Patricia-Baleen Non-Operations Phase Environment Plan Summary (NOPSEMA)

CONTROLLED DOCUMENT
(PBN-EN-EMP-0002)

Revision 0 – July 2017

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Revision History

Rev	Issue Date	Revision summary	Originator	Reviewer	Approver
0	28/07/2017	Issued for acceptance to NOPSEMA	L. Chapman	J Hinks	I. MacDougall

Approvals

This Patricia-Baleen Environment Plan Summary has been approved by Cooper Energy for the Non-Operational Phase.

Name	Signature	Date
Iain MacDougall General Manager Operations Cooper Energy Limited	I D MacDougall	28/7/17

Glossary

Item	Description
ADIOS	Automated Data Inquiry for oil spills
AFMA	Australian Fisheries Management Authority
AFZ	Australian Fishing Zone
AHS	Australian Hydrographic Service
ALARP	As low as reasonably practicable
AMOSC	Australian Marine Oil Spill Centre
AMSA	Australian Maritime Safety Authority
API	American Petroleum Institute
AQIS	Australian Quarantine Inspection Service
ATBA	Area to be Avoided
AVCZ	Central Zone Abalone Industry Association
AVEZ	Eastern Zone Abalone Industry Association
BIA	Biologically Important Area
BMG	Basker-Manta-Gummy
BOD	Biological Oxygen Demand
BOM	Bureau of Meteorology
BOP	Blowout Preventer
CH_4	Methane
CHN	Casino Henry Netherby
CMR	Commonwealth Marine Reserve
CO_2	Carbon Dioxide
CoA	Commonwealth of Australia
CP	Coastal park
CTS	Commonwealth Trawl Sector
dB	Decibels
DEDJTR EMD	Department of Economic Development Jobs Transport and Resources Emergency Management Division
DEDJTR ERR	Department of Economic Development Jobs Transport and Resources Earth Resource Regulation (formally Department of Primary Industries (DPI))
DELWP	Department of Environment, Land Water and Planning (Vic) (formally Department of Environment, Planning & Infrastructure (DEPI))
DIIS	Department of Innovation, Industry and Science (Com)
DoD	Department of Defence
DoEE	Department of Energy and Environment (formally Department of Sustainability Environment, Water Population and Communities (SEWPC)) (Com)

Item	Description
DP	Dynamically positioned
DPCD	Department of Planning and Community Development
EAC	East Australian Current
EES	Environmental Effects Statement
EEZ	Exclusive Economic Zone
EMBA	Environment that may be affected
EMT	Emergency Management Team
EP	Environment Plan
EPBC	Environment Protection and Biodiversity Conservation (Act) (Com)
EPO	Environment Performance Outcome
EPS	Environment Performance Standard
ERP	Emergency Response Plan
ESD	Ecologically Sustainable Development
EVUDA	Eastern Victoria Sea Urchin Divers Association
FPSO	Floating Production Storage & Offloading (vessel)
GAB	Great Australian Bight
GHG	Greenhouse Gas
GHTS	Gillnet Hook and Trap Sector
GRT	Gross Register tonnage
GVI	General Visual Inspection
HDD	Horizontal Directional Drill
HIPPS	High Integrity Pipeline Protection System
HSEC	Health Safety Environment & Community
HSEC MS	Health Safety Environment & Community Management System
Hz	Hertz
IAFS	International anti-fouling system
IAPP	International Air Pollution Prevention
IEAPP	International Engine Air Pollution Prevention
IMCA	International Marine Contractor Association
IMCRA	Integrated Marine and Coastal Regionalisation of Australia
IMO	International Maritime Organisation
IMR	Inspection maintenance & repair
IMS	Invasive Marine Species
ISV	Installation Support Vessel
ITOPF	International Tanker Owners Pollution Federation

Item	Description
IWCF	International Well Control Forum
JHA	Job Hazard Analysis
KEF	Key Ecological Feature
LEFCOL	Lakes Entrance Fishermen's Cooperative
LEL	Lower Explosive Limit
LOC	Loss of Containment
LWD	Logging while drilling
M	Metres
MAE	Major Accident Event
MAOP	Maximum Allowable Operating Pressure
MARPOL	International Convention for the Prevention of Pollution from Ships
MBC	Marine Border Control
MDO	Marine diesel oil
MEG	Mono-ethylene Glycol
MMSCFD	Million standard cubic feet per day
MOC	Management of Change
MODU	Mobile Offshore Drilling Unit
NATPLAN	National Plan for Maritime Environmental Emergencies
NE	Northeast
NEBA	Net Environmental Benefits Assessment
NFMS	National Marine Fisheries Service
N_2O	Nitrous Oxide
NO_x	Nitrous Oxides
NOO	National Oceans Office
NOP	Non-operations phase
NOPSEMA	National Offshore Petroleum Safety and Environmental Management Authority
NOPTA	National Offshore Petroleum Titles Administrator
NSW	New South Wales
NZ	New Zealand
OCNS	Offshore Chemical Notification Scheme
OIM	Offshore Installation Manager
OIW	Oil in water
OGP	Orbost Gas Plant
OPEP	Oil Pollution Emergency Plan
OPGGSER	Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Com)

Item	Description
OPGGSR	Offshore Petroleum and Greenhouse Gas Storage Regulations 2011 (Vic)
OSMP	Operational & Scientific Management Plan
OSRA	Oil Spill Response Atlas
OWS	Oily Water Separator
PLEM	Pipeline End Manifold
PLONOR	Poses Little or No Risk
POB	Persons on Board
Ppt	Parts per thousand
PSZ	Petroleum Safety Zone
PTW	Permit to Work
RO	Reverse Osmosis
RCC	Rescue Coordination Centre
SA	South Australia
SCM	Subsea Control Modules
SDS	Safety Data Sheets
SEEMP	Shipboard Energy Efficiency Management Plan
SITHP	Shut-in Tubing Head Pressure
SIV	Seafood Industry Victoria
SGH	Seven Group Holdings
SMPEP	Shipboard Marine Pollution Emergency Plan
SO_X	Sulphur Oxides
SOLAS	International Convention for the Safety of Life at Sea
SOP	Standard Operating Procedure
SESSF	Southeast Scalefish and Shark Fishery
SETFIA	Southeast Trawl Fishing Industry Association
SSF	Sustainable Shark Fishing Inc.
SST	Subsea Tree
STCW	Standards of Training Certification and Watch-keeping
SW	Southwest
TAC	Total allowable catch
TACC	Total allowable commercial catch
TEC	Threatened Ecological Community
TPC	Third Party Contractors
TSSC	Threatened Species Scientific Community
TSV	Transport Safety Victoria

Item	Description
UXO	Unexploded Ordinances
VADA	Victorian Abalone Divers Association
VEMP	Victoria Emergency Management Plan
VRFish	Victorian Recreational Fishers Association
VSFA	Victorian Scallop Fisherman's Association
WA	Western Australia
WHO	World Health Organisation
WNW	West-northwest
WOMP	Well Operations Management Plan

1 Introduction

This Environment Plan (EP) summary has been prepared to meet Regulation 11(4) of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (OPGGSER) and summarises the information provided in the Patricia-Baleen Non-Operations Phase Environment Plan accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA).

1.1 Background

1.1.1 Patricia-Baleen Gas Field

Cooper Energy (PBF) Pty Ltd ('Cooper') is the titleholder for Production Licence VIC/L21, which contains the Patricia and Baleen gas fields, offshore from East Gippsland in the eastern waters of Bass Strait. Cooper Energy (PB Pipelines) Pty Ltd ('Cooper') is also the titleholder for pipeline licences VIC/PL31 and VIC/PL31 (V), the Patricia-Baleen offshore pipeline, which was used to transport gas and condensate from the Longtom-3 and Longtom-4 wells to the Orbost Gas Plant (OGP) for gas processing.

The Longtom wells and the Patricia-Baleen offshore pipeline are shut-in and the OGP is non-operational (mothballed).

The Longtom gas field, pipeline, electrical system and associated control systems are outside the scope of this EP. Seven Group Holdings (SGH) is the titleholder and operator of the Longtom gas field.

The offshore Patricia-Baleen facilities consist of the:

- Patricia-2 and Baleen-4 gas wells which are shut-in;
- Patricia-1 suspended well; and
- A 24 km subsea pipeline and umbilical cable connecting the Patricia-2 and Baleen-4 wells to the OGP.

1.1.2 Sole Gas Field

Cooper Energy (Sole) Pty Ltd ('Cooper') is the titleholder for Production Licence VIC/L32 which contains the Sole gas field.

Development activities lie outside the scope of this EP however an existing suspended well, Sole-2, requires monitoring as part of the VIC/L32 Well Operations Management Plan (WOMP). This EP covers activities associated with monitoring the integrity of the suspended Sole-2 well.

Sole-2 lies approximately 50 km east-southeast of Patricia-2 and 35 km south of Sydenham Inlet on the Victorian coastline.

2 Activity Location

The Patricia and Baleen wells are located in water depths of approximately 54 m in VIC/L21 approximately 25km south of Marlo (East Gippsland) in the waters of eastern Bass Strait (refer Figure 2-1). The coordinates of the Patricia and Baleen wells and subsea infrastructure is provided in Table 2-1.

The Patricia Baleen gas pipeline system includes:

- Two subsea production wells (Patricia-2 and Baleen-4) tied to the pipeline located in water depth of approximately 54 m;
- The Patricia-Baleen pipeline, a 25 km 300mm nominal diameter pipeline running from the Patricia Baleen Pipeline End Manifold (PLEM) to the Gippsland shoreline, which was used to transport production fluids to the shore-based OGP; and
- A subsea control umbilical which runs from the OGP to the Patricia-2 and Baleen-4 wells. The umbilical runs parallel to the Patricia Baleen pipeline approximately 20 m to the west.

Sole-2 is located approximately 40 km south-west of Point Hicks, 50 km east-southeast of the Patricia-2 well and 35km south of Sydenham Inlet in a water depth of approximately 125 m (refer Figure 2-2).

The suspended Patricia-1 and Sole-2 well coordinates are also provided in Table 2-1.

Figure 2-1: Patricia and Baleen Gas Field and Pipeline Location

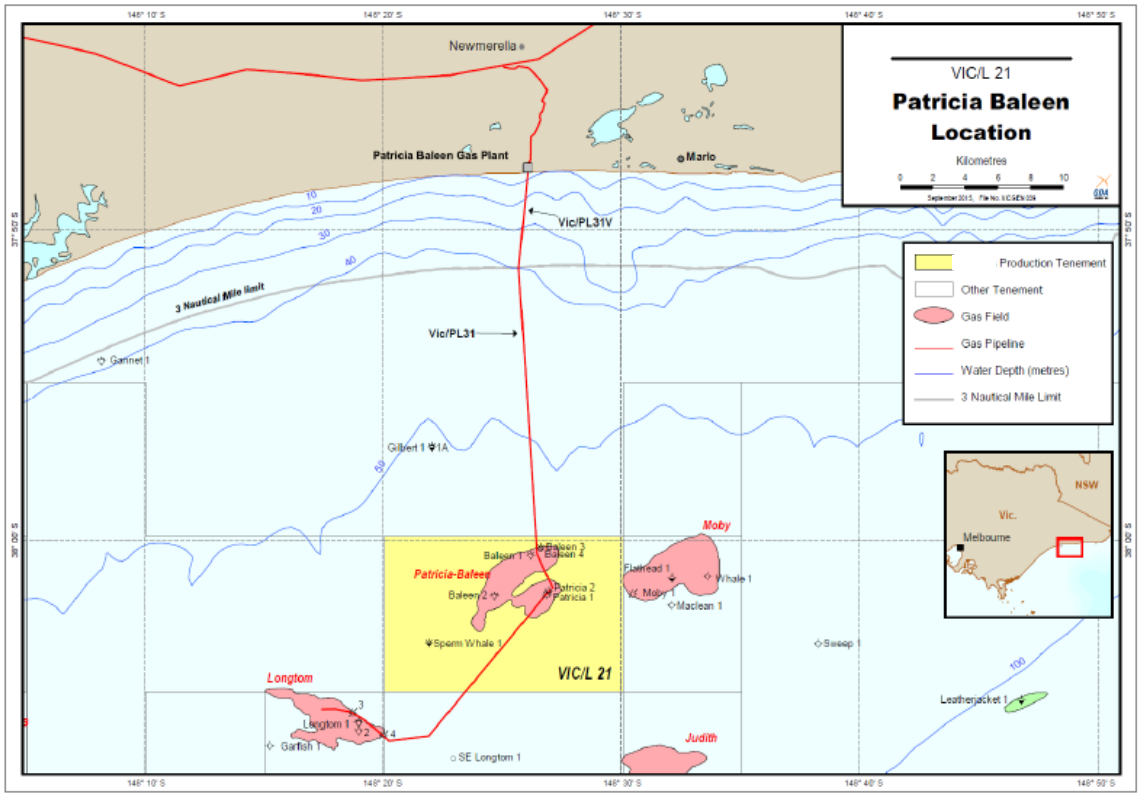


Figure 2-2: Sole-2 Location relative to Patricia-Baleen Facilities

Table 2-1: Coordinates of Patricia-Baleen Infrastructure and Suspended Patricia-1 and Sole-2 Wells

Infrastructure	Location (GDA 1994 – Degrees Minutes, Seconds)	
	Latitude	Longitude
Patricia – Baleen Pipeline System		
Patricia-2 (shut-in)	38° 1' 34.400" S	148° 27' 2.32" E
Baleen-4 (shut-in)	38° 0' 15.434" S	148° 26' 38.97" E
Patricia-Baleen PLEM	38º 01’ 34.38” S	148º 27’ 2.7” E
Orbost Gas Plant (NE Corner)	37º 47’ 50” S	148º 27’ 07” E
Main Umbilical Termination Assembly (MUTA)	38º 00’ 15.68” S	148º 26’ 38.56” E
Horizontal Directional Drill (HDD) exit point	37º 48’ 14.0” S	148º 26’ 34.44” E
Suspended Wells		
Patricia-1 (suspended)	38° 01’ 47.46” S	148° 26' 51.82”E
Sole-2 (suspended)	38° 06’ 13.10” S	149° 00' 33.51”E

3 Activity Description

3.1 Equipment Summary and Status

3.1.1 Patricia-Baleen Wells

The Patricia and Baleen fields are significantly depleted and consist of dry gas.

The Patricia-2 and Baleen-4 wells are currently shut-in at their subsea trees and valves have been confirmed closed. A general visual inspection (GVI) survey conducted in January 2015 found the wells to be in good condition.

The subsea system consists of wellheads with a subsea tree, fitted with production chokes, chemical injection facilities, subsea control modules (SCMs) and instrumentation. Control and monitoring of the wells was via an electro-hydraulic multiplexed control system supplied via an umbilical that connects the wells to the onshore facilities. However, in the current non-operational (shut-in) state control of the subsea system from the OGP is not possible.

Shut-in tubing head pressures (SITHPs) for Patricia-2 and Baleen-4 are 250 psi (1,720 kPa) and 430 psi (2,970 kPa).

Well cavity testing was conducted most recently in April 2015.

Both the Patricia-2 and Baleen-4 wells have 500m petroleum safety zones gazetted around the wellheads[1].

3.1.2 Patricia-Baleen Pipeline

The Patricia-2 and Baleen-4 wells tie into the 300 mm (12 inch) Patricia Baleen pipeline via short carbon steel jumper spools. The Patricia Baleen pipeline is connected to the Longtom pipeline via a Pipeline End Manifold (PLEM) which consists of a manual valve and a T-junction which has a double isolation. Production from the Longtom field was shut-down in May 2015 due to an electrical fault.

The status of the Patricia Baleen offshore pipeline system is (Santos, 2016):

- The pipeline is isolated from the Longtom wells at the High Integrity Pipeline Protection System (HIPPS) isolation valve and it is also positively isolated at the onshore plant inlet.
- The pipeline has been depressured to 230 kPa and this pressure is monitored for pressure change to identify any valve leakages into the system.
- The pipeline has been injected with nitrogen to establish a pressure of 630 kPa. This positive pressure has been chosen to allow for the early identification of a valve leak and prove the ongoing pipeline integrity.
- Residual fluids left in the pipeline includes approximately 2700 m^3 natural gas, 4550 m^3 nitrogen, 5 m^3 Longtom condensate and 150 m^3 Monoethylene Glycol (MEG)/water mix.
- The electro-hydraulic multiplexed control system is offline.
- The control system hydraulics has been depressured and all downhole/tree valves for the wells are closed.

[1] NOPSEMA Gazettal Notice: A528370 (6th December 2016)

3.1.3 Patricia-1

The Patricia-1 well is located approximately 480m southwest of Patricia-2 and has been suspended. The well is suspended with a 762mm (30”) conductor protruding about 2 m above the seabed. There is also a four post permanent guide base with sacrificial anodes on the structure.

3.1.4 Sole-2

The Sole-2 well is suspended with a 762mm (30”) conductor protruding about 2 m above the seabed. There is also a four post permanent guide base with sacrificial anodes on the structure.

3.2 Corrosion Potential

The Patricia-Baleen pipeline (Vic/PL31 and Vic/PL31(v)) was commissioned in 2003 with a design life of 15 years. The 2014 Offshore Pipeline Integrity Review concluded the pipeline was in good condition with sufficient integrity to maintain the current Maximum Allowable Operating pressure (MAOP) of 10 MPa (g).

The pipeline remaining life review is due in 2018 and will involve a review of integrity data to confirm the pipeline remains fit-for-purpose and can continue to be maintained in the non-operational state through to 2020.

3.2.1 Internal Corrosion

The risk of internal pipeline corrosion is minimised due to a combination of the following:

- Wells are shut-in and production has ceased, therefore further corrosive compounds will not be produced.
- The introduction of nitrogen results in a pipeline gaseous composition of approximately 63% nitrogen and this serves to additionally absorb water.
- The remaining natural gas in the pipeline consists of 1.3% carbon dioxide. The overall carbon dioxide percentage is further reduced by the nitrogen content in the pipeline. The partial pressure of carbon dioxide based on the natural gas composition is 9 kPa, well below the NACE SP0106 partial pressure of the 21 kPa threshold above which the carbon dioxide fraction is considered as ‘may be corrosive’.
- The pipeline corrosion allowance (3 mm) remains (design mitigation).
- The residual MEG in the pipeline maintains a high pH minimising acid gas corrosion. The average pH readings prior to production shutdown were 7.7 and a low iron count was being maintained.
- Relatively high MEG to water content with the MEG acting to prevent hydrates forming, it also acts as a corrosion inhibitor by:
    - decreasing carbon dioxide solubility;
    - decreasing carbon dioxide diffusivity/increasing solution viscosity; and
    - decreasing water activity and decreasing water polarity.
- Residual amine corrosion inhibitor acts to form a hydrophobic film on the pipe wall that repels water and further serves to prevent internal corrosion.
- Pipeline gas composition is confirmed to not contain hydrogen sulphide.

3.2.2 External Corrosion

Design mitigation for external corrosion on the pipeline is:

- Anti-corrosion Coating: External corrosion protection of the pipeline is provided by a factory applied 4 mm asphalt enamel for the offshore pipeline and a 0.5 mm fusion bonded epoxy with 2 mm anti abrasion layer for the HDD section at the shore crossing. Field joints were addressed by using HDPF/Sea Sleeves and Servi-Wrap M30A.
- Cathodic Protection: The Patricia-Baleen pipeline is protected by the sacrificial anode system as per DNV RP B401.

Pipeline coating, cathodic protection and external corrosion are inspected during GVIs in accordance with the Patricia-Baleen Pipeline Integrity Management Plan.

3.2.3 Wells (Shut-in and Suspended)

All wellheads are protected by sacrificial anodes.

3.3 Field Characteristics

3.3.1 Patricia-Baleen

The Patricia and Baleen reservoirs are dry gas reservoirs as provided in Table 3-1. The reservoirs are now substantially depleted, however in the event of a leak at the wellhead, there would be little to no condensate production.

Table 3-1: Patricia-Baleen Reservoir Conditions (Santos, 2014)

Parameter	Patricia-2	Baleen-4
Maximum Pressure at Reservoir Depth	400 psi	650 psi
Maximum temperature	120 ºF	120 ºF
Gas Specific Gravity	0.572	0.563
Condensate to Gas Ratio	<1 bbl/MMscf	<1 bbl/MMscf

3.3.2 Longtom Condensate

The Longtom fluid physical characteristics are provided in **Table 3-2** and composition is provided in Table 3-3. Approximately 5 m^3 of Longtom condensate remains in the offshore Patricia-Baleen pipeline in its current 'non-operations phase'.

Table 3-2: Longtom Condensate Physical Properties (Santos, 2015)

		Longtom Condensate
API Gravity		51.2
Density@25ºC g/ml		0.777
Dynamic Viscosity @ 20ºC (cP)		1.081
GOR		10.85 stb/MMscf
Pour Point (ºC)		-9 (when fresh)
Boiling Point Distribution	Volatiles (<180ºC)	61.5

		Longtom Condensate
	Semi-volatile (180-265ºC)	14.3
	Low Volatility (265-380ºC)	21.1
	Residual (>380ºC)	3.1
Group		I

Table 3-3: Longtom Fluid Composition (Santos, 2015)

Component	Lower Mole Percent	Upper Mole Percent
Hydrogen Sulphide	0	0
Carbon Dioxide	0.9	2.2
Water	0.05	1.4
Glycol	0.1	0.2
Nitrogen	0.7	1.3
Methane	87.2	92.8
Ethane	3.5	4.7
Propane	1.1	1.8
i-Butane	0.19	0.42
n-Butane	0.22	0.45
i-Pentane	0.06	0.18
n-Pentane	0.05	0.16
Hexane	0.08	0.3
Heptane	0.14	0.35
Octane	0.05	0.13
Nonane	0.04	0.1
Decane	0.01	0.1
Undecane	0.01	0.07
Dodecane+	0.03	0.2

3.3.3 Sole Reservoir

The Sole reservoir is a dry gas reservoir with no condensate observed or recovered during the well test on Sole-2. This is supported by the current HYSYS model which predicts no condensate at reservoir conditions. The Sole reservoir conditions are provided in Table 3-4.

Table 3-4: Sole Reservoir Conditions (Expro, 2002)

Parameter	Sole-2
Maximum Pressure at Reservoir Depth	1170 psi
Maximum temperature	109 ºF
Gas Specific Gravity	0.58

Condensate to Gas Ratio	<1 bbl/MMscf

3.4 Non-Operations Phase (NOP) Activities

3.4.1 Inspection, Maintenance & Repair (IMR) Activities

3.4.2 Scope

Offshore IMR activities will generally require remotely operated vehicles (ROV) operating from a vessel. Works will involve:

Planned inspections during the NOP will consist of:

- Routine GVI of wellheads, pipeline and suspended well conductors;
- Cathodic protection measurement; and
- Scour around infrastructure.

Unplanned IMR activities may consist of:

- IMR work on the pipeline, wells and associated subsea infrastructure such as marine growth removal, operation of valves, recovery of debris, anode repair/replacement, valve control unit change-out, following a severe storm, known fishing impact, etc.
- Pipeline span rectification works.

Prior to the offshore campaign, the following shall be undertaken:

- Risk assessment of the proposed activities and identification of control measures to eliminate or reduce environmental impacts and risks to ALARP;
- Development of campaign specific procedures, work instructions, work-packs, etc. for the proposed activities including a clear definition for environment and emergency response;
- Identifying and obtaining (as necessary) regulatory approvals;
- Identifying and obtaining any marine vessel class certificates.

Mooring procedures and systems will be developed to prevent incidents such as anchor drag (as required).

3.4.3 Planned Inspections

The Patricia-Baleen pipeline, wells and associated subsea infrastructure are designed to not require constant maintenance or repairs. GVIs are undertaken in accordance with the schedule outlined in the Patricia-Baleen Pipeline Integrity Management Plan. In accordance with the Integrity Management Plan inspection frequencies could range from 1 to 5 years depending upon the assessment of survey results.

ROVs undertaking GVI works are powered via an umbilical cable that contains a group of cables carrying electrical power, video and data signals back and forth between the ROV and the vessel-based operator. Work-class ROVs may also be required for maintenance or repair activities.

Suspended well surveillance: Surveillance will consist of a GVI to check for the following:

- Anode wastage outside allowable limits;
- Coating damage;

- CP Readings;
- External corrosion;
- Metallic debris on structure;
- Lack of integrity (missing components, broken loose or damaged appurtenances);
- Marine growth;
- Mechanical damage (impact, environment or third party);
- Scour;
- Variation of inspected components or operating condition from drawings or documented state; and
- Leaks (gas or liquid).

The next GVI will be on the Patricia-1, Patricia-2, Baleen-4 and Sole-2 wells prior to the 31st December 2017.

3.4.4 Repair Activities

Span Rectification: Future pipeline span rectification may be required to prevent possible damage to the pipeline. Spans generally occur in water depths up to 20 m and the proximity to the shoreline means the supports are exposed to both current and wave effects, both of which can impact on the stability of the support and/or the pipeline and can cause issues with scour resulting in de-stabilisation of the support. The bulk of this type of work generally occurs close to the HDD exit that is in approximately 10 m water depth.

Spans are typically filled in through the use of a grout bag (a bladder/bag) that is positioned under the pipeline and pumped full of grout until the bag supports the pipeline. A vessel is used to support this activity. The 2015 offshore inspection campaign determined that there was no requirement for interventions to rectify any free spans. Monitoring of the pipeline spans will continue during the next GVI.

Anodes: Foreseeable activity may include to replacement of anodes.

3.4.5 Daily Monitoring Arrangements

During the NOP, the onshore plant has two operator/ maintainers in attendance. These personnel monitor the Patricia-Baleen pipeline pressure from the onshore gas plant.

Pressure transmitter set-points have been set to alarm at high pressure (800 kPa) and low pressure (50 kPa) to identify changed conditions and leakage into or from the pipeline. No changes to pipeline pressure have been observed.

In addition, the chemical injection lines are pressurised and monitored daily for changes in pressure.

3.4.6 Support Arrangements

3.4.7 Aviation Support

Due to the expected size of vessel to be used for IMR activities and short distance to shore, helicopters are not expected to be used during NOP activities.

3.4.8 Vessel Support

IMR activities are undertaken with the aid of a support vessel. Vessels are contracted from international or national suppliers when required and will vary depending on the proposed activity and vessel availability.

Typical vessels utilised in IMR activities are expected to be local service vessels. These vessels are usually small in size with limited fuel capacity spread across a number of tanks (maximum ~12m^3). Depending on the IMR activities required, vessels are likely to be at sea between 7-9 days. No vessel refuelling will be undertaken at sea.

Any vessels used will have the necessary certification/registration and be fully compliant with the relevant MARPOL and SOLAS convention requirements specific for the vessel's size and purpose.

3.4.9 Supply Base

Locally sourced vessels are expected to mobilized from Lakes Entrance approximately 45 km west-north-west (WNW) from the offshore Patricia-Baleen assets and 95 km WNW from Sole-2.

Vessels may also be sourced internationally and may utilise alternate ports such as the Port of Eden or Geelong.

3.5 Source Control Activities

The external threats present at the Patricia-Baleen and Sole-2 locations have been considered in the design, construction and maintenance of the facilities present. While considered as a remote possibility, Cooper has considered the impact of a wellhead release from these facilities and possible remedial actions which might be implemented to control the release source as part of this EP.

The Sole and Patricia-Baleen reservoirs contain 'dry gases. Accordingly, oil spill residues from liquid hydrocarbons are not expected as part of any well release from this infrastructure.

Remedial actions considered possible for the Patricia-Baleen and Sole-2 wells in the event of a release include the following:

- Vessel-based surveillance monitoring;
- Intervention through vessel-based work class ROV in conjunction with ROV tooling;
- Well capping – mobilising an ISV for deployment of a capping Blow-out prevention (BOP) stack; and
- Mobilising a Mobile Offshore Drilling Unit (MODU) and materials to drill a relief well.

3.5.1 Well Capping

Well capping serves to curtail the hydrocarbon flow prior to permanent plugging of the well. Activities expected to be undertaken to support well capping include site surveys, to understand the issues and constraints of installation; possible debris removal involving the use of ROVs, the cutting and removal of subsea equipment to ensure a clear surface for capping; and capping stack deployment and installation by an Installation Support Vessel (ISV).

3.5.2 Relief Well

Parallel with the assessment of well capping options will be assessment of a relief well to contain the well. A relief well is typically drilled as a straight hole down to a planned kick-off point, where it is turned towards the target using directional drilling technology and tools to get within 30-60 m of the original well. Directional drilling continues with routine magnetic ranging

checks to allow for the original well to be intersected. Once the target well is intersected dynamic kill commences by pumping mud and or cement downhole to seal the original well bore.

4 Receiving Environment

The Patricia-Baleen and Sole-2 assets are located within the South-east marine region and twofold shelf marine bioregion as classified by the Integrated Marine and Coastal Regionalisation of Australia (IMCRA). This region extends from east of Wilson's Promontory to north of Tathra (NSW). The coastline is exposed with long sandy beaches broken by rocky headlands and numerous coastal lagoons. The sea surface temperatures in the area reflect the influence of warmer waters brought into Bass Strait by the East Australia current (EAC) (EA, 1998).

The receiving environment has been defined as the "environment that may be affected (EMBA)" based upon the maximum credible oil spill footprint which might occur during NOP activities. During NOP activities, vessels will carry small Marine Diesel Oil (MDO) volumes (~12 m^3 marine diesel oil (MDO)). The EMBA footprint is estimated to include waters and coastline within a radial distance of 50 km of the Patricia-Baleen and Sole-2 asset locations. This covers a coastal area 50 km west of the Patricia-Baleen shore-crossing site to Sydenham Inlet (Patricia-Baleen assets) and the coastline between Point Hicks and Cape Conran for an MDO spill at the Sole-2 location.

4.1 Physical Environment

4.1.1 Bathymetry, Seabed and Shallow Geology

The Patricia-Baleen asset is located in relatively shallow water depths ranging from 10 to 54 m with the seabed reaching a depth of 20 m within a few kilometres of the shoreline and then gently sloping to a depth of around 100 m about 60 km offshore. The wide shelf area is relatively featureless and flat (Santos, 2015). The Gippsland Basin also consists of rocky-substrate habitat, submarine canyons, escarpments, and a knoll that juts out from the base of the continental slope. To the south-east of the Patricia-Baleen asset lies the large Bass Canyon, reaching 4,000 m in depth, connected to the continental shelf by smaller canyons and valleys (NOO 2002).

Near-shore sediments consist of coarse sands with isolated areas of gravels, shells and pebbles. The inshore seabed consists of symmetrical, wave-generated sandy ripples, becoming shelly in troughs as the depth increases. Further offshore, a change to an irregular bed colonised by marine growth occurs near 35 m to 40 m depth. Finer, muddy sands occur further offshore in the mid-shelf regions (Esso, 2009).

A geophysical survey undertaken as part of the Patricia-Baleen Environmental Effects Statement (EES) (OMV, 2001) identified there were no reef systems along the offshore pipeline alignment.

At the Sole-2 location, in 125 m water depths, the seabed is comprised of fine to coarse sand and areas of shell (CEE Consultants, 2003).

4.1.2 Metocean Conditions

4.1.3 Climate

The region's climate is cool temperate, 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. In winter, when the subtropical ridge moves northwards over the Australian continent, cold fronts generally create sustained west to south-westerly winds and frequent rainfall in the region (McInnes and Hubbert, 2003). In summer, frontal systems are often more shallow and occur between two ridges of high pressure, bringing more variable winds and rainfall.

Average monthly air temperatures at nearby Point Hicks range from 23.9ºC in January to 8.2ºC in July (1962 to 2016) (BoM, 2017). Mean rainfall is 970mm with the rainfall fairly evenly distributed throughout the year (BOM, 2017).

4.1.4 Winds

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 intensity and behaviour, but are most common between September and February (McInnes and Hubbert 2003).

Wind data demonstrates high occurrence of south-westerly and north-easterly winds all year-round, with intensities ranging from 5 to 25 m/s (10 knots to 48 knots) (APASA, 2013).

4.1.5 Currents

Currents within Bass Strait are primarily driven by tides, winds and density driven flows. During winter the South Australian current moves dense, salty, warmer water eastward from the Great Australian Bight into the western margin of the Bass Strait (Sandery and Kampf, 2007; cited in APASA, 2013). In winter and spring, waters within the Strait are well mixed with no obvious stratification, while during summer the central regions of the strait become stratified (Baines and Fandry. 1983; Middleton and Black 1994; cited in APASA, 2013).

During winter, the Bass Strait cascade occurs, a wintertime down-welling caused by cooling of the shallow waters of Bass Strait in the Gippsland Basin (Gibbs et al., 1986; Luick et al. 1994; cited in APASA, 2013). Down-welling currents that originate in the shallow eastern waters of Bass Strait flow down the continental slope to depths of several hundred metres or more into the Tasman Sea (Luick et al. 1994; cited in APASA, 2013). Lateral flushing within the strait results from inflows from the South Australian current, the EAC and sub-Antarctic surface waters (Newell, 1961; cited in APASA, 2015).

4.1.6 Tides

Tidal movements in eastern Bass Strait are semi-diurnal with some diurnal inequalities (Jones and Padman, 1983; Easton, 1970) predominantly in a NE-SW direction. Tides inflow from the east and west during a rising (flood) tide and flow out to the east and west during a falling (ebb) tide (Esso, 2009). Tides vary in phase by about 3 to 4 hours from east to west (most of phase change occurs between Lakes Entrance and Wilson's Promontory).

Tides show seasonal variation with spring tides of approximately 0.9m and neap tides of 0.6m. Strong tidal currents (~2 knots [~1m/s]) are characteristic of this area (Barton et al. 2012).

4.1.7 Sea Temperature

Monthly sea-surface water temperature according to the National Oceanographic Data Centre – World Ocean Atlas (www.metoc.gov.au) was found to vary seasonally from a minimum of 12.6ºC to a maximum of 18.4ºC (APASA, 2013).

Waters of eastern Bass Strait are generally well mixed, but surface warming sometimes cause weak stratification in calm summer conditions. During these times mixing and interaction between varying water masses leads to variations in horizontal water temperature and a thermocline (temperature profile) develops. The thermocline acts as a low-friction layer separating the wind-driven motions of the upper well-mixed layer of Bass Strait from the bottom well-mixed layer (Esso, 2009).

4.1.8 Waves

Bass Strait is a high-energy environment exposed to frequent storms and significant wave heights. Storms may occur several times a month resulting in wave heights of 3 to 4 m or more (Esso, 2008).

4.2 Biological Environment

4.2.1 Benthic Environment

Benthic investigations conducted by the Victorian Museum on the continental shelf of Bass Strait between 1979 and 1984 reported infauna communities to be rich and diverse, and invertebrate communities were identified as diverse comprising mainly of sponges, octo-corals, ascidians and bryozoans (Poore et al. 1985, Wilson and Poore 1987).

A survey undertaken along the Patricia-Baleen pipeline identifies four general habitat associations on the seabed. Large epibiota are very sparse, with extensive areas of sandy and shell/rubble seabed devoid of large epibiota except for introduced screw shells and sponges. These habitats include:

1. Medium sand and shell grit – extensive areas with pronounced sand waves. Epibiota was generally sparse to relatively commonly occurring sea pens and occasional sponges and stalked colonial ascidians.

2. Shell accumulations – large patches of seabed comprised of old large shells, predominantly bivalves and scallops, with New Zealand screw shells present in large numbers.

3. Sponge garden – a small and distinct area of large sponges and bryozoans at approximately 50 m water depth. Sponges varied in form and colour and included fans, spheres, massives, cups and fingers. Bryozoans included lace-like corals, concertina fans, perforated rigid sheets and fern-like branches. These associations indicate that although the seabed is comprised predominantly of sand and shell grit, it is stable enough to allow these associations to grow. Schools of jackass morwong, butterfly perch and individual gurnard and leatherjackets were attracted to the sponge garden.

4. Introduced New Zealand (NZ) screw shell aggregations – the NZ screw shell (*Maoricolpus roseus*) was common in the survey area, generally in water depths greater than 40 m, sometimes forming dense beds covering 100% of the seabed.

The benthic environment at Sole-2 is expected to be similar to those areas observed along the Patricia-Baleen pipeline alignment however this deeper habitat is expected to have less wave influence than the shallower seabeds. There has been extensive demersal fishing activity in the area so seabed biota is expected to be modified from trawling and netting activities (CEE Consultants, 2003).

4.2.2 Pelagic Environment (Protected Species)

A search of the Commonwealth Department of Environment and Energy's (DoEE) Environment Protected Matters database (2017b) was undertaken for the Patricia-Baleen and Sole-2 EMBAs. Table 4-1 details pelagic fauna identified in the Protected Matters Search, applicable management plans and relevant management actions. Species identified are likely to transit through the area with the exception of the pygmy blue whale and a number of albatross where the EMBA overlaps biologically important areas (BIA) (foraging) for these species.

