A. 1994. Production facilities. In: *Environmental implications of offshore oil and gas development in Australia – the findings of an independent scientific review*. Swan, J.M., Neff, J.M. and Young, P.C. (eds) Australian Petroleum Exploration Association. Sydney. Pp 209-407.

Blackwell, S.B., C.S. Nations, T.L. McDonald, A.M. Thode, D. Mathias, K.H. Kim, C.R. Greene, Jr., and A.M. Macrander. 2015. Effects of airgun sounds on bowhead whale calling rates: evidence for two behavioral thresholds. PLoS ONE 10(6): e0125720. http://journals.plos.org/plosone/article?id=10.1371/journal.pone.0125720.

Blumer, M. 1971. Scientific aspects of the oil spill problem. *Environmental Affairs* 1:54–73.

Bok, M. 2017. Personal communications between Giulio Pinzone, Environmental Advisor at CarbonNet and Melanie Bok, Environmental Advisor at Esso Australia Resources Pty Ltd. March 2017.

BoM. 2017. Climate Statistics for Australian Locations: Lakes Entrance. A WWW database accessed at http://www.bom.gov.au/climate/averages/tables/cw_084083.shtml. Bureau of Meteorology.

BP. 2014. Abundance and Safety of Gulf Seafood. Seafood Background White Paper. A WWW publication accessed at https://www.thestateofthegulf.com/media/1428/seafood-background-white-paper.pdf. BP Exploration and Production Inc. London.

BP. 2015. Gulf of Mexico Environmental Recovery and Restoration. Five year Report. March 2015. BP Exploration and Production Inc. London.

Brown, P.B. and Wilson, R.I. 1980. A Survey of the Orange-bellied Parrot Neophema chrysogaster in Tasmania, Victoria and South Australia. Tasmanian National Parks & Wildlife Service. Hobart.

Brown, P.B. and Wilson, R.I. 1984. Orange-bellied Parrot Recovery Plan. Department of Environment, Water, Heritage and Arts. Canberra.

Carls, M.G., Holland. L., Larsen, M., Collier, T.K., Scholz, N.L. and Incardona, J.P. 2008. Fish embryos are damaged by dissolved PAHs, not oil particles. *Aquatic Toxicology* 88:121– 127.

Carroll, A.G., Przeslawski, R., Duncan, A., Gunning, M. and Bruce, B. 2017. A critical review of the potential impacts of marine seismic surveys on fish & invertebrates. *Mar. Poll. Bull*. 114 (2017) 9-24.

Castellote, M., Clark, C.W. and Lammers, M.O. 2012. Acoustic and behavioural changes by fin whales (*Balaenaptera physalus*) in response to shipping and airgun noise. *Bio. Cons.* 147: 115-122.

Cato, D.H., Noad, M.J., Dunlop, R.A., McCauley, R.D., Gales, N.J., Kent, C.P.S., Kniest, H., Paton, D., Jenner, K.C.S. 2013. A study of the behavioural response of whales to the noise of seismic air guns: Design, methods and progress. *Acoustics Australia* 41(1): 88-97.

CEE. 2001. Patricia Baleen Gas Field Development. Technical Report. Marine Biological Issues. A report prepared by CEE Consultants Pty Ltd for OMV Australia Pty Ltd.

CEE. 2003. Sole Development (Patricia Baleen Extension). Technical Report. Marine Biological Issues. A report prepared by CEE Consultants Pty Ltd for OMV Australia Pty Ltd.

CER. 2015. ALARP Guidance. Part of the Petroleum Safety Framework and the Gas Safety Regulatory Framework. The Commission for Energy Regulation. Dublin.

Challenger, G. and Mauseth, G. 2011. Chapter 32 – Seafood safety and oil spills. In: *Oil Spill Science and Technology*. M. Fingas (ed) 1083-1100.

Charlton-Robb, K., Gershwin, L., Thompson, R., Austin, J., Owen, K. and McKechnie, S. 2011. A New Dolphin Species, the Burrunan Dolphin Tursiops australis sp. nov., Endemic to Southern Australian Coastal Waters. *PLoS ONE* 6(9): e24047.

Charlton, C.M., Guggenheimer, S.N. and Burnell, S.R. 2014. Long term Southern Right Whale population monitoring at the Head of the Great Australian Bight, South Australia (1991-2013). Report to the Department of Environment, Australian Antarctic Division, Australian Marine Mammal Centre. May 2014.

Christensen-Dalsgaard, J., Brandt, C., Willis, K.L., Christensen, C.B., Ketten, D., Edds-Walton, P., Fay, R.R., Madsen, P.T. and Carr, C.E. 2012. Specialization for underwater hearing by the tympanic middle ear of the turtle, Trachemys scripta elegans. *Proceedings of the Royal Society of London B: Biological Sciences* 279(1739): 2816-2824.

Clark, R.B. 1984. Impact of oil pollution on seabirds. *Environmental Pollution* (Series A) 33 :1–22.

Clarke, R.H. 2010. The Status of Seabirds and Shorebirds at Ashmore Reef, Cartier Island and Browse Island. Monitoring Program for the Montara Well Release. Pre-impact Assessment and First Post-Impact Field Survey. Prepared on behalf of PTTEP Australasia and the Department of the Environment, Water, Heritage and the Arts by the Australian Centre for Biodiversity, Monash University. Melbourne.

CoA. 2009. National Biofouling Management Guidance for the Petroleum Production and Exploration Industry. Commonwealth of Australia. Canberra.

Cogger, H.G., Cameron, E.E., Sadlier, R.A., and Eggler, P. 1993. The Action Plan for Australian Reptiles. Canberra. Australian Nature Conservation Agency.

Cooper Energy. 2017. Quarterly Report for 3 months to 30 June 2017. A WWW document accessed at http://www.cooperenergy.com.au/Upload/Documents/ReportsItem/2017.07.26-Quarterly-Report-Q417.pdf. Cooper Energy. Adelaide.

Curtin University. 2009. Report on Biopsy Collections from Specimens Collected from the Surrounds of the West Atlas Oil Leak – Sea Snake Specimen. Curtin University, Perth.

Curtin University. 2010. Report on Necropsies from a Timor Sea Horned Sea Snake. Curtin University, Perth.

DAFF. 2009. The National Biofouling Management Guidance for the Petroleum Production and Exploration Industry. A WWW document downloaded from http://www.marinepests.gov.au/marine_pests/publications/Pages/petroleum-exportation.aspx. Department of Agriculture, Fisheries and Forestry.

DAFF. 2017. Marine Pests Interactive Map. A WWW database accessed in April 2017 at http://www.marinepests.gov.au/Pages/marinepest-map.aspx.

Dalen, J., Ona, E., Soldal, A.V. and Saetre, R. 1996. Seismic investigations at sea: an evaluation of consequences for fish and fisheries. Institute of Marine Research Fisken og Havet. 9.

Danion, M., Le Floch, S., Lamour, F., Guyomarch, J. and Quentel, C. 2011. Bioconcentration and Immunotoxicity of an Experimental Oil Spill in European Sea Bass (*Dicentrarchus labrax* L.). *Ecotoxicology and Environmental Safety*. 74(8): 2167– 2174.

Davis, H.K., Moffat, C.F. and Shepherd, N.J. 2002. Experimental Tainting of Marine Fish by Three Chemically Dispersed Petroleum Products, with Comparisons to the Braer Oil Spill. *Spill Science & Technology Bulletin*. 7(5–6): 257– 278.

DAWR. 2015. Ballast Water. A WWW database accessed at http://www.agriculture.gov.au/biosecurity/avm/vessels/quarantine-concerns/ballast. Department of Agriculture and Water Resources. Canberra.

DAWR. 2016. The Australian Ballast Water Management Requirements (v6). A WWW document downloaded from http://www.agriculture.gov.au/biosecurity/avm/vessels/ballast/australian-ballast-water-management-requirements-version6. Department of Agriculture and Water Resources.

Day, R.D., McCauley, R., Fitzgibbon, Q.P. and Semmens, J.M. 2016a. Assessing the Impact of Marine Seismic Surveys on Southeast Australian Scallop and Lobster Fisheries. FRDC Report 2012/008. University of Tasmania. Hobart.

Day, R.D., McCauley, R.D. Fitzgibbon, Q.P. and Semmens, J.M. 2016b. Seismic air gun exposure during early stage embryonic development does not negatively affect spiny lobster *Jasus edwardii* larvae (Decapoda:Palinuridae), Scientific Reports 6, Article Number: 22733.

DEDJTR. 2013. Advisory Note: Offshore Petroleum Industry Oil Pollution Emergency Planning Consultation. A WWW document downloaded from http://economicdevelopment.vic.gov.au/transport/emergency-management/marine-pollution/marine-oil-spill-publications. The Department of Economic Development, Jobs, Transport and Resources. Melbourne.

DEDJTR. 2015. Prospectivity and reserves. A WWW database accessed in April 2015 at http://www.energyandresources.vic.gov.au/earth-resources/victorias-earth-resources/oil-gas/prospectivity-and-reserves. Department of Economic Development, Jobs, Transport and Resources. Melbourne.

