Upstream

Otway Offshore Environment Plan - Summary

Review record

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1. Introduction

Origin Energy Resources Ltd (Origin Energy) is the operator of the Otway Gas Project. The gas and condensate being commercialised by the project were discovered in the Geographe and Thylacine gas fields, located in the Bass Strait some 55 and 70km south of Port Campbell, Victoria, respectively. The Geographe and Thylacine gas fields lie in 95 and 100 m of water respectively and are serviced by the Thylacine-A Platform (TAWHP). An undersea pipeline transports the gas and condensate from the TAWHP to the Victorian mainland, via a Horizontal Directionally Drilled (HDD) coastline crossing near Port Campbell. The pipeline terminates at the Otway Gas Plant where the hydrocarbons are processed prior to distribution to south-eastern Australian gas market.

Origin Energy Resources Ltd (Origin) is the operator for the Geographe field, Thylacine field, the Otway Gas Pipeline and Otway Gas Plant on behalf of joint venture partners Benaris Exploration (Otway) Pty Ltd and Toyota Tsusho Gas E&P Otway Ltd. A locality map and a schematic of offshore components of the Otway Gas Project are provided inFigure 1-1.

The relevant permit or licence areas for the Geographe and Thylacine fields are listed in Table 1-1, along with approximate distances to key shore based locations.

Table 1-1: Otway Operations Area Locality

Operations Area	Approximate distance from (in kilometres)				
	King Island (km)	Cape Otway (km)	Port Campbell (km)	Warrnambool (km)	Closest point on mainland (km)
Geographe wells (Vic/L23)	99	57	55	90	45
Thylacine-A Platform (T/30P)	92	72	70	100	60