Table 4-1: Threatened and Migratory Species which may occur in the Patricia-Baleen and Sole-2 EMBA

Scientific Name	Common Name	EPBC Act Status (Com)	FFG Act Status (Vic)	Management Plan/ Recovery Plan and Approved Conservation Advice	Presence of BIA	Relevant Management Actions
FISH						
Carcharodon carcharias	Great white shark	Vulnerable, Migratory	Threatened	Recovery Plan for the White Shark (SEWPC, 2013)	✓ [Known Distribution Area for species]	No threats applicable to NPP activities
Carcharias Taurus (east coast population)	Grey Nurse Shark	Critically Endangered	Threatened	Recovery Plan for the Grey Nurse Shark (DoE, 2014)	X	No threats applicable to NPP activities
Isurus oxyrinchus	Shortfin mako shark	Migratory	-	-	X	-
Lamna nasus	Porbeagle shark	Migratory	-	-	X	-
Prototroctes maraena	Australian grayling	Vulnerable	Threatened	National recovery plan for the Australian Grayling (DEWHA, 2008)	X	No threats applicable to NPP activities
Rhincodon typus	Whale shark	Vulnerable, Migratory	-	Whale Shark Recovery Plan 2005-10 (DEH, 2005 (Expired), Whale Shark TSSC Advice (2015a)	X	Adopt relevant legislated marine pollution controls and debris prevention measures.
CETACEANS						
Balaenoptera acutorostrata	Minke whale	Migratory	-	-	X	-
B. bonaerensis	Antarctic minke whale	Migratory	-	-	X	-
B. borealis	Sei whale	Vulnerable, Migratory	-	Sei Whale TSSC Conservation Advice (2015d)	X	Assess anthropogenic impacts to sei whales and identify mitigation measures Assess and adopt measures to minimise and report cetacean strikes
B. edeni	Bryde's whale	Migratory	-	-	X	-

Scientific Name	Common Name	EPBC Act Status (Com)	FFG Act Status (Vic)	Management Plan/ Recovery Plan and Approved Conservation Advice	Presence of BIA	Relevant Management Actions
B. musculus	Blue whale	Endangered, Migratory	Threatened	Blue whale Conservation Management Plan (DoE, 2015a)	✓ [Known Foraging Area for species]	Assess and reduce anthropogenic noise associated with IMR activity Report collisions to regulators and adopt measures to minimise collisions
B. physalus	Fin whale	Vulnerable, Migratory	-	Fin Whale TSSC Conservation Advice (2015b)	X	Assess anthropogenic impacts to fin whales and identify mitigation measures Assess and adopt measures to minimise and report cetacean strikes
Caperea marginata	Pygmy right whale	Migratory	-	-	X	-
Eubalaena australis	Southern right whale	Endangered, Migratory	Threatened	Conservation Management Plan for Southern Right Whale (SEWPC, 2012)	X	Assess impacts and mitigation measures with respect to vessel use Adopt measures to minimise cetacean strikes.
Megaptera novaeangliae	Humpback whale	Vulnerable, Migratory	Threatened	Humpback Whale TSSC Conservation Advice (2015c)	X	Threat abatement Plan (marine debris) will be applied in EP. Assess and adopt measures to minimise cetacean strikes.
Orcinus orca	Killer whale	Migratory	-	-	X	-
Physeter macrocephalus	Sperm whale	Migratory	-	-	X	-
Lagenorhynchus obscures	Dusky dolphin	Migratory	-	-	X	-
REPTILES						
Caretta caretta	Loggerhead turtle	Endangered , Migratory	-		X	

Scientific Name	Common Name	EPBC Act Status (Com)	FFG Act Status (Vic)	Management Plan/ Recovery Plan and Approved Conservation Advice	Presence of BIA	Relevant Management Actions
Chelonia mydas	Green turtle	Vulnerable, Migratory	-	Recovery Plan for Marine Turtles in Australia 2017-2027 (CoA, 2017)	X	Implement legislative requirements for garbage discharge Integrate oil pollution plans with National Plan requirements
Dermochelys coriacea	Leatherback turtle	Endangered, Migratory	Critically Endangered		X	
Eretmochelys imbricata	Hawksbill turtle	Vulnerable, Migratory	-		X	
BIRDS						
Seabirds						
Diomedea antipodensis	Antipodean albatross	Vulnerable, Migratory		National Recovery Plan for threatened albatrosses and giant petrels 2011-2016 (SEWPC, 2011)	✓ [Known Foraging Area for species]	Evaluate marine debris risk to species
Diomedea antipodensis gibsoni	Gibson's albatross	Vulnerable, Migratory		National Recovery Plan for threatened albatrosses and giant petrels 2011-2016 (SEWPC, 2011)	X	Evaluate marine debris risk to species
Diomedea epomophora	Southern royal albatross	Vulnerable, Migratory	Threatened	National Recovery Plan for threatened albatrosses and giant petrels 2011-2016 (SEWPC, 2011)	X	Evaluate marine debris risk to species
Diomedea exulans	Wandering albatross	Vulnerable, Migratory	Threatened	National Recovery Plan for threatened albatrosses and giant petrels 2011-2016 (SEWPC, 2011)	✓ [Known Foraging Area for species]	Evaluate marine debris risk to species
Diomedea sanfordi	Northern royal albatross	Vulnerable, Migratory		National Recovery Plan for threatened albatrosses and giant petrels 2011-2016 (SEWPC, 2011)	X	Evaluate marine debris risk to species
Haliaeetus leucogaster	White-bellied sea-eagle	-	Threatened	-	X	-
Fregetta grallaria grallaria	White-bellied storm petrel	Vulnerable	-	-	X	-
Halobaena caerulea	Blue petrel	Vulnerable	-	Approved Conservation Advice for *Halobaena caerulea* (blue petrel). (TSSC, 2015f)	X	-
Macronectes giganteus	Southern giant-petrel	Endangered, Migratory	Threatened	National Recovery Plan for threatened albatrosses and giant petrels 2011-2016 (SEWPC, 2011)	X	Evaluate marine debris risk to species

Scientific Name	Common Name	EPBC Act Status (Com)	FFG Act Status (Vic)	Management Plan/ Recovery Plan and Approved Conservation Advice	Presence of BIA	Relevant Management Actions
Macronectes halli	Northern giant-petrel	Vulnerable, Migratory	Threatened	National Recovery Plan for threatened albatrosses and giant petrels 2011-2016 (SEWPC, 2011)	X	Evaluate marine debris risk to species
Pachyptila turtur subantarctica	Fairy prion (southern)	Vulnerable	-	-	X	-
Phoebetris fusca	Sooty albatross	Vulnerable, Migratory	Threatened	National Recovery Plan for threatened albatrosses and giant petrels 2011-2016 (SEWPC, 2011)	X	Implement legislative requirements for discharge of garbage to prevent ingestion of marine debris
Pterodroma leucoptera leucoptera	Gould's petrel	Endangered	-	-	X	-
Puffinus carneipes	Flesh-footed shearwater	Migratory	-	-	X	-
Thalassarche bulleri	Buller's albatross	Vulnerable, Migratory	Threatened	National Recovery Plan for threatened albatrosses and giant petrels 2011-2016 (SEWPC, 2011)	X	Implement legislative requirements for discharge of garbage to prevent ingestion of marine debris
Thalassarche bulleri platei	Northern Buller's albatross	Vulnerable, Migratory	-	National Recovery Plan for threatened albatrosses and giant petrels 2011-2016 (SEWPC, 2011)	X	Implement legislative requirements for discharge of garbage to prevent ingestion of marine debris
Thalassarche cauta cauta	Shy albatross	Vulnerable, Migratory	Threatened	National Recovery Plan for threatened albatrosses and giant petrels 2011-2016 (SEWPC, 2011)	✓ [Known Foraging Area for species]	Implement legislative requirements for discharge of garbage to prevent ingestion of marine debris
Thalassarche cauta steadi	White-capped albatross	Vulnerable, Migratory	-	National Recovery Plan for threatened albatrosses and giant petrels 2011-2016 (SEWPC, 2011)	X	Implement legislative requirements for discharge of garbage to prevent ingestion of marine debris
Thalassarche chrysostoma	Grey-headed albatross	Endangered, Migratory	Threatened	National Recovery Plan for threatened albatrosses and giant petrels 2011-2016 (SEWPC, 2011)	X	Implement legislative requirements for discharge of garbage to prevent ingestion of marine debris

Scientific Name	Common Name	EPBC Act Status (Com)	FFG Act Status (Vic)	Management Plan/ Recovery Plan and Approved Conservation Advice	Presence of BIA	Relevant Management Actions
Thalassarche eremita	Chatham albatross	Endangered, Migratory	-	National Recovery Plan for threatened albatrosses and giant petrels 2011-2016 (SEWPC, 2011)	X	Implement legislative requirements for discharge of garbage to prevent ingestion of marine debris
Thalassarche impavida	Campbell albatross	Vulnerable, Migratory	-	National Recovery Plan for threatened albatrosses and giant petrels 2011-2016 (SEWPC, 2011)	✓ [Known Foraging Area for species]	Implement legislative requirements for discharge of garbage to prevent ingestion of marine debris
Thalassarche melanophris	Black-browed albatross	Vulnerable, Migratory	-	National Recovery Plan for threatened albatrosses and giant petrels 2011-2016 (SEWPC, 2011)	✓ [Known Foraging Area for species]	Implement legislative requirements for discharge of garbage to prevent ingestion of marine debris
Thalassarche salvini	Salvin's albatross	Vulnerable, Migratory	-	National Recovery Plan for threatened albatrosses and giant petrels 2011-2016 (SEWPC, 2011)	X	Implement legislative requirements for discharge of garbage to prevent ingestion of marine debris
Thalassarche sp. nov.	Pacific albatross	Vulnerable	-	National Recovery Plan for threatened albatrosses and giant petrels 2011-2016 (SEWPC, 2011)	X	Implement legislative requirements for discharge of garbage to prevent ingestion of marine debris
Shorebirds/Coastal Wetland Species						
Apus pacificus	Fork-tailed swift	Migratory	-	-	X	-
Calidris ferruginea	Curlew sandpiper	Critically Endangered, Migratory	-	Approved Conservation Advice for *Calidris ferruginea* (Curlew Sandpiper) (TSSC, 2015e)	X	Not Applicable to NOP activities
Limosa lapponica bauera	Bar-tailed godwit	Vulnerable, Migratory	-	Approved Conservation Advice for *Limosa lapponica baueri* (Bar-tailed godwit (western Alaskan) (TSSC, 2016a)	X	Not Applicable to NOP activities
Limosa lapponica menzbieri	Northern Siberian bar-tailed godwit	Critically Endangered	-	Approved Conservation Advice for *Limosa lapponica menzbieri* (Bar-tailed godwit (northern Siberian) (TSSC, 2016b)	X	Not Applicable to NOP activities
Pandion haliaetus	Osprey	Migratory	-	-	X	-
Sterna albifrons	Little tern	Migratory	Threatened	-	X	-

Scientific Name	Common Name	EPBC Act Status (Com)	FFG Act Status (Vic)	Management Plan/ Recovery Plan and Approved Conservation Advice	Presence of BIA	Relevant Management Actions
Sternula nereis nereis	Australian fairy tern	Vulnerable	Threatened	Commonwealth Conservation Advice on *Sternula nereis nereis* (Fairy Tern) (TSSC, 2011)	X	Ensure relevant management measures are adopted during any spill response activities which require shoreline access.
Thinornis rubricollis	Hooded plover	Vulnerable	Threatened	Conservation Advice for *Thinornis rubricollis rubricollis* hooded plover (eastern) (TSSC, 2014)	X	Manage the use (and access to) key beaches when plovers are breeding. Prepare oil spill response plans to ensure effective rehabilitation of oiled birds. Reduce in-shore marine debris.
Migratory (Overfly over coastal waters))						
Calidris ruficollis	Red-necked Stint	Migratory	-	-	X	-
Gallinago hardwickii	Latham's Snipe	Migratory	-	-	X	-
Himantopus caudacutus	White-throated needle-tail	Migratory	Threatened	-	X	-
Himantopus himantopus	Black-winged stilt	Migratory	-	-	X	-
Monarcha melanopsis	Black-faced monarch	Migratory	-	-	X	-
Myiagra cyanoleuca	Satin flycatcher	Migratory	-	-	X	-
Numensis madagascariensis	Eastern curlew	Critically Endangered, Migratory	-	Approved Conservation Advice for *Numenius madagascariensis* (Eastern Curlew) (TSSC, 2015g)	X	Not Applicable to NOP activities
Numensis minutus	Little Curlew	Migratory	-	-	X	-
Numensis phaeopus	Whimbrel	Migratory	-	-	X	-
Rhipidura rufifrons	Rufous Fantail	Migratory	-	-	X	-
Terrestrial Only						
Ardea ibis	Cattle egret	-	Threatened	-	X	-

Scientific Name	Common Name	EPBC Act Status (Com)	FFG Act Status (Vic)	Management Plan/ Recovery Plan and Approved Conservation Advice	Presence of BIA	Relevant Management Actions
Anthochaera Phrygia	Regent Honeyeater	Critically Endangered	Threatened	-	X	Not Applicable to NOP activities
Botaurus poiciloptilus	Australasian bittern	Endangered	Threatened	-	X	Not Applicable to NOP activities
Dasyornis brachypterus	Eastern Bristlebird	Endangered	-	-	X	Not Applicable to NOP activities
Grantiella picta	Painted honeyeater	Vulnerable	-	-	X	Not Applicable to NOP activities
Lathamus discolour	Swift parrot	Critically endangered	Threatened	-	X	Not Applicable to NOP activities
Neophema chrysogaster	Orange-bellied parrot	Critically Endangered	Threatened	-	X	Not Applicable to NOP activities
Rostratula benghalensis	Painted snipe	-	Threatened	-	X	-

4.3 Conservation Values

4.3.1 Commonwealth Marine Reserves

The Patricia-Baleen and Sole-2 EMBAs do not intersect any Commonwealth Marine Reserves (CMRs). The closest CMRs are:

- East Gippsland CMR located approximately 150 km east (Patricia-Baleen assets) and 100km east (Sole-2); and
- Beagle CMR located approximately 160 km south-west (Patricia-2) and 200km south-west (Sole-2).

4.3.2 Victorian Marine Reserves

The Patricia-Baleen EMBA intersects the Beware Reef Marine Sanctuary (~30km east of Patricia-Baleen shore crossing).

The Sole-2 EMBA intersects the Point Hicks Marine Park (~37 km northeast of Sole-2) and Beware Reef Marine Sanctuary (~ 37 km northwest of Sole-2).

Figure 4-1 provides the location of these marine reserves.

Figure 4-1: State Marine Reserves and Coastal Parks (Parks Victoria, 2003a)

4.3.3 Victorian Terrestrial Reserves

The Patricia-Baleen EMBA intersects the:

- Marlo Coastal Reserve and Corringle Foreshore Reserve located ~ 2 km east of the Patricia-Baleen shore crossing;
- Cape Conran Coastal Park (CP) ~ 13 km east of the Patricia-Baleen shore crossing.

The Sole-2 EMBA intersects the:

- Cape Conran CP ~ 40 km north-west of Sole-2; and
- A small section of the Croajingolong National Park (western extremity) (~40 km north-east of Sole-2).

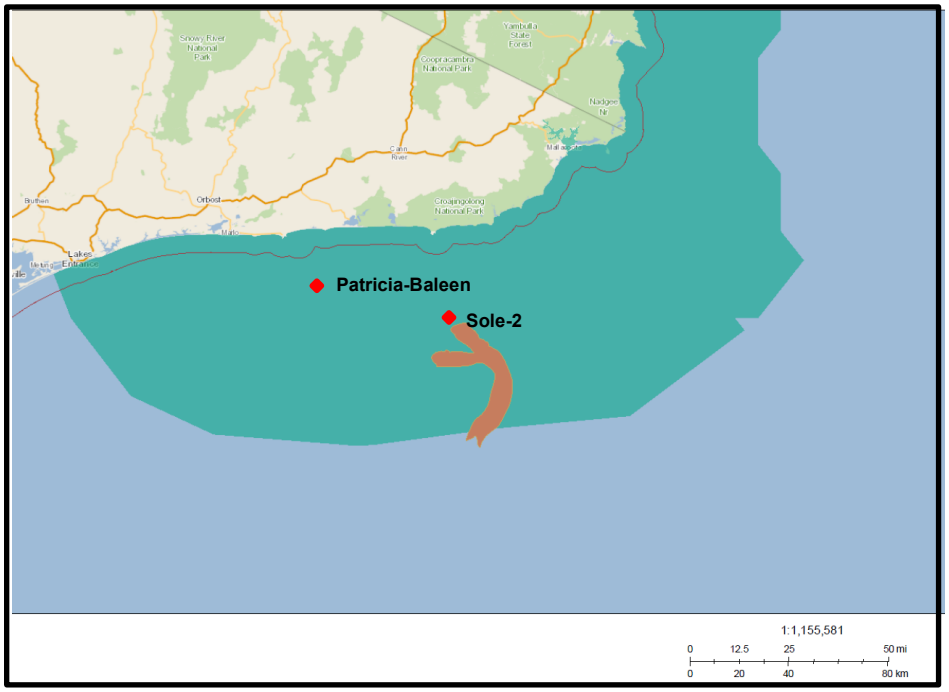
Figure 4-1 provides the location of these terrestrial reserves.

4.3.4 Key Ecological Features

The Patricia-Baleen and Sole-2 assets are located within the 'upwelling east of Eden' Key Ecological Feature (KEF) and are located approximately 75km west (Patricia-Baleen) and 25 km west (Sole-2) of the Big Horseshoe KEF. Both areas are recognised for high productivity and aggregations of marine life (CoA, 2015).

The location of the KEFs relative to the Patricia-Baleen and Sole-2 assets is provided in Figure 4-2.

Figure 4-2: Key Ecological Features in proximity to Patricia-Baleen and Sole-2 (DoEE, 2017)



4.3.5 Upwelling East of Eden

This KEF is associated with the dynamic eddies of the East Australian Current which cause episodic productivity events when they interact with the continental shelf. This mixing drives nutrient enrichment events and phytoplankton blooms that are the basis of productive food chains including zooplankton, copepods, krill and small pelagic fish (CoA, 2015).

The upwelling supports regionally high primary productivity in turn supporting 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, when significant krill aggregations form. The area is also important for seals, other cetaceans, sharks and seabirds (CoA, 2015).

This KEF displays seasonal and annual variation (CoA, 2015).

4.3.6 Big Horseshoe

The Big Horseshoe Canyon is the easternmost arm of the Bass Canyon system and its steep, rocky slopes provide hard substrate habitat for site-attached fauna. Sponges and other habitat forming species provide structural refuges for benthic fishes, including the commercially

important pink ling. It is the only known temperate location of the stalked crinoid *Metacrinus cyaneu* (CoA, 2015).

This KEF lies outside the Patricia-Baleen EMBA and overlaps the Sole-2 EMBA.

4.3.7 Matters of National Environmental Significance

Other matters of national environmental significance with respect to the Patricia-Baleen and Sole-2 assets are as follows:

- *World Heritage Properties:* No world heritage areas are listed within the Patricia-Baleen and Sole-2 EMBAs.
- *National Heritage Places:* Gabo Island Lighthouse, located approximately 130 km east of the Patricia-Baleen pipeline shore-crossing is a listed Commonwealth heritage place. It does not lie within the Patricia-Baleen or Sole-2 EMBAs.
- *Wetlands of International Importance*: The nearest wetland of international significance to the Patricia-Baleen and Sole-2 assets is the Gippsland Lakes RAMSAR site located on the coast of Ninety Mile Beach. This is approximately 45 km west of the Patricia-Baleen Pipeline shore-crossing and 90 km west-northwest of Sole-2.
- *Threatened Ecological Communities (TEC)*: The Patricia-Baleen and Sole-2 EMBAs may intersect the Giant Kelp Forest marine-based threatened ecological community and shoreline Subtropical and Temperate Coastal Saltmarsh Community.
    - *Subtropical and Temperate Coastal Saltmarsh Community:* The lower Snowy River estuary contains saltmarsh which is classified as part of this TEC. It consists of salt-tolerant vegetation including grasses, herbs, sedges, rushes and shrubs and supports nursery habitats for fish and prawn species (CoA, 2013).
    - *Giant Kelp Forests*: Giant kelp (*Macrocystis pyrifera*) plants are the foundation species of this ecological community which also supports a large range of marine algae, reef associated fish and numerous invertebrates that shelter, feed and reproduce. It is possible that suitable conditions exist for this ecological community between Point Hicks and Cape Howe (CoA, 2012).

4.4 Cultural Heritage

4.4.1 Historic Shipwrecks

The National Shipwreck and Relic database (DoEE, 2017c) did not identify any historic shipwrecks within the Patricia-Baleen or Sole-2 offshore area or within the area between the offshore pipeline shore-crossing and Cape Conran.

A review of the Victorian Heritage Register (Victorian Heritage Database, 2017) identified thirteen shipwrecks within 20 km of the Patricia-Baleen offshore assets or Sole-2 location:

- Albert San (1926) – East Coast Cape Conran, Beware Reef;
- Anne and Mary (1887) – Bass Strait off Lake Tyers;
- Bogong (1896) – west of the Snowy River mouth;
- Curlip (1919) – mouth of the Snowy River near Marlo;
- Falcon (1903) – Snowy River Entrance, Marlo;
- FV Turraghty (1900) – 33km east of Lakes Entrance;
- Glengarry (1898) – Marlo;

- Karingal (1985) – Two miles south of Cape Conran;
- Lady of the Lake (1880) – Snowy River Entrance;
- Pomona (1866) – Between Lake Tyers and Snowy River;
- Ridge Park (1881) – Beware Reef Cape Conran;
- S.S. Auckland (1871) – Beware Reef, Cape Conran;
- Wongrabell (1912) – Snowy River Bar, Marlo.

None of the shipwrecks on the Victorian East Gippsland coast are covered by shipwreck protected zones declared under Section 103 of the *Victorian Heritage Act 1995* (DELWP, 2017).

4.4.2 Aboriginal Heritage

The Gippsland coastline is of significance with respect to aboriginal cultural. This includes areas where there may be no physical evidence of past cultural activities but includes places of spiritual or ceremonial significance, places where traditional plant or mineral resources occur or trade and travel routes (DPCD, 2008). These places are often found near major food sources such as rivers, lakes, swamps and the coast (DEPI, 2014).

Along the Gippsland coastline, encounter with areas containing coastal shell middens is possible. These areas may also contain charcoal and hearth stones from fires, and items such as bone and stone artefacts. These areas are located within sheltered positions in the dunes, coastal scrub and woodlands, within rock shelters or on exposed cliff tops with good vantage points. Threats to coastal shell middens include exposure by wind and water erosion; degradation by human or animal interference; and people destabilizing ground using unregulated tracks or off-road vehicles (DPCD, 2008).

4.5 Socio-Economic Environment

4.5.1 Commercial Shipping

The South-east marine region carries significant shipping activity and shipping volumes. This includes international and coastal cargo trade, passenger services and cargo and vehicular ferry services across Bass Strait from the major ports of Melbourne, Geelong and Western Port. Other minor ports important to commercial and recreational fishing, yachts and other pleasure craft are Lakes Entrance (Victoria) and Eden (NSW) (CoA, 2015).

An ‘Area to be Avoided’ (ATBA) shipping exclusion zone exists around the operating oil and gas platforms in the Gippsland Basin, whereby unauthorised vessels larger than 200 gross tonnes are excluded from entry. This ATBA is located immediately south of the Patricia-Baleen Pipeline assets.

Ship tracking data from AMSA (2016-7) has indicated that high traffic volumes are located approximately 50 km southeast of Patricia-Baleen and 12 km southeast of the Sole-2 well.

4.5.2 Commercial Fishing

Table 4-2 provides a summary of the Commonwealth and Victorian commercial fisheries which may operate in the Patricia-Baleen and Sole-2 EMBAs.

4.5.3 Recreational Fishing

Recreational fishing and boating is largely confined to nearshore coastal waters. As the 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. Typically, recreational fishing targets snapper, King George whiting, flathead, bream, sharks, tuna, calamari, and Australian salmon (DPI, 2012).

Recreational activities undertaken in and around the Snowy River estuary include water, boating and fishing activities within the river, at Mots Beach, Sampsons Beach and up from the Marlo jetty.

Table 4-2: Commercial Fisheries operating in the Patricia-Baleen and Sole-2 EMBAs

Fishery	Target Species	Known Fishing intersection with Patricia-Baleen or Sole-2 Assets?	Does Known Fishing intersect with EMBA?	Fishing Method and Permits/Licences	Fishing Management Area Location	Comments
COMMONWEALTH FISHERIES						
Bass Strait Central Zone Scallop Fishery	Scallops (*Pecten fumatus*).	**No.**	**No**	Towed dredge fishing method. Fishery managed via seasonal/area closures and total allowable catch (TAC) controls together with quota statutory fishing rights (65 permits) and individual transferrable quotas. 11 vessels were active in the fishery in 2015	20 - 200 nm from the coast of Victoria and Tasmania	Scallop spawning occurs from winter to spring (June to November). The timing is dependent on environmental conditions such as wind and water temperature (Sause *et al*., 1987). Fishery can operate down to 120m water depth but prefers water depth of 70-80 m. Sole-2 is located in 125 m water depth. Value of Fishery: $2.8M (2015)
Eastern Tuna and Billfish Fishery	Albacore tuna (*Thunnus alulunga*) Bigeye tuna (*Thunnus obesus*) Yellowfin tuna (*Thunnus albacares*) Broadbill swordfish (*Xiphias gladius*) Striped marlin (*Tetrapturus audux*).	No. Fishery effort is concentrated along the NSW coast and southern Queensland coast (2015 data). No Victorian ports are used to land catches.	No.	Pelagic longline, minor line (such as handline, troll, rod and reel). A total of 90 boat Statutory Fishing Rights, and 101 minor line Statutory Fishing Rights were issued in 2015. Vessels operating – 39 longline and 2 minor-line.	South Australia/Victoria border, around east coast of Australia to Cape York, including waters around Tasmania within the Exclusive Economic Zone (EEZ).	Spawning occurs through most of the year in water temperatures greater than 26°C (Wild Fisheries Research Program, 2012). Value of Fishery: $35M (2015)
Skipjack Tuna Fishery (Eastern)	Skipjack tuna (*Katsuwonus pelamis)*	No. No fishing effort since 2008-9 fishing season (stock highly variable and Australia is at the edge of the species range).	No.	Historically, over 98% of the catch was taken using purse seine catch method. Pole and line method was used for the remaining 2% of the catch. Currently 18 fishing permits (2014-15) but no active Australian vessels.	Extends from the border of Victoria and South Australia to Cape York, Queensland.	Skipjack tend to congregate at convergences, boundaries between cold and warm water masses and spawn in spring (Food and Agriculture Organization of the United Nations, 2012). Coastal areas managed by the States rather than Commonwealth.

Fishery	Target Species	Known Fishing intersection with Patricia-Baleen or Sole-2 Assets?	Does Known Fishing intersect with EMBA?	Fishing Method and Permits/Licences	Fishing Management Area Location	Comments
Small Pelagic Fishery	Jack mackerel (*Trachurus declivis, T. symmetricus, T. murphyi*) Blue mackerel (*Scomber australasicus*), Redbait (*Emmelichthys nitidus*) and Australian sardine (*Sardinops sagax).*	No. Fishery effort concentrated in the near-shore GAB (west of Port Lincoln and kangaroo Island) and Western Victoria. Eastern sub-area effort is concentrated in far southern NSW and Tasmania (2015-16 data).	No.	Purse seine and mid-water trawl are the main fishing methods. There were 32 Statutory Fishing Rights in the 2015-16 fishing season, with 2 purse seine and 1 mid-water trawl vessels active.	The fishery extends from southern Queensland to Western Australia to the edge of the Australian Fishing Zone (AFZ) (200 nm).	The Eastern Small Pelagic Fishery is limited entry, with total allowable catch limits and gear restrictions. Value of Fishery: Not released (confidential) (2014-5)
SESSF – CTS & Danish Seine	Blue grenadier (Macruronus novaezelandiae), tiger flathead (Platycephalus richardsoni), pink ling (Genypterus blacodes) silver warehou (Seriolella punctata).	Yes Trawl sector is concentrated around shelf-break areas. Danish seine activity is located on the continental shelf and operate in sandy bottom environments.	Yes	Fishing methods include otter trawl and Danish seine. There are 57 trawl licences with 38 trawl and 16 Danish seine vessels operational in the 2015/16 season.	CTS: 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 to the limit of the AFZ. No access by otter board trawlers in State waters.	The SESSF is a limited entry fishery. Other management arrangements include trip, incidental catch and size limits, prohibited take, gear restrictions and spatial and temporal closures. Major Danish seine port is Lakes Entrance (where majority of fleet is located) Value of Fishery: $37.7M (2014-5)

Fishery	Target Species	Known Fishing intersection with Patricia-Baleen or Sole-2 Assets?	Does Known Fishing intersect with EMBA?	Fishing Method and Permits/Licences	Fishing Management Area Location	Comments
SESSF – Shark Gillnet and Shark Hook sector	Elephantfish (Callorhinchus milii) Gummy shark (Mustelus antarcticus) Sawshark (Pristiophorus cirratus, P. nudipinnis)	Yes (Gillnet) Gillnet sector heavily utilises the continental shelf. Hook sector does not fish in the Gippsland Basin.	Yes (Gillnet)	Within the Shark Gillnet and Hook sector there were 61 gillnet fishing permits and 13 hook fishing permits issued in 2015-16 season. Vessels actively fishing during the season included 37 gillnet vessels and 24 hook vessels.	Shark Gillnet and Hook sector extends for the Victorian-NSW border around Tasmania to the SA-WA border and includes waters to the edge of the AFZ. Sector is not permitted to fish within Victorian state waters.	Value of Fishery: $16.9M (2014-15)
Southern Bluefin Tuna Fishery	Southern bluefin tuna (*Thunnus maccoyii*).	No. Fishery effort concentrated in the Great Australian Bight (GAB) off Kangaroo Island and in southern NSW coast off the continental shelf (2015 data).	No.	The primary fishing method is purse seine in waters off South Australia with a number of fish captured by longline vessels off the East Coast. Tuna caught in SA are then transferred to aquaculture farming pens off Port Lincoln in South Australia. In the 2014-15 fishing season, there were 89 Statutory Fishing Rights with 6 active purse seine vessels and 18 longline vessels.	The fishery extends throughout all waters in the AFZ.	Southern Bluefin Tuna spawn in the north-east Indian Ocean. Spawning occurs from Spring to Autumn after which juveniles are thought to migrate south. Young tuna surface in the GAB between November and April. Value of Fishery: $36.8M (2014-5)

Fishery	Target Species	Known Fishing intersection with Patricia-Baleen or Sole-2 Assets?	Does Known Fishing intersect with EMBA?	Fishing Method and Permits/Licences	Fishing Management Area Location	Comments
Southern Squid Jig Fishery	Arrow squid (*Nototodarus gouldi*).	No. Data indicates that fishing is concentrated south of Portland and Warrnambool. Commonwealth fishery does not operate in Victorian State waters.	No	Squid jigging is the fishing method used, mainly in water depths of 60 to 120 m, at night. In 2015, there were 7 active jig vessels in the Commonwealth fishery. Portland is a primary landing port.	The fishery extends from the SA/WA border east to southern Queensland to the edge of the AFZ.	Fishing is seasonal with the season starting in February and ending in June. The season starts off the Port Phillip Bay heads and slowly moves westwards to Portland as the season progresses, following the natural migration of the squid (SIV, 2016). Most of the jig catch is taken between January and June each year, with the highest catches concentrated in March and April. Value of Fishery: $2.3M (2015)
VICTORIAN FISHERIES						
Rock Lobster Fishery	Predominantly southern rock lobster (*Jasus edwardsii*), along with small quantities of eastern rock lobster (*Jasus verreauxi)*.	Yes.	**Yes** (Patricia-Baleen) **No** (Sole) (SETFIA, 2016).	47 licences in the eastern zone, permitted to use baited rock lobster pots. In 2014/15, 59 tonnes were harvested in the eastern zone. Fished from rocky reefs in waters up to 150 m depth, with most of the catch coming from inshore waters less than 100 m deep. Pots are generally set and retrieved each day, marked with a surface buoy. Catch data for the eastern zone indicates fishing occurs year-round, with catches being much reduced during April, May, June & July, and highest catches occurring from December and January.	Assets covered by Eastern Zone include Apollo Bay to the Victorian-NSW border border).	Larvae hatching areeen September and November. Fishing is prohibited from 15 September to 15 November for male rock lobsters, and from 1 June to 15 November for female rock lobsters. Value of Fishery: $15M (2015) (SIV, 2017)

Fishery	Target Species	Known Fishing intersection with Patricia-Baleen or Sole-2 Assets?	Does Known Fishing intersect with EMBA?	Fishing Method and Permits/Licences	Fishing Management Area Location	Comments
Giant Crab Fishery	Giant crab (*Pseudocarcinus gigas*).	No Fishery is located in the Western Zone (Apollo Bay to SA-Victorian border)	No	Giant crabs can only be taken using commercial rock lobster pots by Western Zone lobster fishers. In 2016 there were 33 licences within the fishery (SIV, 2017). Fished mostly on the shelf break (150-350 m water depth).	Assets covered by Western Zone (Apollo Bay to the SA/Vic border) and south to 40°S.	The closed season for female and male giant crabs is from 1 June until 15 November and from 15 September to 15 November, respectively. There is a total year round prohibition on the retention of berried females. Fishery sets pots at depths 150-300m which is outside the depths of Patricia-Baleen and Sole-2 (SETFIA, 2016). Value of Fishery: $0.6M (2015)
Abalone Fishery	Blacklip abalone (*Haliotis rubra*)	**Unlikely** (no rocky reefs) Abalone diving activity occurs close to shoreline (generally to depths of 30 m on rocky reefs).	No.	The fishery consists of 71 fishery access licences of which 23 operate in the Victorian Eastern Zone. Commercial fishing methods use diving equipment such as a surface air supply to the diver (hookah system) from small high speed fishing boats. Diving is normally to depths less than 20 m.	Victorian Eastern Abalone Zone is located between Lakes Entrance and the Victorian-NSW border.	Blacklip abalones spawn between February and April and again between October and December. Total TACC is 806 tonnes with landed value $20M (2009/10 prices) (SIV, 2017)

Fishery	Target Species	Known Fishing intersection with Patricia-Baleen or Sole-2 Assets?	Does Known Fishing intersect with EMBA?	Fishing Method and Permits/Licences	Fishing Management Area Location	Comments
Scallop Fishery	Scallop (Pecten fumatus).	**Possible** (Dependent on quota setting) Historically, most fished from Lakes Entrance and Welshpool.	**Yes** (Patricia-Baleen). **No** (Sole – At boundary of the fishery) (SETFIA, 2016)	A total of 91 commercial licenses are issued each year and approximately 10-15 vessels operate within the fishery. Commercial vessels tow a single dredge that is dragged along the seabed. Dredges are deployed from the rear of the vessel, and are up to 4.5 metres wide. Fishing usually occurs from May to end of November.	Extends 20 nm south of the Victorian coastline.	The fishery is not opened unless the abundance of scallops in specific locations meets the agreed criteria for the average number of scallop meats per kilogram. A total allowable commercial catch (TACC) is set annually for the period 1 April to 31 March (following year). In the seasons 2010/11, 2011/12 and 2012/13 there was a zero TACC for the Victorian Scallop Fishery. A small conservative quota was in place for the 2013/4 season of 136.5 tonnes and for 2014/5 of 135 tonnes. Value of Fishery: Not available

Fishery	Target Species	Known Fishing intersection with Patricia-Baleen or Sole-2 Assets?	Does Known Fishing intersect with EMBA?	Fishing Method and Permits/Licences	Fishing Management Area Location	Comments
Ocean (General Access) Fishery	Snapper (Pagrus auratus). King George Whiting (Sillaginodes punctatus) Blue-throat wrasse (*Notolabrus tetricus*), Saddled (or purple) wrasse (*Notolabrus fucicola*) Rosy Wrasse (*Pseudolabrus psittaculus*) Senator Wrasse (*Pictilabrus laticlavius*) Southern Maori Wrasse (*Ophthalmolepis lineolatus*)	**Yes** (Patricia-Baleen) **No** (Sole) Wrasse is fished along the entire Victorian coast but in recent years, catches have been the highest off the central coast (Port Phillip Heads, Western Port, and Wilsons Promontory) and west coast of Victoria (Portland). Catches of saddled wrasse are highest in the Western part of Victoria, which is thought to be related to a greater proportion of suitable reef habitat in this area	**Yes** (Patricia Baleen) **No** (Sole)	A total of 246 ocean fishery access licences issued (SIV, 2016) which are not transferrable (SIV, 2017) Considerable dormant licences within this fishery (SETFIA, 2016). A variety of commercial fishing equipment is used including line methods (dropline, long line, handline) dip nets, bait traps, nets and bait pumps (long lines, haul seines, mesh nets, and hand lines. There are a maximum number of 22 licences (2017) in the wrasse fishery.	Extends 20 nm from the Victorian coastline in marine waters other than Port Philip Bay, Western port, Gippsland Lakes and any Inlet to the Sea.	In East Gippsland, fishery conducts day trips in small vessels (<10 m) with most fishing undertaken off Lakes Entrance during April to July. Two-thirds of the total commercial snapper catch is taken by long lines. Other methods of fishing include haul seine (maximum length of 460m) and mesh nets (maximum mesh size 130mm, maximum length 2500m per license) (SIV, 2017). Whiting, a minor target species, is taken using haul seine nets, mesh nets and hand lines. Commercial whiting catches are concentrated in Port Philip Bay, Corner Inlet with a small catch also harvested in Victorian coastal waters and from other inlets and estuaries (SIV, 2017). All species of wrasse are near-shore and are highly territorial with limited home ranges. Value of Fishery: Not available

Fishery	Target Species	Known Fishing intersection with Patricia-Baleen or Sole-2 Assets?	Does Known Fishing intersect with EMBA?	Fishing Method and Permits/Licences	Fishing Management Area Location	Comments
Ocean (Purse Seine) Fishery	Australian Salmon (*arripis truttaceus*) Pilchards (sardinops neophilchardus) Sprat (spratelloides robustus) Anchovy (Engraulis australis)	**Yes** (Patricia-Baleen) **No** (Sole)	**Yes** (Patricia Baleen) **No** (Sole)	One Ocean Purse Seine Licence issued in Victoria domiciled in Lakes Entrance and conducts day trips (SETFIA, 2016). Equipment uses is a purse seine net or lampara net (SETFIA, 2016). Equipment does not touch the sea floor (SETFIA, 2016).	Extends 20 nm from the Victorian coastline in marine waters other than Port Philip Bay, Western port, Gippsland Lakes and any Inlet to the Sea	Opportunistically fishes on pelagic migratory fish (SETFIA, 2016). Value of Fishery: Not available
Inshore Trawl Fishery	Eastern king prawns (*Melicertus plebejus*) School prawns (Metapenaeus macleayi)	**Yes** (Patricia-Baleen) **No** (Sole)	**Yes** (Patricia Baleen) **No** (Sole)	A total of 60 inshore trawl Licences however most of those are dormant (SETFIA, 2016). Capture method is via trawl nets with ground chains so it skims the seabed and encourages prawns into the nets (SETFIA, 2016)	Extends 20 nm from the Victorian coastline in marine waters other than Port Philip Bay, Western Port, Gippsland Lakes and any Inlet to the Sea	Fishermen often fish as far east as the existing Patricia-Baleen pipeline (SETFIA, 2016). Value of Fishery: Not available
Sea Urchin Fishery	Heliocidaris erythrogramma (white urchin) Centrostephanus rodgersii (black urchin).	Yes	Yes	Licences linked to quotas (not capped). 20 tonnes per licence. Divers collect sea urchin by hand.	Eastern Zone extends from Lakes Entrance to NSW border east of 148°E	Inhabit sub-tidal reefs in macro-algae between 6-10 m deep. Mallacoota is primary fishing port.