DEDJTR. 2016. Value of Tourism to Gippsland 2013-14. A WWW document accessed at http://www.tourism.vic.gov.au/research/economic-significance.html. Department of Economic Development, Jobs, Transport and Resources. Melbourne.

DEDJTR. 2017a. Oil Spill Response Atlas. Maintained by Transport for Victoria. Department of Economic Development, Jobs, Transport and Resources. Melbourne.

DEDJTR. 2017b. Production statistics. A WWW database accessed at http://earthresources.vic.gov.au/earth-resources/victorias-earth-resources/petroleum/production-statistics. Department of Economic Development, Jobs, Tourism and Resources. Melbourne.

DEH. 2004. Assessment of the South Australian Pilchard Fishery. September 2004. A WWWW document accessed at http://fishesofaustralia.net.au. Department of the Environment and Heritage. Canberra.

DELWP. 2017. Victorian biodiversity atlas. A WWW database accessed at https://vba.dse.vic.gov.au/vba/#/. Department of Environment, Land, Water and Planning. Melbourne.

Department of Treasury and Finance. 2015. Victorian Government Risk Management Framework. Department of Treasury and Finance. Melbourne.

DEWHA. 2008. EPBC Act Policy Statement 2.1-Interaction between offshore seismic exploration and whales, Department of Environment, Water, Heritage & the Arts, Canberra.

DIBP. 2017. Bass Strait Area to be Avoided. A WWW document accessed at https://www.border.gov.au/AustralianBorderForce/Documents/Bass%20Strait%20Area%20to%20be%20Avoided%20Industry%20information%20sheet.pdf. Department of Immigration and Border Protection.

DNP. 2013. South-east Commonwealth Marine Reserves Network Management Plan 2013-23. Director of National Parks. Canberra.

DNRE. 1996. Croajingolong National Park Management Plan. A WWW document accessed at http://parkweb.vic.gov.au/__data/assets/pdf_file/0018/313263/Croajingolong-National-Park-Plan-.pdf. Department of Natural Resources and Environment. East Melbourne.

DoE. 2013. EPBC Act Policy Statement 1.1 – Significant Impact Guidelines – Matters of National Environmental Significance. A WWW document downloaded from http://www.environment.gov.au/epbc/publications/significant-impact-guidelines-11-matters-national-environmental-significance. Department of the Environment. Canberra.

DoE. 2014. Conservation Advice – *Thinornis rubricollis rubricollis* (hooded plover, eastern). Department of the Environment.

DoE. 2014. Recovery Plan for the Grey Nurse Shark (*Carcharias taurus*). Department of the Environment. Canberra.

DoE. 2015a. South-east Marine Regional Profile. A WWW document accessed at http://www.environment.gov.au/system/files/resources/7a110303-f9c7-44e4-b337-00cb2e4b9fbf/files/south-east-marine-region-profile.pdf. Department of the Environment. Canberra.

DoE. 2015b. Conservation Management Plan for the Blue Whale. A Recovery Plan under the Environment Protection and Biodiversity Conservation Act 1999. Department of the Environment. Canberra.

DoEE. 2018a. EPBC Act Protected Matters Search Tool. A WWW database accessed at http://www.environment.gov.au/epbc/pmst/. Department of the Environment and Energy. Canberra.

DoEE. 2018b. National Conservation Values Atlas. Department of the Environment and Energy. Canberra.

DoEE. 2018c. Australia's World Heritage List. A WWW database accessed at http://www.environment.gov.au/heritage/places/world-heritage-list. Department of the Environment and Energy. Canberra.

DoEE. 2018d. Australia's National Heritage List. A WWW database accessed at http://www.environment.gov.au/heritage/places/national-heritage-list. Department of the Environment and Energy. Canberra.

DoEE. 2018e. Australian Ramsar Wetlands. A WWW database accessed at http://www.environment.gov.au/cgi-bin/wetlands/alphablist.pl. Department of the Environment and Energy. Canberra.

DoEE. 2018f. Australia's Commonwealth Heritage List. A WWW database accessed at http://www.environment.gov.au/topics/heritage/heritage-places/commonwealth-heritage-list. Department of the Environment. Canberra.

DoEE. 2018g. Key Ecological Features. A WWW database accessed at https://www.environment.gov.au/sprat-public/action/kef/search. Department of the Environment and Energy. Canberra.

DoEE. 2018h. Nationally Important Wetlands. A WWW database accessed at http://www.environment.gov.au/cgi-bin/wetlands/search.pl?smode=DOIW. Department of the Environment and Energy. Canberra

DoEE. 2018i. Biologically Important Areas. A WWW database accessed at http://www.environment.gov.au/marine/marine-species/bias. Department of the Environment and Energy. Canberra.

DoEE. 2018j. Australian National Shipwreck Database. A WWW database accessed at https://dmzapp17p.ris.environment.gov.au/shipwreck/public/wreck/search. Department of the Environment and Energy. Canberra.

DoEE. 2018k. Threat Abatement Plan for the impacts of marine debris on the vertebrate wildlife of Australia's coasts and oceans 2018. Department of the Environment and Energy. Canberra.

DoEE. 2017. Recovery Plan for Marine Turtles in Australia. A WWW database accessed at http://www.environment.gov.au/marine/publications/recovery-plan-marine-turtles-australia-2017. Department of the Environment and Energy. Canberra.

Doodie, H. 2003. Personal communication. Dedicated marine mammal observation team member – 2002 Bass Strait seismic surveys. Heath Doodie, Environmental Consultant, NSR Environmental Consultants Pty Ltd.

DPI. 2005. Statement of Management Arrangements for the Victorian Commercial Scallop (*Pecten fumatus*) Fishery. Victorian Department of Primary Industries. Melbourne.

DPI. 2016. Fisheries Victoria Commercial Fish Production Information Bulletin 2016. Fisheries Victoria. Queenscliff.

DRI. 2016. Burrunan Dolphins. A WWW database accessed at http://www.dolphinresearch.org.au/burrunan-dolphins/. Dolphin Research Institute. Hastings, Victoria.

DSE. 2008. Victorian Desalination Project Environment Effects Statement. Environmental Effects of Marine Structures. Volume 2. Department of Sustainability and Environment. Melbourne.

DSEWPC. 2011. National Recovery Plan for Threatened Albatrosses and Giant Petrels 2011-2016. Department of Sustainability, Environment, Water, Population and Communities. Australian Antarctic Division. Canberra.

DSEWPC. 2012a. Fact Sheet: Giant Kelp Forest of South East Australia Ecological Community. Department of Sustainability, Environment, Water, Population and Communities. Canberra.

DSEWPC. 2012b. Conservation Management Plan for the Southern Right Whale 2011-21. Department of Sustainability, Environment, Water, Population and Communities. Canberra.

DSEWPC. 2013. Recovery Plan for the White Shark (*Carcharodon carcharias*). Department of Sustainability, Environment, Water, Population and Communities. Canberra.

Dunlop, R.A. 2016. The effect of vessel noise on humpback whale, *Megaptera novaeangliae*, communication behaviour. *Animal Behaviour* 111: 13-21.

Dunlop, R.A., M.J. Noad, R.D. McCauley, E. Kniest, D. Paton, and D.H. Cato. 2015. The behavioural response of humpback whales (Megaptera novaeangliae) to a 20 cubic inch air gun. *Aquatic Mammals* 41(4): 412.

Dunlop, R.A., M.J. Noad, R.D. McCauley, E. Kniest, R. Slade, D. Paton, and D.H. Cato. 2016. Response of humpback whales (*Megaptera novaeangliae*) to ramp-up of a small experimental air gun array. *Mar. Poll. Bull.* 103(1–2): 72-83.

Dutson, G., Garnett, S. and Gole, C. 2009. Australia's Important Bird Areas. Key site for bird conservation. A WWW document accessed at http://birdlife.org.au/documents/OTHPUB-IBA-supp.pdf. BirdLife International.

EA. 2001. National Recovery Plan for Albatross and Giant Petrel, Wildlife Scientific Advice, National Heritage Division. A WWW document accessed at

http://www.environment.gov.au/biodiversity/threatened/publications/recovery/albatross/index.html. Environment Australia. Canberra.

ECC. 2000. Marine Coastal & Estuarine Investigation. Final Report. Environment Conservation Council. East Melbourne.

Ecologically Sustainable Development Steering Committee. 1992. National Strategy for Ecological Sustainable Development. Council of Australian Governments. Canberra.

Edmonds, N.J., C.J. Firmin, D. Goldsmith, R.C. Faulkner, and D.T. Wood. 2016. A review of crustacean sensitivity to high amplitude underwater noise: Data needs for effective risk assessment in relation to UK commercial species. *Mar. Poll. Bull*. 108(1–2): 5–11.