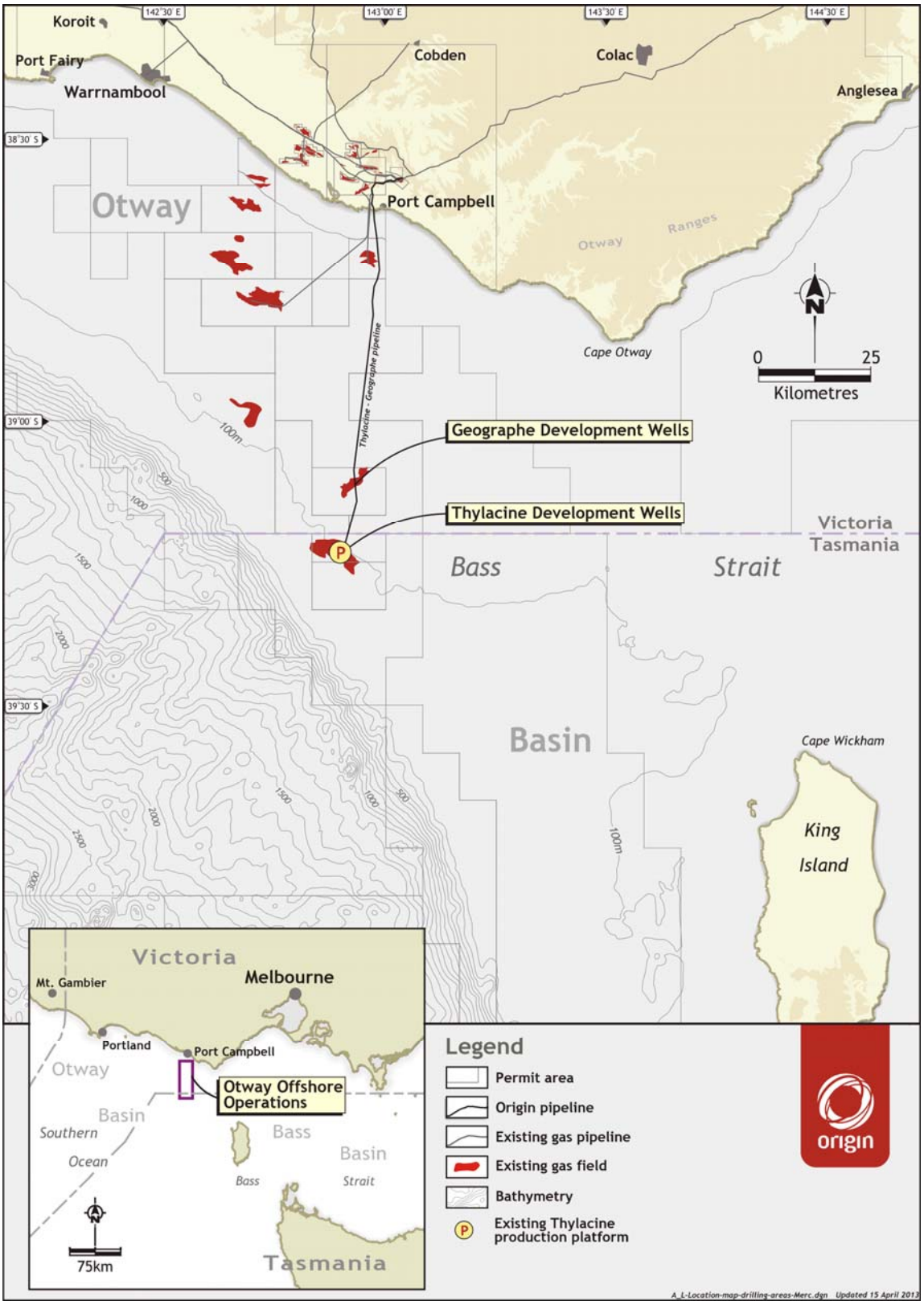


Figure 1-1: Location of the activity

2. Description of the activity

The Offshore Otway facilities are in place to safely transport raw gas from the offshore sub-sea Thylacine and Geographe hydrocarbon reservoirs to the onshore Otway Gas Plant for processing. From this gas stream the Otway Gas Plant produces natural gas, condensate and liquefied petroleum, for sale.

The well fluids in the Thylacine and Geographe hydrocarbon reservoirs are a mixture of reservoir gas, associated liquids and formation water. The reservoir consists of approximately 80-81% methane, 8-10% carbon dioxide (CO_2), 5-6% ethane and smaller quantities of heavier hydrocarbons. No heavy oils are present. Reservoir analysis of the liquid hydrocarbons produced from the Geographe field shows very light condensate with density range of 0.751 – 0.775g/cm^3. The product at Thylacine is again a very light condensate with a slightly higher density of 0.805g/cm^3.

The Thylacine field is serviced via the TAWHP and the Geographe field is serviced by subsea infrastructure and supported by the umbilical that connects to the TAWHP. The TAWHP is a normally unmanned structure and all systems are capable of being remotely operated via the Otway Gas Plant.

The TAWHP is designed to support four platform well heads and umbilical connection to the two Gegraphe subsea wells and associated servicing and maintenance of the wells and pipeline. The Geographe field is a subsea instillation that ties in to the export pipeline and is supported from the TAWHP via a 15km umbilical connection. This configuration was chosen as the Gegraphe field is situated close to a major shipping lane and the subsea facilities effectively eliminate the risk of accidental collision.

The Otway offshore facilities incorporate;

- Four producing Thylacine gas wells;
- Two subsea Geographe wells, one which is producing and one of which is suspended and will be completed at a later date.
- The unmanned production TAWHP, supporting the wellhead and topsides facilities required for production metering from the combined Thylacine wells; and
- An offshore pipeline system consisting of a 500mm (20 inch) offshore production pipeline and a 100mm diameter mono ethylene glycol (MEG) piggyback service pipeline from the TAWHP to the shore crossing near the Port Campbell Rifle Range area.

The offshore facilities operate 24 hrs a day 365 days a year to supply gas to the onshore facilities and there is a range of equipment and safety devices that support these operations. As such there is an ongoing program of maintenance, and inspection activities associated with the safe ongoing operation of the field.

2.1 Operation, maintenance and inspection

The typical operational activities associated with the Otway facilities include cold start-up, start-up and shutdown of wells, operation of valves and methanol/MEG injection. All these activities are covered by specific operational procedures.