Sources: Commonwealth: ABARES 2016 unless otherwise noted; Victoria: Agriculture Victoria (2016) unless otherwise noted

4.5.4 Tourism

In East Gippsland, primary tourist locations are the Gippsland Lakes, extending from Sale to Lakes Entrance, the largest inland waterway in Australia, Lakes Entrance, Marlo, Cape Conran and Mallacoota. The area is renowned for its nature-based tourism (e.g. Croajingolong National Park), recreational fishing and water sports (lake and beaches) (Travel Victoria, 2017).

4.5.5 Petroleum Exploration, Production and Carbon Capture & Storage

The Gippsland Basin has 13 exploration permit areas and 25 current offshore production licenses. A total of 23 offshore platforms have been installed in Bass Strait since first production was established (excluding subsea production wells). Petroleum production has centred on the Esso Australia Resources Pty Ltd offshore facilities consisting of 23 offshore platforms, subsea developments and 880 km of associated pipelines tied back to the Gippsland Gas Plant.

Other hydrocarbon facilities, outside the Patricia-Baleen facilities, in the Gippsland Basin include:

- Longtom Gas Development developed by Nexus Energy Pty Ltd (now SGH Energy) from 2009-2015. A pipeline connected the Longtom wells to the Patricia Baleen gas pipeline, feeding into the OGP.
- Basker-Manta-Gummy (BMG): The BMG field was developed in 2005 using a leased Floating Production Storage Offloading (FPSO) vessel concept. Recovery of hydrocarbons through a series of subsea wells connected back to the vessel continued until 2010. In 2010, the FPSO was removed and all subsea equipment depressurised, flushed and preserved. During 2012, the mooring and mid-water equipment have been removed and is now under ‘care and maintenance’ pending assessment of future development options.
- Tasmanian Gas Pipeline operated by Alinta Energy which transports natural gas from Victoria (Seaspray) to Tasmania (Five Mile Bluff) (CoA, 2015).

Cooper is developing the Sole field located 36 km from the Gippsland coast and approximately 50 km east of Patricia-2. This includes drilling at least one development well and installation of a 65 km offshore pipeline to the Orbost Gas Plant where sole gas will be treated to sales quality gas. The Sole gas field has 241 PJ of gas (2C Contingent Resource) and will be produced at 25 PJ/annum. It is expected to have a field life of approx. 10 years to (2029) with first gas expected in March 2019 (COE, 2016).

The Patricia-Baleen and Sole-2 assets are not located in, or in proximity to, any areas covered by Greenhouse Gas Assessment Permits.

4.5.6 Defence Activities

Defence uses offshore areas for training operations including live firing, bombing practice from aircraft, air-to-air and air-to-sea or ground firing, anti-aircraft firing, firing from shore batteries or ships, remote controlled craft firing, and rocket and guided weapons firing. The Patricia-Baleen and Sole-2 assets are not located in proximity to defence training areas with the nearest facility located more than 400 km to the north-east at Jervis Bay (NSW) (CoA, 2015).

Mine fields were laid in Australian waters during World War II. Post-war minefields were swept to remove mines and to make marine waters safe for maritime activities. There are three areas identified as dangerous due to unexploded ordinances (UXO), though these are located south and east of Wilson’s Promontory.

4.5.7 Submarine Cables

Submarine cables located in Bass Strait are limited to the subsea floor between Tasmania and the Australian mainland. This includes two Telstra fibre optic cables as well as Basslink, a subsea interconnector, completed in 2006 which joins the Tasmanian and national electricity grid. These assets are not located in proximity to the Patricia-Baleen or Sole-2 assets.

5 Environmental Impact and Risk Assessment Methodology

5.1 General

5.1.1 Method

The methodology adopted for determining environmental impacts and risks associated with Patricia-Baleen and Sole-2 NOP activities is consistent with the approach outlined in ISO 14001 (Environmental Management Systems), ISO 31000:2009 (Risk Management) and HB203:2012 (Environmental Risk Management – Principles and Process). Figure 5-1 provides the process adopted for managing impacts and risks associated with the petroleum activity.

Figure 5-1: Impact and Risk Management Methodology

For the Patricia-Baleen and Sole-2 NOP activity, environmental hazards and their associated impacts or risks have been identified and assessed undertaking the following steps:

- Defining the activity and associated environmental hazards (routine and non-routine (emergency) activities);
- Identifying the environmental and social values at risk within, and adjacent to, the petroleum activity area;
- Establishing the credible environmental impact of the hazard to receptors and determining the maximum credible impact for each hazard associated with the activity (i.e. inherent impact);
- For environmental hazards with the potential to impact the environment during the activity, identifying the likelihood of occurrence of the impact;
- Identifying control measures to eliminate or reduce the level of impact and/or the likelihood of the impact occurring; and
- Assigning a level of residual impact or risk (after control measures are implemented) utilizing Cooper's qualitative risk matrix (refer Table 5-1 [Consequence Definition], Table 5-2 [Likelihood Definition], Table 5-3 [Qualitative Risk Matrix] and Table 5-4 [Management of Impact & Risk]). In accordance with the Cooper acceptance criteria, the impacts and risks continue to be reassessed until it is demonstrated the impact or risk is reduced to a level which is as low as reasonably practicable (ALARP) and is acceptable according to Cooper's acceptance criteria.

For the Patricia-Baleen and Sole-2 assets, environmental hazard identification and assessment considered the following:

- Activities that will occur during the NOP and the typical equipment and vessels to be utilized in those activities;
- The environmental sensitivity of the receiving environment with respect to species distribution, subsea habitat types and location of environmentally sensitive areas (i.e., BIAs, conservation areas, etc.) undertaken as part of literature reviews; and
- Feedback from marine stakeholders to understand socio-economic activities that may conflict with NOP activities during consultation.

Within this context, a listing of credible activity-related environmental hazards and possible impacts were identified for the NOP activities.

Table 5-1: Definition of Consequence

Descriptor	Environment	Regulatory, reputation, community and media	Financial/Legal
5. Critical	Severe long-term impact on highly-valued ecosystems, species populations or habitats. Significant remedial/recovery work to land/water systems over decades (if possible at all).	Critical impact on business reputation &/or international media exposure. High-level regulatory intervention. Potential revocation of License/Permit. Operations ceased.	Catastrophic structural failure/damage/loss. Financial loss >$50 M. Public inquiry, major litigation, prosecution with damages/fines >$50 M. Custodial sentence for a Cooper Manager
4. Major	Extensive medium to long-term impact on highly-valued ecosystems, species populations or habitats. Remedial, recovery work to land or water systems over years (~5-10 years).	Significant impact on business reputation and/or national media exposure. Significant regulatory intervention. Operations ceased.	Major structural failure/ damage/loss. Financial loss >$25 M. Major litigation or prosecution with damages or fines of >$25 M + significant costs.
3. Moderate	Localised medium-term impacts to species or habitats of recognized conservation value or to local ecosystem function. Remedial, recovery work to land/water systems over months/year.	Moderate to small impact on business reputation. Potential for state media exposure. Significant breach of regulations, attracting regulatory intervention.	Moderate structural failure/damage/loss. Financial loss >$10 M. Litigation or prosecution costing >$10 M. Investigation by regulatory body.
2. Minor	Localised short-term impacts to species/habitats of recognised conservation value but not affecting local ecosystem functioning. Remedial, recovery work to land, or water systems over days/weeks. No significant impacts to third parties.	Some impact on business reputation and/or industry media exposure. Breach of regulations - event reportable to authorities.	Minor structural failure/damage/loss Financial loss >$5 m Major breach of regulation with punitive fine Involvement of Senior Management
1. Negligible	Temporary localised impacts or disturbance to plants/animals. Nil to negligible remedial/recovery works on land/water systems.	Minimal impact on business reputation. Negligible media involvement. No regulatory breaches or reporting.	Insignificant structural failure/damage/loss. Financial loss <$5 m. Breach of regulation with investigation or report to specialist with possible prosecution and fine.

Table 5-2: Definition of Likelihood

Descriptor	Description
A. Almost certain	Common event, expected to occur in most circumstances within Cooper operations (i.e., several times a year).
B. Likely	Event likely to occur once or more during a campaign, ongoing operations or equipment design life.
C. Possible	Infrequent event that may occur during a campaign, ongoing operations or equipment design life.
D. Unlikely	Unlikely event, but could occur at sometime within Cooper operations (has occurred previously in similar industry).
E. Remote	Rare event. May occur in exceptional circumstances of Cooper operations (not heard of in recent similar industry history).

Table 5-3: Cooper Qualitative Risk Matrix

		CONSEQUENCE				
		1.Negligible	2.Minor	3.Moderate	4.Major	5.Critical
LIKELIHOOD	A. Almost Certain	M	M	H	H	H
	B. Likely	M	M	M	H	H
	C. Possible	L	M	M	H	H
	D. Unlikely	L	L	M	M	H
	E. Remote	L	L	L	M	M

Table 5-4: ALARP determination for impact (consequence) and risk

IMPACT	NEGLIGIBLE	MINOR	SIGNIFICANT	MAJOR	CRITICAL
	Broadly acceptable	Tolerable if ALARP			Intolerable
RISK	LOW	MEDIUM			HIGH
	Broadly acceptable	Tolerable if ALARP			Intolerable

Table 5-5: Management response to impact and risk determinations

Category	Description & Response
HIGH	**Intolerable risk** (in particular at level A5 MAE) - Urgent Executive Management action immediately required, operations not to proceed without Executive Management oversight and approval. Unless specific corrective action(s) taken, possible curtailment of operations, isolate activity or task. Of material interest to the Board, Board advised of corrective action, project does not continue or commence without the support of the Board. Notification: Board of Directors (notified by Managing Director).
MEDIUM	**Tolerable if ALARP**, if all reasonably practicable risk reduction measures have been implemented. Local Senior Management responsibility and approval is required, if not yet ALARP, improve existing controls and/or implement new control(s) operational planning, management responsibility and actions must be specified, corrective & preventative action plan required. Notification: Managing Director (notified by Executive Management).
LOW	**Tolerable risk** that can be managed by routine procedures; accept risk. Senior Management/Supervisor decision required. Reporting & decision making at management level. Managed by routine Standard Operating Procedures (SOPs) and onsite management responsibility, approval and monitoring. Notification: Executive Manager (notified by Manager/Superintendent/Supervisor).

The following definitions for impact and risk assessment methodology:

- **Impacts** result from activities that by their very nature do result in a change to the environment or a component of the environment, whether adverse or beneficial. Impacts can occur as a result of a routine or non-routine event. For example, there will be underwater sound emissions with associated impacts as a result of vessel activity.
- **Risks** result from activities where a change to the environment or component of the environment may occur as a result of the activity (i.e., there *may* be consequences *if* the incident event actually occurs). Risk is a combination of the *consequences* of an event and the associated *likelihood* of its occurrence. For example, a hydrocarbon spill may occur if a vessel's fuel tank is punctured by a collision incident during activities. 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).

5.1.2 Selection of Control Measures

For each identified impact and risk, control measures are identified to reduce the impact or risk. The hierarchy of controls framework has been used to identify controls that are effective (refer Figure 5-2) within assessment activities.

Multiple controls selected from this hierarchy provide a depth (number) and breadth (control type) to prevent an impact or risk from occurring. Control types listed in the upper section of the hierarchy are recognised as being more effective in terms of functionality, availability, reliability, survivability, independence and compatibility given their inherent design characteristics.

Figure 5-2: Hierarchy of Controls

Control Type	Effectiveness	Examples
Eliminate		*Eliminate the impact or risk.* Hydraulic lines are replaced with electrical umbilicals.
Substitute		*Change or substitute the impact or risk for a lower one.* Chemicals selected are OCNS 'Gold' or 'Silver' compared with 'Purple'
Engineer		*Engineer out the impact or risk* For seismic use solid streamers rather than fluid-filled.
Isolate		*Isolate the environment from the impact or risk* No anchoring within sensitive areas.
Administrative		*Provide instructions or training to people to lower impact or risk* At-sea refuelling procedures or pre-work Job Hazard Analyses (JHA).

5.2 ALARP Criteria

The ALARP model adopted for this assessment is dependent upon the:

a) Residual impact or risk level (provided in Figure 5-3). For higher level impact and risk residuals ALARP assessments consider options for alternative (replacement) controls; additional controls to reduce the environmental impact/risk; and improvements to already adopted controls to increase their effectiveness.

Uncertainty in impact/risk (shown diagrammatically in Figure 5-4). Based upon the level of uncertainty associated with the assessment of impact or risk, the following framework, adapted from the Guidance on Risk Related Decision Making (Oil & Gas UK, 2014) provides the decision-making framework to establish ALARP. This framework provides appropriate tools, commensurate to the level of uncertainty or novelty associated with the impact or risk (referred to as the Decision Type A, B or C). The decision type is selected based on an informed decision around the uncertainty of the risk. Decision types and methodologies to establish ALARP are outlined in Table 5-6.

Table 5-6

Figure 5-3: ALARP Determination for Impact & Risk

IMPACT	MINOR	MODERATE	SERIOUS	MAJOR	SEVERE	CATASTROPHIC
	Broadly acceptable	Tolerable if ALARP				Intolerable
RISK	LOW	MEDIUM / HIGH				VERY HIGH/ EXTREME
	Broadly acceptable	Tolerable if ALARP				Intolerable

Figure 5-4: Impact and Risk 'Uncertainty' Decision Making Framework

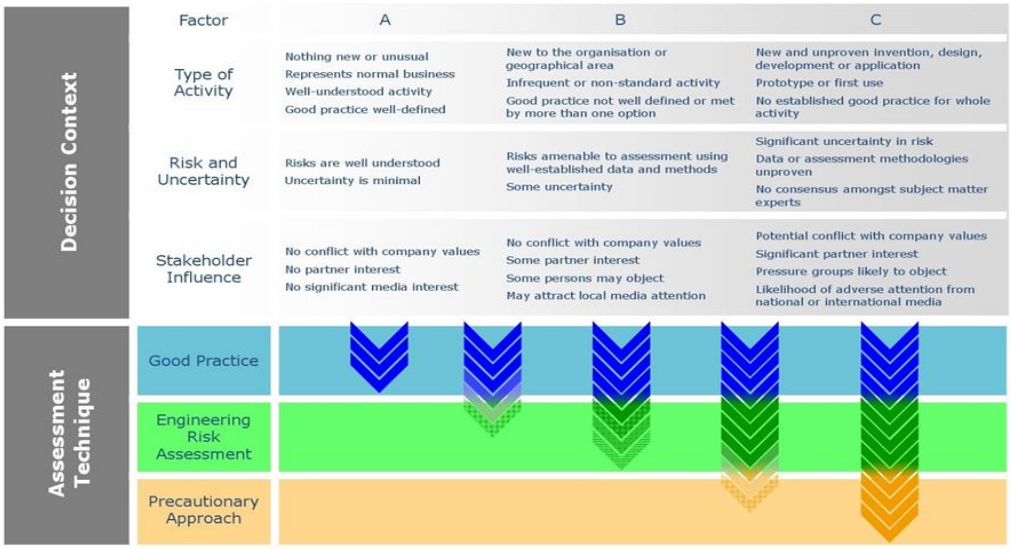


Table 5-6: ALARP decision-making based upon level of uncertainty

Decision type	Description	Decision-making tools
A	Risks classified as a Decision Type A are well-understood and established practice	**Legislation, codes and standards:** Identifies the requirements of legislation, codes and standards that are to be complied with for the activity. **Good Industry Practice**: Identifies further engineering control standards and guidelines that may be applied over and above that required to meet the legislation, codes and standards. **Professional Judgement**: Uses relevant personnel with the knowledge and experience to identify alternative controls. When formulating control measures for each environmental impact or risk, the 'Hierarchy of Controls' philosophy, which is a system used in the industry to identify effective controls to minimise or eliminate exposure to impacts or risks, is applied.
B	Risks classified as a Decision Type B are typically in areas of increased environmental sensitivity with some stakeholder concerns. These risks may deviate from established practice or have some life-cycle implications and therefore require further analysis using the following tools in addition to those described for a Decision Type A.	**Risk-based tools such as cost based analysis or modelling:** Assesses the results of probabilistic analyses such as modelling, quantitative risk assessment and/or cost benefit analysis to support the selection of control measures identified during the risk assessment process. **Company values:** Identifies values identified in Cooper's Health, Safety, Environment and Community (HSEC) Policy.
C	Risks classified as a Decision Type C will typically have significant risks related to environmental performance. The risks may result in significant environmental impact; significant project risk/ exposure; or may elicit strong stakeholder awareness and negative perception. For these risks, in addition to Decision Type A and B tools, company and societal values need to be considered by undertaking broader internal and external stakeholder consultation as part of the risk assessment process.	**Societal Values:** Identifies the views, concerns and perceptions of relevant stakeholders and addresses relevant stakeholder concerns as gathered through consultation.

5.3 Acceptability Criteria

Cooper considers a range of factors when evaluating the acceptability of environmental impacts or risks associated with its activities. This evaluation works at several levels as outlined in Table 5-7.

Table 5-7: Cooper Acceptability Criteria

Test	Question	Acceptability demonstrated
Policy compliance	Is the proposed management of the risk or impact aligned with Cooper's HSEC Policy?	The impact or risk must be compliant with the objectives of the company's policies.
Management System Compliance	Is the proposed management of the impact or risk aligned with the HSEC Management System?	Where specific procedures and work instructions are in place for management of the impact and risk in question, acceptability is demonstrated.
Commonwealth and State legislative criteria	Is the impact or risk or impact being managed in accordance with existing Australian, State and/or international laws or standards?	Compliance with specific laws or standards is demonstrated.
Stakeholder Expectations	Have stakeholders raised any objections or claims about adverse impacts associated with the activity, and if so, have merits of the objection been assessed? For those objections and claims with merit, have measures been put in place to manage those concerns?	Stakeholder concerns must have been adequately responded to and closed out.
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 controls to protect them than environments widely represented in a region)? Have applicable objectives and actions within marine reserve management plans, species recovery plans, threat abatements plans or conservation advices plans been addressed?	The proposed impact or risk controls, performance outcomes and performance standards must be consistent with the nature of the receiving environment. Compliance with objectives and actions contained in relevant plans.
Environmentally Sustainable Development (ESD) Principles	Does the proposed risk/impact comply with the APPEA Principles of Conduct (APPEA, 2008), requiring integration of ESD principles into company decision-making, and Government policy frameworks that integrate ESD principles into implementation strategies?	The overall operations are consistent with the APPEA Principles of Conduct and Commonwealth environmental strategy documents.
Environmental impact & risk (ALARP)	Are there any further reasonable and practicable controls that can be implemented to further reduce the impact or risk?	There is a consensus within Cooper that residual impact or risk has been demonstrated to ALARP.

6 Environmental Assessment

A summary of impact and risk assessment outcomes for the Patricia-Baleen and Sole-2 NOP activity is detailed in Table 6-1. The residual impact or risk is based upon the control measures identified and implemented as detailed in each of the hazard sections within this section.

Table 6-1: Patricia-Baleen and Sole-2 Environmental Impact and Risk Assessment Summary

#	Environmental Impact or Risk	Residual Impact or Risk Ranking
NOP Impacts		
1	Seabed Disturbance	NEGLIGIBLE
2	Cooling water & brine discharges (Vessel)	NEGLIGIBLE
3	Light Emissions (Vessel)	NEGLIGIBLE
4	Noise Emissions (Vessel)	MINOR
5	Treated Bilge Discharges (Vessel)	NEGLIGIBLE
6	Treated Sewage/Grey Water Discharges (Vessel)	NEGLIGIBLE
7	Food-scrap Discharges (Vessel)	NEGLIGIBLE
8	Air Emissions (Vessel)	NEGLIGIBLE
NOP Risks		
1	Introduction of Invasive Marine Species	MEDIUM
2	Disruption to Commercial Shipping & Fishing	LOW
3	Injury to cetacean (vessel strike)	LOW
4	Waste overboard incident	LOW
5	Equipment loss to the Environment	LOW
6	Spills: Minor – Vessel, ROV, IMR Activities	LOW
7	Spills: Infrastructure (Condensate/MEG)	LOW
8	Spills: Vessel Collision (Marine Diesel)	LOW

6.1 Impact: Seabed Disturbance

6.1.1 Hazard

The following activities have the potential to disturb the seabed:

- Erosion or sediment build-up around seabed infrastructure;
- Temporary ‘wet parking’ of equipment on seabed during IMR activities;
- Vessel anchoring during IMR activities (contingent activity);
- Marine growth removal; and
- Span rectification activities.

6.1.2 Known and Potential Impacts

The known and potential impacts of these environmental hazards are:

- Localised disturbance or loss or benthic habitat;

- Localised turbidity of the near seabed water column;
- Seabed infrastructure acting as artificial habitat.

This impact may occur in both Commonwealth and Victorian State waters.

6.1.3 Evaluation of Environmental Impact

6.1.4 Localised disturbance or loss of benthic habitat/artificial habitat

Patricia-Baleen assets: The Patricia-Baleen pipeline, which is partially trenched, has the potential to act as a water obstruction and could cause minor and localised alterations to the hydrodynamic regime directly around infrastructure, such as localised scouring/erosion or deposition of sediment. This may lead to a build-up against infrastructure over time with localised impact to benthic habitat which is not of conservation significance (negligible consequence).

The subsea infrastructure also acts as a habitat, providing a localised artificial environment for marine organisms. Given the small footprint of this infrastructure while it is present, alterations to benthic habitat is localised and not considered significant (negligible consequence).

Placement of objects on the seabed such as vessel anchors, ROV, replacement infrastructure, and span rectification grout bags can also cause a minor disturbance or loss of benthic habitat. It is noted that the benthic habitat present at Patricia-Baleen and Sole-2 are not significant ecologically with the habitat type widespread within Bass Strait. Additionally given the dynamic nature of Bass Strait, anchor depressions will be rapid recolonised by adjacent benthic species given the high energy environment (negligible consequence). Note vessel anchoring is included as a contingency within this EP. The survey vessel usually engages vessels with station–keeping ability or dynamic positioning.

A small and distinct area of large sponges and bryozoans occurs at about 50 m water depth along the pipeline. No anchoring or placement of equipment on the seabed will occur within this area.

Near-shore sediments along Ninety Mile Beach, due to wave action and currents are considered to be too mobile to support fixed biota such as seagrass and no other sensitive or primary producing habitats have been identified within the vicinity of the Patricia-Baleen wells or pipeline. Given the highly localised area affected by these disturbance activities, seabed impacts are expected to be negligible.

Sole-2 (suspended well): Sole-2 has a 30” conductor protruding about 2m above the seabed, with a four-post permanent guide base containing sacrificial anodes on the structure. The seabed environment is sand.

This structure may alter the local hydrodynamic regime with localised scouring/erosion or deposition of sediment around the conductor over time. Given the extremely localised area affected, the impact to benthic habitat is assessed as negligible.

6.1.5 Localised turbidity of the near seabed water column

Patricia-Baleen: Minor localised and temporary turbidity may occur from the placement of objects on the seabed (e.g. grout bag installation) or via pipeline marine growth removal.

Grout Bag Installation

The installation of grout bag for pipeline stabilisation involves pumping grout (cement and water) through a hose from the vessel to fill grout bags underwater. Minor leakage of grout may occur during filling of the bags and when the hose is flushed with seawater at the completion of operations, dispersing residual grout into the marine environment. The volume of grout involved is expected to be very low (generally < 50 L).

The release of grout may create a localised increase in turbidity and a localised alteration to sediment composition and/or smothering of the benthos. All cement chemicals are assessed and meet Cooper chemical selection standards.

The level of turbidity associated with the small volume of grout discharged is expected to be minimal given grout is designed to set rapidly in the marine environment and will therefore not disperse widely. Installation of grout bags is undertaken within a very short duration (< 1 day) and relatively rapid recovery/recolonisation of benthic biota disturbed by settling cement material is expected to occur from adjacent areas following sedimentation (URS, 2001).

The volume of grout released to the marine environment is very low and the potential affects would be restricted to the immediate vicinity of the operation. No sensitive or primary producing habitats (e.g. seagrass) have been identified within the vicinity of the wells and pipeline. Given the very small extent of effects, the widespread distribution of the habitats involved, the rapid dispersion in Bass Strait waters and the non-toxic nature of the grout, the consequence would be temporary, localised and recoverable (negligible impact).

Marine Growth Removal

Patricia-Baleen: As part of ongoing maintenance and to facilitate inspections, the removal of marine growth from infrastructure by ROV may be required. Marine growth may be removed with high-pressure water blasting or brushing or a combination of the two.

- Water jetting – typically conducted by ROV, water will be pressurized to above hydrostatic pressure. Generally water jetting activities shall be through small diameter water jets that act locally on the pipe/structure. Wash out or induced currents are typically not experienced during this activity due to the nature of the operation; or
- Brushing – typically a coarse brush would be applied to the pipeline or structure on a localized area only, this is less common.

Marine growth removal may result in a localised increase in water column turbidity, due to the suspended marine growth. This is unlikely to affect benthic productivity around the Patricia-Baleen offshore assets due to the localised and short period over which marine growth removal will be conducted at any location (< 1 day) and the lack of sensitive habitats in the immediate vicinity of the infrastructure. This minor increase in water column turbidity is in the context to Bass Strait which is a dynamic environment where there are significant levels of sediment movements which biota accommodates. The impacts associated with this activity are localised, temporary and recoverable not affecting any recognised conservation values (negligible consequence).

Sole-2: Any objects placed in proximity to this well may create extremely localized and temporary turbidity to the water column during placement. The impacts would be insignificant in this sandy environment given the known mobility of sediment in Bass Strait (negligible consequence).

6.1.6 Environmental Impact and Control Measure Summary

Aspect:	IMR activities impacting on the seabed
Impact summary:	Disturbance to seabed habitat and reduced water quality.
Extent of impact:	Localized (immediately around infrastructure or work area).
Duration of impact:	Seabed (short-term and long-term [placement of grout bags]); Reduced water quality (temporary ~ minutes)
Level of Certainty of Impact:	**HIGH:** Activity is well understood and seabed sensitivities are known along the pipeline alignment.
Uncertainty: Impact Decision Framework	**A**: Nothing new or unusual; represents business as usual; well understood activity; good practice well defined. *ALARP to be demonstrated on adherence to legislation, industry codes and good professional judgement*

Control measures to be implemented to prevent disturbance to sponges/bryozoans at 50 m water depth along the Patricia-Baleen Offshore Pipeline are:

- *Sensitive receptors are identified and avoided*: Sponge and bryozoan habitat at 50 m water depth is communicated to the IMR project team to ensure awareness of local sensitivity;
- *IMR Work Program*: No equipment laydown or anchoring within the sponge and bryozoan habitat at ~ 50 m water depth along the Patricia-Baleen pipeline.

Control measures to be implemented to control this hazard and prevent disturbance to the seabed during IMR activities are:

- *Contractor (Vessel) Selection:* Vessel selected for IMR activities has Dynamic Positioning (DP) or station-keeping capability;
- *Anchoring*: Anchoring is only permitted in an emergency or when DP or station-keeping is not practicable;
- *Equipment Deployment/Retrieval:* ROV activities are undertaken by qualified and competent personnel (IMCA or equivalent standard) in accordance with approved procedures.

The control measures to be implemented to control grout toxicity while meeting technical requirements is:

- *Chemical Assessment Process*: All chemicals used in grout bags are assessed and approved in accordance with the Cooper chemical selection process.

Control measures to be implemented to control IMR activities to ALARP conditions are:

- *IMR Activity Risk Assessment:* A campaign-specific IMR risk assessment is undertaken to ensure all environmental impacts are identified and controls incorporated into work-packs prior to offshore work commencing;
- *Work Control Implementation*: IMR activities are controlled via a permit-to-work (PTW) which incorporates the relevant controls from the risk assessment to prevent seabed disturbance.

6.2 Impact: Cooling Water and Brine Discharge

6.2.1 Hazard

Seawater: Seawater is used as a heat exchange medium for cooling machinery engines on vessels. Seawater is drawn up from the ocean, where it is de-oxygenated and sterilised by electrolysis (by release of chlorine from the salt solution) and then circulated as coolant for various equipment through the heat exchangers (in the process transferring heat from the machinery) and is then discharged to the ocean at depth (not at surface). Upon discharge, it will be warmer than the surrounding ambient water and may contain low concentrations of residual biocide and scale inhibitors if used to control biofouling and scale formation. Cooling water volumes discharged are vessel dependent. Temperature of the discharged cooling water is generally several degrees Celsius above ambient sea water temperatures.

Brine: Concentrated brine is a waste stream created through the vessels desalination equipment for potable water generation. Potable water is generated through reverse osmosis (RO) or distillation resulting in the discharge of seawater with a slightly elevated salinity (~10-15% higher than seawater). Freshwater produced is then stored in tanks on board.

The concentration of the brine is likely to range from 44-61 parts per thousand (ppt), which is 9-26 ppt higher than seawater (35 ppt), however this is dependent on throughput and plant efficiency.

6.2.2 Known and Potential Impacts

The known and potential environmental impact of cooling water and brine discharges are:

- Temporary and localised increase in sea water temperature causing thermal stress to marine biota;
- Temporary and localised increase in sea surface salinity potentially causing harm to fauna unable to tolerate higher salinity; and
- Potential toxicity impacts to marine fauna.

This impact may occur in both Commonwealth and Victorian State waters.

6.2.3 Evaluation of Environmental Impact

The volume of seawater affected by cooling water and brine discharge from a vessel is expected to be within the top 10 m of the water column and within a 100 m radius of the discharge point. This is based on modelling of continuous wastewater discharges undertaken by Woodside for its Torosa South-1 drilling program (in the Scott Reef complex), which found that discharge water temperatures decrease rapidly as it mixes with receiving waters. The discharge water temperature less than 1°C above background levels within 100 m (horizontally) of the discharge point, and within background levels 10 m vertically from the discharge point (Woodside, 2008).

Cooling waters associated with vessel discharges are expected to be smaller in magnitude than this drilling example.

Increases in sea surface temperatures: Laboratory tests undertaken to determine the tolerance threshold of organisms to stress from thermal power plant discharges identified that most tropical and temperate organisms had a common upper lethal temperature limit of about 35^{o}C. Acclimation of test organisms at 15, 20 and 25^{o}C allowed them to tolerate temperature increments of 8-9^{o}C without damage (UNEP, 1983). On this basis, impacts to marine biota from the discharge of elevated water temperatures are expected to be very localised and temporary (negligible consequence).

Increases in sea surface salinity: The World Health Organisation (2007) identified that many marine organisms are naturally adapted to changes in seawater salinity given variances in evaporation rates from the ocean surface and land runoff/surface water discharges. Typically, the range of natural salinity fluctuation is at least ±10% of the annual ambient seawater salinity concentration. This level serves as a conservative measure of aquatic life tolerance to elevated salinity and actual salinity tolerances are usually significantly higher than this level. On this basis, impacts to marine biota from hypersaline discharges are expected to be very localised and temporary (negligible impact).

Residual biocides and scale inhibitors: Scale inhibitors and biocide may be used in the heat exchange and desalination process to avoid fouling of pipework. Scale inhibitors are typically low molecular weight phosphorous compounds that are water-soluble, and only have acute toxicity to marine organisms about two orders of magnitude higher than typically used in the water phase (Black et al., 1994). The biocides typically used in the industry are highly reactive, degrade rapidly and are very soluble in water (Black et al., 1994)

These chemicals are inherently safe at the low dosages used, as they are usually ‘consumed’ in the inhibition process (e.g. reaction with available oxygen), ensuring there is little or no residual chemical concentration remaining upon discharge.

6.2.4 Environmental Impact and Control Measure Summary

Aspect:	Cooling Water and Brine Discharge
Impact summary:	Elevated temperature and salinity impacts to the marine environment

Extent of impact:	Localized (~1ºC within 100m and 10m).
Duration of impact:	Short-term (duration of survey)
Level of Certainty of Impact:	**HIGH:** Activity impacts well studied and fauna sensitivities present around pipeline are known.
Uncertainty: Impact Decision Framework	**A**: Nothing new or unusual; represents business as usual; well understood activity; good practice well defined. *ALARP to be demonstrated on adherence to legislation, industry codes and good professional judgement*

Control measures to be implemented to control this hazard and ensure that cooling and brine water discharges are within specified operating parameters are:

- *Equipment Maintenance*: Vessel engines and associated equipment that require cooling by water will be maintained in accordance with the vessel's preventative maintenance system so they are operating within accepted manufacturer's parameters;
- *Contractor (Chemical) Selection:* As part of contractor selection chemicals utilized as biocides or scale inhibitors utilised in the cooling and brine water system will be low toxicity and meet Cooper chemical standards.

6.3 Impact: Light Emissions

6.3.1 Hazard

Light emissions will be emitted from all survey vessels on a 24 hour per day basis during survey activities from the following sources:

- For marine safety, vessel navigation lighting in accordance with the *Navigation Act 2012*, Marine Order Part 30 (Prevention of Collisions) will be maintained to provide clear identification to other marine users;
- Deck lighting will be provided to allow for the safe movement of personnel around the deck during hours of darkness; and
- ROV operations will utilise light underwater to illuminate the area of interest.

The IMR vessel will generate light while in the activity area. Lighting is used for marine safety to ensure clear identification of vessels to other marine users and to allow activities to be undertaken 24 hours a day. Spot lighting may also be used on an as-needed basis, for example for a specific task such as ROV inspection, deployment and retrieval. Lighting will typically consist of bright white (i.e., metal halide, halogen, fluorescent) lights, and are not dissimilar to other offshore activities in the region, including fishing and shipping.

6.3.2 Known and Potential Impacts

The known and potential impacts of artificial lighting sources in the marine environment are:

- Light on vessels may attract light-sensitive species such as seabirds, squid and zooplankton in turn affecting predator-prey dynamics; and
- Artificial lighting may affect species during breeding periods (e.g. shearwaters, turtle hatchlings).

This impact may occur in both Commonwealth and Victorian State waters.

6.3.3 Evaluation of Environmental Impact

Localised light glow that may act as an attractant to light sensitive species: High levels of marine lighting can attract and disorient seabird species resulting in species behavioural

changes (e.g. circling light sources leading to exhaustion or disrupted foraging), injury or mortality in the vicinity of the light source. It is understood that bird strikes have been recorded on fishing vessels in the Southern Ocean where powerful ice lights are used in back-deck activities, however bird mortality arising from these events are generally low (Black, 2004). IMR vessels do not utilise these lights on back-deck activities with the lighting emitted diffuse and considered to be similar to passing commercial shipping. Given the temporary and moving nature of the light sources measurable impacts to marine bird species are not expected (negligible consequence).

Artificial light can cause significant impacts on burrow-nesting petrels and shearwaters. Fledglings often become disoriented and grounded as a result of artificial light adjacent to rookeries as they attempt to make their first flights to sea, a phenomenon known as 'fallout' (Birdlife International, 2012). Rodrigez at al. (2014) investigated the effects of artificial lighting from road lighting on short-tailed shearwater fledglings. The study established by removing this light source located in close proximity to nesting areas there was a decrease in grounded fledglings and a corresponding reduction in bird fatalities. Marine operations operate at least 400 m to sea and any measureable impacts on fledglings from vessel lighting would be temporary and localised (negligible consequence).