Edyvane, K.S. 1999. Conserving Marine Biodiversity in South Australia – Part 2 – Identification of areas of high conservation value in South Australia. A WWW document accessed at http://www.ffc.org.au/FFC_files/MPA%20refs/SARDI%20reports%20and%20maps/marine_biodiversity_part2_full_version.pdf. South Australian Research and Development Institute. Adelaide.

EMV. 2016. Emergency Management Manual Victoria. Emergency Management Victoria. Melbourne.

EMV. 2016. State Maritime Emergencies (non-search and rescue) Plan. Edition 1. Emergency Management Victoria. Melbourne.

Engås, A., S. Løkkeborg, E. Ona, and A. V. Soldal. 1996. Effects of seismic shooting on local abundance and catch rates of cod (*Gadus morhua*) and haddock (*Melanogrammus aeglefinus*). *Canadian Journal of Fisheries and Aquatic Sciences* 53:2238-2249.

Engelhardt, F.R. 1982. Hydrocarbon metabolism and cortisol balance in oil- exposed ringed seals, *Phoca hisvida*. Comp. *Biochem. Physiol*. 72C:133- 136.

Engelhardt, F.R. 1983. Petroleum Effects on Marine Mammals. *Aquatic Toxicology* 4:199– 217.

Erbe, C., Reichmuth, C., Cunningham, K., Lucke, K. and Dooling, R. 2015. Communication masking in marine mammals: A review and research strategy. *Mar. Poll. Bull*. 103(1-2): 15–38.

Fandry, C. B. 1983. Model for the three-dimensional structure of winddriven and tidal circulation in Bass Strait. *Aust. J. Mar. Freshwater Res*. 34:121–141.

Felder, D.L., Thoma, B.P., Schmidt, W.E., Sauvage, T., Self-Krayesky, S.L., Christoserdov, A., Bracken-Grissom, H.D. and Fredericq, S. 2014. Seaweeds and Decapod Crustaceans on Gulf Deep Banks after the Macondo Oil Spill. *Bioscience* 64: 808– 819.

Finneran, J.J. 2016. Auditory weighting functions and TTS/PTS exposure functions for marine mammals exposed to underwater noise. Technical Report.

Flegg, J. 2002. Photographic Field Guide Birds of Australia. Second Edition. Reed New Holland. Sydney.

Fogden, S.C.L. 1971. Mother-young behavior at gray seal breeding beaches. *J. Zoo*. 164:61-92.

FRDC. 2017. Fish species profiles. A WWW database accessed at fish.gov.au. Fisheries Research Development Corporation.

French-McCay, D.P. 2003. Development and application of damage assessment modelling: example assessment for the North Cape oil spill. Marine Pollution Bulletin 47 (9):9-12.

French-McCay, D.P. 2009. State-of-the-art and research needs for oil spill impact assessment modelling. *Proceedings of the 32nd Arctic and Marine Oil Spill Program Technical Seminar*. Environment Canada, Ottawa.

French-McCay, D.P., 2002. Development and application of an oil toxicity and exposure model, OilToxEx. *Environmental Toxicology and Chemistry* 21:2080-2094.

French, D. Schuttenberg, H. and Isaji, T. 1999. Probabilities of oil exceeding thresholds of concern: examples from an evaluation for Florida Power and Light In: *Proceedings of the 22nd Artic and Marine Oil Spill Program (AMOP), Technical Seminar, June 1999*. Alberta, Canada.

Fugro. 2005. Longtom to Patricia Baleen Pipeline Route Survey and Culverin Site Survey. Report prepared for Nexus Energy Australia NL by Fugro Survey Pty Ltd, April 2005.

Fugro. 2007. Report for the Sea Lion-1 Site Survey. Fugro Survey Job No: P0635-8. Prepared by Fugro for Australian Drilling Associates, Melbourne.

Gagnon, M.M. and Rawson, C. 2011. Montara Well Release, Monitoring Study S4A – Assessment of Effects on Timor Sea Fish. Curtin University, Perth, Australia.

Gala, W.R. 2001. Predicting the Aquatic Toxicity of Crude Oils. *International Oil Spill Conference Proceedings* (2):935–940.

Gausland, I. 2000. Impact of seismic surveys on marine life. SPE International Conference on Health, Safety and the Environment in Oil and Gas Exploration and Production. 26-28 June, 2000.Gotz et al - cetaceans

Geoscience Australia. 2017. Gippsland Basin. A WWW database accessed at http://www.ga.gov.au/scientific-topics/energy/province-sedimentary-basin-geology/petroleum/offshore-southern-australia/Gippsland. Geoscience Australia. Canberra.

Geraci, J.R. and St. Aubin, D.J. 1988. Synthesis of Effects of Oil on Marine Mammals. Report to US Department of the Interior, Minerals Management Service, Atlantic OCS Region, OCS Study. Ventura, California.

Gill, P. and Morrice, M. 2003. Cetacean Observations. Blue Whale Compliance Aerial Surveys. Santos Ltd Seismic Survey Program Vic/P51 and P52. November-December 2002. Report to Santos Ltd.

Gill, P.C., Kemper, C.M., Talbot, M. and Lyons, S.A. 2008. Large group of pygmy right whales seen in a shelf upwelling region off Victoria, Australia. *Marine Mammal Science* 24(4): 962-968.

Gippsland Times. 2014. Beach oil spill. Report by Julianne Langshaw, March 17, 2014. Gippsland Times and Maffra Spectator.

Godwin, E.M., Noad, M.J., Kniest, E. and Dunlop, R.A. 2016. Comparing multiple sampling platforms for measuring the behavior of humpback whales (Megaptera novaeangliae). Marine Mammal Science 32(1): 268-286. http://dx.doi.org/10.1111/mms.12262.

Gohlke, J.M. 2011. A Review of Seafood Safety after the Deepwater Horizon Blowout. *Environmental Health Perspectives*. 119(8):1062– 1069.

Gomez, C., Lawson, J.W., Wright, A.J., Buren, A.D., Tollit, D. and Lesage, V. 2016. A systematic review on the behavioural responses of wild marine mammals to noise: the disparity between science and policy. Canadian Journal of Zoology 94(12): 801–819.

Gotz, T., Hastie, G., Hatch, L., Raustein, O, Southall, B., Tasker, M, Thomsen, F. 2009. Overview of the impacts of anthropogenic underwater sound in the marine environment. OSPAR Commission. London.

Green, R.H. 1969. The birds of Flinders Island. Records of the Queen Victoria Museum, 34:1-32.

Gwyther, D. and McShane, P.E. 1988. Growth rate and natural mortality of the scallop *Pecten alba* tate in Port Phillip Bay, Australia, and evidence for changes in growth rate after a 20-year period. *Fisheries Research* 6(4): 347-361.

Harris, P.T. and Heap, A. 2009. Geomorphology and Holocene sedimentology of the Tasmanian continental margin. J. *Geo. Soc. Aus.*

Hastie, G.D, Swift, R.J, Gordon, J.C.D., Slesser, G. and Turrell, W.R. 2003. Sperm Whale Distribution and Seasonal Density in the Faroe Shetland Channel. *J Cetacean Res*. Manage 5(3): 247-252.

Hawkins, A.D. and Popper, A.N. 2016. A sound approach to assessing the impact of underwater noise on marine fishes and invertebrates. *ICES Journal of Marine Science*: 17.

Hawkins, E. R. and Gartside, D. F. 2009. Interactive Behaviours of Bottlenose Dolphins (*Tursiops aduncus*) During Encounters with Vessels. *Aquatic Mammals* 2009 35(2): 259-268.

Hayworth, J.S., Clement, T.P. and Valentine, J.F. 2011. Deepwater Horizon oil spill impacts on Alabama Beaches. *Hydrology and Earth System Sciences* 15 :3639– 3649.

Heyward, A., Moore, C., Radford, B. and Colquhoun, J. 2010. Monitoring Program for the Montara Well Release Timor Sea: Final Report on the Nature of Barracouta and Vulcan Shoals. Report prepared by the Australian Institute of Marine Science for PTTEP Australasia (Ashmore Cartier) Pty Ltd.

Higgins, L.V. and Gass, L. 1993. Birth to weaning: parturition, duration of lactation, and attendance cycles of Australian sea lions (*Neophoca cinerea*). *Canadian Journal of Zoology* 71:2047-2055.

Higgins, P.J. (ed.) 1999. Handbook of Australian, New Zealand and Antarctic Birds. Volume Four - Parrots to Dollarbird. Oxford University Press, Melbourne.

Holdway, D.A. 2002. The acute and chronic effects of wastes associated with offshore oil and gas production on temperate and tropical marine ecological processes. *Marine Pollution Bulletin* 44:185– 203.

Hook, S., Batley, G., Holloway, M., Irving, P. and Ross, A. 2016. Oil Spill Monitoring Handbook. CSIRO Publishing. Melbourne.

Horwood, J. 1987. The sei whale: Population biology, ecology, and management. Croom Helm, Sydney.

Hotchkin, C. and Parks, S. 2013. The Lombard effect and other noise□induced vocal modifications: insight from mammalian communication systems. *Biological Reviews* 88(4): 809-824.