The TAWHP also provides for operation of the umbilical that travels out to the Geographe field and supplies services to the well heads and production facilities, including:

- Electric power;
- Hydraulic power;
- Methanol;
- MEG and chemicals;
- Pressure and flow control via choke changes;

- Hydrate prevention and control (including technical monitoring); and
- Monitoring and depressurisation of the well annulus.

An important process for the ongoing operation of the offshore facilities is the ability to control corrosion and suppress hydrate formation. This is largely controlled through the use of MEG which is supplied via the piggy back pipeline from the Otway Gas Plant. The TAWHP also has a chemical injection system that can supply Methanol (for hydrate suppression and remediation), scale inhibitor injection and batch dosing of corrosion inhibitor for the production pipeline. All these chemicals once used are contained and transported to shore via the pipeline for treatment through the Otway Gas Plant.

Regular maintenance and inspection of equipment is undertaken in accordance with the computerised maintenance management system (CMMS) and with the Origin HSEMS system – Standard 15 Equipment maintenance and inspection. Typical inspection and maintenance activities are covered in the Otway pipeline safety case and the TAWHP safety case (approved and accepted by NOPSEMA), and include;

- Pigging.
- Remote operated vehicle (ROV) surveys conducted from a ROV support vessel.
- Safety equipment and pressure control maintenance.
- Routine planned maintenance and Critical Function Testing of equipment such as shutdown valves and safety critical instrumentation.
- Geographe and Thylacine non-routine well Sub-Surface Shutdown Valves passing/leakage testing.

Routine inspection and maintenance activities are designed to maintain the safety and reliability of the Otway offshore facilities.

Non routine activities for the subsea Geographe and Thylacine facilities utilising ROVs include repair and replacement of the following:

- Subsea Control Module (SCM).
- Subsea Choke insert change outs.
- Subsea Valve change outs.
- Flying leads - installing short length flexible pipe or jumper if no hydrocarbon in pipe.
- Laying cables and umbilicals.
- Placing support structures or foundations.
- Attaching CP anode to pipe without welding.
- Acoustic sand detectors.
- Pipeline Span remediation.

Various subsea surveys will be undertaken as required. These surveys may include metrology surveys, sidescan sonar surveys, sub-bottom profiling surveys, metocean surveys and remotely operated vehicle surveys.

Maintenance activities including subsea welding and cutting, cleaning and marine growth removal, repair and replacement of subsea assets will be undertaken as required.

2.2 Logistics

Access to the TAWHP is principally by helicopter. The TAWHP is visited approximately fortnightly during daylight hours, sometimes more often for specific maintenance activities. A supply vessel will also attend the TAWHP for operational and maintenance requirements such as to supply freshwater, fuel or replacement parts. Based on

current TAWHP operations the supply vessel visits approximately once every two months.

During activities such as wire lining, well interventions and over board work or pipeline maintenance a stand by vessel will also remain in attendance at the facility. A ROV support vessel may also be required to support ROV operations in the case of maintaining subsea infrastructure. It is anticipated that these activities may occur approximately once a year.

3. Description of the environment

This section describes the environmental conditions in and around the Otway offshore operations, as well as within the wider area encompassed by the Zone of Potential Impact (ZPI). The ZPI is the area that could be impacted from both planned and unplanned events that may result from the Otway offshore operations.

3.1 Physical environment

The Otway Basin is characterised by high wave energy and cold temperature waters subject to upwelling events (Bonny upwelling) around the continental shelf margin. The nutrient enrichment associated with these upwelling events plays an important role in the generation of plankton blooms and the associated aggregation of other marine species as well as the structure of the ocean floor as the continental shelf transitions to the coastal mainland.

The Bass Strait and Otway Basin are known for a complex, high energy wave climate and strong ocean currents.

The TAWHP and Geographe fields are located near the outer edge of the slope of the Australian Continental Shelf. The seabed sediment in the well fields consists of calcrete, limestone, sandstone, marl and granite, with areas of sand of varying grain size. The seabed along the pipeline route from TAWHP to the HDD exit comprises uncemented carbonate sands in the shallow area near shore to interspersed zones of moderate to high relief out cropping calcarenite and thin coarse patches in deeper water.