Other marine life may also be attracted to the IMR vessel (e.g., fish, squid and plankton) that can aggregate directly under downward facing lights. These are prey species to many species of marine fauna. This is a technique used by squid jig fishermen, who utilise powerful downward facing lights on stationary vessels, to attract and capture squid species. Fur seals have been reported as being a minor irritation to squid vessels, as they chase prey species attracted to light sources (Gales et al. 2003). As most IMR vessel lighting is directed onto deck surfaces rather than marine waters and given the constant movement of the vessel, any impacts arising from light emissions will be localised and temporary only (negligible consequence).

There is no evidence to suggest that artificial light sources adversely affect the migratory, feeding or breeding behaviours of cetaceans. Cetaceans predominantly utilise acoustic senses to monitor their environment rather than visual sources (Simmonds et al., 2004), so light is not considered to be a significant factor in cetacean behaviour or survival.

Underwater light from using an ROV is unlikely to cause environmental impacts. While the ROV dives, fauna in different strata of the water column will be exposed to light for only very brief moments, and usually for a few minutes at a time near the seabed where the ROV conducts most of its work.

Given the limited duration of IMR activities any alteration to marine species foraging patterns or behavioural impacts are considered to be localised, temporary and restricted to a small proportion of the population (negligible consequence).

Attraction of light-sensitive species during breeding periods: Light pollution can be an issue along, or adjacent to, turtle nesting beaches where emerging hatchlings orient to, and head towards, the low light of the horizon unless distracted by other lights which disorient and affect their passage from the beach to the sea (EA, 2003). Given the lack of turtle nesting in Victoria, no impacts are expected.

6.3.4 Environmental Impact and Control Measure Summary

Aspect:	Vessel Lighting
Impact summary:	Light spill attracting light-sensitive species (seabirds, fish, nesting turtles) which may affect predator-prey dynamics.
Extent of impact:	Localized (immediately around vessel).
Duration of impact:	Temporary (duration of survey) and recoverable
Level of Certainty of Impact:	**HIGH:** Impacts from lighting in the marine environment have been studied and documented. Source of lighting is small and diffuse.

Uncertainty: Impact Decision Framework	**A**: Nothing new or unusual; represents business as usual; well understood activity; good practice well defined. *ALARP to be demonstrated on adherence to legislation, industry codes and good professional judgement*

The control measure to be implemented to control lighting to a minimum which still allows for safe operation is:

- *Back Deck and Navigation Lighting:* Vessel deck and navigational lighting aligns with Marine Order Part 30 (Prevention of Collisions) 2016 and Marine Order 59 (Offshore Support Vessel Operations) 2011 to prevent light spill to marine waters while ensuring safety requirements are met.

6.4 Impact: Noise Emissions

6.4.1 Hazard

The following vessel activities have the potential to create underwater sound:

- Engine noise transmitted through the vessel hull;
- Propeller/thruster sound; and
- ROV propellers.

Shipping sound generally dominates ambient noise at frequencies from 20 to 300 Hz (Richardson et al. 1995). High frequency sound components rapidly dissipate with distance from the sound source with lower frequency wavelengths travelling further distances.

Vessels engaged for IMR activities will in general generate low levels of machinery noise and will be of a similar nature to other vessels operating in the region.

The sound levels and frequency characteristics of underwater noise produced by vessels are related to ship size and speed. When idle or moving between sites, vessels generally emit low-level noise. Tugboats, crew boats, supply ships, and many research vessels in the 50-100 m size class typically have broadband source levels in the 165-180 dB re 1µPa$_{RMS}$ range (Gotz *et al.*, 2009). In comparison, underwater sound levels generated by large ships can produce levels exceeding 190 dB re 1µPa$_{RMS}$ (Gotz *et al.*, 2009) and vessels up to 20 m size typically emit 151-156dB re 1µPa$_{RMS}$ (Richardson *et al.*, 1995).

McCauley (1998; McCauley and Duncan, 2001) examined the sound from a 64 m, 2,600 tonne rig tender vessel underway, which had a broadband source level of 177 dB re 1µPa @ 1m (units not specified) in approximately 110m water depth. The use of thrusters or main propellers under load produced very high levels of cavitation noise. During these activities, the measured vessel noise was broadband in nature, with the highest level measured at 137 dB re 1µPa (units not specified) at 405 m astern; levels of 120 dB re 1µPa (units not specified) recorded at 3-4 km; and the noise audible at up to 20 km against a 'natural background level' of 90 dB re 1µPa (units not specified). IMR vessels are expected to have a smaller sound footprint given the smaller size vessel.

6.4.2 Known and Potential Impacts

The primary concern arising from underwater sound generation is the potential non-physiological effects on marine fauna including:

- Attraction;
- Increased stress levels;
- Disruption to underwater acoustic cues;
- Behavioural changes;
- Localised avoidance; and
- Secondary ecological effects that may occur as a result of an effect on one (or more) species influencing another species, for example, by alteration of a predator–prey relationship.

Sound sensitive fauna present in the area of operation are cetaceans, pinnipeds and pelagic species such as fish.

6.4.3 Evaluation of Environmental Impact

Ambient Sounds: Physical and biological processes contribute to natural background sound including wind and waves; biological noise sources; and iceberg calving, shoaling and disintegration has recently been identified as a dominant source of low frequency (<100 Hz) noise in the Southern Ocean. Above 200 Hz, the ambient noise is mainly affected by sea state which is driven by wind speed. For normal variations in wind speed, the ambient noise between 200-10,000 Hz can vary by at least 20 dB. However between 20-200Hz, the ambient noise of the ocean is driven by the propulsion of ships (Tyack, 2008).

Ambient sound levels have been measured by BP (McCauley et al. 2012; cited in BP, 2015) in the Great Australian Bight to understand the underwater sound characteristics of the area. Sound loggers were deployed near the Head of Bight in a water depth of 50 m and two along the shelf break at water depths of approximately 200 m. The following ambient sound levels were determined:

- Head of Bight: Ranged from 73.5 to 131.9 dB re 1µPa$_{RMS}$, with an average of 97.1 dB re 1µPa$_{RMS}$; and
- Shelf Break: Ranged from 74.5 to 144.9 dB re 1µPa$_{RMS}$, with an average of 111.7 dB re 1µPa$_{RMS}$.

As seen from these measurements, there is significant variance in background sound levels within the marine environment and sound-sensitive marine fauna tolerates this level of background sound variance.

Sound Thresholds – Marine Fauna: The criteria set by Southall et al. (2007) suggests that to cause an instantaneous injury to cetaceans (including porpoises) resulting in a permanent loss in hearing, the sound must exceed 230 dB re 1µPa (peak).

The US National Marine Fisheries Service (NMFS) (2016) guidance for pulsed sound to prevent temporary thresholds shifts in hearing in marine mammals is 180 dB re 1µPa$_{RMS}$ with disturbance likely at 160 dB re 1µPa$_{RMS}$. Given sound levels emitted by vessels, hearing impacts to cetaceans are not expected.

For non-pulsed sound, such as vessel noise, a behavioural disturbance limit of 120 dB re 1µPa$_{RMS}$ is adopted. It should be noted that these thresholds are conservative.

Increased levels of underwater noise generated by vessels supporting ROV activities, particularly from vessel (DP) thrusters, have the potential to disturb noise sensitive marine fauna.

Behavioural Responses to Vessel Noise: Studies reviewed by Richardson et al. (1995) identify the following reactions of marine fauna to vessel presence/sound:

- Sea lions (an octariid seal similar to fur seals) in water tolerate close and frequent approaches by vessels and sometimes congregate around fishing vessels. However, the amount of evidence is slender and it is not known whether these animals are affected or are stressed by these encounters (Peterson and Bartholomew, 1967; cited in Richardson et al, 1995).
- Dolphins of many species tolerate or even approach vessels but sometimes members of the same species show avoidance. Reactions appear to be dependent on the dolphin's activity at the time - resting dolphins tend to avoid boats, foraging dolphins ignore them and socialising dolphins may approach vessels (B. Wursig, pers.obs; cited in Richardson et al, 1995). Dolphins also reduce the energy costs of travel by riding the bow and stern waves of vessels (Williams et al, 1982; cited in Richardson et al, 1995).
- Killer whales rarely showed avoidance to boats within 400 m (Duffus and Dearden, 1993; cited in Richardson et al, 1995), however further analysis showed subtle tendencies to swim faster especially if more than one boat was nearby and tend to move toward less confined waters (Kruse, 1991; cited in Richardson et al, 1995).
- Sperm whales were observed to avoid out-board motored whale-watching vessels up to 2 km away with behavioural changes including altered surfacing/respiration dive patters and more erratic surface movements. Near those boats, surface times tended to be reduced with fewer blows per surfacing, shorter intervals between successive blows and increasing frequency of dives without raised flukes (J. McGibbon, in Cawthorn 1992; cited in Richardson et al, 1995). Researchers have found that small non-motorised or sailing vessels operating non-aggressively can be used near sperm whales without disturbing them appreciably (Papastavrou et al. 1989; cited in Richardson et al, 1995).
- Baleen whales seem to ignore weak vessel sounds and move away in response to strong or rapidly changing vessel noise. Avoidance was particularly strong when vessels approached directly (Watkins, 1986; cited in Richardson et al, 1995). Vessels operating in Gray whale breeding lagoons can cause short term escape reactions in the species particularly when the vessels are moving fast and erratically, however there is little response to slow-moving or anchored vessels (Reeves 1977; Swartz and Cummings, 1978; Swartz and Jones, 1978, 1981; cited in Richardson et al. 1995). Some whales are attracted to noise from idling outboard motors and are not seriously disturbed by small vessels however calling behaviour may change to reduce masking by boat noise. During migration, Gray whales were observed to change course at 200-300 m in order to move around a vessel in their path (Wyrick, 1954; cited in Richardson et al, 1995);
- Studies undertaken into Hawaiian humpbacks reaction, mostly to small vessels, identified that behaviours varied according to social groupings of whales (e.g. mothers, calves, etc.). Overall humpbacks tended to avoid vessels and sometimes directed threats toward them. The various effects often occurred when vessels were 500-1000 m away (Bauer, 1986; Bauer and Herman, 1986; cited in Richardson et al, 1995). Another study found when a boat approached within half a mile, humpbacks showed significant changes in the proportion of time at the surface, longer dives, altered direction (avoidance) and reduced speeds after the boat departed (M.L. Green and Green, 1990; cited in Richardson et al, 1995). A subsequent study confirmed that humpbacks often moved away when vessels were within several kilometres (Baker et al, 1982, 1883; Baker and Herman, 1989; cited in Richardson et al, 1995).
- Northern right whales appear approachable in a slowly moving boat but moved away from vessels that approach rapidly (Watkins, 1986; Goodyear 1989; 1993; Brown et al, 1991; all cited in Richardson et al. 1995). The species was consistently silent when disturbed by boats (Watkins 1986; cited in Richardson et al, 1995). When mating or feeding they seem oblivious to the close passage of small vessels providing there was

no change in course or engine speed (Goodyear 1989; Mayo and Marx, 1990; Gaskin, 1991; all cited in Richardson et al, 1995).

- Rorqual (fin, blue, minke whales) reactions to vessels have been assessed in only a few studies. In one study, results identified that rorqual whales moved away from vessels in approximately 15% of 232 vessel whale encounters. In other cases the whales remained, but most changed direction abruptly or dove to avoid the close approach by the vessel (Mitchell and Ghanime, 1982: cited in Richardson et al, 1995). Fin whales were also observed to avoid most vessels by slight changes in heading or by increasing the duration and speed of underwater travel at distances of more than 1 km (Edds and Macfarlane, 1987; cited in Richardson et al, 1995). The most marked reaction by fin and blue whales was when boats made fast erratic approaches and/or sudden changes in speed or direction. A slow approach even in a large vessel usually caused little reaction (Edds 1988; cited in Richardson et al, 1995).

Sound sensitive species will be present in the Patricia-Baleen and Sole-2 areas during IMR activities. While sound levels generated by the IMR vessel are not expected to be sufficient to damage fauna, it is considered that localised and short-term displacement of sound sensitive species around the IMR vessel may occur. It is noted the Victorian State waters section of the Patricia-Baleen pipeline alignment is a BIA for migrating and resting southern right whales and the asset locations lie within the East of Eden upwelling KEF where blue whales are recorded as foraging. Avoidance effects demonstrated by these species will be localised, short-term and not significant at a population level (minor consequence).

6.4.4 Environmental Impact and Control Measure Summary

Aspect:	Vessel sound disturbance
Impact summary:	Disturbance to fauna from vessel sound.
Extent of impact:	Localized (immediately around vessel).
Duration of impact:	Short-term (duration of survey)
Level of Certainty of Impact:	**HIGH:** Activity impacts well documented and fauna sensitivities present to sound are known.
Uncertainty: Impact Decision Framework	**A**: Nothing new or unusual; represents business as usual; well understood activity; good practice well defined. *ALARP to be demonstrated on adherence to legislation, industry codes and good professional judgement*

Control measures to be implemented to control this hazard and reduce behavioural impacts to sound sensitive species are:

- *Vessel Maintenance:* Vessel engine and propulsion systems are maintained in accordance with manufacturer's specifications;
- *Vessel/cetacean caution zones*: Vessels will adhere to proximity distances and vessel management practices for sound sensitive species as detailed in the Commonwealth Environment Protection and Biodiversity Conservation Regulations 2000 (Part 8) and Victorian Wildlife (Marine Mammals) Regulations 2009:
    - Vessels will travel at less than 6 knots within the caution zone of a cetacean and minimise noise (Caution Zone is 150m radius for dolphins and 300 m for whales);
    - The vessel must not drift closer than 50 m (dolphin) and 100 m (whale);
    - If whale comes within above limits, the vessel master must disengage gears and let the whale approach or reduce the speed of the vessel and continue on a course away from the whale;
    - If cetacean is disturbed immediately withdrawn at speed less than 6 knots;

- The vessel must not restrict the path of the cetacean;
- If a dolphin approaches the vessel, the master must not change the course or speed of the vessel suddenly.

6.5 Impact: Treated Bilge

6.5.1 Hazard

Routine oily water discharges from the survey vessel's bilge water treatment system to marine waters is possible during NOP activities. Bilge water consists of water, oily fluids, lubricants, cleaning fluids, and other similar wastes that have accumulated in the lowest part of the vessel typically from closed deck drainage and machinery spaces that may contain contaminants such as oil, detergents, solvents, chemicals and solid waste. An oily water separator (OWS) then treats prior to discharge overboard in order to meet the MARPOL requirement of no greater than 15 ppm oil-in-water (OIW) overboard.

6.5.2 Known and Potential Impacts

The known and potential environmental impacts of treated bilge water discharges to the marine environment are:

- Temporary and localised reduction in water quality (organics and toxics) around the discharge location; and
- Toxicity impacts to marine fauna through ingestion of contaminated water.

This impact may occur in both Commonwealth and Victorian State waters.

6.5.3 Evaluation of Environmental Impact

Temporary and localised reduction of surface water quality: Small volumes and low concentrations of oily water (<15 ppm) from bilge discharges may temporarily reduce water quality. The bilge water will be rapidly diluted, dispersed and biodegraded to undetectable levels (negligible consequence).

Acute toxicity to marine fauna: Small volumes and low concentrations of oily water from bilge discharges may temporarily reduce water quality are not expected to induce acute or chronic toxicity impacts to marine fauna or plankton through ingestion or absorption through the skin (negligible consequence).

6.5.4 Environmental Impact and Control Measure Summary

Aspect:	Treated Bilge Discharge
Impact summary:	Degradation of water quality from treated bilge discharge.
Extent of impact:	Localized (immediately around vessel discharge point).
Duration of impact:	Short-term (intermittent during survey)
Level of Certainty of Impact:	**HIGH:** Activity impacts well understood and highly regulated.
Uncertainty: Impact Decision Framework	**A**: Nothing new or unusual; represents business as usual; well understood activity; good practice well defined. *ALARP to be demonstrated on adherence to legislation, industry codes and good professional judgement*

Control measures to be implemented to control this hazard and ensure that bilge discharges comply with MARPOL Annex I requirements are:

- *Oil Water Separation Equipment:* For vessels > 400 tonnes, bilge water is treated in a MARPOL-approved OWS;
- Treated Bilge Discharge Quality:
    - For vessels > 400 tonnes, treated bilge water discharge occurs if:
        - Treatment is via a MARPOL–compliant OWS;
        - The OIW content is less than 15 ppm; and
        - Oil detection monitoring and control equipment are operating.
    - For vessels < 400 tonnes, treated bilge is discharged if:
        - Vessel is proceeding en-route;
        - Approved treatment equipment ensures oil content is less than 15ppm.
    - If the above cannot be met oil residues must be retained in on-board storage tanks for onshore disposal or further treatment.
- *OWS Reliability*: OWS and oil detection equipment are routinely calibrated and maintained to ensure that reliable discharge concentrations are being met;
- *Residual Oils*: Residual whole oils from the OWS are disposed onshore.

6.6 Impact: Treated Sewage & Grey Water Discharge

6.6.1 Hazard

The use of ablution, laundry and galley facilities by vessel crew will result in the discharge of sewage and grey water. While the number of on-board the vessel/s at any one point in time is currently unknown, this activity is likely to result in the intermittent discharge of several hundred litres of treated sewage and greywater each day during IMR activities.

6.6.2 Known and Potential Impacts

The known and potential environmental impacts of sewage discharges are:

- Temporary and localised reduction in water quality (organics and bacteria) around the discharge location;
- Increased biological oxygen demand; and
- Visual amenity impacts.

This impact may occur in both Commonwealth and Victorian State waters.

6.6.3 Evaluation of Environmental Impact

Sewage and grey water discharges associated with vessel activities is likely to affect the top 10 m of the water column and a 50 m radius from the discharge point. This is based on modelling of continuous wastewater discharges (including treated sewage and greywater) undertaken by Woodside for its Torosa South-1 drilling program (in the Scott Reef complex), which found:

- Rapid horizontal dispersion of discharges occurs due to wind-driven surface water currents;
- Vertical discharge is limited to about the top 10 m of the water column due to the neutrally buoyant nature of the discharge; and

- A concentration of a component within the discharge stream is reduced to 1% of its original concentration at no less than 50 m from the discharge point under any condition (Woodside, 2008).

Intermittent release of sewage and greywater will cause localised nutrient enrichment of the water column. Sewage can also contain hazardous pathogens (including faecal coliform bacteria), intestinal parasites, viral agents that, if released untreated to the marine environment, may cause harm to fauna. Grey water can contain a wide variety of pollutant substances at different strengths, including oil and some organic compounds, hydrocarbons, detergents and grease, metals, suspended solids, chemical nutrients, and coliform bacteria.

The effects of sewage and sullage discharges on the water quality at Scott Reef were monitored for a drill rig operating near the edge of the deep-water lagoon area at South Reef. Monitoring at stations 50, 100 and 200 m downstream of the platform and at five different water depths, confirmed that the discharges were rapidly diluted in the upper 10 m water layer and no elevations in water quality monitoring parameters (e.g. total nitrogen, total phosphorous and selected metals) were recorded above background levels at any station (Woodside, 2011). Conditions associated with this example at Scott Reef are considered conservative given the numbers of personnel on-board a drill rig compared with IMR activities; and the environment much less dispersive than vessels which are in constant movement in Bass Strait.

Discharges of treated sewage and grey water will be rapidly diluted in the surface layers of the water column and dispersed by currents. The biological oxygen demand (BOD) of the treated effluent is unlikely to lead to oxygen depletion of the receiving waters (Black *et al.,* 1994), as it will be treated prior to release. On release, surface water currents will assist with oxygenation of the discharge.

Given the high dilution and dispersal, low volumes and short discharge period, impacts to water quality and secondary impacts on marine life associated with sewage and grey water discharged from vessels during IMR activities is considered temporary and localised (negligible consequence).

6.6.4 Environmental Impacts and Control Measure Summary

Aspect:	Vessel sewage discharge
Impact summary:	Degradation of water quality from treated sewage and grey water discharge which may modify feeding habits of pelagic fish and seabirds.
Extent of impact:	Localized (immediately around vessel discharge point - <50 m radius and < 10 m water depth).
Duration of impact:	Short-term (intermittent during survey)
Level of Certainty of Impact:	**HIGH:** Activity impacts well understood and highly regulated.
Uncertainty: Impact Decision Framework	**A**: Nothing new or unusual; represents business as usual; well understood activity; good practice well defined. *ALARP to be demonstrated on adherence to legislation, industry codes and good professional judgement*

Control measures to be implemented to control this hazard and ensure that sewage discharges comply with MARPOL Annex IV requirements are:

- *Sewage Treatment Plant Standard:* Where sewage is treated, the sewage treatment plant meets MARPOL standards (i.e. IMO approved);
- *Sewage Discharge Quality*: Sewage discharges meet the following conditions:
  - Sewage is treated in an IMO approved/compliant treatment plant and does not produce visible floating solids or discolouration of surrounding waters;
  - Sewage is comminuted and disinfected is discharged when vessel is > 3nm from nearest land; and sewage originating from holding tanks is discharged at rates defined by Marine Order 96 while the vessel is proceeding en-route at a speed not less than 4 knots;

  - Sewage not comminuted or disinfected is discharged when vessel is > 12nm from nearest land; and sewage originating from holding tanks is discharged at rates defined by Marine Order 96 while the vessel is proceeding en-route at a speed not less than 4 knots;
  - If discharges cannot meet these requirements, the sewage is retained on-board for onshore disposal/treatment.
- *Sewage Treatment Plant Reliability*: Sewage treatment equipment is routinely maintained in accordance with the vessel's planned maintenance system to ensure system performance.

6.7 Impact: Food Scrap Discharge

6.7.1 Hazard

The generation of food waste from the vessel galley will result in the discharge of macerated putrescible waste.

It is expected that the average volume of putrescible waste discharged overboard from the vessel will vary depending on the number of Persons on Board (POB) and the types of meals prepared, but would be in the order up to 46 litres per day per person (USEPA, 2011)[2].

6.7.2 Known and Potential Impacts

The known and potential environmental impacts of food-scrap/putrescible discharges are:

- Temporary and localised reduction in water quality (nutrients) around the discharge location;
- Increased biological oxygen demand; and
- Increase in scavenging behaviour of marine fauna and seabirds.

This impact may occur in both Commonwealth and Victorian State waters.

6.7.3 Evaluation of Environmental Impact

The overboard discharge of macerated food wastes may create a localised and temporary increase in the nutrient load of the surface waters. This may in turn act as a food source for scavenging marine fauna or seabirds, whose numbers may temporarily increase as a result. However, the rapid consumption of this food waste by scavenging fauna, and its physical and microbial breakdown, ensures that the impacts of putrescible waste discharges are insignificant (negligible consequence).

6.7.4 Environmental Impact and Control Measure Summary

Aspect:	Vessel food-scrap discharge
Impact summary:	Degradation of water quality from food-scrap discharges.
Extent of impact:	Localized (immediately around vessel discharge point).
Duration of impact:	Short-term (intermittent during survey)
Level of Certainty of Impact:	**HIGH:** Activity impacts well understood and highly regulated.

[2] This is based upon passengers on a cruise liner which are expected to generate more waste per capita than that of cargo or survey vessels

Uncertainty: Impact Decision Framework	**A**: Nothing new or unusual; represents business as usual; well understood activity; good practice well defined. *ALARP to be demonstrated on adherence to legislation, industry codes and good professional judgement*

Control measures to be implemented to control this hazard and ensure that food-scrap discharges comply with Annex V requirements are:

- *Food-scrap Discharge Standard:* Putrescible waste is discharged overboard when:
  - For macerated food-scraps the vessel is greater than 3 nm from the coastline proceeding en-route;
  - For unmacerated food-scraps the vessel is more than 12 nm from the coastline proceeding en-route.
- *Macerator Equipment Standard*: A food macerator is on-board, functional, in use and set to macerate to ≤ 25 mm particle size;
- *Macerator Equipment Reliability*: Maceration equipment is routinely maintained in accordance with the vessel's planned maintenance system to ensure system performance and efficient operation;
- *Induction:* All vessel crew are aware of the vessel garbage management arrangements through information provided in the vessel induction;
- *Non-putrescible wastes*: Non-putrescible waste is returned to shore for disposal.

6.8 Impact: Air Emissions

6.8.1 Hazard

The use of fuel (specifically marine-grade diesel) to power engines, generators and mobile and fixed plant (e.g., ROV, back-deck crane, generators), will result in gaseous emissions of greenhouse gases (GHG) such as carbon dioxide (CO_2), methane (CH_4) and nitrous oxide (N_2O), along with non-GHG such as sulphur oxides (SO_X) and nitrous oxides (NO_X). Combustion emissions will be expelled from exhaust stacks several metres above deck level to ensure adequate aerial dispersion.

6.8.2 Known and Potential Impacts

The known and potential environmental impacts of atmospheric emissions are:

- Localised and temporary decrease in air quality;
- Contribution to global greenhouse gas effect.

This impact may occur in both Commonwealth and Victorian State waters.

6.8.3 Evaluation of Environmental Impact

Diesel combustion in vessels during IMR activities may result in a localised reduction in air quality. Greenhouse gases will also be produced via the combustion of diesel in vessel engines and on-board power generators, and on-board equipment.

The IMR vessel would typically consume in the order of 0.3m^3 of fuel per day which is 0.000000155% of the National Greenhouse Gas inventory for 2014 (DoEE, 2017d). Infrequent incineration of a small volume of solid waste may also occur and portable equipment on the back deck would emit minor volumes of combustion products.

Air emissions will disperse rapidly in prevailing winds and, given the volumes involved, are likely to cause only a temporary and highly localised effect on ambient air quality. Due to the temporary nature of IMR activities the air emissions generated would represent an insignificant

contribution to overall greenhouse gas emissions. On this basis the emission poses a temporary and localised impact (negligible consequence).

6.8.4 Environmental Impact and Control Measure Summary

Aspect:	Air Emissions (Vessel)
Impact summary:	Degradation of local air quality and contribution to greenhouse gas emissions.
Extent of impact:	Localized (immediately around emission point).
Duration of impact:	Short-term (intermittent during survey)
Level of Certainty of Impact:	**HIGH:** Activity impacts well understood and highly regulated.
Uncertainty: Impact Decision Framework	**A**: Nothing new or unusual; represents business as usual; well understood activity; good practice well defined. *ALARP to be demonstrated on adherence to legislation, industry codes and good professional judgement*

Control measures to be implemented to control equipment air emissions and ensure emissions limited to those necessary for operations with no third party complaints are:

- *Air Emissions Equipment*: Vessels with diesel engines > 130 kW must be certified to emission standards (e.g. IAPP, IEAPP);
- *Fuel Quality*: Vessels utilize low sulphur fuels to reduce SOx emissions from combustion sources (i.e. fuel that contained less than 3.5% m/m sulphur);
- *Shipboard Energy Efficiency Management Plan (SEEMP)*: Vessels > 400 gross tonnes and involved in an overseas voyage shall implement their Ship-board Energy Efficiency Management Plan (SEEMP) to monitor and reduce air emissions;
- *Equipment Maintenance:* Vessel equipment which emits combustion products (e.g. engines) are maintained in accordance with vessel planned maintenance system to ensure performance;
- *Fuel Monitoring*: Fuel consumption is monitored on IMR vessels (and portable back-deck equipment) and abnormally high consumption investigated ;
- *Back-deck Equipment:* Back-deck portable equipment are inspected and found to be in good condition prior to mobilization and routinely inspected during IMR activities for emissions;
- *Poor Air Quality Incidents:* All incidents of poor air quality will be reported and incidents and investigated in accordance with the Cooper Incident management process.

Control measures to be implemented to control incineration emissions, if the vessel has an incinerator, to regulated standards are:

- The incinerator is IMO-certified;
- Personnel responsible for the operation of the incinerator are trained;
- The minimum flue temperature is maintained at 850^{o}C).

6.9 Risk: Invasive Marine Species

6.9.1 Hazard

The following activities have the potential to result in the introduction of invasive marine species (IMS) to the project area:

- Vessel ballast discharge containing IMS;
- Translocation of foreign species through biofouling of the vessel hull, niches (e.g., sea chests, bilges, strainers) or ROV equipment; or
- ROV equipment.

While on location, the vessel/s will ballast and de-ballast to improve stability, even out vessel stresses and adjust vessel draft, list and trim, with regard to the weight of equipment on board at any one time. The Commonwealth Biosecurity department indicates that ballast water is responsible for 20-30% of all marine pest incursions into Australian waters (DAWR, 2015a). The DAWR (formerly AQIS) declares that all saltwater from ports or coastal waters outside Australia's territorial seas presents a high risk of introducing foreign marine pests into Australia (AQIS, 2011).

Biofouling is the accumulation of aquatic micro-organisms, algae, plants and animals on vessel hulls and submerged surfaces. More than 250 non-indigenous marine species have established in Australian waters, with research indicating that biofouling has been responsible for more foreign marine introductions than ballast water (DAWR, 2015b).

6.9.2 Known and Potential Impacts

The known and potential environmental impacts of IMS introduction (assuming their survival, colonisation and spread) are:

- Ecological disruption through increased competition with native species and for resources;
- Reduction in native species diversity and abundance.

This impact may occur in both Commonwealth and Victorian State waters.

6.9.3 Evaluation of Environmental Impact

Vessels have the potential to transport and introduce IMS from ballast water or biofouling of hull and niche areas. Successful IMS colonisation requires the following three steps (CoA, 2009):

- Colonisation and establishment of the marine pest on a vector (e.g., vessel, equipment, internal vessel niches or structures) in a donor region (e.g., home port where species is established);
- Survival of the settled marine species on the vector during the voyage from the donor to the recipient region; and
- Colonisation (e.g., dislodgement or reproduction) in the recipient region by the marine species, followed by successful establishment of a viable new local population.

IMS are likely to have little or no natural competition or predation, thus potentially outcompeting native species for food or space, preying on native species or changing the nature of the environment. It is estimated that Australia has over 250 established marine pests, and it is estimated that approximately one in six introduced marine species becomes pests (DoEE, 2017e).

Marine pest species can also deplete fishing grounds and aquaculture stock, with between 10% and 40% of Australia's fishing industry being potentially vulnerable to marine pest incursion. For example, the introduction of the Northern Pacific seastar (*Asterias amurensis*) in Victorian and Tasmanian waters was linked to a decline in scallop fisheries (DSE, 2004). Marine pests can also damage marine and industrial infrastructure, such as encrusting jetties and marinas or blocking industrial water intake pipes. By building up on vessel hulls, they can slow the vessels down and increase fuel consumption.

Contracted vessels for IMR activities are likely to be sourced from within Australia (typically Victoria) but if international vessels are contracted they will be required to be compliant with Australian quarantine entry requirements.

As part of vessel contractor pre-selection, vessel contractors mobilising vessels from international locations or domestic vessels from ports outside the IMCRA Twofold shelf bioregion, the contractor will undertake an IMS risk assessment in accordance with the

Biofouling Risk Assessment Tool developed by the WA Department of Fisheries (or equivalent assessment tool) to ensure that the risk of IMS introduction is low.

For Australian vessels which are normally domiciled and operating within the IMCRA Twofold Shelf bioregion (i.e. operate in Gippsland Basin), the risk of IMS introduction is considered low given their limited geographic exposure to IMS risk. The IMCRA bio-regionalization is an ecosystem-based framework appropriate for integrated resource management (EA, 1998).

The Victorian *Environment Protection (Ships Ballast Water) Regulations 2006* protects Victorian territorial seas (to 12 nm from the Victorian coastline) from discharges of high risk domestic ballast water to ensure the risk of IMS introduction is low. Domestic ballast water is ballast that originates from Australian ports or from territorial seas (to 12 nm of coastline) within Australia. Approval from the Victorian EPA is required to discharge any domestic ballast water anywhere within Victorian territorial seas. This includes, but is not limited to domestic ballast water discharges in Victorian ports.

New Zealand Screw Shell: The New Zealand screw shell, an IMS, is present along the Patricia-Baleen pipeline seabed. The species competes with native shellfish for food (NSW DPI, 2017). The species is thought to have been introduced into Australia attached to live oysters shipped from New Zealand or on ships loaded with dry ballast that consisted of stones gathered from New Zealand's shore (MESA, 2017).

Given the water depths along the pipeline (10 - 54 m) it is highly unlikely that the species will attach itself to the vessel, however it is possible that the ROV may contact the seabed and act as a vector to transport the IMS to another location. Cooper has contacted the key fishing industry group within the area (SETFIA) which utilise demersal trawl to understand any protocols adopted to prevent the spread of the IMS. No protocols can be provided at this time.

Utilising available literature and recognising the key risk is translocation by the ROV, Cooper will ensure that at the completion of IMR activities at Patricia-Baleen, the ROV and its cabling is removed from the water, inspected, washed down thoroughly and dried at the location where it is recovered (NIMPIS, 2017). Deck locations where the cleaning has occurred will also be inspected and cleaned at the location where the ROV is recovered and the cleaning residue disposed overboard, before proceeding to other survey or port locations. With this control implemented the likelihood of transporting the IMS to other locations is considered remote. The residual risk is assessed as medium.

6.9.4 Environmental Impact and Control Measure Summary

Aspect:	Vessel Activity (biofouling and ballast discharge)
Impact summary:	Predation of native marine species and the possible loss of diversity and abundance of native marine species
Extent of impact:	Localised (isolated locations around the assets if there is no spread) to widespread (if colonisation and spread occurs).
Duration of impact:	Short-term (IMS is detected and eradicated, or IMS does not survive long enough to colonise and spread) to long-term (IMS colonises and spreads).
Level of Certainty of Impact:	**HIGH:** Impacts associated with IMS introduction have been studied and the vectors of introduction established. Corresponding regulatory guidelines controlling these vectors have been established. The oil and gas industry takes a precautionary approach to IMS introduction by its adoption of all relevant Government Guidelines.
Uncertainty: Impact Decision Framework	**A**: Nothing new or unusual; represents business as usual; well understood activity; good practice well defined. *ALARP to be demonstrated on adherence to legislation, industry codes and good professional judgement*

Control measures to be implemented to control this hazard and ensure that vessels entering and operating in Australian waters carry a low risk with respect to IMS introduction are:

- *Contractor Pre-qualification*: Cooper undertakes vessel contractor pre-qualification against the vessel requirements of the Patricia-Baleen NOP EP which includes biofouling risk. For vessels > 500 gross tonnes and/or less than 50 m in length, Cooper also requires an assessment against the IMCA Marine Inspection for Small Workboats;
- *Ballast Water (International Vessels):* For international vessels, ballast water exchange will occur in accordance with the Australian Ballast Water Management Requirements (DAWR, 2016) prior to entry into Australian waters;
- *IMS Risk Assessment (International Vessels and Vessels mobilizing from ports outside IMCRA Twofold shelf bioregion):* As part of Contractor pre-qualification, for international vessels and vessels mobilizing from ports outside the Twofold shelf bioregion, an IMS risk assessment in accordance with the Cooper Biofouling Risk Assessment requirements consistent with the *National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (2009).*Corrective actions (as required) are implemented as determined by a qualified independent third party marine pest inspector to ensure a low risk of IMS introduction;
- *International Anti-Fouling System (IAFS) Certificate (all vessels):* For vessels > 400 tonnes, vessels carry a current International Antifouling System Certificate (IAFS);
- *High risk Domestic Ballast Water Discharges (all vessels):* IMR vessels will not discharge high-risk domestic ballast water within Victorian Territorial seas (to 12 nm). This includes, but is not limited to, domestic ballast water discharges originating from Victorian ports. Domestic ballast water discharges in the IMR operational area will be assessed and undertaken in accordance with the requirements of the *EPA Protocol for Environmental Management: Domestic Ballast Water Management in Victorian Waters*.

Control measures to be implemented to control this hazard and ensure that equipment deployed into the survey area carries a low risk with respect to IMS introduction are:

- *In-water Equipment Cleaning:* In-field equipment has been removed from the water, inspected and cleaned prior to deployment in Victorian waters.
- *IMR Activities on Patricia-Baleen Pipeline*: In-field equipment used on the Patricia-Baleen pipeline will be removed from the water at Patricia-Baleen and inspected, cleaned and dried at the location it is recovered. Deck locations where the cleaning has occurred will also be inspected and cleaned at the location where the ROV is recovered and the cleaning residue disposed overboard, before proceeding to other survey or port locations.

6.10 Risk: Displacement of Third Party Vessels

6.10.1 Hazard

The physical presence of an IMR vessel may have an adverse effect on third-party vessel operators, such as merchant or commercial fishing vessels (noting that vessel presence for IMR activities will be a rare occurrence).

Also note that interference with commercial and/or recreational divers and swimmers is not considered credible because:

- Divers – there are no recognised dive sites in the immediate vicinity of the assets.
- Swimmers – the assets are located too far from the shore and Bass Strait is hazardous for swimmers.

6.10.2 Known and Potential Impacts

The known and potential impacts associated with interference to commercial fishing and shipping users in the area are:

- Deviation of vessels around IMR activities;
- Damage to fishing equipment;
- Loss of commercial catch; and
- Possible vessel collision.

This section deals with interference on a spatial (socio-economic) basis only. Diesel spill risks associated with a vessel collision from a diesel spill is addressed in Section 6.16.

This impact may occur in both Commonwealth and Victorian State waters.

6.10.3 Evaluation of Environmental Impact

Commercial Shipping: Both the Patricia-Baleen and Sole-2 assets lie outside of the Area to be Avoided (ATBA). Accordingly, vessels prohibition over 200 tonnes gross, afforded to assets which lie within the ATBA, cannot be applied to IMR activity.