Hume F., Hindell M.A., Pemberton D. and Gales R. 2004. Spatial and temporal variation in the diet of a high trophic level predator, the Australian fur seal (*Arctocephalus pusillus doriferus*). *Mar. Biol.* 144(3): 407-415.

IAGC. 2013. Environmental Manual for Worldwide Geophysical Operations. A WWW document accessed at www.iagc.org/uploads/4/5/0/7/45074397/environmental_compliance_manual.pdf. International Association of Geophysical Contractors.

IMCA. 2016. Marine Inspection for Small Workboats. A WWW document downloaded from www.imca-int.com/marine. International Marine Contractors Association. IMCA M 189 Rev 3, June 2016.

IMCRA. 1998. Interim Marine and Coastal Regionalisation for Australia: An ecosystem-based classification for marine and coastal environments. IMCRA Technical Group. Version 3.3.

IOGP. 2015. Conduct of offshore drilling hazard Site Surveys – Technical Notes. International Association of Oil & Gas Producers. Report 373-18-2. October 2015.

IOGP. 2017. Conduct of offshore drilling hazard site surveys. International Association of Oil & Gas Producers. Report 373-18-1. October 2017.

IPIECA. 1995. Biological Impacts of Oil Pollution: Rocky Shores. International Petroleum Industry Environmental Conservation Association. London.

IPIECA. 1999. Biological Impacts of Oil Pollution: Sedimentary Shores. International Petroleum Industry Environmental Conservation Association. London.

IPIECA. 2002. Guidelines on Biological Impacts of Oil Pollution. International Petroleum Industry Environmental Conservation Association. London.

IPIECA/OGP. 2014a. A guide to oiled shoreline assessment (SCAT) surveys. Good practice guidelines for incident management and emergency response personnel. International Petroleum Industry Conservation Association and International Association of Oil & Gas Producers. London.

IPIECA/OGP. 2014b. Oil spill waste minimisation and management. Good practice guidelines for incident management and emergency response personnel. International Petroleum Industry Conservation Association and International Association of Oil & Gas Producers. London.

IPIECA/OGP. 2014c. Wildlife response preparedness. Good practice guidelines for incident management and emergency response personnel. International Petroleum Industry Conservation Association and International Association of Oil & Gas Producers. London.

IPIECA/OGP. 2015. Aerial observation of oil spills at sea. Good practice guidelines for incident management and emergency response personnel. International Petroleum Industry Conservation Association and International Association of Oil & Gas Producers. London.

ISO. 2009. ISO 31000 Risk management–-Principles and guidelines. International Standards Organisation. Switzerland.

ITOPF. 2011a. Effects of Oil Pollution on the Marine Environment. Technical Information Paper 13. The International Tanker Owners Pollution Federation Ltd. London.

ITOPF. 2011b. Aerial Observation of Marine Oil Spills. Technical Information Paper 2. The International Tanker Owners Pollution Federation Ltd. London.

ITOPF. 2011c. Use of Booms in Oil Pollution Response. Technical Information Paper 3. The International Tanker Owners Pollution Federation Ltd. London.

ITOPF. 2011d. Use of Skimmers in Oil Pollution Response. Technical Information Paper 5. International Tanker Owners Pollution Federation Ltd. London.

ITOPF. 2011e. Recognition of Oil on Shorelines. Technical Information Paper 6. The International Tanker Owners Pollution Federation Ltd. London.

ITOPF. 2011f. Clean-up of Oil from Shorelines. Technical Information Paper 7. The International Tanker Owners Pollution Federation Ltd. London.

ITOPF. 2011g. Disposal of Oil and Debris. Technical Information Paper 9. International Tanker Owners Pollution Federation Ltd. London.

IUCN. 2017. Protected Areas Categories. A WWW database accessed at https://www.iucn.org/theme/protected-areas/about/protected-areas-categories. International Union for the Conservation of Nature. Switzerland.

Jasco Applied Sciences. 2018. Pelican 3-D Seismic Survey Sound Source Characterisation. Prepared by Jasco Applied Sciences (Brisbane) for RPS Energy Services Pty Ltd (Perth).

Jenssen, B.M. 1994. Effects of Oil Pollution, Chemically Treated Oil, and Cleaning on the Thermal Balance of Birds. *Env Poll* 86:207– 215.

Jones, I.S.F. 1980. Tidal and Wind-drive Currents in Bass Strait. *Aus. J. Mar. Freshwater Res*. 31. 109-17.

Jones, I.S.F. and Padman, L. 1983. Semidiurnal internal tides in eastern Bass Strait. *Aust. J. Mar. Freshwater Res* 34:159–171.

Jung, J. 2011. Biomarker Responses in Pelagic and Benthic Fish Over One Year Following the Hebei Spirit Oil Spill (Taean, Korea). *Mar. Poll. Bull*. 62(8):1859–1866.

Kasamatsu, F. and Joyce, G. 1995. Current status of odontocetes in the Antarctic waters. *Antarct Sci*. 7:365-379.

Kasamatsu, F., Matsuoka, K. and Hakamada, T. 2000. Interspecific relationships in density among the whale community in the Antarctic. *Polar Biol*. 23:466-473.

Kent., C.S., McCauley, R.D, Duncan, A., Erbe, C., Gavrilov, A., Lucke, K. and Parnum, I. 2016. Underwater Sound and Vibration from Offshore Petroleum Activities and their Potential Effects on Marine Fauna: An Australian Perspective. Prepared by the Centre for Marine Science and Technology (CMST), Curtin University for the Australian Petroleum Production and Exploration Association (APPEA). Project CMST 1218. Report 2015-13. April 2016.

Ketten, D.R. 1992. The cetacean ear: form, frequency, and evolution. In Thomas, J.A., R.A. Kastelein, and A.Y. Supin (eds.). Marine Mammal Sensory Systems. Plenum Press, New York. 53-75.

Ketten, D.R. and Bartol, S.M. 2005. Functional measures of sea turtle hearing. ONR project final report. Document Number ONR Award Number N00014-02-1-0510. Office of Naval Research (US).

Ketten, D.R., Merigo, C., Chiddick, E., Krum, H. and Melvin, E.F. 1999. Acoustic fatheads: parallel evolution of underwater sound reception mechanisms in dolphins, turtles, and sea birds. *Journal of the Acoustical Society of America* 105(2): 1110.

Klimley, A.P. and Myrberg, Jr A.A. 1979. Acoustic stimuli underlying withdrawal from a sound source by adult lemon sharks, Negaprion brevirostris (Poey). Bull. Mar. Sci. 29: 447–458.

Koopman, M., Knuckey, I., Harris, A. and Hudson, R. 2018. Eastern Victorian Ocean Scallop Fishery 2017-18 Abundance Survey (VFA Project Number 17/646976). Prepared by Fishwell Consulting (Queenscliff) for the Victorian Fisheries Authority (Melbourne).

Kooyman, G.L., Davis, R.W. and Castellini, M.A. 1977. Thermal conductance of immersed pinniped and sea otter pelts before and after oiling with Prudhoe Bay crude. pp. 151-157. In: *Fate and Effects of Petroleum Hydrocarbons in Marine Ecosystems and Organisms*. D.A. Wolfe (ed.). Pergammon Press, New York, New York.

Kooyman, G.L., Gentry, R.L. and McAllister, W.B. 1976. Physiological impact of oil on pinnipeds. Report N.W. Fisheries Center. *Natl. Mar. Fish. Serv*. Seattle, WA.

Kostyuchenko, L.P. 1973. Effects of elastic waves generated in marine seismic prospecting on fish eggs in the Black Sea. *Hydrobiological Journal* 9: 45-48.

Laist, D.W., Knowlton, A.R., Mead, J.G., Collet, A.S., & Podesta, M. 2001. Collisions between Ships and Whales. *Marine Mammal Science* 17(1): 35-75.

Lamendella, R., Strutt, S., Borglin, S., Chakraborty, R., Tas., N., Mason, O., Hultman, J., Prestat, Hazen, T. and Jansson, J. 2014. Assessment of the Deepwater Horizon oil spill impact on Gulf coast microbial communities. *Front. Microbiol*. 5: 130.

Lavender, A.L., Bartol, S.M. and Bartol, I.K. 2012. Hearing capabilities of loggerhead sea turtles (*Caretta caretta*) throughout ontogeny. In: *The Effects of Noise on Aquatic Life*. Springer. 89-92.

Lavender, A.L., Bartol, S.M. and Bartol, I.K. 2014. Ontogenetic investigation of underwater hearing capabilities in loggerhead sea turtles (*Caretta caretta*) using a dual testing approach. *Journal of Experimental Biology* 217(14): 2580-2589.

Lee, H.J., Shim, W.J., Lee, J. and Kim, G.B. 2011. Temporal and geographical trends in the genotoxic effects of marine sediments after accidental oil spill on the blood cells of striped beakperch (*Oplegnathus fasciatus*). *Mar. Poll. Bull.* 62:2264– 2268.

Lenhardt, M.L. 1994. Seismic and very low frequency sound induced behaviors in captive loggerhead marine turtles (Caretta caretta). In: Bjorndal, K.A., A.B. Bolten, D.A. Johnson, and P.J. Eliazar (eds.). 14th Annual Symposium on Sea Turtle Biology and Conservation. NOAA Technical Memorandum, NMFS-SEFSC-351, National Technical Information Service, Springfield, Virginia.

Lenhardt, M.L., Klinger, R. and Musick, J. 1985. Marine turtle middle-ear anatomy. *Journal of Auditory Research* 25(1): 66-72.

Lewis, M. and Pryor, R. 2013. Toxicities of oils, dispersants and dispersed oils to algae and aquatic plants: Review and database value to resource sustainability. *Env. Poll.* 180:345–367.

Limpus, C.J. 2008a. A biological review of Australian Marine Turtles. 1. Loggerhead Turtle *Caretta caretta* (Linneaus). Queensland Environment Protection Agency.

Limpus, C.J. 2008b. A Biological Review of Australian Marine Turtles. Green Turtle, *Chelonia mydas* (Linnaeus). Prepared for the Queensland Environment Protection Agency.

Limpus, C.J. 2009. A Biological Review of Australian Marine Turtles. Leatherback Turtle, *Dermochelys coriacea* (Vandelli). Prepared for the Queensland Environment Protection Agency.

Lindquist, D., Shaw, R. and Hernandez, F Jr. 2005. Distribution patterns of larval and juvenile fishes at offshore petroleum platforms in the north-central Gulf of Mexico. *Estuar Coast Shelf Sci* 62(4):655–665.

Loyn, R.H., Lane, B.A., Chandler, C and Carr, G.W. 1986. Ecology of Orange-bellied Parrots *Neophema chrysogaster* at their main remnant wintering site. *Emu*. 86:195-206.

Marquenie, J., Donners, M., Poot, H., Steckel, W. and de Wit, B. 2008. Adapting the spectral composition of artificial lighting to safeguard the environment, Petroleum and Chemical Industry Conference Europe – Electrical and Instrumentation Applications, 2008, PCIC Europe 2008.

Martin, K.J., S.C. Alessi, J.C. Gaspard, A.D. Tucker, G.B. Bauer, and D.A. Mann. 2012. Underwater hearing in the loggerhead turtle (Caretta caretta): A comparison of behavioral and auditory evoked potential audiograms. *Journal of Experimental Biology* 215(17): 3001-3009.

Matishov, G.G. 1992. The reaction of bottom-fish larvae to airgun pulses in the context of the vulnerable Barents Sea ecosystem. *Contr. Petro Piscis* II '92 F-5, Bergen, Norway, 6-8 April, 1992.

McCauley, R. and Gavrilov, A. 2013. Analysis of sea noise April 2012 to January 2013 in Bass Strait: whales; fish; drill rig; vessel; and ambient noise. Unpublished report for Origin Energy. Centre for Marine Science and Technology Curtin University. Report 2013-17.

McCauley, R. D. 1994. 'Seismic Survey.' In: *Environmental Implications of Offshore Oil and Gas Developments in Australia – the Findings of an Independent Scientific Review*. Swan J.M., Neff J.M. and Young P.C. (eds) Australian Petroleum Exploration Association. Sydney.

McCauley, R. D. and Kent, C.S. 2012. A lack of correlation between air gun signal pressure waveforms and fish hearing damage. *Advances in Experimental Medicine and biology* 730:245–250.

McCauley, R. D., Fewtrell, J., Duncan, A., Jenner, C., Jenner M-N., Penrose, J. D., Prince, R. T., Adhitya, A., Murdoch, J. and McCabe, A. K. 2003. 'Marine seismic surveys: analysis and propagation of source signals; and effects of exposure on humpback whales, sea turtles, fishes and squid.' In: *Environmental Implications of Offshore Oil and Gas Developments in Australia:*

Further Research. Australian Petroleum Production and Exploration Association. Canberra.

McCauley, R.D. and Kent, C.S. 2012. 'A lack of correlation between airgun signal pressure waveforms and fish hearing damage.' In: *The effects of noise on aquatic life*. Popper, A.N. and Hawkins, A.D. (eds) Springer Science+Business Media, LLC, New York.

McCauley, R.D., Day, R.D., Swadling, K.M., Fitzgibbon, Q.P., Watson, R.A. and Semmens, J.M. 2017. Widely used marine seismic survey air gun operations negatively impact zooplankton. *Nat. Ecol. Evol*. 1, 0195.

McCauley, R.D., Fewtrell, J., Duncan, A.J., Jenner, C., Jenner, M.-N., Penrose, J.D., Prince, R.I.T., Adhitya, A., Murdoch, J. and McCabe, K. 2000a. 'Marine Seismic Surveys: Analysis and propagation of air-gun signals; and effects of air-gun exposure on humpback whales, sea turtles, fishes and squid.' In: *Environmental implications of offshore oil and gas development in Australia: Further research*. Australian Petroleum Production and Exploration Association. Canberra.

McCauley, R.D., J. Fewtrell, A.J. Duncan, C. Jenner, M-N., Jenner, J.D., Penrose, R.I.T., Prince, Adihyta, A. and Murdoch, J. 2000b. Marine seismic surveys: A study of environmental implications. *Australian Petroleum Production Exploration Association Journal* 40: 692-708.

McDonald, M.A., Hildebrand, J.A. and Webb, S.C. 1995. Blue and fin whales observed on a seafloor array in the Northeast Pacific. *Journal of the Acoustical Society of America* 98(2): 712–721.

McInnes, K. L. and Hubbert, G. D. 2003. A numerical modelling study of storm surges in Bass Strait. *Australian Meteorological Magazine* 52(3).

McPherson, C. 2017. Personal communications with Giulio Pinzone, Environmental Advisor to CarbonNet. Underwater acoustics engineer with JASCO Applied Sciences. Personal conversation. June 2017.

Meekan, M. G., Wilson, S. G., Halford, A. and Retzel, A. 2001. A comparison of catches of fishes and invertebrates by two light trap designs, in tropical NW Australia. *Mar. Biol*. 139: 373 – 381.

MESA. 2017. Marine Pests of Australia. New Zealand Screw Shell. A WWW database accessed at http://www.mesa.edu.au/marine_pests/marine_pests07.asp. Marine Education Society of Australasia.

Milicich, M. J., Meekan, M. G. and Doherty, P. J. 1992. Larval supply: a good predictor of recruitment in three species of reef fish (Pomacentridae). *Mar. Ecol. Prog. Ser*. 86: 153-166.

Minerals Management Service. 1983. Draft Environmental Impact Statement. Proposed 1983 Outer Continental Shelf Oil and Gas Lease Sale Offshore Central California. Department of the Interior, Minerals Management Service. Los Angeles, California.

Moein, S.E., Musick, J.A., Keinath, J.A., Barnard, D.E., Lenhardt, M.L. and George, R. 1995. Evaluation of Seismic Sources for Repelling Sea Turtles from Hopper Dredges, in Sea Turtle Research Program: Summary Report. In: Hales, L.Z. (ed.). Report from U.S. Army Engineer Division, South Atlantic, Atlanta GA, and

U.S. Naval Submarine Base, Kings Bay GA. Technical Report CERC-95. 90 pp.

Mooney, T.A., Yamato, M. and Branstetter, B.K. 2012. Hearing in cetaceans: From natural history to experimental biology. *Advances in Marine Biology* 63: 197–246.

Morrice, M.G., Gill, P.C., Hughes, J. and Levings, A.H. 2004. Summary of mitigation aerial surveys for the Santos Ltd EPP32 seismic survey, 2-13 December 2003. Report # WEG-SO 02/2004, Whale Ecology Group-Southern Ocean, Deakin University.

Morris, C.J., Cote, D., Martin, B. and Kehler, D. 2017. Effects of 2D seismic on the snow crab fishery. *Fisheries Research* (2017). A WWW paper accessed at http://dx.doi.org/10.1016/j.fishres.2017.09.012.

Museums Victoria. 2017. Fishes of Australia database. A WWW database accessed at http://fishesofaustralia.net.au. Museums Victoria. Melbourne.

Mustoe, S.H. 2008. Killer Whale (*Orchinus orca*) sightings in Victoria. *Victorian Naturalist* 125(3): 76-81.

Myrberg, A.A. 2001. The acoustical biology of elasmobranchs. *Environmental Biology of Fishes* 60(3): 31- 45.

NATO. No date. Part II: Saclantcen Marine Mammal and Human Divers Risk Mitigation Rules – Planning. North Atlantic Treaty Organisation. Brussels.

NERA. 2017. Environment Plan Reference Case: Planned discharge of sewage, putrescible waste and grey water. National Energy Resources Australia. Perth.

NMFS. 2001. Biological Opinion on the Endangered Species Act 1973 - Section 7 Consultation relating to the minerals management Service's (MMS) proposed approval of a development and production plan for the construction and operation of the Liberty project in the Beaufort Sea, Alaska. Consultation No. F/AKR/2001/00889. National Marine Fisheries Service, Alaska region, Office of protected resources. pp. 1-51.