Bass Strait carries high traffic volume and a traffic separation scheme operates within the basin to prevent vessel incidents. Ship track data from AMSA (2016-7) has indicated that high traffic volumes are located approximately 50 km southeast of Patricia-Baleen and 12km southeast of the Sole-2 well.

AMSA has advised that marine warnings may be initiated for IMR activities to avoid third party vessel interference. All routine navigation warnings (Notice to Mariners, AusCoast warnings) will be adopted for IMR activities to minimise the risk of interference. Cooper will adopt relevant pre-activity notification periods for these warnings as per advice provided by these authorities (AHS, 2016).

Possible impacts to third party commercial vessels associated with IMR activities include minor deviation in vessel routes which potentially lead to an increase in fuel consumption (negligible consequence). However with appropriate controls adopted deviation impacts are considered unlikely and the risk is assessed as low.

Commercial Fishing: The Patricia-2 and Baleen-4 wellheads and the pipeline are marked on navigation charts and described in nautical publications. The infrastructure is known to commercial fishermen in the area and there have been no issues to date with damage to fishing equipment.

Commercial fishing is excluded within the 500 m Petroleum Safety Zone (PSZ) around the Patricia-Baleen wellheads. This exclusion has been in place for a number of years and has not significantly impacted upon fishing catch in the area.

Commercial fisheries which maybe operating within the Patricia-Baleen and Sole-2 areas include the Commonwealth Trawl Sector (CTS) (including Danish seine); Commonwealth Gillnet, Hook and Trap Sector (GHTS); Victorian Ocean (General Access) Fishery; Victorian Ocean (Purse-seine) Fishery; Victorian In-shore Trawl Fishery; Victorian Lobster Fishery; and Victorian scallop fishery (if quotas are set).

It is possible that all fisheries may be present although given the sandy substrates around the Patricia-Baleen facilities and the Sole-2 well, lobster fishing is not anticipated. The CTS, Danish seine and shark gillnet sectors (Commonwealth fisheries) all have a medium level of fishing intensity within the general Patricia-Baleen and Sole-2 areas. Studies (SETFIA, 2016) indicate that the Victorian-based fisheries do not fish at the Sole-2 area. However, the presence of an IMR vessel at Sole-2 or along the Patricia-Baleen pipeline alignment may lead to the disruption of Commonwealth Danish seine ‘shots’, trawl or shark gillnets with associated loss of equipment and catch. Along the Patricia-Baleen pipeline alignment the Victorian inshore trawl

fishery and scallop fishery may also be affected although the presence of these fisheries in the area is low (negligible consequence)[3].

With navigation warnings and notification protocols, infrastructure identification on plotters and activity notifications provided by the SETFIA to the local fishing fleet during the IMR activity on behalf of Cooper, it is considered that spatial conflicts would be rare. The residual risk is assessed as low with controls implemented.

6.10.4 Environmental Impacts and Control Measure Summary

Aspect:	Vessel Activity in fishing and commercial shipping areas
Impact summary:	Interference with commercial shipping and fishing activities (route deviation, lost catch, damaged equipment)
Extent of impact:	Localised
Duration of impact:	Short-term
Level of Certainty of Impact:	**HIGH:** Impacts associated with commercial fishing and shipping in the area is well understood – relating to the establishment of an ATBA in the region.
Uncertainty: Impact Decision Framework	**A**: Nothing new or unusual; represents business as usual; well understood activity; good practice well defined. *ALARP to be demonstrated on adherence to legislation, industry codes and good professional judgement*

Control measures to be implemented to control this hazard and ensure no incidents or complaints of spatial conflict with third party vessels during IMR activities are:

- *Navigational Requirements (Charts):* Sole-2, Patricia-Baleen wellheads and pipeline are marked on navigation charts;
- *Navigation Requirements (PSZ)*: Patricia-2 and Baleen-4 have a PSZ gazetted around the wellheads;
- *Fishery Plotters (Infrastructure Installation):* All local fishing vessels have the Patricia-Baleen infrastructure and Sole-2 wellhead installed into their plotters for awareness;
- *Fishery Notifications (Prior to Activity):* Cooper will notify fishing industry associations of pending IMS activity one month prior to commencement and five days prior to mobilization.
- *Fishery Notifications (During Activity):* SETFIA will send IMR activity reminders via SMS during activities to local fishermen.
- Navigational Requirements (Vessel/Contractor): Contractor selection verifies that vessel complies with class certification requirements under the Navigation Act 2012 and Marine Order 27 (Safety of Navigation and Radio Equipment) 2016; and Marine Order 30 (Prevention of Collisions) 2009;
- *Vessel Watch (Competency):* The vessel master and deck officers have a valid STCW certificate in accordance with *Marine Order 70 (seafarer certification)* (or equivalent) to operate radio equipment to warn of third party spatial conflicts;
- *Navigational Warnings:* AMSA Rescue Coordination Centre (RCC) is notified of the IMR survey activities 24-48 hours before operations commence, at survey commencement and at completion. A daily notification of vessel position is made to the RCC.
- *Navigational Warnings:* The Australian Hydrographic Service (AHS) is advised 4 weeks prior to IMR activity to allow for the issue of a Commonwealth Notice to Mariners;

[3] This has been assessed on Cooper financial risk criteria.

- *Navigational Warnings:* Transport Safety Victoria (TSV) is advised 4 weeks prior to IMR activity to allow for the issue of a Victorian Notice to Mariners;
- *Vessel Watch (Activity):* Visual and radar watch is maintained on the bridge at all times;
- *Spatial Conflict Incidents:* All incidents of spatial conflict will be reported to Cooper via the Cooper incident management procedure.

6.11 Risk: Injury to Megafauna

6.11.1 Hazard

The movement of vessels undertaking IMR activities has the potential to result in collision with megafauna, this being cetaceans and pinnipeds.

6.11.2 Known and Potential Impacts

The known and potential environmental impacts associated with vessel strikes to marine fauna are injury or death.

This impact may occur in both Commonwealth and Victorian State waters.

6.11.3 Evaluation of Environmental Impact

Cetaceans and pinnipeds are naturally inquisitive marine mammals often attracted to offshore vessels, and dolphins commonly 'bow ride' offshore vessels. The reaction of whales to the approach of a vessel is quite variable. Some species remain motionless when in the vicinity of a vessel (e.g., narwhals) while others are known to be curious and often approach ships that have stopped or are slow moving; although they generally do not approach, and sometimes avoid, faster moving ships (Richardson et al., 1995).

Peel et al. (2016; cited in DoEE, 2016b) reviewed vessel strike data (1997-2015) for marine species in Australian waters and identified the following:

- Whales including the humpback, pygmy blue, Antarctic blue, southern right, dwarf minke, Antarctic minke, fin, bryde's, pygmy right, sperm, pygmy sperm and pilot species were identified as having interacted with vessels. The humpback whale exhibited the highest incidence of interaction followed by the southern right whale. A number of these species may migrate through the waters of the Patricia-Baleen and Sole-2 assets.
- Dolphins including the Australian humpback, common bottlenose, indo-pacific bottlenose and Risso's dolphin species were also identified as interacting with vessels. The common bottlenose dolphin exhibited the highest incidence of interaction. A number of these species may reside in or pass through the waters of the Patricia-Baleen and Sole-2 assets.
- There were no vessel interaction reports during the period for either the Australian or New Zealand fur seal. There have been incidents of seals being injured by boat propellers, however all indications are, rather than 'boat strike', these can be attributed to be the seal interacting/playing with a boat. A number of experts indicate the incidence of boat strike for seals is very low.

Literature identifies that most collisions between vessels and cetaceans occur on the continental shelf reflecting areas of high usage by both vessels and cetaceans. In general the populations which are most frequently struck are those living on or near busy vessel routes (particularly shipping or ferry routes) or where there is an unusual concentration of vessels in a shallow, confined area (e.g. east coast of America or Canary Islands) (Dolman et al. 2006).

Laist et al. (2001) has identified that larger vessels (container vessel and fast ferries), moving in excess of 10 knots may cause fatal or severe injuries to cetaceans, with the most severe injuries caused by vessels travelling faster than 14 knots.

IMR vessels will operate on a 24/7 basis for the duration of the survey.

The Patricia-Baleen and Sole-2 area lies within the “east of Eden upwelling”, which is an intermittent upwelling for foraging pygmy blue whales and within Victorian State waters the Patricia-Baleen pipeline traverses a BIA for migrating and resting southern right whales.

Collision with marine fauna with survey vessels/equipment is credible however, due to the slow speed of the IMR vessel while undertaking survey activities, if contact made with species, the impact is expected to be slight. Accordingly, the likelihood of vessel strike and associated severe injury or death of an individual whale, dolphin or pinniped (moderate consequence) is considered remote.

The residual risk is assessed as low.

6.11.4 Environmental Impact and Control Measure Summary

Aspect:	Vessel strike to megafauna
Impact summary:	Fauna injury or death.
Extent of impact:	Limited to individual pinnipeds or cetaceans in direct contact with vessel (no large scale population impact).
Duration of impact:	At a population level, impact is considered short-term
Level of Certainty of Impact:	**HIGH:** Impacts from cetacean and pinniped strikes have been studied and the impacts are well documented resulting in the new draft strategy document.
Uncertainty: Impact Decision Framework	**A**: Nothing new or unusual; represents business as usual; well understood activity; good practice well defined. *ALARP to be demonstrated on adherence to legislation, industry codes and good professional judgement*

Control measures to be implemented to control this hazard and ensure no injuries or death to megafauna resulting from vessel collision during IMR activities are:

- *Vessel Management Measures:* IMR vessel monitors for marine fauna and vessel operations conform to proximity distances, speeds and vessel management practices contained in the Environment Protection and Biodiversity Conservation Regulations 2000 (Part 8) and the Victorian Wildlife (Marine Mammals) Regulations 2009 (Part 2/Part 3) which includes:
    - Vessels will travel at less than 5 knots within the caution zone of a cetacean and minimise noise (Caution Zone is 150m radius for dolphins, 300 m for whales and 50 m for pinnipeds);
    - The vessel must not drift closer than 50 m (dolphin and pinnipeds) and 100 m (whales);
    - If whale comes within above limits, the vessel master will disengage gears and let the whale approach or reduce the speed of the vessel and continue on a course away from the whale;
    - The vessel must not restrict the path of a marine mammal;
    - The vessel must not separate any individual from a group of marine mammals or come between a mother whale and calf or a seal and pup;
    - If the vessel is within the caution zone of a marine mammal the vessel must move the vessel at a constant speed that does not exceed 5 knots, and avoid sudden changes in speed or direction and manoeuvre the vessel to outside the caution zone if the marine mammal shows any sign of disturbance;

  - If a vessel is within the caution zone of a marine mammal, the vessel shall not approach a marine mammal from head on, from the rear or be in the path ahead of a marine mammal at an angle closer than 30° to its observed direction of travel.

- *Observations during Vessel movement in Petroleum Activity Area*: Marine mammal observation will be undertaken during vessel movements in the petroleum activity area.
- *Environmental Induction:* All survey personnel on-board have completed an environmental induction covering the requirements for cetacean/vessel interaction consistent with EPBC Regulations 2000 (Chapter 8) and Victorian Wildlife (marine Mammals) Regulations 2009 (Part 2/Part 3) and are familiar with the requirements. This includes a requirement to notify the bridge if marine mammals are sighted.
- *Reporting Vessel Strikes:* Any vessel strike incident to whales or dolphins shall be reported as soon as possible via the National Vessel Strike Database; to DoEE within 7 days and to NOPSEMA/DEDJTR within 2 hrs.
- *Reporting mega-fauna injuries:* A mega-fauna injury will be reported to the Victorian Department of Environment, Land Water and Planning (DELWP) for assistance.
- *Other Marine User Notifications:* The vessel master shall alert other marine users of the presence of whales in the area via radio.

6.12 Risk: Waste Overboard Incident

6.12.1 Hazard

The handling and storage of materials and waste on board a vessel has the potential for accidental overboard releases of hazardous and non-hazardous materials and waste.

Small quantities of hazardous and non-hazardous materials will be used and waste created, and then handled and stored on the vessel/s. In the normal course of operations, solid and liquid hazardous and non-hazardous materials and wastes will be stored on the vessel until it is disposed of via port facilities for disposal at licensed onshore facilities. However, accidental releases to sea are a possibility, especially in rough ocean conditions when items may roll off or be blown off the deck.

The following non-hazardous materials and wastes will be disposed of to shore, but have the potential to be accidentally dropped or disposed overboard due to overfull bins or crane operator error:

Solid non-biodegradable wastes:

- Paper and cardboard;
- Wooden pallets;
- Scrap steel, metal and aluminium;
- Glass; and
- Plastics and rope.

Hazardous wastes:

- Hydrocarbon contaminated material (e.g., oily rags, oil filters, hydraulic oils); and
- Batteries, empty paint cans, cleaning products, aerosol cans, fluorescent tubes.

6.12.2 Known and Potential Impacts

Potential impacts associated with the accidental release of solid/non-biodegradable wastes include:

- Disturbance (smothering or pollution) of seabed habitats;
- Injury, ingestion or entanglement by marine fauna (particularly plastics by turtles and seabirds);
- Hydrocarbon contaminated wastes can result in localised water quality reduction (including toxics); and
- Litter (visual pollution).

This impact may occur in both Commonwealth and Victorian State waters.

6.12.3 Evaluation of Environmental Impact

The accidental disposal of hazardous and non-hazardous materials and waste may extend for kilometres from the release site (as buoyant waste drifts with the currents) or may be localised for non-buoyant items that drop to the seabed.

Solid non-biodegradable/hazardous wastes will be handled in accordance with the vessel's Garbage Management Plan which will work to a 'no solid non-biodegradable/hazardous waste overboard' policy. In normal circumstances, no impacts to the marine environment should occur. However, accidental release to the marine environment is possible.

Assessment of individual impacts follows:

- In the instance of windblown material, the volume will be small in volume however for materials such as plastic, impacts to individual animals (i.e. mortality) may occur. The TSSC (2015c) reports that there have been 104 records of cetaceans in Australian waters impacted by plastic debris through entanglement or ingestion since 1998 (humpback whales being the main species). Given the presence of threatened species in the region, the worst-case possible impact has been assessed as mortality to a protected species (single animal) (moderate consequence). With the on-board controls implemented impacts from such incidents are considered remote and the residual risk is assessed as low.
- Solid hazardous waste, such as paint cans containing paint residue and batteries would be expected to settle on the seabed if dropped overboard. Over time, if this is not retrieved, this may result in the leaching of hazardous materials to the seabed, which may result in small localised areas of substrate becoming toxic and unsuitable for colonisation by benthic fauna. Given the habitat is not of conservation significance this is assessed as a negligible consequence. With the on-board controls implemented such incidents are considered remote and the residual risk is assessed as low.
- Hazardous wastes released to the sea may cause water quality reduction with either direct or indirect effects on marine organisms. Impacts would be limited to the immediate area surrounding the release, prior to the dilution with the surrounding seawater. In the open ocean environment of the survey area, it is expected that a release would be small in volume and rapidly diluted and dispersed. Therefore pollution of the surrounding waters would be temporary, localised and recoverable (negligible impact). With the on-board controls implemented such incidents are considered unlikely (refer also to Section 6.14 (*Minor Spills*)) and the residual risk is assessed as low.

6.12.4 Environmental Impact and Control Measure Summary

Aspect	Release of solid hazardous/non-hazardous waste overboard to the marine environment

Impact summary:	Localised decrease in water quality with possible toxicity impacts to marine biota (e.g. fish plankton). Injury or damage to individual marine fauna through ingestion of plastics. Localised seabed smothering or contamination by non-buoyant solid hazardous waste.
Extent of impact:	In general, localised impacts around point of discharge. Solid, buoyant materials will be dispersed by local currents and may travel long distances, but volumes will be small
Duration of impact:	Short-term (water quality impact). Longer term (seabed smothering, species ingestion)
Level of Certainty of Impact:	**HIGH:** Impacts from waste disposal overboard (particularly plastics) has been well studied and documented. This is verified through the production of regulatory guidelines for threat abatement from marine debris.
Uncertainty: Impact Decision Framework	**A**: Nothing new or unusual; represents business as usual; well understood activity; good practice well defined. *ALARP to be demonstrated on adherence to legislation, industry codes and good professional judgement*

Control measures to be implemented to control this hazard and ensure there is no release of hazardous or solid waste overboard during IMR activities are:

- *Garbage Management Plan:* IMR vessels will operate under a Garbage Management Plan (applicable to vessels >100 GRT or certified to carry more than 15 people) which incorporates IMO requirements with respect to waste minimization, garbage handling and disposal restrictions on solid and hazardous waste.
- *Crew Induction:* Crew members are inducted into the vessel garbage management procedures to minimise the potential for unpermitted wastes being discharged overboard and to ensure effective waste segregation.
- *Waste Overboard (Recovery):* Wind-blown or solid waste overboard is recovered if reasonably practicable (by ROV or other means as appropriate).
- *Waste Handling and Disposal:* Handling of solid and hazardous wastes on-board the survey vessels will comply with the requirements of *Protection of the Seas (Prevention of Pollution from Ships) Act 1983* and Marine Order (Part 95: Garbage). This may include:
  - No discharge of general operational or maintenance wastes or plastics or plastic products of any kind;
  - Waste containers are covered with tightly fitting, secure lids to prevent any wastes from blowing overboard;
  - All solid, liquid and hazardous wastes (other than bilge water, sewage and food wastes) are incinerated or compacted (if possible) and stored in designated areas before being sent ashore for recycling, disposal or treatment;
  - Any liquid waste storage on deck must have at least one barrier (i.e. bunding) to prevent deck spills entering the marine environment. This can include containment lips on deck (primary bunding) and/or secondary containment measures (bunding, containment pallet, transport packs, absorbent pad barriers) in place; and
  - Correct segregation of solid and hazardous wastes.

6.13 Risk: Equipment loss to the Marine Environment

6.13.1 Hazard

IMR activities utilise ROVs to undertake visual inspections of subsea facilities. This equipment or vessel equipment utilised in IMR activities may be dropped overboard or lost to the environment during IMR activities.

6.13.2 Known and Potential Impacts

The known and potential impacts of equipment loss to the environment are:

- The presence of a marine hazards leading to impacts on third party vessels or equipment (e.g. fishing nets);
- Benthic habitat impacts through physical contact.

This impact may occur in both Commonwealth and Victorian State waters.

6.13.3 Evaluation of Environmental Impact

It is possible that during the use of ROVs during survey activities, the control umbilical is caught in the IMR vessel propeller and severed. In such an event the ROV would drift (if neutrally buoyant) or sink to the seabed smothering the benthos within its footprint (typically small ~1m x 1m).

In the event of seabed contact, impacts to benthic species in the sandy habitats which prevail and have widespread distribution in Bass Strait are considered localised. The area will rapidly recolonise via adjacent benthic fauna (negligible consequence). The sponge garden area at 50 m water depth is considered more sensitive however the localised impact to this area is not considered significant (negligible consequence). With control measures adopted to prevent the loss of equipment, the event is considered unlikely and the risk is assessed as low.

Neutrally buoyant equipment can present a hazard to other marine users which operate in the area (e.g., fishermen). Collision with equipment may cause damage to fishing vessels/ equipment with damage estimated at <$5M (negligible consequence). Again with control measures adopted, this event is considered unlikely and the risk is assessed as low.

6.13.4 Environmental Impact and Control Measure Summary

Aspect	Release of equipment to the marine environment
Impact summary:	Marine hazard causing potential damage to third party vessels. Localised benthic habitat disturbance.
Extent of impact:	Localised if lost to seabed. Possible to drift long distances if neutrally buoyant.
Duration of impact:	Short-term (equipment retrieved). Longer term (equipment lost)
Level of Certainty of Impact:	**HIGH:** Equipment loss during surveys has occurred within the industry with causal factors well understood and controls developed to prevent loss. Impacts within the affected environment can be reasonably derived.
Uncertainty: Impact Decision Framework	**A**: Nothing new or unusual; represents business as usual; well understood activity; good practice well defined. *ALARP to be demonstrated on adherence to legislation, industry codes and good professional judgement*

Control measures to be implemented to control this hazard and prevent equipment loss to the environment are:

- *Equipment Deployment/Retrieval:* ROV operations are undertaken by qualified and competent personnel (IMCA or equivalent competency standard) in accordance with approved procedures.
- *Pre-dive Inspections:* ROV undergoes a pre-dive inspection to verify the equipment is fit-for-purpose. This will include controls to prevent control umbilical entanglement and detection of ROV if lost to marine environment.
- *In-water Equipment Retrieval:* If ROV lost, all attempts made to retrieve and recover are made.

- *Stakeholder Notifications:* Marine stakeholder notifications (VHF Channel 16) are made in the event of an in-water equipment loss.
- *Stakeholder Notifications:* Loss of equipment will be reported to AMSA as soon as possible of the potential hazard to other mariners.
- *Stakeholder Complaints*: All marine stakeholder complaints associated with the in-water equipment loss will be recorded and actioned (as appropriate).

6.14 Risk: Loss of Containment – Spills

Based upon an assessment of the Patricia-Baleen and Sole-2 NOP activity scope, the following hydrocarbon spills have been identified and risk assessed:

- Minor spills (estimated < 200 litres) from vessel deck spills, ROV hydraulic line failure on IMR subsea activities or umbilical failure;
- A leak or rupture from the offshore Patricia-Baleen Pipeline releasing gas, condensate (~5 m^3) and MEG/water (~150m^3) (refer Section 6.15);
- A collision between the IMR vessel and a third party vessel or vessel grounding near-shore resulting in a diesel tank rupture (~12 m^3 MDO) (refer Section 6.16).

These spills may occur in both Commonwealth and Victorian State waters.

Vessel refuelling will occur in port facilities.

Loss of Well Control (Suspended Wells: Patricia-1 and Sole-2):

- Well integrity risk assessments completed on the suspended wells Patricia-1 and Sole-2, deemed a loss of well control unlikely and the well integrity risk was determined to be ALARP. For both Sole-2 and Patricia-1, a loss of containment would require the failure of multiple well barriers including failure of a cement seal against rock formation plus casing corrosion. Although considered not credible, this type of failure may result in a small (< 5 MMSCFD) gas flow from the well.
- The Well Operations Management Plan (WOMP) for these wells conservatively allows for an escalating well response strategy for such an incident up to and including a relief well. As the Sole and Patricia-Baleen reservoirs are ‘dry gas’ any release from well control incidents do not carry a liquid hydrocarbon spill risk.

To align with the WOMP scope, the EP also provides for this escalation strategy scope.

An environmental risk assessment of well loss of containment (LOC) is provided in Section 6.17.

Loss of Well Control (Impacts to Wellheads): An assessment of external threats to wellheads was undertaken with the following results:

- *Fishing equipment/anchor damage to wellheads*: A review of potential damage to wellheads and subsea trees from fishing equipment and anchors used in the Patricia-Baleen and Sole areas identified the potential for fishing equipment to cause damage (without hydrocarbon release) to wellheads or fixture/connection damage to the subsea trees on Patricia-2/Baleen-4 (shut-in wells). The latter scenario may lead to a gas release to the environment of maximum credible leak rate of 900scf/hr (based upon API 14B leak rates).
- *Commercial shipping/anchor damage to wellheads*: Damage from such a scenario was not deemed credible based upon the depth of Sole-2 (125 m), which is too deep to consider anchoring; and for the Patricia-2/Baleen-4 wells the distance from shore (25 km) and depth of water (55 m). A commercial vessel (e.g. container ship) would typically drop its anchor to avoid grounding in water depths less than 30 m or within 10 km of land.

- *Dropped Objects (Fishing Vessels/Container Ships):* A review of fishing vessels in the Patricia-Baleen and Sole-2 area identifies anchors up to 300 kg (max) are used. A review of dropped object risk to subsea infrastructure (Dropped Objects Prevention Scheme, 2010) indicates an anchor of mass <1.5 tonnes would be insufficient to cause damage to a wellhead to cause a release.

Both suspended wells, Sole-2 and Patricia-1 can withstand impacts from much greater loads (circa 30 tonnes) including a lost, fully loaded sea container given their well barriers are protected hundreds of metres below the seabed and thus protected. Patricia-2 and Baleen-4, might suffer minor damage from a fully loaded sea container (30 tonnes) however such damage would be mitigated by the closed subsurface safety valve resulting in a 900 scf/hr (max) gas leak.

As the Sole and Patricia-Baleen reservoirs are 'dry gas' any releases from well control incidents do not carry a liquid hydrocarbon spill risk, however source control in accordance with the Cooper Offshore Victoria Source Control Plan would be implemented.

An assessment for well loss of containment is provided in Section 6.17.

6.14.1 Hazard – Minor Liquid Hydrocarbon Spills (ROV, Deck Spills)

The following activities have the potential to result in minor spills (< 200 litres) to the marine environment:

- Vessel hydraulic hose leak;
- Vessel material bulk storage or package chemical leak (deck spill);
- ROV hydraulic hose leak; and
- Disconnection of subsea umbilical during IMR activities.

6.14.2 Known and Potential Impacts

The potential environmental impacts of minor spills (< 200 litres) to the marine environment are:

- Localised degradation of water quality;
- Toxic effects to the marine environment including marine fauna and benthic habitats.

6.14.3 Evaluation of Environmental Impact

Vessel leaks: Small volumes of chemicals and oils are stored on-board the IMR vessel. The storage and handling locations where there is a spill risk have either permanent or temporary bunding to prevent spills from entering the marine environment. In the event of a spill, crew have been trained in spill response and have access to Chemical Safety Data Sheets (SDSs) and spill clean-up equipment to remove spill residues.

ROV hydraulic hose leaks: IMR activities will normally utilise observation class ROVs which are electrically operated and contain only small amounts of liquid in the thrusters and the sonar head. These fluids are unlikely to be released to the environment.

It is possible that ROVs utilised for IMR activities may be hydraulically controlled. Entanglement of the umbilical with subsea obstacles on a worst case basis may lead to a control line breakage and hydraulic oil discharge of an estimated 200 litres to the marine environment. To prevent line failure, the ROV is piloted by fully qualified personnel; the equipment is maintained in accordance with a preventative maintenance program to ensure the control lines and tethers are fit for purpose; the equipment undergoes pre-dive checks; and all hoses and fittings are pressure-rated.

Disconnection of subsea umbilical: The Patricia-Baleen subsea umbilical, designed to relevant offshore codes has been depressured, however still contains hydraulic fluid (Castrol Transaqua HT2 with an OCNS rating of 'D'). Each core within the umbilical is fitted with a non-return valve. In the event of a disconnection of this line as a result of IMR activities, minimal volume of this fluid is expected to enter the environment. In the event of damage to the line, small amounts of liquid would be expected to be released, however given the line is depressured, at seabed pressures (10-50 m water column), release volumes would be small. The total umbilical volume is ~3.2 m^3.

All spill scenarios are small in size and are expected to rapidly dissipate and dilute in the high energy environment of Bass Strait. Given these low volumes, the impact is expected to be localised, short-term and recoverable (minor consequence).

With controls adopted, it is considered unlikely these spill events will occur and the residual risk is assessed as low.

6.14.4 Environmental Impact and Control Measure Summary

Aspect	Spills from IMR activities, ROV activities or vessel activity
Impact summary:	Degradation of water quality. Toxic impacts to marine environment (marine fauna and benthic habitats).
Extent of impact:	Localised only
Duration of impact:	Short-term and recoverable
Level of Certainty of Impact:	**HIGH:** Spill source volumes are limited in size and the environmental impact of discharge is understood.
Uncertainty: Impact Decision Framework	**A**: Nothing new or unusual; represents business as usual; well understood activity; good practice well defined. *ALARP demonstrated via compliance with legislation, codes and standards; adoption of good industry practice and application of professional judgement*.

Control measures to be implemented to control this hazard and prevent spills to the environment are:

- *Vessel-based Spills (Containment*): All vessel storage and chemical handling areas are bunded to contain spills. Housekeeping within these areas is maintained at high standards.
- *Pre-dive Inspections (ROV):* ROV undergoes a pre-dive inspection to verify the equipment is fit-for-purpose (serviced and maintained, pressure hoses appropriately rated and in good condition).
- *Trained Operators (ROV Spill Prevention):* ROV operations are undertaken by qualified and competent personnel (IMCA or equivalent competency standard) in accordance with approved procedures.
- *Deck Detergent*: Deck cleaning detergents are biodegradable and not a 'harmful substance' in accordance with MARPOL Annex III requirements.
- *Safety Data Sheets (SDSs):* All hazardous materials on-board have SDSs which are readily available.
- *Vessel-based Spills (Crew Training):* Marine crew undertakes regular on-the-job training in spill response techniques. Routine spill response drills are undertaken on-board the vessel.
- *Vessel-based Spills (Spill Response Kits):* Spill response bins/kits are located in close proximity to high spill risk areas. The kits are routinely checked for their adequacy and replenished as necessary.

- *Vessel-based Spills (SMPEP Implementation – Source Control):* The vessel-specific Shipboard Marine Pollution Emergency Plan (SMPEP) (or equivalent appropriate to class) and spill clean-up procedure is implemented in the event of a spill to prevent/limit discharge/impacts to the environment.

6.15 Risk: Loss of Containment (LOC) – Patricia-Baleen Pipeline

6.15.1 Hazard

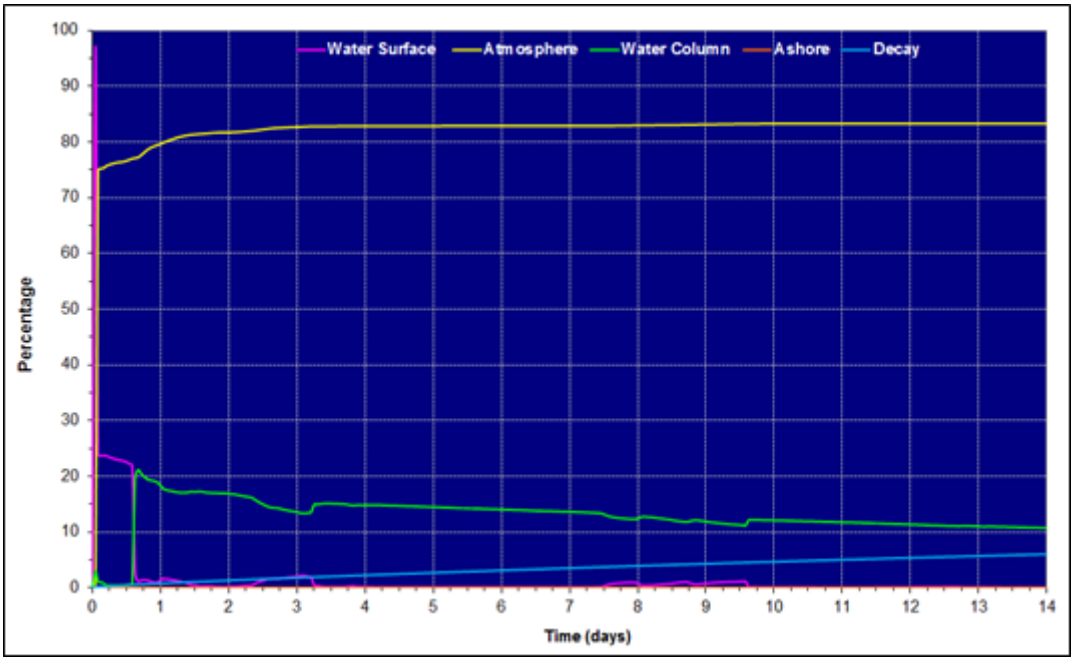
The loss of pipeline integrity as a result of erosion, corrosion or external forces (e.g. fishing vessel interactions or dropped object) could potentially cause a leak or rupture.

The Patricia-Baleen pipeline is shut in and depressurised to 630 kPa. It is estimated that it contains ~ 2700 m^3 natural gas, 4550 m^3 nitrogen, 5 m^3 Longtom condensate and 150 m^3 MEG/water mix. The worst case spill is a pipeline rupture where all condensate and MEG is lost. Based on relative pipeline fluid specific gravities, pipeline contents would be in the order (top to bottom) gas, condensate and MEG, so the rupture location would determine which material would be lost before the pipeline equalised to the seabed pressure.

The worst case spill is the loss of the entire inventory of condensate (5m^3) has been utilised. This is highly unlikely given the condensate is distributed along the length of the pipeline and pressure equalisation would occur prior to the loss of the entire contents. Similarly the complete pipeline inventory of MEG would not occur.

Longtom Condensate: Longtom condensate is a low viscosity, low pour point, highly evaporative and non-persistent Group I oil. When released into the environment, Longtom condensate is expected to quickly evaporate and not persist on the water surface (APASA 2013). Figure 6-1 illustrates the weathering and fate for an instantaneous 80 m^3 subsea release of the condensate modelled for the operational phase of Patricia-Baleen (APASA, 2013). Although a significantly larger volume, the fate and weathering of a smaller 5 m^3 spill would be similar, albeit, more rapid given larger volumes released decrease weathering rates (due to the smaller surface area available per unit of hydrocarbon). The figure also demonstrates the highly volatile nature of the condensate with almost 75% evaporating on release. Within a few hours of release ~20% had entrained into the water column leaving only small volume on the sea surface (APASA 2013).

Figure 6-1: Predicted Fate and Weathering for an instantaneous subsea release of 80m^3 of Longtom Condensate (as a percentage) (APASA, 2013)



From an impact perspective, the worst case for a condensate spill would be from a near-shore pipeline rupture. The closest shoreline point is where the pipeline exits the HDD site ~ 400 m from shore. In this scenario the condensate would likely spread in the direction of the prevailing winds/currents (either north-east or south-west) as it evaporates and disperses. If the prevailing current was:

- North-easterly and winds were from the south/south-west at the time of the spill there is the potential for small quantities of condensate residue to contact the shoreline. Based on local knowledge and the previous modelling undertaken by Santos for the Patricia-Baleen operational phase (APASA, 2013), the spill would move along the coastline where the near shore easterly currents would move it towards Cape Conran until it fully dispersed and evaporated.
- South-westerly at the time of the spill, the trajectory would move to the west and tend offshore. Shoreline impact is not predicted under this scenario and weathering would fully occur at sea.

In both cases, the dissolved aromatic and entrained phase hydrocarbon exposures are expected to be low exposure in close proximity to the release location.

Mono-ethylene Glycol (MEG) Spill: MEG is a PLONOR (poses little or no risk to the environment) substance (OSPAR, 2013). It is water miscible, biodegradable, has a low capacity for bioaccumulation and has a low toxicity to aquatic organisms (WHO, 2000). The pipeline has approximately 150 m^3 of rich MEG (60% water) but for reasons outline above not all this material would be released from a pipeline rupture.

Due to the dynamic wind and current conditions in the area of the Patricia-Baleen pipeline it is anticipated that any MEG spilt would disperse rapidly and mix with the receiving waters. As it is not toxic and will readily biodegrade, no significant impact to receptors is predicted.

6.15.2 Known and Potential Impacts

The potential impacts of a pipeline leak or rupture and the release of hydrocarbons (i.e. condensate) are:

- Toxic effects to the marine environment including marine fauna.

Possible receptors within the immediate area of a pipeline rupture include:

- Marine mammals such as dolphins, fur seals and migratory whales;
- Migratory marine birds such as albatross and petrels;
- Shorebirds such as plovers and terns; and
- Fish such as sharks and commercial species such as scallops, lobster and abalone.

6.15.3 Evaluation of Environmental Impact

As Longtom condensate is expected to weather rapidly (within hours) and not persist on the water surface (APASA, 2013) exposure time to surface receptors is very low, particularly as the spill is limited to 5 m^3. There are no known fauna aggregation areas (feeding or breeding) within the potential condensate spill area based upon the predominant currents/winds (north-east/south-west). Hence, only fauna individuals (rather than populations) would be present in the immediate area of the spill as it weathers.

As the condensate is less dense than water the material would rise to the sea surface where it would rapidly evaporate. Hence impact to benthic habitats near the pipeline such as the sponge garden present in 50 m water depth is not expected to be significant. A pipeline rupture near shore may move surface oil towards the shoreline within the few hours it takes to weather. As the condensate is not very sticky or viscous it would be expected to act in a similar way to MDO on shorelines. MDO tends to penetrate porous sediments quickly, however is also flushed by waves and tidal action, and therefore shoreline clean-up is usually not needed (NOAA, 2015).

Based on the fate of an instantaneous 5 m^3 condensate spill, a smaller condensate leak would evaporate and disperse rapidly and is predicted to be undetectable in the marine environment (negligible consequence).

Given the small scale of the condensate spill scenarios, very rapid evaporation and dispersion and the low numbers of receptors present in the immediate area, the consequence of a pipeline leak or rupture would be localised, short-term and recoverable (minor consequence).

Likelihood of LOC: An assessment of third party activities in the area of the pipeline recognises the following threats:

- Fishing vessel/equipment interaction;
- Dropped objects from third party vessels;
- Impacts from emergency anchoring by commercial shipping.

An engineering assessment identified the following with respect to these threats:

- Trawl fisheries within the Patricia-Baleen area (fishery with the largest impact damage potential) (SETFIA, 2016) are not expected to threaten pipeline integrity;
- The Patricia-Baleen pipeline lies well outside any commercial shipping lanes and the probability of vessels crossing the area is very low. Any anchor drop or drag from a third party vessel would only occur as a result of an emergency situation. A quantitative risk assessment of this threat identified a probability of an anchor drag across the pipeline at 1.417×10^{-5} per year (remote likelihood) (Stolt Offshore, 2005).
- A dropped objects impact assessment has identified that the Patricia-Baleen pipeline and its concrete weight coat will survive most dropped objects up to an anchor size of

1000kg. Given the largest size anchors used by fisheries in the Patricia-Baleen and Sole area is 300 kg, the likelihood of a direct hit causing rupture to the pipeline is considered remote.