NMFS. 2013. Marine Mammals: Interim Sound Threshold Guidance. National Marine Fisheries Service, National Oceanic and Atmospheric Administration, U.S. Department of Commerce. National Marine Fisheries Service

NMFS. 2016. Technical Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Thresholds for Onset of Permanent and Temporary Threshold Shifts. U.S. Department of Commerce, NOAA. NOAA Technical Memorandum NMFS-OPR-55. National Marine Fisheries Service.

NMSC. 2010. Marine Incidents during 2009. Preliminary Data Analysis. A WWW database accessed at http://www.nmsc.gov.au. Australian National Marine Safety Committee.

NNTT. 2017. Search register of Native Title claims. A WWW database accessed at http://www.nntt.gov.au/searchRegApps/NativeTitleRegisters/Pages/Search-Register-of-Native-Title-Claims.aspx. National Native Title Tribunal.

NOAA. 2002. Environmental Sensitivity Index Guidelines. Version 3. March 2002. National Oceanic and Atmospheric Administration. Washington.

NOAA. 2013. Deepwater Horizon Oil Spill: Assessment of Potential Impacts on the Deep Softbottom Benthos. Interim data summary report. NOAA Technical

Memorandum NOS NCCOS 166. National Oceanic and Atmospheric Administration. Washington.

NOAA. 2016. Document Containing Proposed Changes to the NOAA Draft Guidance for Assessing the Effects of Anthropogenic Sound on Marine Mammal Hearing: Underwater Acoustic Threshold Levels for Onset of Permanent and Temporary Threshold Shifts. National Oceanic and Atmospheric Administration.

NOO. 2002. Ecosystems - Nature's Diversity. The South-East Regional Marine Plan Assessment Reports. National Oceans Office. Hobart.

NOPTA. 2018. Petroleum Titles interactive map. A WWW database accessed at http://www.nopta.gov.au/maps-and-public-data/interactive-map.html. National Offshore Petroleum Titles Administrator. Perth.

Nowacek, D. and Southall, B. The Effective Planning Strategies for Managing Environmental Risk associated with Geophysical and other Imaging Surveys: A Resource Guide for Managers. International Union for the Conservation of Nature. Gland, Switzerland.

Nowacek, D., Johnson, M. and Tyack, P.L. 2004. North Atlantic right whales (*Eubalaena glacialis*) ignore ships but respond to alarm stimuli. *Proceedings of the Royal Society of London* B 271: 227–231.

NRC. 2003. Ocean Noise and Marine Mammals. National Research Council (U.S.), Ocean Studies Board, Committee on Potential Impacts of Ambient Noise in the Ocean on Marine Mammals. National Research Council. The National Academies Press, Washington, DC.

NRDA. 2012. April 2012 Status Update for the Deepwater Horizon Oil Spill. A WWW publication accessed at: http://www.gulfspillrestoration.noaa.gov. Natural Resource Damage Assessment.

NSF (U.S), U.S. Geological Survey, and National Oceanic and Atmospheric Administration (U.S.). 2011. Final Programmatic Environmental Impact Statement/Overseas. Environmental Impact Statement for Marine Seismic Research Funded by the National Science Foundation or Conducted by the U.S. Geological Survey. National Science Foundation, Arlington, VA.

O'Brian, P. and Dixon, P. 1976. The effects of oils and oil components on algae: A review. *British Phycological Journal* 11:115– 141.

O'Hara, J. and Wilcox, J.R. 1990. Avoidance responses of loggerhead turtles, *Caretta caretta*, to low frequency sound. *Copeia* 2: 564-567.

Oil & Gas UK. 2014. Guidance on Risk Related Decision Making. Issue 2, July 2014. Oil & Gas UK. London.

OMV. 2001. Patricia Baleen Gas Field Development. Environment Effects Statement-Public Environment Report. OMV Australia Pty Ltd.

OMV. 2003. Sole Development (Patricia Baleen Extension). Environment Effects Statement Supplementary Report to the Patricia Baleen Gas Field Development EES-PER. OMV Australia Pty Ltd.

Oritsland, N.A. 1975. Insulation in marine mammals: the effect of crude oil on ringed seal pelts. pp. 48-67. In: The Effect of Contact and Ingestion of Crude Oil on Ringed Seals of the Beaufort Sea. T.G. Smith and J.R. Geraci (eds.). Beaufort Sea Project. *Inst. of Ocean Sci*. Sidney, British Columbia. Technical Report No. 5.

Pade, N., Queiroz, N., Humphries, N., Witt, M., Jones, C., Noble, L. and Sims, D. 2009. First results from satellite-linked archival tagging of Porbeagle shark, *Lamna nasus*: area fidelity, wider-scale movements and plasticity in diel depth changes. *Journal of Experimental Marine Biology and Ecology*. 370:64-74.

Parks, S.E., Clark, C.W. and Tyack, P.L. 2007. Short-and long-term changes in right whale calling behavior: The potential effects of noise on acoustic communication. *Journal of the Acoustical Society of America* 122(6): 3725-3731.

ParksVic. 2017. Marine pests. A WWW database accessed at http://parkweb.vic.gov.au/park-management/environment/weeds-and-pests/marine-pests. Parks Victoria. Kew.

ParksVic. 2006. Ninety Mile Beach Marine National Park Management Plan. A WWW document accessed at http://parkweb.vic.gov.au/__data/assets/pdf_file/0004/313366/Ninety-Mile-Beach-Marine-National-Park-Management-Plan.pdf. Parks Victoria. Kew.

ParksVic. 2003. Gippsland Lakes Ramsar Site Strategic Management Plan. Department of Sustainability and Environment. East Melbourne.

ParksVic. 1999. Information Sheet on Ramsar Wetlands (Ramsar Information Sheet) Gippsland Lakes. A WWW document accessed at http://www.environment.gov.au/water/topics/wetlands/database/pubs/21-ris.pdf. Parks Victoria. Kew.

ParksVic. 1998. The Lakes National Park and Gippsland Lakes Coastal Park Management Plan. Parks Victoria. Kew.

Parry, G.D. and Gason, A. 2006. The Effect of Seismic Surveys on Catch Rates of Rock Lobsters in Western Victoria, Australia. *Fisheries Research* 79(2006): 272-284.

Parvin S.J., Nedwell, J.R. and Harland, E. 2007. Lethal and physical injury of marine mammals, and requirements for Passive Acoustic Monitoring. Subacoustech Report Reference: 565R0212, February 2007, Submitted to the UK DTI, 1 Victoria Street, London, SW1H 0ET. Published by the UK Department of Business, Enterprise and Regulatory Reform.

Patterson, H., Noriega, R., Georgeson, L., Larcombe, J and Curtotti, R. 2017. Fishery status reports 2017. Australian Bureau of Agricultural and Resource Economics and Sciences. Canberra.

Payne, J.F., Andrews, C., Fancey, L., White, D. and Christian, J. 2008. Potential Effects of Seismic Energy on Fish and Shellfish: An Update since 2003. Report Number 2008/060. Canadian Science Advisory Secretariat.

Pearson, W. H., Skalski, J.R. and Malme, C.I. 1992. Effects of Sounds from a Geophysical Survey Device on Behavior of Captive Rockfish (*Sebastes* spp.). *Canadian Journal of Fisheries and Aquatic Sciences* 49:1343–1356.

Peel, D., Kelly, N., Smith, J., Childerhouse, S. 2016. National Environmental Science Program Project C5 – Scoping of Potential Species for Ship Strike Risk Analysis, Pressures and impacts. CSIRO. Australia.

Perrin, W.F. 1998. *Stenella longirostris*. *Mammalian Species* 599: 1-7.

PFPI. 2017. About little penguins. A WWW database accessed at https://penguinfoundation.org.au/about-little-penguins/. Penguin Foundation Phillip Island. Victoria.

Pichegru, L., Nyengera, R., Sutton, G., Arnould, J. and Pistorius, P. 2016. Poster presentation titled 'Influence of Seismic surveys on African and Little Penguin Behaviour.' Percy Fitzpatrick Institute for African Ornithology & Department of Zoology, Nelson Mandela Metropolitan University, South Africa and Deakin University, Victoria, Australia.

Pickett, G. D., Eaton, D., Seaby, R. and Arnold, G. 1994. Results of bass tagging in Poole Bay during 1992. Ministry of Agriculture, Fisheries and Food, Directorate of Fisheries Research, Laboratory Leaflet.

Piniak, W.E., Mann, D.A., Eckert, S.A. and Harms, C.A. 2011. Amphibious hearing in sea turtles. In: Hawkins, T. and Popper, A.N. (eds.). *Proceedings of the 2nd International Conference on the Effects of Noise on Aquatic Life*. August 15-20, 2010. Springer-Verlag. (In Press).