The residual risk associated with a LOC from the Patricia-Baleen Pipeline is assessed as low.

6.15.4 Environmental Impact and Control Measure Summary

Aspect	LOC from Patricia-Baleen Pipeline (Impact, Corrosion)
Impact summary:	Degradation of water quality. Toxic impacts to marine environment (marine fauna and benthic habitats).
Extent of impact:	Localised only
Duration of impact:	Short-term and recoverable
Level of Certainty of Impact:	**HIGH:** Spill source volumes are limited in size and the environmental impact of discharge is well understood based upon the operational phase.
Uncertainty: Impact Decision Framework	**A**: Nothing new or unusual; represents business as usual; well understood activity; good practice well defined. *ALARP demonstrated via compliance with legislation, codes and standards; adoption of good industry practice and application of professional judgement*

Control measures to be implemented to control this hazard and ensure no spills to the marine environment include:

- *Navigational Requirements:* Patricia-Baleen wellheads and pipeline are marked on navigation charts.
- *Fishing Vessel Plotters:* Local fishing vessels have vessel plotters updated with Patricia-Baleen infrastructure coordinates.
- *Commercial Fishing Risk Assessment:* Cooper monitors fishing risk factors on a routine basis to ensure commercial fishing threats are maintained to ALARP.
- *Pipeline Pressure Monitoring*: Pipeline pressure is monitored with high and low pressure alarms to alert to any pipeline integrity issues or wellhead gas leakage.
- *Routine GVIs*: GVIs are undertaken in accordance with the Patricia-Baleen Offshore Integrity Management Plan and on suspended wellheads in accordance with the accepted WOMPs.
- *Pipeline Integrity Review*: Pipeline integrity review is undertaken annually in accordance with the Offshore Integrity Management Plan.
- *Oil Pollution Emergency Plan (OPEP) Implementation:* The OPEP is implemented by Cooper in response to a spill.
- *OPEP Training*: The Cooper Emergency Management Team (EMT) is trained to respond to a hydrocarbon spill (competent and routine exercises).

6.16 Risk: Vessel Spills (Collision or Grounding)

6.16.1 Hazard

AMSA's guideline for indicative maximum credible spill volumes for other, non-oil tanker vessel collisions (AMSA 2015) is the volume of the largest fuel tank. The loss of a full tank is most likely an overestimate as hydrostatic pressure would limit the release and pumping of material to another tank could also restrict the amount lost. A typical IMR vessel used for offshore IMR activities has a largest tank size of 12 m^3.

MDO is the common marine fuel used in vessel engines and is a mixture of both volatile and persistent hydrocarbons and is classified as a Group II hydrocarbon (AMSA 2015). Table 6-2 provides the physical properties of MDO.

The general behaviour of MDO at sea includes the following:

- Substance spreads very rapidly with the slick elongated in the direction of prevailing wind and current;
- Evaporation is the dominant process contributing to the removal of MDO from the sea surface and can account for 60-70% loss (depending on wind conditions and sea temperature);
- There is a strong tendency to physically entrain in the upper water column in the presence of moderate winds (i.e. > 12 knots) or in breaking waves and can re-float if these energies abate.

The physical properties of MDO limit the available spill response options which may be adopted to respond to a spill. Given the rapid spreading characteristics of the fuel, together with the evaporative loss, rapid slick break-up is expected. Spill response techniques such as containment and recovery and dispersant application are ineffective on these types of hydrocarbons (ITOPF, 2011).

Table 6-2: Marine Diesel Oil Properties (APASA, 2013)

Properties		Marine Diesel Oil
API Gravity		37.6
Density @25°C (kg/l)		0.83
Viscosity @ 25°C (sCt)		4.0
Pour Point °C		-14
Distillation (% mass)	Volatiles (<180°C)	6
	Semi-Volatiles (180°C-265°C)	34.6
	Low Volatility (265°C-380°C)	54.4
	Residual (>380°C)	5
Group		Group II

Figure 6-2 shows a weathering and fate graphs for an instantaneous 160 m^3 surface release of MDO modelled for the Patricia-Baleen operational phase. Although a significantly larger volume, the fate and weathering of a smaller 12 m^3 spill would be similar, albeit, more rapid given evaporation factors associated with smaller spills. Figure 6-2 shows that after the immediate weathering of the MDO via evaporation and dispersion into the water column, ongoing weathering is dependent on wind conditions. Under calm wind conditions (5 knots) 40 – 50 % of the MDO could persist on the sea surface, however as wind conditions increase, the weathering rate increases significantly (APASA, 2013). ADIOS modelling (NOAA, 2017) for a 12m^3 oil spill at 15°C water temperature predicts the following:

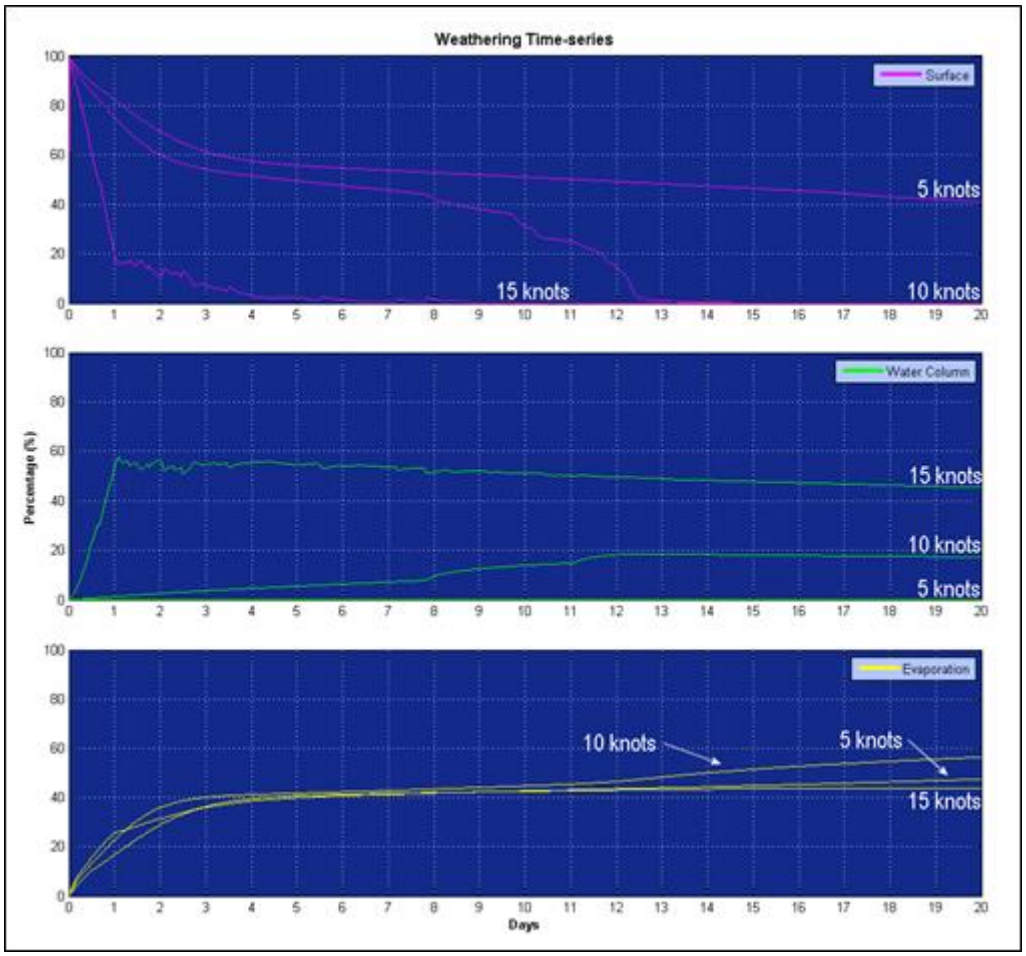
- At wind speeds of 5 knots after 24 hrs approximately 55% of the spill remains on the sea surface (6.6 m^3) with approximately 45% evaporated;
- At wind speeds of 15 knots, 23% of the volume has evaporated after four hours, 70% of the spill volume has become entrained in the water column and 7% remains at the sea-surface (0.84m^3).

Nearshore spills: For Patricia-Baleen, the worst case shoreline MDO spill scenario would be from a third party vessel collision with the IMR vessel near shore. Stochastic modelling undertaken for the Patricia-Baleen operations phase (APASA, 2013) showed that hydrocarbon

spill trajectories are influenced by the northeast/ south-west winds and currents in the region. A MDO surface spill would spread rapidly in the direction of the prevailing wind and surface currents. The entrained phase would move with the surface currents only.

The current regime in Bass Strait is semi-diurnal (i.e. reversal in current direction every 6 hours). Based upon the maximum currents reported in literature for the region (~2 knots or 1 m/s (Barton et al, 2012), within a six hour period, surface oil and entrained phase hydrocarbons would spread rapidly in the direction of the prevailing wind and surface currents. While the net current drift is easterly, given the small size of the spill, it is considered that after one tidal excursion of 6 hrs, dispersion and dilution with current reversal would be expected to dissipate spill residues to below ecological and social impact levels.

Figure 6-2: Predicted fate and weathering graphs as a percentage for 3 static wind conditions (5, 10 and 15 knots). Results are based upon an instantaneous 160 m^3 surface spill of MDO (APASA, 2013)



Based on the local wind and current patterns:

- For a near shore vessel collision if the prevailing current was north-easterly and winds were from the south/south-west at the time of the spill there is the potential for MDO to contact the shoreline. Based on previous modelling the spill would move along the coastline towards Cape Conran (~25 km to the east) until it fully dispersed and evaporated.

- If the prevailing current was south-westerly at the time of the spill the trajectory would be along the coast to the west and tending offshore. Shoreline impact is not predicted under this scenario and weathering would fully occur at sea.

Offshore spills: For spills further offshore (i.e. at the Patricia-Baleen PLEM location or Sole-2) MDO will spread with the prevailing currents and wind. Modelling undertaken by APASA in 2013 for the Patricia-Baleen operational phase for a 160 m^3 spill offshore (at PLEM) has been used to identify areas which may be affected by MDO residues from a 12 m^3 MDO spill (7.5% of modelled volume size). The following was identified:

- Surface Oils: The maximum distance for a sea surface concentration of 1 g/m^2 is 27 km from the spill source in a south-west/north-east direction (i.e. surface oil sheens may be experienced within this distance);
- Entrained Phase: Low level entrained phase hydrocarbons (i.e. 1-10 ppb over 96 hours) would be expected in proximity to the spill source.
- Shoreline residues: Shoreline areas impacted to the threshold of 100 g/m^2 may be observed on shorelines from Patricia-Baleen to Sydenham Inlet (~50 km from the Patricia Baleen facilities).

Accordingly the EMBA for the MDO spill has adopted a 50 km area around both the Patricia-Baleen and Sole-2 assets.

6.16.2 Known and Potential Impacts

The potential impacts of a vessel collision resulting in a loss of diesel are:

- Toxic effects to the marine environment including marine fauna;
- Tainting to commercial fish catch;
- Impacts to shoreline fauna and tourism on adjacent coastlines.

This spill risk is present in both State and Commonwealth waters.

6.16.3 Evaluation of Environmental Impact

Receptors within the EMBA potentially impacted by spill residues (marine and shoreline) – Marlo to Point Hicks are identified in Table 6-3 together with a summary of possible lethal and sub-lethal impacts to those sensitivities.

Note within the EMBA, there are no known aggregation areas for marine species. Given the very localised and temporary nature of surface oiling and entrained phase with this MDO spill, it is possible that individual animals may be affected however at a population level impacts are not considered to be significant.

Table 6-3: Impacts and Effects to Sensitivities in the EMBA

Receptor	Potential Impact
Cetaceans	• Cetaceans can be exposed to hydrocarbons by consuming oil or contaminated prey; inhaling oil compounds when surfacing; dermal contact through direct contact with oils and maternal transfer of contaminants to embryos. • Effects can include – hypothermia due to conductance changes in skin, resulting in metabolic shock; Toxic effects and secondary organ dysfunction due to ingestion of oil; congested lungs; damaged airways; Interstitial emphysema due to inhalation of oil droplets and vapour; Gastrointestinal ulceration and haemorrhaging due to ingestion of oil during grooming and feeding; Eye and skin lesions from continuous exposure to oil; Decreased body mass due to restricted diet; and Stress due to oil exposure and behavioural changes. • French-McCay (2009) identifies a 10-25µm oil thickness threshold has a probability of 0.1% mortality to cetacean species based on the proportion of time spent at surface. *Impacts for Patricia-Baleen and Sole-2 locations*: Cetaceans present may be exposed to very localised zones of exposure for very short periods of time. Biological consequences of physical contact by individual whales with these localised are unlikely to lead to any long-term impacts. Population level effects on cetaceans are considered to be negligible.
Pinnipeds	• Fur seals are vulnerable to oil as a result of oil adhering to fur. Heavy oil coating and tar deposits on fur seals may result in reduced swimming ability and lack of mobility out of the water (AMSA, 2014b). Oil residues may also disguise scent that seal pups and mothers rely upon to identify each other which may lead to pup abandonment and starvation. • Ingestion of oil may damage digestive tracts, suppress immune systems or damage mucous membranes (AMSA, 2014b). Fur seals possess only a thin subcutaneous fat layer instead having a thick pelage that thermally insulates the animal (NOAA, 2006) and can suffer from hypothermia when oiled; • Surfacing in fresh oil slicks can also have sub-lethal impacts on sensitive tissues (e.g. mucous membranes around eyes and nasal cavities) leading to corneal abrasions, conjunctivitis and ulcers (AMSA, 2014b). It is also possible for hydrocarbon accumulation in fatty tissues due to the ingestion of contaminated prey (Brady et al. 2002). • French-McCay (2009) estimates encounter with a 10-25 µm oil thickness carries a 75% probability of mortality to the species based upon the proportion of time the species spends at the sea surface. *Impacts for Patricia-Baleen and Sole-2 locations*: Foraging pinnipeds are expected to be present in the Patricia-Baleen and Sole-2 EMBAs. Given the rapid evaporation of diesel, the limited time (~24hrs) and spatial area of the surface diesel slick at 10µm it is expected that that if present in the area, individual pinnipeds may be temporarily affected however no population level impacts are expected (negligible consequence). Given the expected limited travel of surface sheens (~27km) intersection with pinniped haul-out areas are not expected.
Turtles	• Turtles through surfacing activities may contact a surface slick which may coat the species and allow for inhalation exposure. Turtles may experience skin irritation and injury to airways or lungs, eyes and mucous membranes of the mouth and nasal cavities (AMSA, 2014b). • From the Montara crude oil spill turtles also exhibit severe dermal pathologies (particularly in the softer skin of the neck) through surfacing behaviour (Gagnon, 2010). A stress response associated with this exposure pathway includes an increase in the production of white blood cells, and even a short exposure to hydrocarbons, such as crude oil, may affect the functioning of their salt gland (Lutcavage *et al*., 1995). • Adult sea turtles spend 1-10% of their time at the surface with each dive lasting between 30-70 minutes (French-McCay, 2009). French-McCay (2009) identified that a 10-25µm oil thickness has a probability of 5% mortality to turtle species based on the proportion of the time turtles spend at surface. *Impacts for Patricia-Baleen and Sole-2 Locations*: Adult turtles may transit through the Patricia-Baleen and Sole-2 EMBA but the area is not a recognised BIA for turtles. Given the small spill volume and its rapid evaporation only individual turtles may be affected. Due to the sparse nature of turtles within the Gippsland Basin, potential impacts to marine reptile populations are considered to be negligible.

Receptor	Potential Impact
Seabirds	• Seabirds are particularly vulnerable to hydrocarbon spills owing to their high potential for contact at the sea surface where they feed or rest. Ingestion of oil can be sub-lethal or acute depending on the type of oil, its weathering stage and inherent toxicity. This can occur directly when preening or by consuming contaminated prey. Effects may include tissue and organ damage, altered metabolism, pneumonia and reduced reproduction capability (AMSA, 2014b). Exposure to hydrocarbons may have longer term effects, with impacts to population numbers due to decline in reproductive performance and malformed eggs and chicks, affecting survivorship and loss of adult birds. • Direct contact with surface hydrocarbons can lead to irritation of skin and eyes. Oil-coated birds can suffer hypothermia, dehydration, drowning and starvation, and become easy prey. • Smothering of feathers can also lead to excessive preening, diverting time away from other behaviours leading to starvation and dehydration. Preening of oiled feathers will also result in to ingestion of hydrocarbons and the associated impacts of toxicity and potential illness. *Impacts for the Patricia-Baleen and Sole-2 locations*: Seabirds are expected to be present in offshore open waters of the EMBA. Given the rapid evaporation of diesel, the limited time and spatial area of the surface diesel slick at 10µm it is expected that individual birds might be affected however no significant impacts at a population level are expected. Accordingly, only a localised short-term impact to the species population would occur (minor consequence).
Sharks and Fish	• In the open ocean, most pelagic species are highly mobile and demersal fish live relatively deep in the water column and are unlikely to contact surface spills. Fish and sharks do not generally break the sea surface however it is possible that individuals may feed at the surface. • Entrained hydrocarbon droplets can physically affect fish exposed for an extended duration (weeks to months). Smothering through coating of gills can lead to the lethal and sub-lethal effects of reduced oxygen exchange, and coating of body surfaces may lead to increased incidence of irritation and infection. Fish may also ingest hydrocarbon droplets or contaminated food leading to reduced growth. Effects will be greatest in the upper 10 m of the water column and areas close to the spill source where hydrocarbon concentrations are likely to be highest and therefore demersal fish communities are not expected to be impacted. • Shark species inhabit all levels of the water column and feed on fish and seals. Impacts to sharks may occur through direct contact with entrained hydrocarbons contaminating tissues and internal organs or indirect contact via the food chain (consumption of prey). Sub-lethal impacts in adult fish include altered heart and respiratory rates, gill hyperplasia, enlarged liver, reduced growth, fin erosion, impaired endocrine systems, behavioural modifications and alterations in feeding, migration, reproduction, swimming, schooling and burrowing behaviour (Kennish, 1996). For commercial shark and fish stock this also includes tainting (refer *commercial fishing).* • Eggs, larvae and young fish are comparatively sensitive to oil (particularly dispersed oil), as demonstrated in laboratory toxicity tests (AMSA, 2014b), however there are no case histories to suggest that oil pollution has significant effects on fish populations in the open sea. This is partly because any oil-induced deaths of young fish are often of little significance compared with natural losses each year through natural predation and as fish spawn over large areas (AMSA, 2014b). *Impacts for the Patricia-Baleen and Sole-2 locations*: Pelagic free-swimming fish and sharks are not expected to suffer long-term damage from oil spill exposure because dissolved/entrained hydrocarbons in water are not expected to be sufficient to cause harm (ITOPF, 2014). Given the limited areal and temporal presence of the spill and the limited numbers of fish potentially affected, impacts are assessed as temporary, localised and recoverable (negligible consequence). Impacts on eggs and larvae entrained in the upper water column are not expected to be significant given the temporary period of water quality impairment, and the limited areal extent of the spill. As egg/larvae dispersal is widely distributed in the upper layers of the water column it is expected that current induced drift will rapidly replace any oil affected populations. Impact is assessed as temporary and localised (negligible consequence).

Receptor	Potential Impact
Benthic Fauna	• Invertebrates reside in benthic substrates, surface oil not considered to pose a high risk to invertebrates except where oil reaches shoreline. • Exposure to entrained phase hydrocarbons may lead to local impacts (mortality) to larval stages impacting on recruitment for that year. • Hydrocarbon contamination can lead to tainting (e.g. lobsters took 2-5 months to loose taint when exposure to light hydrocarbon (NOAA, 2002)). • Oil drops can mechanically affect filter feeders or expose invertebrate to semi-soluble hydrocarbons taken up by gills of digestive tract) (McCay-French, 2009). • Sub-lethal hydrocarbon concentrations can lead to narcosis (death-like appearance when the organism has not actually died). The invertebrates often recover but are more vulnerable to predators or being swept away by currents. Other sub-lethal effects of oil on invertebrates include developmental problems such as slow growth and deformities (Fingas, 2001). *Impacts for the Patricia-Baleen & Sole-2 locations*: Given the small volume of MDO spilt at surface, no significant impacts to benthic fauna are expected (negligible consequence).
Plankton	• Exposure to hydrocarbons at surface or in the water column can result in changes in species composition with declines or increases in one or more species or taxonomic groups (Batten, 1998). Phytoplankton may also experience decreased rates of photosynthesis (Goutz *et al*., 1984; Tomajka, 1985). For zooplankton, direct effects of contamination may include suffocation, changes in behaviour, or environmental changes that make them more susceptible to predation (Chamberlain and Robertson, 1999). • Numerous studies on the influence of oil on plankton communities has been carried out, including one study by Varella et al (2006) which compared results from the Prestige oil spill with other published studies. Despite the limitations of the review (oil type, environmental conditions, etc.) it was not possible to demonstrate any significant effects on planktonic communities and changes were in the range of natural variability. Variations in the temporal scale of the ocean appear to have a greater influence on plankton communities than the direct effect of spilt hydrocarbons. *Impacts for the Patricia-Baleen & Sole-2 locations*: As plankton is widely distributed and dispersed through the upper layers of the water column it is expected that current induced drift would rapidly replace any oil affected populations (ECOS, 2001). Once background water quality conditions are re-established, planktonic communities will rapidly re-establish due to high population turnover with and short generation time that buffers the potential for long-term population declines (ITOPF, 2011). Based on the limited areas temporarily affected by surface and entrained oils, impacts are short-term, recoverable and localised and not expected to have a significant impact on plankton populations located in irregular megafauna foraging grounds (negligible consequence).
Commercial Shipping	No impacts are expected to commercial shipping.
Commercial Fishing	Impacts to fish species from diesel spills are outlined above in Fish and Sharks. The following additional impacts may be experienced by commercial fishing activities in the area: • Significant levels of surface oil can foul vessels and equipment used to catch commercial fish, and transfer contaminants to the catch. For fisheries operating in the Patricia-Baleen and Sole-2 area, this would occur when demersal trawl/line and trap or pots are retrieved through surface slicks to the vessel. • Studies have indicated that fish tainting may occur when exposed to diesel at low hydrocarbon concentrations (~250 ppb) (Davis et al. 2002). Tainting is reversible but, whereas the uptake of oil taint is frequently rapid, the depuration process where contaminants are metabolised and eliminated is slower (weeks to months) (ITOPF, 2014) making commercial species unpalatable. Fish have a high capacity to metabolise hydrocarbons while crustaceans (such as lobster and crab) have a reduced ability (NOAA, 2002). Actual or potential contamination of seafood can affect commercial and recreational fishing, and can impact seafood markets long after any actual risk to seafood from a spill has subsided (NOAA, 2002) which can have economic impacts to the industry. *Impact for the Patricia-Baleen & Sole-2 locations*: Given the very small volumes of diesel released to the environment and its rapid dispersion, individual fish in the vicinity of the spill source may be affected by taint however this will be temporary and localised – not sufficient to cause contamination issues with consumers. Localised impacts from the MDO spill are also not expected to affect fishing activities (localised and temporary) (negligible consequence).
Shipwrecks	Shipwrecks in the immediate vicinity of the Patricia-Baleen facilities are sub-tidal and not expected to be affected by entrained phase residues.

Receptor	Potential Impact
Oil & Gas	No impacts are expected to adjacent oil and gas facilities.
SHORELINE FLORA AND FAUNA	
Pinniped Colonies	Oiling impacts to pinnipeds has been described in 'seabirds' above. In addition to this: • Impacts to a fur seal colony, after severe oiling, may be significant at a population level and recovery is expected to be on a moderate timescale. A medium term impact of oiling was reported for the Australian Fur Seal following the Iron Baron oil spill with the number of pups born on the adjacent Tenth Island reduced the year following the spill (Pemberton, 1998; cited in Salazar, 2003). For the Jessica Oil spill, no major long term negative impacts were detected with population numbers decreasing in the first six months after the spill, but after that time falling within the range of natural variability for the region (Salazar, 2003). *Impact for the Patricia-Baleen and Sole-2 EMBAs*: Given the small volumes of MDO spilt and the distance of the haul-out areas from Patricia-Baleen and Sole-2, it would be expected that little to no visible oil would be present at these locations. Minor sub-lethal impacts to individual animals may occur but no significant impacts at a population level (negligible consequence).
Shoreline Birds	Oiling impacts to birds has been described in 'seabirds' above. In addition to this: • Direct oiling to breeding bird nesting locations from MDO residue wash-up is not expected however birds incubating eggs can transfer oil to their eggs from plumage. Literature identifies that hatching success for mallards with plumage exposed to 0.1mm (100g/m^2) of Prudhoe Bay Crude oil for 48hrs while incubating eggs was significantly reduced, with the reduction in hatchling success not significant at 0.05mm. (Albers, 1980; cited in French-McCay, 2009). *Impact for the Patricia-Baleen and Sole-2 EMBAs:* Minor levels of shoreline oiling may result from spills at Patricia-Baleen or Sole-2, however when small spills of MDO do strand on the shoreline the oil tends to penetrate porous sediments and are washed by waves and tidal flushing (NOAA, 2015). Localised and temporary shoreline residue impacts are therefore not expected to have a significant impact on shoreline bird species (minor consequence).
Saltmarsh (Estuary Systems)	• Oil can adhere readily to saltmarsh and recovery times are variable depending upon the oiling level (IPIECA, 1994). Impacts are related to oil toxicity (lighter, non-weathered products causing more impacts such as MDO) or smothering (physical effect). Oil loading also determines recovery times. For light to moderate oiling with little penetration into the sediments, the plant may be killed in part, but recovery can take place from the underground systems – generally good recovery in 1-2 years. Oiling of shoots with substantial penetration into the sediments with damage to underground systems may delay recovery (~7years). With thick deposits of oil, vegetation is likely to be killed by smothering and the recovery period for species can be significant (~20years) (IPIECA, 1994) *Impact for the Patricia-Baleen Location*: It is considered unlikely that weathered MDO will enter the lower Snowy River given the shallow bar at the entrance and the general outflow from the river to Bass Strait. If oil enters, it will be weathered and have small thicknesses. Saltbush is located at high-tide level within the estuary and exposure would be limited. If contacted by residues, localised short-term impacts may be possible (minor consequence).
Macrophages (Bull kelp, algae, etc.)	Bull kelp stands are located at Beware reef and at Point Kicks Marine Park (sub-tidal). • Kelp is relatively insensitive to oil, but the fauna associated with it may be more sensitive. For example, following the Exxon Valdez spill, the abundance of some macro-benthic invertebrates associated with the kelp forests declined in the year following the spill though the macroalgae were unchanged (Dean et al, 1996; cited in Hook et al, 2016) • Sub-tidal kelp beds are considered not particularly vulnerable to petroleum hydrocarbons. Studies indicate around shallow-water natural petroleum seeps, the large kelp *Macrocyctis pyrifera* does not accumulate petroleum hydrocarbons to very high concentrations, despite being continually inundated with surface oil (Straughn, 1976; cited in NRC, 2003). *Impact for the Patricia-Baleen and Sole-2 EMBAs*: Given the very low volumes of MDO which might be spilt and the distance of these receptors to the spill site, surface oil and entrained phase oils are expected to be very low with negligible impacts to the macrophages and associated biota (negligible consequence).

Receptor	Potential Impact
Sandy Beaches	• Sandy beaches have a relatively low biodiversity but do provide important habitats for foraging seabirds and shorebirds. They also provide habitat for polychaetes, molluscs, marine crustaceans, semi-terrestrial crustaceans and insects. Long-term depletion of sediment fauna could have an adverse effect on birds or fish that use beaches as feeding grounds (IPIECA, 1999). *Impacts for the Patricia-Baleen and Sole-2 EMBAs*: MDO residues, if they strand along shorelines will be localised and temporary with sediment washing by wave and water movement. The localised area affected will undergo rapid recolonization by adjacent shoreline fauna (negligible consequence).
Inter-tidal Platforms	• Intertidal reefs occur in shallow near shore waters within the wider environment and contain animals such as abalone, barnacles, crabs, limpets, snails and worms. • Surface hydrocarbons may make contact with intertidal reefs. Impacts of oil contact can include mortality by smothering, the narcotic effect of the oil causing snails, gastropods and grazing molluscs to loose grip on rocks (desiccate or become available to predators), impair feeding, fertilisation, larval settlement or decrease growth rates (IPIECA, 1995). • Inter-tidal invertebrate taxa exhibit a wide range of tolerances and responses to oil exposure. Mortality is a major impact from an oil spill through coating and toxicity of persistent residues. Sub-lethal impacts at an individual species level can result in altered respiration, growth, reproduction and behaviour to more specific processes such as calcification, moulting, transport and enzyme function. Oil spill impacts also typically result in changes in abundance, density, reproduction and recruitment, age structure, tolerance and population genetic structures within the invertebrate community (McFarlane and Burchett, 2003). *Impacts for the Patricia-Baleen and Sole-2 EMBAs*: The closest inter-tidal platform is located at Cape Conran (Patricia-Baleen) and Point Hicks (Sole-2) which is a significant distance from the spill site. It is considered unlikely that sheens will intersect this area and impacts from entrained phase components are expected to be negligible (negligible consequence).
Aboriginal Heritage	Primary coastal areas for cultural heritage are identified as “sheltered sand dune areas” which can be affected by human access and erosion. Inter-tidal shoreline areas are not expected to contain a significant amount of indigenous cultural heritage “items”. Shoreline residues carries limited disturbance to aboriginal cultural heritage (negligible consequence). A more significant concern regarding indigenous heritage impacts are secondary impacts associated with shoreline access for clean-up activities (e.g., personnel access across sand dunes that may contain shell middens). Without controls, impacts may be significant.
Tourism	Sandy beaches along the Gippsland coastlines support recreational activities such as naturalism, swimming, boating. National/coastal parks are also present along the coastline. Tourism in the area peaks over the summer period (December to March). Coastal sheens or hydrocarbon stranding may lead to beach closures or visual amenity impacts during clean-up activities. Given the levels of MDO spilt would expect minimal residues any impacts associated with closure for clean-ups (not expected) will be temporary, localised and not expected to impact significantly on tourism given the availability of a number of beaches in the area (minor consequence).
Recreational Fishing	Impacts on recreational fishing have been covered in marine – commercial fishing

Spill Likelihood/Frequency: Table 6-4 provides an analysis of oil spill frequency data for eastern Gippsland waters (DNV, 2011) for spills over 1 tonne and 100 tonnes. The intermediate area (12-50nm) is identified as one of the areas of higher potentials for spills around the Australian coastline.

Table 6-4: Spill Frequencies in Gippsland Basin (DNV, 2011)

Spill Size	Spill Frequency Nearshore (0-12 nm)	Spill Frequency Intermediate (12-50nm)
Spills > 1 tonne	High 1 event every 10 to 100 years	Very High 1 event within 10 years
Spills > 100 tonnes	Moderate	Moderate

Spill Size	Spill Frequency Nearshore (0-12 nm)	Spill Frequency Intermediate (12-50nm)
	1 event every 100-1000 years	1 event every 100-1000 years

Note these spill statistics are from all causal pathways (not just vessel collision). While DNV (2011) compares the frequencies to Australian averages, the report states that in absolute terms compared with world statistics, oil spill frequencies in all Australian sub-regions are considered low (1 event in 1000-10,000 years) to very low (1 event > 10,000 years). On this basis, the likelihood of vessel collision with all controls adopted is assessed as unlikely.

The residual risk associated with an MDO spill is assessed as low.

6.16.4 Environmental Impact and Control Measure Summary

Aspect	Vessel Collision
Impact summary:	Degradation of water quality. Toxic effects to the marine environment including marine fauna; Tainting to commercial fish catch; Impacts to tourism on adjacent coastlines
Extent of impact:	EMBA expected to extend approximately 25 km around the release point.
Duration of impact:	Short-term and recoverable
Level of Certainty of Impact:	**HIGH:** Spill source volumes are very limited and small in size and the characteristics of MDO releases and weathering are well understood. Conservative bases have been used to estimate the EMBA for the spill.
Uncertainty: Impact Decision Framework	**A**: Nothing new or unusual; represents business as usual; well understood activity; good practice well defined. *ALARP to be demonstrated on adherence to legislation, industry codes and good professional judgement*.

Control measures for this hazard should be read in conjunction with the prevention of commercial shipping and fishing spatial conflicts (refer Section 6.10).

Additional control measures to be implemented to control this hazard include:

- *Fuel Selection:* Fuel use on-board is marine diesel.
- *Refuelling:* No refuelling will be undertaken at sea (this will be done in port).
- *Vessel Selection:* The vessel selected for IMR activities will meet:
  - Class certification requirements under the Navigation Act 2012;
  - Relevant crew shall hold valid STCW certificates (or equivalent to class);
  - Marine Inspection for Small Workboats IMCA audit shows vessel safety and integrity requirements are met.
- *SMPEP Implementation:* Vessels have a current approved SMPEP (or equivalent appropriate to class) that is implemented in a spill event.
- *SMPEP Crew Induction*: Vessel crew members are inducted and trained into vessel spill response procedures.
- *Vessel SMPEP Exercises/Drills*: Vessel implements routine emergency exercises (including spills) as part of its drills matrix.
- *OPEP Exercise*: Prior to IMR activities an oil spill response exercise will be conducted to test interfaces between the SMPEP, OPEP, National Plan for Maritime Environmental

Emergencies (NATPLAN) and Victorian Maritime Emergency (Non search and Rescue) Plan.

- *Spill Reporting*: Cooper will report the spill to regulatory authorities within 2 hours of becomes aware of the spill.
- *OPEP Implementation*: The Cooper Offshore Victoria OPEP is implemented in response to a spill during IMR activities;
- *Operational and Scientific Monitoring Plan (OSMP) Implementation*: Cooper will undertake operational and scientific monitoring in accordance with the Offshore Victorian OSMP.

6.17 Risk: Well Loss of Containment

6.17.1 Hazard

Review of the threats to wellheads and subsea trees (SST) at the Patricia-Baleen and Sole-2 locations identified that fishing equipment/anchor impacts to the Patricia-Baleen SSTs may result in a release of gas from the wellhead. An impact, damaging SST fixtures/connections may result in an estimated maximum release rate of 900 scf/hr. These wells are shut-in with two tested barriers, a closed SSSV and meet API RP14B leakage rates.

6.17.2 Known and Potential Impacts

The main concern associated with a gas (methane) release in the marine environment is the possibility that methane-consuming microbes (methano-trophic bacteria) may exhaust oxygen in the water column. It is important to note that all wellhead LOC incidents are not expected to result in liquid hydrocarbon release as these are dry gas wells.

6.17.3 Area Affected by Release:

The area affected by this small gas release is likely to be localised around the wellhead (across all depths of the water column).

Based upon an APASA study (2013b) undertaken for the Casino-Henry-Netherby (CHN) field, a gas plume of approximately 500 SCF/min in 60 m of water rose to the surface in approximately 1 minute at an average speed of less than 1 m/s and spread over a diameter of 12 m. For an instantaneous gas plume of approximately 316 MMSCF, the plume rose to the surface in less than 10 seconds and spread laterally over an area of 10 m.

Due to the lateral movement of the currents in the region, both plumes were predicted to surface anywhere inside a 50 m radius of the release point (APASA, 2013). While this location is not in proximity to Patricia-Baleen, a comparison of surface currents between the two sites show similar maximum current speeds and both developments are located in similar depths, however given the much lower release rates at Patricia Baleen 15 SCF/min, and a potentially slower rise time, more dispersion across a wider area might be observed, however this is still expected to remain localised.

For the smaller CHN plume, the study identified the plume surfacing might be visible under certain conditions, however there would be no effect on the buoyancy of vessels and only a very small risk of exceeding the Lower Explosive Limit (LEL) safety limit in sheltered areas where gas may accumulate. This is not considered to be a risk at the Patricia-Baleen site given the lower release rates.

A similar study was undertaken at the adjacent BMG field now operated by Cooper to quantify the dispersion of a natural gas plume following a loss of well control from the Basker-5 location in water depths of 153m. The modelled maximum gas rate of 24MMSCFD predicted that the plume would advect gas to the surface in 57 seconds and upon reaching the surface the gas

would predominantly disperse to the atmosphere and the entrained water would form a mound at the water's surface. The near surface plume was predicted to be circular with a diameter of 17.5 m and was predicted to produce sea surface concentrations which exceeded the LEL for natural gas most of the time within the core of the plume, then fall below this threshold when the currents were strong (APASA, 2011).

6.17.4 Receptors:

Receptors which may be within the area affected by the gas release include:

- Pelagic species (plankton, fish);
- Cetaceans; and
- Pinnipeds.

This impact will be contained in Commonwealth waters only.

6.17.5 Evaluation of Environmental Risk

Gas released at the seabed will rapidly dissipate through the water column with only temporary and minor water quality reduction and little to no impact to marine fauna.

Research undertaken for the Macondo oil blowout in the Gulf of Mexico in 2010 indicates that there is a large gap in the data regarding that impacts of methane released to the ocean. The following information is sourced from 'BP Oil Spill - Crisis in the Gulf' (Anonymous, 2010).

Low-oxygen conditions that may be created by the gas release could threaten small marine organisms – plankton, fish larvae, and other creatures that can't roam large distances, but form a vital link in the marine food chain.