Piniak, W.E.D., Mann, D.A., Harms, C.A., Jones, T.T. and Eckert, S.A. 2016. Hearing in the Juvenile Green Sea Turtle (*Chelonia mydas*): A Comparison of Underwater and Aerial Hearing Using Auditory Evoked Potentials. *PLOS ONE* 11(10): e0159711.

Pinzone, G. 2003. Personal observations. Dedicated marine mammal observation team member – 2002 Bass Strait seismic surveys. Giulio Pinzone, Environmental Consultant, NSR Environmental Consultants Pty Ltd.

Polarcus. 2018. Polarcus Naila Final Acquisition Report. Prepared by Polarcus Seismic Ltd (Dubai) for CarbonNet (Melbourne).

Poore, G.C.B., Wilson, R.S., Gomon, M. and Lu, C.C. 1985. Museum of Victoria Bass Strait Survey, 1979-1984. Museum of Victoria, Melbourne.

Popper A.N., Halvorsen, M.B., Kane, E., Miller, D.D., Smith, M.E., Stein, P. and Wysocki, L.E. 2007. The effects of high-intensity, low-frequency active sonar on rainbow trout. *J. Acoust. Soc. Am*. 122: 623–635.

Popper, A. N., Gross, J.A., Carlson, T.J., Skalski, J., Young, J.V., Hawkins, A.D. and Zeddies, D. 2016. Effects of exposure to the sound from seismic airguns on pallid sturgeon and paddlefish. *PLoS One* 11:e0159486.

Popper, A.N. and Løkkeborg, S. 2008. Effects of anthropogenic sound on fish. *Bioacoustics* 17: 214-217.

Popper, A.N., Carlson, T., Gross, J.A., Hawkins, A.D., Zeddies, D.G. and Powell, L. 2015. Effects of Seismic Air Guns on Pallid Sturgeon and Paddlefish. *Advances in Experimental Medicine and Biology* 875:871-878.

Popper, A.N., Carlson, T.J., Gross, J.A., Hawkins, A.D., Zeddies, D., Powell, L. and Young, J. 2016. Effects of seismic air guns on pallid sturgeon and paddlefish. *Advances in Experimental Medicine and Biology* 875: 871-878. NLM.

Popper, A.N., Hawkins, A.D., Fay, R.R., Mann, D.A., Bartol, S., Carlson, T.J., Coombs, S., Ellison, W.T., Gentry, R.L. 2014. Sound Exposure Guidelines for Fishes and Sea Turtles: A Technical Report prepared by ANSI-Accredited Standards Committee S3/SC1 and registered with ANSI. SpringerBriefs in Oceanography, Volume ASA S3/SC1.4 TR-2014. ASA Press.

Przeslawski, R., Bruce, B., Carroll, A., Anderson, R., Bradford, A., Durrant, A., Edmunds, M., Foster, S., Huang, Z., Hurt, L., Lansdell, M., Lee, K., Lees, C., Nichols, P. and Williams, S. 2016b. Marine Seismic Survey Impacts on Fish and Invertebrates. Final Report for the Gippsland Marine Environmental Monitoring Project. Record 2016/35. Geoscience Australia. Canberra.

Przeslawski, R., Hurt, L., Forrest, A. and Carroll, A. 2016a. Potential short-term impacts of marine seismic surveys on scallops in the Gippsland Basin, FRDC Project No 2014/041. Geoscience Australia. Canberra.

PTTEP. 2013. Montara Environmental Monitoring Program. Report of Research. A WWW document accessed at: www.au.pttep.com/sustainable-development/environmentalmonitoring. PTTEP Australasia. Perth.

Purser, J. and Radford, A.N. 2011. Acoustic noise induces attention shifts and reduces foraging performance in three-spined sticklebacks (*Gasterosteus aculeatus*). *PLoS ONE* 6(2): e17478.

Ramachandran, S.D., Hodson, P.V., Khan, C.W. and Lee, K. 2004. Oil dispersant increases PAH uptake by fish exposed to crude oil. *Ecotoxicology and Environmental Safety* 59:300– 308.

Rawson, C., Gagnon, M.M. and Williams, H. 2011. Montara Well Release Olfactory Analysis of Timor Sea Fish Fillets. Curtin University, Perth, Western Australia, November 2011.

Reilly, S.B., Bannister, J.L., Best, P.B., Brown, M., Brownell Jr, R.L., Butterworth, D.S, Clapham, D.J., Cooke, J., Donovan, G.P., Urbán, J. and Zerbini, A.N. 2008. *Caperea marginata*. In: IUCN Red List of Threatened Species. Version 2011.2.

Reiser, C.M, Funk, D.W., Rodrigues, R. and Hannay, D. (eds.) 2011. Marine mammal monitoring and mitigation during marine geophysical surveys by Shell Offshore, Inc. in the Alaskan Chukchi and Beaufort seas, July–October 2010: 90-day report. LGL Rep. P1171E–1. Rep. from LGL Alaska Research Associates Inc., Anchorage, AK, and JASCO Applied Sciences, Victoria, BC for Shell Offshore Inc, Houston, TX, Nat. Mar. Fish. Serv., Silver Spring, MD, and U.S. Fish and Wild. Serv., Anchorage, AK.

Richardson , A.J., Matear, R.J. and Lenton, A. 2017. Potential impacts on zooplankton of seismic surveys. CSIRO. Australia.

Richardson, W. J., Greene, C. R., Maime, C. I. and Thomson, D. H. 1995. Marine Mammals and Noise. Academic Press. California.

Ross, G.J.B. 2006. Review of the Conservation Status of Australia's Smaller Whales and Dolphins. Report to the Australian Department of the Environment and Heritage. Canberra.

Rowe, C.L., Mitchelmore, C.L. and Baker, J.E. 2009. Lack of Biological Effects of Water Accommodated Fractions of Chemically and Physically Dispersed Oil on Molecular, Physiological, and Behavioural Traits of Juvenile Snapping Turtles Following Embryonic Exposure. *Science of The Total Environment.* 407(20): 5344– 5355.

RPS. 2017. Technical Memo – Review of Potential Effects of CarbonNet Seismic Survey on Pipelines. RPS Group. Brighton, England.

RPS. 2018. Marine Fauna Observer's Report. Pelican 3D Marine Seismic Survey. 4 February 2018 to 26 February 2018. Prepared by RPS Energy Pty Ltd (Perth) for CarbonNet (Melbourne).

Saddlier, S., Jackson, J. and Hammer, M. 2010. National Recovery Plan for the Dwarf Galaxias *Galaxiella pusilla*. Department of Sustainability and Environment. East Melbourne.

Sandegren, F.E. 1970. Breeding and maternal behavior of the Steller sea lion (*Eumetoias jubata*) in Alaska. M.Sc. Thesis, Univ. Alaska, Anchorage, AK. Sergeant.

SARDI. 2011. Conservation management priorities for little penguin populations in Gulf St Vincent. A report prepared by Annelise Wiebkin, South Australian Research and Development Institute for the Adelaide and Mount Lofty Ranges Natural Resources Management Board. June 2011. SARDI Public No F2011/000188-1.

SCAR. 2002. Impacts of Marine Acoustic Technology on the Antarctic Environment. Version 1.2. July 2002. A WWW publication accessed at http://www.scarggi.org.au/geophysics/acoustics_1_2.pdf. Ad Hoc Group on marine acoustic technology and the environment.

Scholten, M.C., Kaag, T., Dokkum, N.H.B.M., Jak, H.P., Jak, R.G., Schobben, H.P.M. and Slob, W. 1996. Toxic Effects of Oil in the Aquatic Environment. TNO-MEP–R96/230. Den Helder, The Netherlands.

SETFIA and Fishwell Consulting. 2017. Report to the CarbonNet Project describing commercial fishing in the area of the proposed CarbonNet 3D Marine Seismic Survey. Prepared by the South East Trawl Fishing Industry Association and Fishwell Consulting for CarbonNet.

Shaughnessy, P.D.1999. The action plan for Australian seals. CSIRO Wildlife and Ecology.

Shaw, R. F., Lindquist, D. C., Benfield, M. C., Farooqi, T., Plunket, J. T. 2002. Offshore petroleum platforms: functional significance for larval fish across longitudinal and latitudinal gradients. Prepared by the Coastal Fisheries Institute, Louisiana State University. U.S. Department of the Interior, Minerals Management Service, Gulf of Mexico OCS Region, New Orleans, LA. OCS Study MMS 2002-077.

Shigenaka, G. 2003. Oil and Sea Turtles: Biology, Planning, and Response. National Oceanographic and Atmospheric Administration, United States of America.

Short, M. 2011. Pacific Adventurer Oil Spill: Big Birds, Sea Snakes and a Couple of Turtles. *International Oil Spill Conference Proceedings* 2011(1).

Simmonds, M., Dolman, S. and Weilgart, L. 2004. Oceans of Noise. Whale and Dolphin Conservation Society. Wiltshire.