A research trip in the Gulf of Mexico took measurements over a distance from about 480 m from the Macondo blowout to 13 km away. The team found that dissolved methane concentrations were low in the surface water and overlying air, very high at depths greater than 1,000 m and somewhat elevated in between. The researchers interpret this to mean that the vast majority of the methane is trapped at depths of around 1 km and only small amounts are likely to escape through the ocean to the atmosphere. The methane is trapped in the deep water because in temperate and tropical oceans, seawater stratifies which limits mixing.

Analysis of the dissolved gas content from another 90 locations (at various depths for each location) within a 48 km x 64 km radius around the Macondo blowout location revealed a layer within 8 km of the blowout where the dissolved methane was six times higher than the dissolved oxygen. This may lead to methanotrophic bacteria consuming oxygen in that 'lens' of seawater resulting in oxygen depletion. However, the breakdown of methane occurs very slowly and oxygen availability will limit the ability of bacteria to fully deplete the oxygen. Consequently microbial breakdown of the methane may reduce oxygen concentrations to levels untenable for a range of marine creatures, and just as a lack of vertical mixing in the deep water is holding the dissolved methane at depth, that lack of mixing keeps high levels of dissolved oxygen in surface waters from replenishing oxygen levels in the deep water. Unlike the Macondo well, the Patricia Baleen and Sole-2 wells are located in shallow waters (ranging in depth from 55 m to 125m).

The rapid rise of gas to surface in any LOC event will release gas to the atmosphere rather than being trapped at depth in the water column. A small portion may remain in the waters occupied by and surrounding the gas plume, but this would not be expected to result in significant oxygen depletion given Bass Strait waters are generally well mixed.

At the water depths of the Patricia-Baleen and Sole-2 wellheads, thermal stratification is not normally expected (some weak thermal stratification may occur in calm summer conditions, but generally only in the middle of Bass Strait). Thus, the 'trapping' of methane in deep cold waters

is unlikely to occur, and oxygen depletion (and consequent impacts to marine life) in any one layer of the water column is unlikely to occur.

A release of gas at the Elgin Platform operated by Total offshore from the United Kingdom did not have any reportable impacts on marine fauna from the release of 175 tonnes of gas per day [8.6MMSCFD] (Government Interest Group (UK), 2012). Given the significantly smaller release rates predicted at the Patricia Baleen well site the consequence of the release is considered negligible.

6.17.6 Likelihood of LOC:

LOC through direct contact with fishing equipment and anchors may result in the release of hydrocarbons from shut-in wellheads (Patricia-2 and Baleen-4). A review of fishing intensity has identified that fishing intensity for Danish Seine (demersal), Commonwealth Otter board Trawl (demersal) and Commonwealth Gillnet Hook and Trap sectors have a high intensity in the area. As such it is possible that impact damage may result.

However given the control measures adopted to inform these fisheries on the presence of wellheads and the routine review and management of fishing risk factors with SETFIA, the likelihood of impact damage is considered very unlikely. There have been no instances of fishing related damage observed on the Patricia-Baleen wellheads.

Accordingly the risk of wellhead LOC is assessed as low.

6.17.7 Environmental Impact and Control Measure Summary

Aspect	Wellhead LOC (gas)
Impact summary:	Localised water quality impacts (dissolved methane)
Extent of impact:	Localised. Expected to extend approximately 25 km around the release point.
Duration of impact:	Short-term and recoverable
Level of Certainty of Impact:	**HIGH:** Hydrocarbon source volumes/compositions are well understood together with the localised nature of impact.
Uncertainty: Impact Decision Framework	**A**: Nothing new or unusual; represents business as usual; well understood activity; good practice well defined. *ALARP to be demonstrated on adherence to legislation, industry codes and good professional judgement*.

Control measures to be implemented to control this hazard and ensure no loss of containment to the marine environment includes:

- *Navigational Requirements:* Patricia-Baleen wellheads, pipeline and Sole-2 wellhead marked on navigation charts.
- *Fishery Plotters (Infrastructure Installation):* All local fishing plotters have Patricia-Baleen infrastructure and Sole-2 wellheads installed on their plotters for infrastructure awareness.
- *Commercial Fishing risk Assessment:* Cooper monitor changes to the fisheries (e.g. new vessel masters, new vessels, increased fishing activity) at the Patricia-Baleen and Sole-2 location to assess for additional controls with may need to be implemented to maintain commercial fishing risk ALARP.
- *Routine GVIs/IMR Activities:* GVIs are undertaken in accordance with the Patricia-Baleen Offshore Integrity Management Plan.
- *Spill Reporting*: Cooper will report a well-related hydrocarbon release or incident to regulatory authorities within 2 hours of becomes aware of the incident.
- *OPEP Implementation*: The Cooper OPEP is implemented in response to a hydrocarbon release from a wellhead.

- *Spill Reporting*: Cooper will report a well-related hydrocarbon release or incident to regulatory authorities within 2 hours of becomes aware of the incident.
- *LOC Monitoring Program*: For a well-related LOC and with regard to safety, analytical testing of any continuous stream of hydrocarbon will be undertaken to assist in determining the leak source, potential for escalation and assist in determining source control options. This will be undertaken in accordance with the Cooper Offshore Victoria OSMP.

7 Environmental Performance Monitoring

7.1 Implementation

Cooper manages the environmental impacts and risks associated with the Patricia-Baleen NOP activity to ALARP and acceptable levels through the implementation of the Cooper Health, Safety, Environment and Community (HSEC) Management System (MS). The HSEC MS is a formal and consistent framework for all activities performed by Cooper and contracted resources.

This EP details a number of Environmental Performance Outcomes (EPOs) and Environmental Performance Standards (EPSs) for the NOP activity. To achieve these performance outcomes, the EP's implementation strategy incorporates the following key HSEC MS processes:

- Position definition (roles and responsibilities);
- Training and awareness (Inductions, competency and training requirements);
- Emergency response (planning, testing, training and competency);
- Communications (workforce participation, communication forums);
- Contractor and supplier management (pre-qualification assessment, ongoing performance management, campaign-specific requirements);
- Impact and risk management (campaign-specific risk assessments, job hazard assessments);
- Operational Controls (permit-to-work, management of change, chemical selection and use);
- Performance Reporting (operational reports, annual reports, incident reporting, emissions monitoring);
- Audit and inspection; and
- Management of non-conformance.

Key roles within the Cooper organisation structure are allocated the responsibility for the implementation or compliance monitoring of EP commitments. All Cooper positions have position descriptions outlining their HSEC role, responsibilities, accountabilities and authorities and where relevant the specific competency requirements. All contractors engaged on Patricia-Baleen and Sole-2 activities undergo prequalification prior to contract award to ensure they have equivalent resource management systems to ensure personnel competencies and training and their procedures meet the requirements of this environment plan.

A key implementation activity is the induction of offshore personnel in a campaign-specific induction prior to activity commencement to ensure personnel understand the environmental requirements of the activity EP and their specific responsibilities in the EP.

7.2 Ongoing Monitoring of Environmental Performance

Environmental performance is monitored via a range of management system processes as detailed below.

7.2.1 Contractor and Supplier Management

7.2.2 General

Cooper has a contractor management system that provides a systematic approach for the selection and management of contractors to ensure any third party has the appropriate management system and structures in place to achieve HSEC performance in accordance with

Cooper's expectations. These requirements are contained within the Cooper Contractor and Supplier Management Standard Instruction.

The procedure applies to sub-contractors, Third Party Contractors (TPCs) and suppliers, attending, conducting work at Cooper sites or providing services for Cooper and its operations. It addresses operational HSEC performance of all contractors while undertaking project work under a Cooper contract, in an area of Cooper responsibility or covered under a Cooper HSEC MS. The key HSEC steps in the Cooper contractor management process include:

- Planning - HSEC assessment of potential contractors, suppliers and/or TPCs;
- Selection - Submission and review of contractors and/or TPC HSEC management data;
- Implementation - Onsite contractors and/or TPC HSEC requirements including induction and training requirements; and
- Monitoring, review and closeout - Ongoing review of contractors and/or TPC HSEC performance including evaluation at work handover.

Planning – Contractor Pre-qualification:

All contractors working directly under contract to Cooper must complete a contractor pre-qualification questionnaire to ensure minimum operational HSEC performance standards and equipment requirements are met. Key aspects of the pre-qualification process include:

- Project and/or workplace risk assessment relative to the risk of the work being undertaken by the contractor, in particular if work will be conducted simultaneously with other work; and
- HSEC assessment determined by Cooper Project Management and based on the nature of the work for which pre-qualification is being sought.

Note that exemptions apply in certain circumstances, and in these cases contractors must comply with the relevant Cooper HSEC Plan.

Contractors are selected based upon an assessment of their ability to:

- Comply with statutory requirements and Cooper standards;
- Have an acceptable HSEC performance record;
- Provide appropriate resources and competency in the services to be provided;
- The services and hardware comply with the requirements of the accepted EP; and
- Any equipment to be used meets regulatory requirements, is fit-for-purpose and meets Cooper standards (includes provision of all certificates, testing and verification of equipment).

Implementation and monitoring contractor performance

As part of any work scope, Cooper reviews and approves contractor procedures to be utilised in asset activities. These procedures will be included in the work plan for the asset and monitored by the Cooper Offshore representative.

Cooper ensures that all works undertaken by contractors are aligned to Cooper's HSEC requirements which include adhering to environmental compliance items. Ongoing contractor performance against these requirements is monitored by both the contractor and Cooper.

7.2.3 Campaign-specific Vessel Compliance

Cooper, as part of contractor pre-qualification and selection, assess vessel compliance with the requirements of this Environment Plan. This covers aspects including, but not limited to:

- Vessel pollution control equipment;
- Assessment of IMS risk:

- Navigational safety (vessel lighting and navigation equipment);
- Crew competencies and training; and
- Emergency/spill response.

For vessels mobilising from international ports or ports outside the IMCRA Twofold shelf bioregion, as part of pre-qualification contractors will be required to undertake an IMS risk assessment[4] supplying relevant supporting documentation to Cooper to validate the IMS risk status. Assessment parameters include:

- Vessel type;
- Vessel activity location in Australia;
- Presence and age of anti-fouling control coating;
- Vessel IMS inspection, cleaning and treatment history (including in-water and dry dock cleaning details);
- Vessel seawater system treatment history;
- Vessel location and movement history (infection risk since anti-fouling coating application or verified IMS inspection); and
- Location and duration of the planned activity within 12 nm of the coastline.

For vessels which can demonstrate via the risk assessment methodology that the IMS risk is low and acceptable without any further corrective actions, the vessel will be deemed suitable for use in IMR activities with respect to IMS risk.

Where the IMS risk is assessed as medium or high, the vessel will require an inspection via a qualified independent third party marine pest inspector to assess and determine the corrective actions required to reduce the vessel to a low IMS risk. The contractor will demonstrate implementation of these corrective actions prior to vessel mobilisation to Gippsland ports. Corrective actions may include vessel dry-dock and cleaning, limiting vessel entry into waters less than 50m water depths or 12 nm from the Australian coastline, or limiting time within shallow water environments.

7.2.4 Impact and Risk Management

HSEC risks are identified, assessed and either eliminated or appropriately controlled to reduce potential harm to personnel and the environment. The risk level of an activity determines the level of management approval required to undertake that activity.

The Cooper risk management processes use qualitative, semi quantitative and quantitative risk assessment or hazard studies to determine risks and opportunities related to activities that Cooper controls or has influence over in accordance with the Risk Management standard instruction.

The Patricia-Baleen Non-Operational Phase activity has been assessed for impact and risk utilising the Cooper Qualitative Risk Matrix and risk management process. This process also outlines the authorised roles for risk acceptance and treatment plan approval.

Environmental hazard identification is carried out throughout the life of the Patricia-Baleen and Sole-2 assets. Qualitative risk assessments are based upon the principles of ISO 31000. These assessments are typically undertaken for operational or task based activities and may be conducted:

[4] Current best practice is the Biofouling Risk Assessment tool currently managed by the WA Department of Fisheries. This assessment tool/criteria will be monitored and updated as necessary.

- As part of a Job Hazard Analysis prior to completion of a work permit;
- In an incident assessment and investigation;
- As part of planning for introduction of new activity, major equipment or method of operation;
- As part of planning for a substantial change to existing equipment or method of operation; and
- Other management of change activities (e.g. chemical change, organisation change, etc.).

For offshore IMR campaigns it is the responsibility of the Cooper General Manager Operations to ensure that a competent contractor is used to perform the work. In addition, a campaign-specific risk assessment is undertaken considering all impacts and risks associated with the proposed scope of works to ensure that impacts and risks are managed to ALARP and acceptable levels.

7.2.5 Management of Change

The Cooper Management of Change (MOC) process describes the requirements for dealing with change and requires all changes to engineering activities, safety critical procedures, operations, facilities, processes, equipment, plant, materials and/or controlled management system documentation changes to be assessed and managed.

This standard details the process requirements to ensure that when changes are made to a project, control systems, an organisational structure or to personnel, the HSE risks and other impacts of such changes are identified and appropriately managed.

The objective of the MOC process is to ensure that additional risks are not introduced by the change that could increase the risk of harm to people, assets or the environment. This includes:

- Deviation from established corporate processes;
- Changes to the sequence or scope of offshore operations;
- Deviation from specified safe working practice or work instructions/procedures;
- Implementing new systems; and
- Significant change of HSEC-critical personnel.

Environmentally relevant changes include:

- New activities, assets, equipment, processes or procedures proposed or implemented that have the potential to impact on the environment and have not been:
    - Assessed for environmental impact previously, in accordance with the relevant standard; and
    - Authorised in existing management plans, procedures, work instructions or maintenance plans.
- Proposed changes to activities, assets, equipment, processes or procedures that have the potential to impact on the environment or interface with an environmental receptor; and
- Change to the requirements of an existing external approval (e.g. changes to conditions of environmental licences).

An impact/risk assessment will accompany any MOC with identified environmental impacts or risks in accordance with the Cooper Risk Management Standard. The impact or risk assessment will consider the impact of the proposed change on the environmental impacts/risks and adopted control measures. It will also consider impacts and risks to

stakeholders and seek their feedback on proposed changes if their interests are affected by the change.

All environmental risk assessments must include an ALARP and acceptability assessment against Cooper criteria which includes obtaining and responding to stakeholder concerns associated with the change (as required).

Additional controls identified as part of the change event shall be effective in reducing the environmental impact and risk to a level which is ALARP and acceptable; and meet the nominated EPOs and EPSs set out in the accepted EP for the activity. The assessment will also consider the impact of the proposed change on the EPOs defined in this EP.

Note: EPOs and EPSs cannot be altered from those set out in the accepted EP. If EPOs/EPSs cannot be met, a recordable or reportable incident must be registered for the activity.

In the event that the proposed change introduces a significant new environmental impact or risk, results in a significant increase to an existing risk, or through a cumulative effect of a series of changes there is a significant increase in environmental risk, this EP will be revised for re-submission to NOPSEMA and the DEDJTR ERR (as appropriate).

Note for changes to the accepted EP, all changes will be traceable via 'track-changes' within the revision document and any changes made are fully justified.

7.2.6 Internal Reporting

7.2.7 Performance Reporting

Routine internal performance reporting of HSE matters includes the following:

- Operations reports – the Operations Superintendent (for routine onshore operations) and the Cooper Site Representative (for vessel-based activities) will prepare a routine operations report, including data on activities conducted for the day and any HSE issues arising. This will be issued to the Cooper General Manager Operations who will then distribute to the extended project team as required;
- Environmental performance report – Cooper will prepare an annual EP performance report detailing the outcomes of each performance standard in the EP. This will be submitted to the DEDJTR and NOPSEMA within 3 months of the end of the reporting year.

7.2.8 Incident Recording and Reporting

All environmental incidents (i.e., non-compliances with the EPOs and EPSs must be communicated immediately to the Cooper General Manager Operations and are recorded and investigated in accordance with Coopers Incident Management process. Recording and close out of corrective actions are tracked to closure in the Cooper's incident action tracking system.

Incident investigations are initiated and closed out in a timely manner and learnings associated with incidents and near misses are communicated across the organisation. Cooper will lead an investigation into the cause, effects and learnings of an incident. Where circumstances warrant it, such an investigation will be conducted jointly with the IMR vessel contractor. Following an investigation, Cooper (and the vessel contractor) will develop remedial actions and communicate these to relevant personnel with the aim of preventing a reoccurrence of the incident.

Risk registers and the management system are reviewed following incidents to ensure that controls are in place to prevent recurrence. This may be reinforced at inductions, toolbox meetings and HSEC meetings (as appropriate).

7.2.9 Environmental Performance Monitoring and Reporting

7.2.10 Emissions Monitoring

Cooper will maintain a quantitative record of emissions and discharges for routine non-operational phase activities involving Patricia-Baleen infrastructure. This information will be collated by the OGP operator/ maintainer. For vessel-based IMR activities the Cooper Offshore Site Representative is responsible for collecting this data.

A summary of these results will be reported in the annual EP performance report submitted to NOPSEMA and DEDJTR. Copies of emission and discharge records will be retained in the Cooper document management system.

7.2.11 Operational and Scientific Monitoring Plan

The Cooper Offshore Victoria OSMP contains details regarding the triggers for commencing operational and scientific monitoring, who will conduct the monitoring and what will be monitored. This document supports the Cooper Offshore Victoria Oil Pollution Emergency Plan by:

- Detailing operational monitoring (Type 1) requirements to be implemented in a level 2/3 spill to inform spill response activities; and
- Scientific monitoring (Type II) to quantify the nature of extent, severity and persistence of environmental impacts from a spill event and inform on appropriate remediation activities.

Cooper has engaged scientific support contractors to assist with the implementation of the OSMP.

The Cooper General Manager Operations is responsible for maintaining operational and scientific monitoring capability within Cooper Energy. Roles relating to the implementation of the Offshore Victoria OSMP are contained within the individual implementation plans which support that document.

7.2.12 Audit and Inspection

Vessel Activities: Environmental performance of NOP activities will be audited and reviewed to ensure that environmental performance is being achieved, potential non-compliances and opportunities for continuous improvement are identified; and all environmental monitoring requirements are being met.

The following arrangements will review the environmental performance of vessel-based activities:

- Due-diligence pre-activity inspection/audit of the IMR vessel may be carried out prior to the work commencing (and after contract award) to verify that procedures and equipment for managing routine discharges and emissions are in place (as described in prequalification material) to enable compliance with this Environment Plan;
- Campaign inspections of the vessel by the Cooper Site Representative to verify vessel activities are in compliance with this Environment Plan. Regular inspections using an environmental checklist will be completed during the activity.

A summary of the EP commitments for the activity will be distributed aboard the vessel

Environment Plan Compliance: Independent of these vessel-based inspection/audit activities, Cooper shall undertake an annual compliance audit of the commitment contained in this Environment Plan and assess the effectiveness of the implementation strategy.

Any non-compliance with the environmental performance standards outlined in this EP will be subject to investigation and follow-up action as per 'management of non-conformance' requirements.

The findings and recommendations of inspections and audits will be documented and opportunities for improvement or non-compliances noted will be communicated to all relevant personnel at the time of the audit to ensure adequate time to implement corrective actions. Results from the environmental inspections and audits will be summarised in the annual EP performance report submitted to the DEDJTR and NOPSEMA.

Oil Spill Response Equipment/Service Assurance: Cooper will undertake regular assurance activities on oil spill response support services. This will include:

- For both the OSMP scientific and aviation supplier, an annual audit and review of equipment and processes necessary to implement effective oil spill response. Audit outcomes will be documented and corrective actions monitored in accordance with the Management of Non-conformance Process.
- The Australian Marine Oil Spill Centre (AMOSC) has in place an annual auditing assurance process by member companies which assesses equipment capability/capacity; competencies to support an industry based oil spill response; and readiness to respond to a level 3 industry-based incident.

Audit results are published on the AMOSC website for members to assure themselves of AMOSC's capability, identify any deficiencies which may affect individual response plans and monitor closeout of actions. This is further supported by AMOSC member forums where issues can be raised by individual member companies. Cooper considers that this assurance process is suitable for the Patricia-Baleen NOP spill risk and does not intend to separately audit AMOSC resources.

7.2.13 Management of non-conformance

In response to any EP non-compliances, corrective actions will be issued which specify the remedial action required to fix the breach and prevent its reoccurrence. The corrective action is closed out only when the remedial action has been verified by the appropriate manager and signed off. The status of the corrective action is monitored through the Cooper corrective action tracking system.

Where more immediacy is required during vessel-based IMR activities, non-compliances are communicated to relevant personnel immediately and responded to as soon as possible. The results of these actions are communicated to the offshore crew during daily toolbox meetings and at daily or weekly HSE meetings.

Cooper will carry forward any non-compliance items for consideration in future operations and IMR activities to assist with continuous improvement in environmental management controls and performance outcomes in future operations.

7.2.14 Management Review

Formal review is undertaken on the performance of the HSEC management system by Cooper management to ensure that the system continues to be suitable, adequate effective and is continuously improved. This is undertaken, at a minimum, on an annual basis in accordance with the Management Review Standards.

8 Oil Pollution Emergency Plan

8.1 General

8.1.1 Oil Spill Response Strategies

The Offshore Victoria Oil Pollution Emergency Plan (OPEP) is Cooper's response strategy in the event of a hydrocarbon spill during Patricia-Baleen and Sole-2 NOP activities. The OPEP has been accepted by NOPSEMA and DEDJTR as compliant with the Commonwealth OPGGSER and Victorian Offshore Petroleum and Greenhouse Gas Storage Regulations 2011(OPGGSR).

Cooper has reviewed the oil spill risks, hydrocarbon types and spill impact results which may occur as part of the NOP activities. Oil spill response options have been assessed for their suitability and effectiveness in reducing oil spill impacts to ALARP.

Cooper have utilised a Net Environmental Benefit Assessment (NEBA) methodology to identify the appropriate response strategies for hydrocarbon spill scenarios possible during the NOP activities. A planning NEBA was conducted to determine the spill response strategies considered viable and expected to offer net benefit to sensitivities within the EMBA.

Given the rapid evaporation/volatilisation of hydrocarbons when released, the rapid spreading rate of MDO, and limited potential for shoreline residue impact for any of the spill risks identified, the response strategy would include the following according to the specific scenario:

- Initiate **source control**:
  - For vessels, this includes the implementation of SMPEP actions to reduce the leak;
  - For Patricia-Baleen or Sole-2 well release this may include:
    - An assessment of the leak (including water quality for continuous leaks) and validation monitoring;
    - Engineering assessment of practicable source control options which may include:
      - Vessel-based intervention via a work-class ROV; or
      - Well capping and/or relief well installation.
- **Monitor and evaluate** the spill via aerial and/or marine surveillance and oil spill trajectory modelling (all spill types) and via oil spill tracking buoys (for IMR vessel MDO spills);
- Initiate **protection and deflection** booming within estuaries which may be at risk (for IMR vessel MDO spills);
- Initiate **shoreline assessment and clean-up** (MDO and condensate spills);
- Initiate **oiled wildlife response** where oiled wildlife are observed (MDO and condensate spills); and
- Initiate **scientific monitoring**.

In the event of a spill, an operational NEBA will be undertaken to review and verify the response option and assess for additional factors which may effected the implementation of these options.

8.1.2 Overview of Response Strategy Impact and Risk Assessment

Response strategies which involve marine or vessel-based activities will typically have environmental impacts and risks arising from the activities similar to those already described in Section 6. Where oil spill response includes activities not covered in IMR activities, new equipment or emissions/discharges and additional impacts and risks exist, an assessment has been provided in Table 8-1(below).

Table 8-1: Oil Spill Response Strategy Impact and Risk Assessment

Response Option	Potential Impact/Risk	Assessment of Impact/Risk	Controls	Residual Impact/Risk
Source Control (MODU-based Relief Well Drilling)	**Drill mud and Cuttings Discharges (IMPACT)**: Smothering of marine benthic habitats and seabed sedimentation structure, possible toxicity impacts from water-based mud additives and temporary alteration to water quality (turbidity)	*Cuttings:* Given the prevailing NE/SW current direction an ellipsoidal sediment pattern which extends 1375m (longitudinally) and 550m (axially) from the MODU might be expected assuming no sediment remobilisation. In high-energy environments such as Bass Strait drill cuttings do not accumulate on the sea floor and solids are redistributed by bottom currents soon after deposition (Neff, 2010). Resuspension of drilling sediments has been observed by adjacent operators (Terrens et al. 1998) and benthic habitats rapidly re-establish. Seabed habitats at relief well locations are expected to comprise predominantly of sandy sediments possibly in the presence of the New Zealand screw shell. On this basis seabed sedimentation is expected to be temporary, localised and rapidly recolonised (negligible consequence). *Water-based muds* (WBM) are proposed for relief well activities. Minor quantities of WBM adhere to cuttings discharged overboard and may form a visible plume which extends from the rig in the prevailing current direction. Visible plumes may also be evident when muds are discharged at the end of a well section, however this discharge rapidly disperses and dilutes in the Bass Strait marine environment. In Australia, the plume is typically visible not more than 1 km from the discharge point (Hinwood et al, 1994). As any relief wells will be located at least 22 km from shore, visual amenity impacts at adjacent shorelines are not expected. Plume discharges will be temporary and localised (negligible consequence). WBM chemicals discharged have the potential to impact to marine life. Cooper utilises the UK OCNS system standard to assess the environmental performance of chemicals to ensure high environmental performance chemicals are selected which meet the technical requirements for drilling. Additives assessed as low toxicity, biodegradable and having no bioaccumulation potential are utilised. Given the localised nature of the discharge, impacts to water quality and secondary impacts to marine fauna are assessed as having a negligible consequence.	WBM additives are of OCNS CHARM rating of GOLD or SILVER, a non-CHARM “E”, “D” or PLONOR classification to minimise eco-toxicity impacts Cuttings treatment system is monitored on a full-time basis to maximize system performance	NEGLIGIBLE

Response Option	Potential Impact/Risk	Assessment of Impact/Risk	Controls	Residual Impact/Risk
	Cementing operations and cement residue discharges (IMPACT): Water quality impacts, ingestion of chemical residues by marine species and alteration to seabed sediments	Cement used in the drilling program guarantees well integrity. The conductor is drilled and cemented in place with the cement returns taken to the seafloor. All subsequent casing strings are cemented below the mudline and the cement returns will not be discharged. Cement additives are selected in accordance with the Cooper chemical management standards and have a CHARM rating of Gold or Silver, non-CHARM rating of "D" or "E" or pose little to no risk to the environment (PLONOR). Minor volumes of cement discharged to the seabed during conductor installation may result in localised smothering of benthic fauna and habitat however given its low toxicity and small area affected, impacts are negligible. During drilling operations, small volumes of excess cement (~1.6 m^3) per well section are disposed to the marine environment. Given the low environmental hazard presented by this discharge and the small volume, impacts are considered negligible.	Cement additives are of OCNS CHARM rating of GOLD or SILVER, a non-CHARM "E", "D" or PLONOR classification to minimise eco-toxicity impacts Excess cement at the end of drilling program shall be returned to shore for disposal, provided to next titleholder or disposed downhole during plug and abandon activities	NEGLIGIBLE
Source Control (MODU-based Relief Well Drilling)	**Blowout Preventer (BOP) Hydraulic Fluid Discharge (IMPACT):** Water quality impacts, possible toxicity impacts to marine species	The BOP is regularly function tested. As part of BOP testing, small volumes of hydraulic fluid (generally a water-based glycol mixture) are released to the environment. Approximately 300 to 350 litres of base chemical diluted in water may be discharged to the marine environment during the drilling of a typical well. Chemicals utilised as hydraulic fluids will meet Cooper Energy's chemical selection criteria. Given the intermittent testing of these valves, the low toxicity fluid utilised and the dispersion and dilution which occurs in Bass Strait, and impacts will be localised and temporary (i.e. negligible consequence).	Hydraulic fluid is OCNS CHARM rating of GOLD or SILVER, a non-CHARM "E", "D" or PLONOR classification to minimise eco-toxicity impacts	NEGLIGIBLE

Response Option	Potential Impact/Risk	Assessment of Impact/Risk	Controls	Residual Impact/Risk
	Bunkering spill (RISK): Water quality impacts within the spill EMBA with impacts to marine fauna (including commercial fish) and possible shoreline impacts	MODU operations require fuel bunkering from supply vessels during drilling. All vessel operations within the MODU's PSZ are strictly controlled by the Offshore Installation Manager (OIM) in accordance with the relevant Marine Operations Manual and a Summary of Operational Boundaries (SOOB) matrix. This activity is only undertaken in suitable weather conditions, is fully supervised and utilises equipment which is fit-for-purpose including dry-break couplings. Impacts from spills which may result from bunkering (volume size ~ 15m^3) offshore are expected to be similar to those from an offshore IMR vessel spill (i.e. primarily marine-based with possible minor shoreline residue impacts). On the basis that the Patricia-Baleen and Sole-2 sites are within an intermittent upwelling KEF, utilised by species of conservation significance (cetaceans), the spill is considered to have localised shot-term impacts but not affecting ecosystem functioning (minor consequence). DNV (2011) documented, based upon AMSA data from 1982-2010 for offshore oil and gas facilities, that only one diesel loading spill of volume less than 1 tonne occurred. On the basis of this information, a refuelling spill size of 15m^3 has a frequency of 1 x 10^{-4} per year (unlikely). Accordingly, with controls applied, the residual risk of a refuelling spill is low.	Bunkering activities are fully supervised in accordance with approved procedures as detailed on the Permit-to-Work All transfer equipment are maintained in accordance with the MODU's Planned Maintenance System and inspected prior to use Crews undertake routine drills to ensure they are familiar with response requirements Vessel/MODU SMPEP is implemented in a bunkering spill incident to mitigate impacts. The Cooper OPEP/OSMP is implemented to reduce impacts from the spill.	LOW

Response Option	Potential Impact/Risk	Assessment of Impact/Risk	Controls	Residual Impact/Risk
Source Control (MODU-based Relief Well Drilling)	**Well LOC during relief well drilling (RISK):** Water quality impacts	In drilling a relief well to obtain well control, there is the potential for a well blowout to occur. In the case of the Patricia-Baleen or Sole the blowout will consist of dry gas with no expected liquid hydrocarbon component creating an oil slick. Reservoir modelling of the Patricia-Baleen wells identifies a blowout rate of up to 34MMSCFD (Patricia-2) and 90MMSCFD (Baleen-4) is possible. Section 6.17 provides an assessment of gas releases in shallow water environments. In the event of a blowout impacts would be expected to be localised, however given the continued release over a number of months in an area which contain species of recognised conservation this is assessed at a moderate consequence. DNV (2011) documents frequencies for "loss of well control" incidents associated with the drilling of development wells is estimated at 6.0×10^{-5} per well drilled. This frequency applies to well operations to a North Sea standard comparable to Australia. Accordingly the likelihood of blowout is considered remote and the risk is assessed as low.	Drilling crew is qualified to IWCF Well Control standards, MODU and Cooper competency requirements. Continuous monitoring of mud flow parameters to detect LOC conditions. LWD tools measure formation properties to inform drillers of anomalies. BOP system is installed prior to entering any hydrocarbon-bearing zone. BOP system is routinely tested. Cement testing is undertaken to ensure it will isolate the well from formation. Routine/surprise MODU blowout drills ensure personnel as familiar with response requirements Cooper undertakes a pre-spud ERP/OPEP exercise to test campaign arrangements. ERP and OPEP implemented to manage and mitigate impacts. Cooper Victorian Source Control Plan is implement in well LOC event Operational and scientific monitoring is undertaken in accordance with the Cooper OSMP.	LOW

Response Option	Potential Impact/Risk	Assessment of Impact/Risk	Controls	Residual Impact/Risk
Monitor & Evaluate (Aerial Observation)	Sound interference with marine fauna causing behavioural disruption to whales, pinnipeds and shoreline bird species.	Helicopter operations produce strong underwater sounds for brief periods when the helicopter is directly overhead (Richardson et al., 1995). Sound emitted is typically below 500Hz and sound pressure in the water directly below a helicopter is greatest at the surface but diminishes quickly with depth. Reports for a Bell 214ST (stated to be one of the noisiest) identify that noise is audible in the air for 4 minutes before the helicopter passed over underwater hydrophones. The helicopter was audible underwater for only 38s at 3m depth and 11s at 8m depth (Green 1985a; cited in Richardson et al, 1995). Sound levels from helicopters are not expected to cause physical damage to marine fauna, however temporary behavioural changes (avoidance) in species (cetaceans, turtles, fish) may be observed. The behavioural reaction of cetaceans to circling aircraft (fixed wing or helicopter) is sometimes conspicuous if the aircraft is below an altitude of 300m, uncommon at 460m and generally undetectable at 600m (NMFS, 2001; cited in Santos 2004; Richardson et al, 1995). Baleen whales sometimes dive or turn away during over-flights, but sensitivity seems to vary depending on the animal's activity. The effect on whales seems transient, and occasional over-flights probably have no long-term consequences (NMFS, 2001; cited in Santos, 2004). Richardson et al. (1995) identifies for Californian sea lions (an Octariid similar to fur seals) the following behaviours to flight sound: • Jets above an altitude of 305 m produced no reaction and below that height caused limited movement but no major reaction; • Light aircraft directly overhead at altitudes of < 150-180 m elicited alert reactions and in sea lions movement; • Helicopters above 305 m usually caused no observable response while those below caused the pinnipeds to raise their heads, often causing some movement and occasionally caused rushes by some animals into the water. Aircraft for safety reasons do not fly low enough to disturb nesting fauna (e.g. birds) (negligible consequence). Aerial surveillance platforms will operate at between 300 – 500 m altitudes when undertaking observation activities (AMSA, 2003). In accordance with the EPBC Regulations (Part 8) a fixed wing aircraft will maintain a buffer of 300 m from a cetacean and a helicopter will maintain 500m from a cetacean. Noise produced by surveillance aircraft is localised and temporary as the platform is in constant movement. On this basis impact to cetaceans, pinnipeds or shoreline bird species is expected to be temporary, localised and recoverable (negligible consequence)	Surveillance aircraft will ensure buffer distances of 500m (helicopters) and 300m (fixed wing) are maintained in accordance with EPBC Regulations 2000 (Part 8) to whales and dolphins.	NEGLIGIBLE

Response Option	Potential Impact/Risk	Assessment of Impact/Risk	Controls	Residual Impact/Risk
Protect & Deflect (Shoreline Boom & Oil Collection Facilities)	Loss of vegetation and impacts to associated fauna habitats and possible aboriginal heritage while deploying boom (IMPACT)	A preliminary assessment of net benefits of this strategy and the positioning of the boom system has been based upon available knowledge, observed flow characteristics in the estuary and use of the Victorian OSRA which details submerged and shoreline sensitivities. The estuary system is a heritage river and provides important habitat for a range of flora and fauna species (including migratory and threatened birds listed under the Commonwealth EPBC Act 1999 and the Victorian Flora and Fauna Guarantee Act 1988. Seagrass beds are also present and are important nursery habitats for estuarine fish species serving a popular recreational fishery in the lower Snowy River. Areas of Littoral Rainforest are also present within the foreshore close to Marlo township. The shorelines of the Snowy River are also areas of aboriginal cultural heritage sensitivity (East Gippsland Shire, 2014). At the time of any spill which threatens the Snowy River estuary, an operational NEBA will be undertaken with DEDJTR to determine if there is a net benefit in undertaking boom deployment in the Snowy River mouth considering all local knowledge on environmental and social sensitivities. Relevant activity controls to prevent disturbance to known environmental and social disturbance are identified.	*Use of Existing Tracks and Pathways*- Access outside of existing tracks and pathways in determined in consultation with DEDJTR EMD.	NEGLIGIBLE
	Restricting access to the area for recreational activities (IMPACT)		*Land and Waterway Manager Consultation* - In conjunction with DEDJTR, consultation is undertaken with land and waterway manager prior to deployment of equipment to establish recreational user controls.	NEGLIGIBLE
	Oil spill from waste handling (RISK)		*Waste Facility Operation* - Waste storage tanks and hoses are within a contained, impervious area where possible in a shallow trench/pit. Spill kits available at oil recovery area. Area is under supervision and secured from public access. *Waste Disposal* - Collected waste is disposed in accordance with Victorian EPA waste disposal requirements *Spills Reported* - Spills from water-handling facilities are reported to Cooper and other external reporting requirements	LOW

Response Option	Potential Impact/Risk	Assessment of Impact/Risk	Controls	Residual Impact/Risk
Shoreline Assessment & Clean-up	Impacts to native vegetation, aboriginal cultural heritage and fauna habitats due to personnel access (IMPACT).	The noise and general disturbance created by shoreline clean-up activities are likely to disturb the feeding, breeding, nesting or resting activities of resident and migratory fauna species present (such as hooded plovers). For example, the eggs of hooded plovers are small and well camouflaged, so they are easily damaged. If the incubating adult is scared away from the nest, the eggs may overheat/become too cold with no subsequent hatching. Similarly, if a chick is disturbed, it quickly runs into the sand dunes and hides using up valuable energy and while hiding it is unable to feed and can easily starve (Birdlife Australia, 2017). Any erosion caused by responder access to sandy beaches, or the removal of sand, may also bury nests. In isolated instances, this is unlikely to have impacts at the population level and with controls adopted is likely to have a negligible consequence. The movement of people through backshore and dune areas may disturb cultural heritage artefacts. The most likely artefacts present are Aboriginal shell middens, especially where freshwater and brackish water sources occur nearby, such as the Snowy River estuary. Disturbance or damage to such sites will be minimised by ensuring shoreline access is undertaken via established pathways (negligible consequence). The presence of stranded oil and clean-up operations may necessitate temporary beach closures (possibly weeks). This means recreational activities (such as swimming, walking, fishing, boating) in affected areas will be excluded until access is again granted by local authorities. Given the prevalence of sandy shorelines in the EMBA, the small areas affected may in-turn affect tourism for a short period of time (negligible consequence). Prior to any shoreline activity, a NEBA will be undertaken to determine if there is a net benefit of undertaking shoreline assessment, and if oil is present on the shorelines, shoreline clean-up. Given the recognised sensitivities of East Gippsland coastlines (protected and nesting shoreline birds, tourism areas, aboriginal cultural heritage), relevant activity controls to prevent disturbance to known environmental and social disturbance are identified.	*Use of Existing Tracks and Pathways- Personnel* - Access to shoreline is via established tracks. Access outside of existing tracks and pathways in determined in consultation with DEDJTR EMD. Along shorelines, activity will keep to the inter-tidal zone as far as possible. *Fauna Handling* Only DELWP trained oiled wildlife officers will approach and handle fauna.	NEGLIGIBLE
	Recreational user restriction to beach during clean-up activity (IMPACT)		*Land Manager Consultation* In conjunction with DEDJTR, consultation undertaken with shoreline land manager if clean-up activities is required	NEGLIGIBLE
	Spread of contamination due to poor secondary contamination management (RISK).		*Waste Facility Operation* - Waste storage is located within a contained, impervious area. Area is under supervision and secured from the public. *Waste Disposal* - Oiled waste is disposed in accordance with EPA waste disposal requirements. *Decontamination Points*- All access points (personnel and equipment) will be controlled via designated access points through decontamination facilities. *Contamination Spread Reported* - Incidents of contamination outside the 'hot-zone' are reported to Cooper and to external reporting requirements.	LOW

Response Option	Potential Impact/Risk	Assessment of Impact/Risk	Controls	Residual Impact/Risk
Oiled Wildlife Response	Inappropriate handling may lead to disturbance, injury or death of fauna (RISK)	Untrained resources capturing and handling native fauna may cause distress, injury and death of the fauna. To prevent these impacts only DELWP trained oiled wildlife responders will approach or handle any fauna. This will eliminate any handling impacts to fauna from Cooper personnel and reduce the potential for distress, injury or death of a species (low residual risk).	*Cooper Inductions* Wildlife is only approached or handled by DELWP trained oiled wildlife responders. Cooper personnel are advised of wildlife interaction restrictions through site safety inductions.	LOW

8.2 Oil Spill Response Arrangements

Cooper has the following oil spill response arrangements in place:

- Associate membership (standing agreement and service contract) with the Australian Marine Oil Spill Centre (AMOSC) for the supply of experienced personnel, equipment and oil spill trajectory modelling services;
- Memorandum of Understanding with the Australian Maritime Safety Authority (AMSA) as managers of the National Plan for Maritime Environmental Emergencies, will support and supply Cooper with response equipment from national stockpiles and trained personnel;
- A service agreement to provide specialist resources for scientific monitoring, analytical services, scientific monitoring vessels and sampling equipment;
- Contract pre-qualification with an aviation supplier for provision of surveillance aircraft and pilots; and
- Contract with a vessel contractor for marine vessel support during an oil spill.

Source control arrangements for well incidents include an agreement with well control specialists (including capping stack capability), well engineering company, casing material suppliers and the APPEA Mutual Assistance Agreement for rig provision.

8.3 Preparedness

8.3.1 Emergency Response

Patricia-Baleen and Sole-2 NOP activities operate under a Cooper Victorian Emergency Management Plan (VEMP) to ensure timely response and effective management of any emergency. This includes environmental incidents and any incidents arising as a result of a hydrocarbon spill. For hydrocarbon spills, the response is managed by the Cooper Offshore Victoria OPEP.

During IMR activities, general vessel emergencies are handled under the contract vessel's Emergency Response Procedures which are supported by the contractor vessel's Shore-side Emergency Management System. The Cooper Emergency Management Team (EMT) provides shore-side support to the contract vessel as necessary in the event of an emergency. This information is detailed in the project-specific interface documentation for IMR activities.

Vessel activities will also operate under the vessel's SMPEP (as appropriate) or approved spill clean-up procedures/equipment by qualified personnel to ensure timely response and effective management of any vessel-sourced oil spills. The SMPEP (or equivalent appropriate to class) is routinely tested with exercise drills are conducted regularly. The SMPEP is designed to ensure a rapid and appropriate response to any oil spill and provides guidance on practical information that is required to undertake an effective response; and reporting procedures in the event of a spill.

8.3.2 Training

Key Cooper and vessel positions to initiate and manage spill response are identified within the Cooper Offshore Victoria OPEP. Cooper position descriptions identify responsibilities for maintaining oil spill response capability and preparedness. Persons fulfilling Cooper's operational/emergency roles which outline the necessary qualifications required to undertake the role.

All contractors engaged on Patricia-Baleen and Sole-2 NOP activities have equivalent resource management systems to ensure equivalent levels of personnel competency and training as required.

All IMR vessel personnel have full inductions into the NOP Environment Plan and OPEP requirements prior to the commencement of vessel activities.

8.4 Testing of Response Arrangements

To ensure readiness oil spill response exercises are conducted in accordance with the exercise schedule contained in the Patricia-Baleen NOP Environment Plan. Testing is undertaken when arrangements are first introduced, prior to the commencement of an IMR campaign, when the oil spill response arrangements are significantly altered or at least, on an annual basis.

Arrangements for testing response arrangements include:

- Defined test objectives;
- Measurable performance outcomes for each of the test objectives and the performance standards to be achieved; and
- Mechanisms to identify, address, document and track to completion corrective actions arising from response exercises.

Where changes are required to the OPEP resulting from exercise outcomes the Cooper General Manager Operations is responsible for ensuring changes are assessed against the Commonwealth OPGGSER and Victorian OPGGSR regulatory revision criteria and where necessary, the OPEP is revised and submitted to NOPSEMA and/or DEDJTR as a formal revision.

9 Consultation

Cooper has consulted with stakeholders in the preparation of the Patricia-Baleen NOP Environment Plan. Cooper has contacted stakeholders known through existing Cooper Gippsland stakeholder registers, the prior titleholder's consultation records, review of Commonwealth and State fishing information and other identified contacts to establish working relationships with stakeholders that have functions, interest or activities in the Patricia-Baleen and Sole-2 areas.

9.1 Stakeholders

Table 9-1 provides details of the relevant stakeholders contacted in the preparation of this EP Revision.

Table 9-1: Relevant Stakeholders

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 Fisheries Management Authority (AFMA)
Australian Maritime Safety Authority (AMSA)	Department of Innovation, Industry and Science (DIIS)
Maritime Border Command (MBC)	Department of Defence (DoD)
National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA)	Australian Hydrological Service (AHS)
Department of Agriculture and Water Resources (DAWR)	
Each Department or agency of a State or the Northern Territory to which the activities to be carried out under the EP may be relevant	
DEDJTR – Earth Resources Regulation (ERR)	DEDJTR – Fisheries Victoria
Transport Safety Victoria (Maritime Safety)	
The Department of the responsible State Minister, or the responsible Northern Territory Minister	
DEDJTR – Earth Resources Regulation (ERR)	
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	South-east Fishing Trawl Industry Association (SETFIA)
Seafood Industry Victoria (SIV)	Lakes Entrance Fisherman's Cooperative Limited (LEFCOL)
Victorian Scallop Fisherman's Association (VSFA)	Sustainable Shark Fishing Inc. (SSF)
Victorian Abalone Divers Association (VADA)	Victorian Abalone Processors Association
Eastern Victoria Sea Urchin Divers Association (EVUDA)	Victorian Bays & Inlets Fisheries Association
Eastern Zone Abalone Industry Association (AVEZ)	San Remo Fishing Cooperative (SRFC)
Central Zone Abalone Industry Association (AVCZ)	Southern Shark Industry Alliance
Victorian Recreational Fishers Association (VRFish)	Eastern Victorian Rock Lobster Industry Association
Port Franklin Fishermen's Association	
Oil Spill preparedness and response agencies:	
Australian Marine Oil Spill Centre (AMOSC)	DEDJTR – Emergency Management Division (EMD)
Department of Environment, Land, Water and Planning (DELWP)	Bairnsdale Air Charter

Department or agency of the Commonwealth to which the activities to be carried out under the EP may be relevant	
GHD (Scientific Resources)	Comchart Marine (Oil Spill Marine Support)
Nearby Titleholders:	
Esso Australia Resources Pty Ltd	Seven Group Holdings
Bass Strait Oil Company Limited	Oils Basins Limited
Local Government	
East Gippsland Shire Council	
Any other person or organisation that the Titleholder considers relevant	
Community interests:	
Victorian Recreational Fishers Association	Victorian Fishery Association into resource management
East Gippsland Estuarine Fishermen's Association	Victorian Fish & Food marketing Association

9.2 Consultation (Environment Plan Collation)

Stakeholders identified in Table 9-1 were engaged during the collation of this Environment Plan. Stakeholders were contacted directly by phone as an introductory activity to confirm stakeholder relevance to the asset, activities and interests in relation to the Patricia-Baleen and Sole-2 activities; to identify further opportunities for engagement; and confirm contact details were correct for the delivery of future correspondence. A letter formally introducing Cooper, the acquisition of the Patricia-Baleen asset, a brief description of the assets and Cooper contact details was sent by email in December 2016.

No concerns or objections have been raised with regard to Patricia-Baleen and Sole-2 asset activities. Cooper believes that the low rate of feedback (i.e., replies to initial and follow up emails and return phone calls) and the low level of concern from stakeholders expressed to date is due to the fact that the asset has been in existence for a number of years without any major incidents; and stakeholders have a level of familiarity with Cooper through stakeholder interaction undertaken for the BMG field.

For those stakeholders which responded, the key theme emerging was that Cooper maintains ongoing engagement and conversation on future activities (Fishing Associations); continued review of changes to fishing which may present an increased risk to Patricia-Baleen and Sole-2 assets (SETFIA) and ensuring that Cooper has an awareness of the abalone fishery when undertaking activities (abalone associations).

A stakeholder consultation summary undertaken to date, together with Cooper's responses and assessment of merits and feedback is included in Table 9-2. This table focuses on stakeholders who have been identified as 'relevant persons' whose functions, interests or actives may be affected by the assets' operations. It also includes key stakeholders with whom engagement has taken place to enable Cooper to determine whether they are 'relevant persons' for the NOP activity.

Table 9-2: Consultation Summary, Assessment of Merits and Titleholder Response

Stakeholder	Relevance to Activity	Information provided (Date, Method, Record, Number)	Summary of Response	Assessment of Merits to Adverse Claim / Objection	Operators Response to each Claim / Objection
Australian Fisheries Management Authority	Management of Commonwealth Commercial Fisheries from 3nm to 200nm (EEZ) Interests: New Facilities/expanded footprint which may impact commercial fishery access to seabed areas	2017.01.16 Email – Letter COE provided information associated with the Patricia-Baleen Environment Plan, changes in titleholder and requested feedback.	No Response to email dated 2017.01.16	Not Applicable	Not Applicable
Commonwealth Fisheries Association	Peak Group for Commonwealth Fisheries Interests: Increased footprint of activities Activity notifications	2017.01.16 Email – Letter COE provided information associated with the Patricia-Baleen Environment Plan, changes in titleholder and requested feedback.	No Response to email dated 2017.01.16	Not Applicable	Not Applicable
Lakes Entrance Fishing Cooperative	Fish Processing Cooperative for fish caught in Bass Strait (PB Area) Interests: Change in operation New activities or increased footprint Fishing Damages Process	2016.12.28 Email – Letter COE provided information associated with the Patricia-Baleen Environment Plan, changes in titleholder and requested feedback.	No Response to email dated 2016.12.28	Not Applicable	Not Applicable
Seafood Industry Victoria	Peak Industry Body for Victorian seafood and fisheries Interests: Increased footprint of activities Activity notifications	2016.12.28 Email – Letter COE provided information associated with the Patricia-Baleen Environment Plan, changes in titleholder and requested feedback.	No Response to email dated 2016.12.28	Not Applicable	Not Applicable

Stakeholder	Relevance to Activity	Information provided (Date, Method, Record, Number)	Summary of Response	Assessment of Merits to Adverse Claim / Objection	Operators Response to each Claim / Objection
San Remo Fishing Cooperative	Fish Processing Cooperative for fish caught in Bass Strait (BMG Area) from Vessels based in San Remo Interests: Increased footprint of activities Activity notifications	2016.12.28 Email – Letter COE provided information associated with the Patricia-Baleen Environment Plan, changes in titleholder and requested feedback.	No Response to email dated 2016.12.28	Not Applicable	Not Applicable
Sustainable Shark Fishing Inc.	Peak Group for Victorian Seafood - Shark fishing Interests: Increased footprint of activities Activity notifications	2016.12.28 Email – Letter COE provided information associated with the Patricia-Baleen Environment Plan, changes in titleholder and requested feedback.	No Response to email dated 2016.12.28	Not Applicable	Not Applicable
Australian Hydrographic Office	Commonwealth Agency responsible for Hydrographic Services such as Notice to Mariners Details of infrastructure placed on Navigation Charts Charting and Information Management	2017.01.16 Email – Letter COE provided information associated with the Patricia-Baleen Environment Plan, changes in titleholder and requested feedback.	No Response to email dated 2017.01.16	No objection to advice obtained.	AHO have previously advised an updated email address, this information is incorporated into the including stakeholder engagement register and OPEP addendum Contacts directory (VIC-ER-EMP-0020).
		2017.05.19 Email - Request to update Navigation Charts - Sole-2 Suspended Well 2017.05.22 Email – additional details as request provided	2017.05.22 Email – from Nautical Assessment Officer request for additional details. 2017.05.22 Email – thanks for information	No objection to advice obtained.	Not Applicable

Stakeholder	Relevance to Activity	Information provided (Date, Method, Record, Number)	Summary of Response	Assessment of Merits to Adverse Claim / Objection	Operators Response to each Claim / Objection
Department of Defence		2017.01.16 Email – Letter COE provided information associated with the Patricia-Baleen Environment Plan, changes in titleholder and requested feedback. Also COE sought feedback associated with any hazards or notifications which need to be adopted into activity management plans for inspection activities relating to the Patricia Baleen and Sole-2 locations. 2017.02.07 Follow-up email sent	No Response to email dated 2017.01.16 No Response to email dated 2017.02.07	Not Applicable	Not Applicable
Marine Border Command	Integrated defence/customs organisation which provides security for offshore marine areas	2017.02.06 Email – Letter COE provided information associated with PB Environment Plan 5 year revision and requested feedback.	2017.02.06 Email response received no comments automatically generated reply from the Department of Immigration and Border Protection including advice of superseded email addresses.	No objection to advice obtained.	Currency of Stakeholder engagement register verified.
Victorian Abalone Divers Association (VADA)		2016.12.20 Phone call - contact details check, Mr Buck advised postal correspondence was preferred. 2016.12.28 Mailed – Letter COE provided information associated with the Patricia-Baleen Environment Plan, changes in titleholder and requested feedback	No Response or feedback received to letter posted dated 2016.12.28	Not Applicable	Not Applicable
South-East Trawl Fishing Industry Association	Peak Industry Group for Trawl Fishermen in the SE Region Interests: Activity Notifications	COE has been liaising with SETFIA since mid-2012 with respect to Stakeholder Engagement mechanisms established for the BMG field asset, ongoing initiatives have developed between COE and SETFIA since.			

Stakeholder	Relevance to Activity	Information provided (Date, Method, Record, Number)	Summary of Response	Assessment of Merits to Adverse Claim / Objection	Operators Response to each Claim / Objection
	Change in Operation New activities or increased footprint Fishing Damages	2016.12.28 Email – Letter COE provided information associated with the Patricia-Baleen Environment Plan, changes in titleholder and requested feedback.	2017.02.07 Email - J Hinks seeking phone conversation to organise quarterly BMG Fishery risk review and discussion to include Patricia-Baleen asset.	No objection to request or advice obtained.	Not Applicable
			2017.02.08 Email calendar invite for phone conversation between SETFIA (S Boag) and COE (J Hinks) 2017.02.08 Phone conversation between SETFIA (S Boag) and COE (J Hinks) included; Agenda items for upcoming formal meeting 2018 Fishing Industry Survey (FIS) – SETFIA to provide map of survey sites, schedule and duration impacts on any scheduled activities. Patricia – Baleen Asset fishery risk review.	No objection to request or advice obtained.	Not Applicable

Stakeholder	Relevance to Activity	Information provided (Date, Method, Record, Number)	Summary of Response	Assessment of Merits to Adverse Claim / Objection	Operators Response to each Claim / Objection
			2017.02.22 Email calendar invite for formal meeting to be held on 2017.03.01 between COE, Upstream P.S and SETFIA representatives. 2017.03.01 Cancelled scheduled meeting by S Boag due to availability of all attendees. Meeting to be reschedule, mid-March 2017.	No objection to invitation request. Await reschedule of Meeting – March 2017	2017.03.01 Meeting scheduled – Phone conference call attendees COE, SETFIA and UPS representatives.
			2017.04.10 Meeting between Coe, Upstream P.S and SETFIA representatives	No Objections to invitation request	
East Gippsland Estuarine Fishermen's Association	Scalefish	2016.12.20 Phone call - contact details check, email updated, confirmed affiliation to LEFCOL for correspondence, but would like to remain on stakeholder listing. 2016.12.28 Emailed – Letter COE provided information associated with the Patricia-Baleen Environment Plan, changes in titleholder and requested feedback	2016.12.20 Phone call, advised not activity fishing, however still main contact for EGEFA, Has ties to LEFCOL and received correspondence through this mechanism. 2012.12.28 Email acknowledgement for letter correspondence."	No objection to advice obtained, LEFCOL have been on the COE Stakeholder register for other assets, acknowledge coverage of members noted.	
Eastern Victorian Rock Lobster Industry Association	Rock Lobster Interests: Sound impacts to Lobsters Interference with fishing equipment deployed.	2016.12.20 Phone call - contact details check, unable to connect. 2016.12.28 Emailed – Letter COE provided information associated with the Patricia-Baleen Environment Plan, changes in titleholder and requested feedback	No Response to email dated 2016.12.28	Not Applicable	Not Applicable

Stakeholder	Relevance to Activity	Information provided (Date, Method, Record, Number)	Summary of Response	Assessment of Merits to Adverse Claim / Objection	Operators Response to each Claim / Objection
Eastern Zone Abalone Industry Association (AVEZ)	Industry Association for Victorian fishery with operations in East Gippsland	2016.12.20 Phone call - in the middle of a function, asked for COE to call back on 2016.12.21 in morning. 2016.12.21 Phone Call - Geoff Ellis supplied contact details. Provided information about other existing Abalone associations, Central and Western Zones. 2016.12.21 Email – asking Geoff for contact details of the Western and Central Abalone association contacts. 2016.12.28 Emailed – Letter COE provided information associated with the Patricia-Baleen Environment Plan, changes in titleholder and requested feedback	2016.12.21 Email – from Geoff Ellis providing Central and Western Abalone contacts & email addresses.	No objection to additional information, COE welcome stakeholder knowledge and assistance to ensure good coverage.	COE Stakeholder register updated with additional Abalone associations.
Eastern Victoria Sea urchin Divers Association	Industry Association for Victorian fishery with operations in East Gippsland	2016.12.20 Phone call - contact details check, in the middle of a function, asked for COE to call back on 2016.12.21 in morning. 2016.12.21 Phone Call - Geoff Ellis supplied contact details. 2016.12.28 Emailed – Letter COE provided information associated with the Patricia-Baleen Environment Plan, changes in titleholder and requested feedback			
Port Franklin Fishermen's Association	Industry Association for Victorian fishery with operations in the Gippsland Basin	2016.12.20 Phone call - contact details check, unable to connect. 2016.12.28 Emailed – Letter COE provided information associated with the Patricia-Baleen Environment Plan, changes in titleholder and requested feedback	No Response to email dated 2016.12.28	Not Applicable	Not Applicable

Stakeholder	Relevance to Activity	Information provided (Date, Method, Record, Number)	Summary of Response	Assessment of Merits to Adverse Claim / Objection	Operators Response to each Claim / Objection
Victorian Abalone Processors Association	Processing facility for Victorian fishery with operations in East Gippsland	2016.12.20 Phone call - contact details check, unable to connect. 2016.12.28 Emailed – Letter COE provided information associated with the Patricia-Baleen Environment Plan, changes in titleholder and requested feedback	No Response to email dated 2016.12.28	Not Applicable	Not Applicable
Victorian Fishery Association into Resource Management	Shark, Scalefish, Bait	2016.12.20 Phone call - contact details check, unable to connect. 2016.12.28 Emailed – Letter COE provided information associated with the Patricia-Baleen Environment Plan, changes in titleholder and requested feedback	No Response to email dated 2016.12.28	Not Applicable	Not Applicable
Victorian Fish & Food marketing Association	Wholesale	2016.12.28 Emailed – Letter COE provided information associated with the Patricia-Baleen Environment Plan, changes in titleholder and requested feedback	No Response to email dated 2016.12.28	Not Applicable	Not Applicable
Victorian Trout Association	Trout	2016.12.28 Emailed – Letter COE provided information associated with the Patricia-Baleen Environment Plan, changes in titleholder and requested feedback	No Response to email dated 2016.12.28	Not Applicable	Not Applicable

Stakeholder	Relevance to Activity	Information provided (Date, Method, Record, Number)	Summary of Response	Assessment of Merits to Adverse Claim / Objection	Operators Response to each Claim / Objection
Central Zone Abalone Industry Association (AVCZ)	Central Zone - largest zone in Victoria (Lake Entrance to Hopkins Rr (Warrnambool) Harvesting is inshore along the coastline and extends no further than 8kms off the coastline.	2016.12.22 Email - to AVCZ to obtain contact phone number and contact details, for information on the AVCZ. 2016.12.28 Emailed – Letter COE provided information associated with the Patricia-Baleen Environment Plan, changes in titleholder and requested feedback	2016.12.23 Phone call from Malcom Petrie, provided contact details and a summary of AVCZ activities; Central Zone being largest zone, spanning from Lakes Entrance to Hopkins Rr (Warrnambool) Approx. 20 active divers at any one time. The season is continuous. Abalone Harvesting is inshore along the coastline and extends no further than 8kms.	No further response received. Not Applicable.	Not Applicable
Victorian Scallop Fisherman's Association	Scallops Interests: cautious about sound impacts - seismic activity	2016.12.29 Emailed – Letter COE provided information associated with the Patricia-Baleen Environment Plan, changes in titleholder and requested feedback	No Response to email dated 2016.12.29	Not Applicable	Not Applicable
Victorian Abalone Council	Abalone	2016.12.20 Phone call - contact details check.	2016.12.20 phone - Sue Adcock advised the Victorian Abalone Council has dissolved and therefore can be removed from the list	No objection to advice obtained	Remove Victorian Abalone Council from the live COE Stakeholder register.

Stakeholder	Relevance to Activity	Information provided (Date, Method, Record, Number)	Summary of Response	Assessment of Merits to Adverse Claim / Objection	Operators Response to each Claim / Objection
Victorian Bays & Inlets Fisheries Association	Scalefish, Bait	2016.12.20 Phone call - contact details check, Gary Lenard stakeholder request to be removed from list as receives information and correspondence from LEFCOL and SIV	2016.12.20 Phone conversation Gary advised LEFCOL and SIV provide him with adequate correspondence and information, therefore Gary does not require direct correspondence sent to him for this purpose. Not a marine user, inland only.	No objection to advice obtained, LEFCOL and SIV have been on the COE Stakeholder register for other assets and good coverage to members are acknowledged and known.	Remove Victorian Bays & Inlets Fisheries Association from the live Stakeholder register.
Southern Shark Industry Alliance	Peak Group for Gummy Shark fishing southern Australia	2016.12.29 Email to contact page to obtain contact details for purpose of stakeholder engagement	No Response to email dated 2016.12.29	Not Applicable	Not Applicable
Victorian Recreational Fishers Association (VRFish)	Peak industry body for Victorian seafood and fisheries	2016.12.28 Emailed – Letter COE provided information associated with the Patricia-Baleen Environment Plan, changes in titleholder and requested feedback	No Response to email dated 2016.12.28	Not Applicable	Not Applicable
Australian Maritime Safety Authority	Safety Regulator for Marine Safety and Vessel-based Oil Spill Response in Commonwealth Waters Impacts on Shipping Routes & Navigation Warnings Marine Pollution Controller in Commonwealth Waters for Vessels	2016.12.23 Email – Letter COE provided information associated with the Patricia-Baleen Environment Plan, changes in titleholder and requested feedback. Also COE sort feedback associated with the potential for encounter of third party vessels during survey activities and advice on the precautions which COE needs to undertake to prevent third party vessel interference and to preserve safety. 2017.01.16 Follow-up email sent to AMSA seeking feedback to email of 2017.12.23	2017.01.16 Received a phone call from Nathan Johnson AMSA, Border Force Control (JRCC) an email received shortly after outlines basis of discussion (see PBEP-R012).	No objection to advice obtained	COE to ensure feedback is incorporated into Patricia-Baleen EP (Section 7.10)

Stakeholder	Relevance to Activity	Information provided (Date, Method, Record, Number)	Summary of Response	Assessment of Merits to Adverse Claim / Objection	Operators Response to each Claim / Objection
		2017.01.25 Email – COE sought an MOU with AMSA for specific spill response arrangements relating to the Patricia-Baleen asset.	2017.02.07 Email correspondence from David Imhoff, AMSA with agreement to sign.	No objection to advice obtained 2017.02.22 COE signed the MOU agreement with AMSA	2017.03.14 MOU Endorsed by AMSA and COE
Bairnsdale Air Charter	Aviation support	Cooper will undertake pre-qualification of Bairnsdale Air Charter to allow for charter during any oil spill response operational monitoring activities. Bairnsdale Air Charter has 3 x Cessna 337 aircraft to be utilised for this activity.	2017.02.23 Email - Confirmation Bairnsdale Air Charter can support COE, in the event of an oil/condensate spill offshore Gippsland or Otway.	No response received COE to follow-up a response	
Comchart Marine Pty Ltd (Bass Trek & Bass Explorer & Bass Rover)	Vessel Services	COE is seeking to formalise a Marine Charter Agreement directly with Comchart Marine going forward with respect to Oil Spill Response. 2017.02.22 Email – Arrangements to utilise the Bass Trek based upon a Supplytime 89 arrangement.	2017.02.22 Email - Confirmation Comchart is willing to support COE, by way of a Marine Charter Agreement similar to that in place with Santos	No Issues with comments provided.	COE to progress a Supplytime 89 Agreement with Comchart Marine Pty Ltd
AMOSC	Oil Spill Response Organisation Review and comment on COE Offshore Victorian Oil Pollution Emergency Plan (OPEP) reviewer	COE has been liaising with AMOSC since mid-2012 with respect to Oil Spill Response. COE maintains an Associate Membership with AMOSC			
		2017.02.08 Email – Review of the COE Offshore Victorian OPEP for the Patricia –Baleen EP.	2017.02.16 Email AMOSC provided minor feedback on Offshore Victorian OPEP. COE updated this OPEP in accordance with the feedback to allow for final review.	Comments received from AMOSC deemed valid and applicable to the Patricia –Baleen field	2017.03.01 All comments incorporated into the OPEP, for finalisation before submission to NOPSEMA

Stakeholder	Relevance to Activity	Information provided (Date, Method, Record, Number)	Summary of Response	Assessment of Merits to Adverse Claim / Objection	Operators Response to each Claim / Objection
		2017.03.01 Email - Final revision of the Offshore Victorian OPEP sent to AMOSC with comments of 16/2/2017 recognised.	2017.03.07 Email AMOSC response indicating AMOSC role responsibilities are accurately reflected within the OPEP	No Issues with comments provided.	Not Applicable
GHD	Scientific Monitoring Body Principal Consultant - COE by agreement for Cooper Energy - Offshore Victoria Operational & Scientific Monitoring Plan (OSMP) (VIC-ER-EMP-0002) and OSMP Addendum – Implementation Strategy (VIC-ER-EMP-0003)	The overarching operational & scientific monitoring plan (OSMP) has been updated to include Patricia -Baleen activity. Individual study implementation plans - GHD has provided updated drawings which accommodate Patricia -Baleen activities GHD provided correct details for the OSMP Addendum – Implementation Strategy			
		2017.02.24 Email - COE confirm with GHD to act as Principal Investigator for OSMP modules and provide necessary staff and resources to implement the modules for the COE Offshore Victoria Operational & Scientific Monitoring Program.	2017.02.24 Email – Confirmation GHD is willing to support Cooper Energy Limited's Offshore Victoria OSMP modules for operations in western Bass Strait and offshore from Gippsland. In the event that the program requires implementation GHD will provide the necessary staff and resources to implement the modules.	No Issues with comments provided.	2017.02.27 COE ensure GHD as PI is incorporated into Patricia -Baleen EP, Offshore Victoria OPEP & OSMP and subsidiary documents.

Stakeholder	Relevance to Activity	Information provided (Date, Method, Record, Number)	Summary of Response	Assessment of Merits to Adverse Claim / Objection	Operators Response to each Claim / Objection
DEDJTR Earth Resources Regulation (ERR)	Department of Economic Development, Jobs, Transport and Resources (Victorian Joint Authority for Offshore Victorian Developments) Regulator offshore to 3mn Victorian coastal Waters	2016.11.22 Meeting – COE requested a meeting with DEDJTR representatives by way of introduction of the offshore asset acquisition, changes in titleholder and guidance for approval of Operator and Titleholder acceptance.	Acceptable attendance at meeting	No Issues with comments provided.	Not Applicable
DEDJTR Emergency Management Division (EMD)	Department of Economic Development, Jobs, Transport and Resources (Control Agency for Level 2/3 spills in Victorian waters) Regulator offshore to 3mn Victorian coastal Waters	2017.02.08 Email – to Environment & Scientific Coordinator, Marine Pollution Emergency Management Division for review of the COE Offshore Victorian OPEP for the Patricia –Baleen EP.	2017.02.22 Email - EMD provided minor feedback on Offshore Victorian OPEP. COE updated this OPEP in accordance with the feedback to allow for final review. Note DEDJTR EMD will also review oil spill response arrangements as part of the Victorian regulator review of the Patricia-Baleen EP (for Victorian waters section).	Comments received from EMD deemed valid and applicable to the Patricia –Baleen field	2017.03.01 All comments incorporated into the OPEP. Thanked DEDJTR for the current information. Final revision of the Offshore Victorian OPEP sent to AMOSC with comments for finalisation before submission to NOPSEMA
		2017.02.13 COE Email request to clarify ownership of booms located at Gippsland Ports in Lakes Entrance, and Port Authority arrangements. Also seeking clarification of DELWP contact for oiled Wildlife response 2017.02.15 DEDJTR EMD response to queries.	DEDJTR EMD confirmed that booms at Lakes Entrance are owned by the State and would make equipment available on request. Gippsland Ports would provide first response in the Snowy River and happy for COE to discuss with Gippsland Ports. DELWP contact is Rodney Vile.	All information utilised in oil spill planning and within OPEP. No adverse claims or objections made.	Not applicable. COE to contact Gippsland Ports to clarify arrangements.

Stakeholder	Relevance to Activity	Information provided (Date, Method, Record, Number)	Summary of Response	Assessment of Merits to Adverse Claim / Objection	Operators Response to each Claim / Objection
Department of Environment, Land Water and Planning (DELWP)	Pipeline Regulation, Regulation and Approvals Energy, Environment and Climate Change Group,	2016.11.22 Meeting – COE requested a meeting with DELWP representatives by way of introduction of the offshore asset acquisition, changes in titleholder and guidance for approval of Operator and Titleholder acceptance.	Acceptable attendance at meeting	No Issues with comments provided, no forward actions for COE	
	State Agency supporting AMSA with oiled wildlife response.	2016.11.30 – Email - COE requesting current information on oiled wildlife response in Victoria. 2017.02.19 – DELWP provided relevant information which supports oiled wildlife response arrangements to be included within the OPEP.	DELWP provides the following details: Agency arrangements for oiled wildlife response; DELWP responses available; Response arrangements during oil spill; Notification pathways; Relevant actions to be taken.	No objections made to the information provided. Included in the OPEP (Oiled Wildlife Response) Section.	Thanked DELWP for the current information.
Esso Australia	Nearby Titleholder	2017.02.27 Mail – Letter COE provided information associated with the Patricia-Baleen Environment Plan, changes in titleholder and requested feedback.	No feedback to date.	Not applicable	Not Applicable
Seven Group Holdings	Nearby Titleholder	2017.02.27 Mail – Letter COE provided information associated with the Patricia-Baleen Environment Plan, changes in titleholder and requested feedback.	No feedback to date.	Not applicable	Not Applicable
Bass Strait Oil Company	Nearby Titleholder	2017.02.27 Email – Letter COE provided information associated with the Patricia-Baleen Environment Plan, changes in titleholder and requested feedback.	No feedback to date.	Not applicable	Not Applicable

Stakeholder	Relevance to Activity	Information provided (Date, Method, Record, Number)	Summary of Response	Assessment of Merits to Adverse Claim / Objection	Operators Response to each Claim / Objection
Gippsland Ports Authority	Control Agency for Level 1 marine oil spills in Victorian State waters.	2017.03.08: Telephone conversation with Peter Bull (Gippsland Ports) regarding first strike response in Snowy River. 2017.03.08 Email sent to Gippsland Ports confirming content of conversation	Peter confirmed that booms located in Lakes Entrance could be deployed to the Snowy River with a transit time of about 1 hour. Gippsland Ports would respond if called.	No adverse claims or objections made.	Not Applicable

9.3 Ongoing Consultation

9.3.1 Ongoing Engagement

Cooper has developed and maintains a register of commercial fishers in the Gippsland Basin via stakeholder engagement initiatives related to the adjacent BMG Field. Engagement is through ongoing liaison with commercial fishing cooperatives and association members. However to ensure broader communications relevant to new commercial fishers associated with the Patricia-Baleen NOP activities, Cooper has sought the support of these existing stakeholders to identify new stakeholders relevant to the Patricia-Baleen NOP activities. This has included members of the abalone associations and other relevant SIV members. Cooper has added an additional seven relevant fishing stakeholders to their existing register via this methodology.

Cooper expects additional stakeholders not currently identified in this EP may be affected by NOP operations, and that these stakeholders may only become known to Cooper through on-going engagement and consultation carried forward. The stakeholder engagement register will be updated as this occurs.

Cooper Energy Website:

Project information has been made available on the Cooper Energy website (http://www.cooperenergy.com.au/) for all interested members of the public to access. Flyers prepared for future project milestones (e.g. scopes outside this EP such as the Sole Development) will also be made available on the website.

9.3.2 Consultation Triggers

Stakeholder consultation will be ongoing during the Patricia-Baleen and Sole-2 NOP. Key milestones that will trigger further consultation include:

- Environment Plan acceptance and the availability of the Environment Plan Summary on the NOPSEMA and DEDJTR website;
- IMR activity;
- Any significant incidents (e.g., large hydrocarbon spill);
- Changes to the NOP activity and its associate impacts or risks or to the way in which Cooper in managing the impacts and risks;
- Future optimization activities (e.g., drilling of additional production wells or bringing assets back into production);
- When a decision is made to decommission the assets.

9.3.3 IMR Activity Consultation

At least four weeks prior to the IMR activity, Cooper will provide to all relevant stakeholders (Fishing Industry Bodies, AHS and TSV) information relating to the following:

- The expected timing, duration and location of the survey;
- Vessel name and call sign (if known);
- A description of the activities which are being undertaken;
- Expected impacts associated with the activity;
- A request to provide feedback on the activities; and
- The Cooper Representative for feedback of issues and concerns.

Any feedback, claims or objections from stakeholders will be assessed for merit and Cooper will provide a response.

Cooper will follow-up with stakeholders providing notifications five days prior to activity commencement (or as requested by the individual stakeholder) and a demobilisation notification will be provided within 10 days of completion of the activity (or at a period requested by stakeholder).

9.3.4 Ongoing Feedback and Response

Should stakeholder feedback identify issues or concerns prior to or during IMR activities, or during the NOP phase in general, that were not previously identified in the preparation of the Environment Plan, the impacts and risks will be assessed and if a significant new or increased impact or risk is identified, the Environment Plan will be reviewed and, as necessary, revised and resubmitted to NOPSEMA and DEDJTR for assessment. If the stakeholder feedback, after assessment, results in a change to operations or procedures but is not considered to result in a significant new or increased impact or risk, the Environment Plan will be updated in accordance with the Cooper Management of Change process.

In the event that a change to the NOP activity is planned which alters the impacts and risks or alters the way those impacts and risks are managed, Cooper will consult with stakeholders, request and obtain feedback from stakeholders to ensure that impacts and risks to stakeholders are managed to levels which are acceptable and ALARP.

10 Titleholder Nominated Liaison Person

Further information associated with the environmental aspects of the Patricia-Baleen Non-Operations Phase activities may be obtained from Cooper by writing to:

Iain MacDougall

General Manager Operations

Cooper Energy

Level 10, 60 Waymouth Street, Adelaide, SA, 5000

Phone: (08) 8100 4900

Email: iainm@cooperenergy.com.au

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