Slotte, A., Hansen, K., Dalen, J. and Ona, E. 2004. Acoustic mapping of pelagic fish distribution and abundance in relation to a seismic shooting area off the Norwegian west coast. *Fish. Res.* 67(2):143-150

Southall, B.L., Bowles, A.E., Ellison, W.T., Finneran, J.J., Gentry, R.L., Greene Jr C.R., Kastak, D., Ketten, D.R., Miller, J.H., Nachtigall, P.E., Richardson, W.J., Thomas, J.A and Tyack, P.L. 2007. Marine Mammal Noise Exposure Criteria: Initial Scientific Recommendations. *Aquatic Mammals*. 33(4): 411–521.

Southall, B.L., Nowaceck, D.P., Miller, P.J.O. and Tyack, P.L. 2016. Experimental field studies to measure behavioral responses of cetaceans to sonar. *Endangered Species Research* 31: 293-315.

Standards Australia Ltd/Standards New Zealand. 2004. Risk Management. AS/NZS 4360:2004. Standards Australia Ltd/Standards New Zealand. Sydney.

Standards Australia Ltd/Standards New Zealand. 2012. HB203:2012 Managing environment-related risk. SAI Global. Sydney.

Stephenson, L.H. 1991. Orange-bellied Parrot Recovery Plan: Management Phase. Tasmanian Department of Parks, Wildlife & Heritage. Hobart.

Stevens, J.D. and West, G.J. 1997. Investigation of school and gummy shark nursery areas in south eastern Australia. A WWW document accessed at http://data.gov.au/dataset/71b4ca23-1ea5-4125-9b16-4e86c288e644. CSIRO Marine Research and Fisheries Research & Development Corporation. FRDC Project 93/061.

Stone, C.J. and Tasker, M.L. 2006. The effects of seismic airguns on cetaceans in UK waters. *Journal of Cetacean Research and Management* 8(3): 255.

Streever, B., Raborn, S.W., Kim, K.H., Hawkins, A.D. and Popper, A.N. 2016. Changes in fish catch rates in the presence of air gun sounds in Prudhoe Bay, Alaska. *Arctic* 69(4): 346-358.

Tasmanian SMPC. 1999. Iron Baron oil spill, July 1995: long term environmental impact and recovery. Tasmania State Marine Pollution Committee. Long Term Impact Assessment Group.

Thomson, R.B., Sporcic, M., Foster, S.D., Haddon, M., Potter, A., Carroll, A., Przeslawski, R., Knuckey, I., Koopman, M. and Hartog J. 2014. Examining Fisheries Catches and Catch Rates for Potential Effects of Bass Strait Seismic Surveys. CSIRO and Geoscience Australia. Hobart and Canberra.

TSSC. 2005. Recovery Plan for the Australian Sea Lion (*Neophoca cinerea*). Threatened Species Scientific Committee.

TSSC. 2011. Approved conservation advice for Sternula nereis nereis (Fairy tern). A WWW document accessed at http://www.environment.gov.au/biodiversity/threatened/species/pubs/82950-conservation-advice.pdf. Threatened Species Scientific Committee.

TSSC. 2014. Conservation Advice. Thinornis rubricollis rubricollis. Hooded plover (eastern). A WWW document accessed at http://www.environment.gov.au/biodiversity/threatened/species/pubs/66726-conservation-advice.pdf. Threatened Species Scientific Committee.

TSSC. 2015a. Conservation Advice – *Rhincodon typus* (whale shark). A WWW document accessed at http://www.environment.gov.au/biodiversity/threatened/species/pubs/66680-conservation-advice-01102015.pdf. Threatened Species Scientific Committee.

TSSC. 2015b. Listing Advice – *Seriolella brama* (blue warehou). A WWW document accessed at http://www.environment.gov.au/biodiversity/threatened/species/pubs/69374-listing-advice.pdf. Threatened Species Scientific Committee.

TSSC. 2015c. Conservation Advice – *Balaenoptera borealis* (sei whale). A WWW document accessed at http://www.environment.gov.au/biodiversity/threatened/species/pubs/34-conservation-advice-01102015.pdf. Threatened Species Scientific Committee.

TSSC. 2015d. Conservation Advice – *Balaenoptera physalus* (fin whale). A WWW document accessed at http://www.environment.gov.au/biodiversity/threatened/species/pubs/37-conservation-advice-01102015.pdf. Threatened Species Scientific Committee.

TSSC. 2015e. Conservation Advice – *Megaptera novaeangliae* (humpback whale). A WWW document accessed at http://www.environment.gov.au/biodiversity/threatened/species/pubs/38-conservation-advice-10102015.pdf. Threatened Species Scientific Committee.

Tsvetnenko, Y. 1998. Derivation of Australian Tropical Marine Water Quality Criteria for Protection of Aquatic Life from Adverse Effects of Petroleum Hydrocarbons. *Environmental Toxicology and Water Quality* 13(4):273-284.

UNEP IE. 1997. Environmental management in oil and gas exploration and production. A WWW document downloaded from https://wedocs.unep.org/rest/bitstreams/13599/retrieve. United Nations Environment Programme Industry and Environment and the Oil Industry International Exploration and Production Forum.

URS. 2001. Review of Environmental Impacts of Petroleum Exploration and Appraisal Activities in Commonwealth Waters. Report prepared for the Department of Science & Resources.

Van Meter, R.J., Spotila, J.R. and Avery, H.W. 2006. Polycyclic Aromatic Hydrocarbons Affect Survival and Development of Common Snapping Turtle (*Chelydra serpentina*) Embryos and Hatchlings. *Env. Poll.* 142(3): 466–475.

VFA. 2017. Scallop Report. A WWW database accessed at https://vfa.vic.gov.au/operational-policy/strategy-and-policy/scallop-report. Victorian Fisheries Authority. Melbourne.

Volkman, J.K., Miller, G.J., Revill, A.T. and Connell, D.W. 1994. 'Oil spills.' In: *Environmental Implications of offshore oil and gas development in Australia - the findings of an independent scientific review*. Edited by Swan, J.M., Neff, J.M. and Young, P.C. Australian Petroleum Exploration Association. Sydney.

Wardle, C.S., Carter, T.J., Urquhart, G.C., Johnstone, A.D.F., Ziolkowski, A.M., Hampson, G. and Mackie, D. 2001. Effects of seismic air guns on marine fish. *Continental Shelf Research*. 21: 1005–1027.

Wartzok, D. and Ketten, D.E. 1999. Marine Mammal Sensory Systems. In: Reynolds, J. and Rommel, S. (eds.). *Biology of Marine Mammals*. Smithsonian Institution Press, Washington DC. 117–175.

WDCS. 2006. Vessel collisions and cetaceans: What happens when they don't miss the boat. Whale and Dolphin Conservation Society. United Kingdom.

Weilgart, L.S. 2007. The impacts of anthropogenic ocean noise on cetaceans and implications for management. *Canadian Journal of Zoology* 85: 1091–1116.

Weir, C. 2007. Observations of marine turtles in relation to seismic airgun sound off Angola. *Mar. Turt. Newsl*. 116(2007):17–20.

Wellington Shire. 2017. Ninety Mile Beach Plan. A WWW database accessed http://www.wellington.vic.gov.au/Developing-Wellington/Planning-Projects/Ninety-Mile-Beach-Plan. Wellington Shire Council.

Wever, E.G. 1978. The Reptile Ear: Its Structure and Function. Princeton University Press, Princeton, N.J.

Wiese, F. K., Montevecci, W. A., Davoren, G. K., Huettmann, F., Diamond, A. W. and Linke, J. 2001. Seabirds at risk around off shore oil platforms in the northwest Atlantic. *Mar. Poll. Bull*. 42:1285-1290

Willis, K.L. 2016. Underwater Hearing in Turtles. In Popper, N.A. and A. Hawkins (eds.). *The Effects of Noise on Aquatic Life II*. Springer New York, New York, NY. 1229-1235.

Wilson, R. and Poore, G. 1987. The Bass Strait survey: biological sampling stations, 1979-1984. Occasional papers from the Museum of Victoria 3, 1–14.

Wilson, S. and Swan, G. 2005. A Complete Guide to the Reptiles of Australia. Reed New Holland. Sydney.

Woodside. 2008. Browse LNG Development. Torosa South-1 Pilot Appraisal Well Environment Plan. Woodside Energy Ltd. Perth.

Woodside. 2011. Browse LNG Development. Draft Upstream Environmental Impact Assessment, EPBC Referral 2008/4111, November 2011. Woodside Energy Ltd. Perth.

World Bank Group. 2015. Environmental, Health and Safety Guidelines for Offshore Oil and Gas Development. A WWW document downloaded from http://www.ifc.org/wps/wcm/connect/f3a7f38048cb251ea609b76bcf395ce1/FINAL_Jun+2015_Offshore+Oil+and+Gas_EHS+Guideline.pdf?MOD=AJPERES. World Bank Group. Washington.

Yudhana, A., Sunardi, J.D., Abdullah, S. and Hassan, R.B.R. 2010. Turtle hearing capability based on ABR signal assessment. *Telkomnika* 8: 187-194.