3.2 Biological environment

The Otway field is located in the Southeast Marine Region (SEMR). The fish fauna in the SEMR consists of an estimated 600 species, with 85% believed to be endemic. Additionally, the SEMR has diverse marine benthic flora, with 62% of its macro algae thought to be endemic. Key components of the biological environment in the vicinity of the Otway offshore operations are described in the following sections.

3.2.1 Threatened and migratory species

The EPBC Act protected matters database was used to identify threatened and migratory species potentially occurring within the Otway offshore operations area. The search of the protected matters database was conducted using a 6km buffer of the pipeline which incorporated the TAWHP and well locations.

A total of 26 threatened species, 32 migratory species and 1 threatened ecological community were identified. There were also 52 marine species and 27 cetaceans listed under the EPBC Act that were identified as potentially occurring within the operations area. These species are listed in Table 3-1.

Table 3-1: EPBC listed species identified in the protected matters search

Scientific name	Common Name	Status	Presence
Birds			
Apus pacificus	Fork tailed swift	M	SHL
Botaurus poiciloptilus	Australasian Bitten	E,	SHM
Domedeae pomophorae pomophora	Southern royal albatross	V	SHM
Domedeae pomophor asanfordi	Northern royal albatross	E	SHM
Diomedea exulans (sensulato)	Wandering albatross	V, M	SHM
Diomedea exulans antipodensis	Antipodean Albatross	V	SHL
Diomedea exulans exulans	Tristan albatross	E, M	FM
Halobaena caerulea	Blue petrel	V	SHM
Macronectes giganteus	Southern giant-petrel	E, M	SHM
Macronectes halli	Northern giant-petrel	V, M	SHM
Neophema chrysogaster	Orange bellied parrot	CE, M	MP
Puffinus carneipes	Flesh footed shearwater	M	FM
Pterodroma mollis	Soft-plumaged petrel	V	SHM
Sternula nereis nereis	Australian fairy tern	V	SHK
Thalassarche bulleri	Buller's albatross	V, M	SHM
Thalassarche cautacauta	Shy albatross, Tasmanian shy albatross	V, M	SHM
Thalassarche cautasalvini	Salvin's albatross	V, M	SHM
Thalassarche chrysostoma	Grey-headed albatross	E, M	SHM
Thalassarche melanophris	Black-browed albatross	V, M	SHM
Thalassarche melanophris impavida	Campbell albatross	V, M	SHM
Mammals			
Balaenoptera bonaerensis	Antarctic minke whale, dark-shoulder minke whale	M	SHM
Balaenoptera edeni	Bryde's whale	M	SHM
Balaenoptera musculus	Blue whale	E, M	FK
Caperea marginata	Pygmy right whale	M	SHK
Eubalaena australis	Southern right whale	E, M	SHK
Lagenorhynchus obscurus	Dusky dolphin	M	SHM
Megapteran ovaeangliae	Humpback whale	V,M	SHK
Orcinus orca	Killer whale, Orca	M	SHK
Physeter macrocephalus	Sperm whale	M	FK
Fish			
Prototroctes maraena	Australian Grayling	V	SHM
Sharks			
Carcharodon carcharias	Great white shark	V, M	SHM
Isurus oxyrinchus	Short-fin mako, mako shark	M	SHL
Lamna nasus	Porbeagle, mackerel shark	M	SHL
Reptiles			
Caretta caretta	Loggerhead turtle	E, M,	SHL[1]
Chelonia mydas	Green Turtle	V, M	SHL
Dermochelys coriacea	Leatherback turtle, leathery turtle	E, M	SHL
Threatened ecological communities			
Macrocystis pyrifera	Giant Kelp Marine Forests	T-E	SHM

Notes: **CE** critically endangered, **E:** Endangered; **V:** Vulnerable; **M:** Migratory. **Presence Legend**: **SHM:** Species or species habitat may occur within area; **SHL:** Species or species habitat likely to occur within area; **SHK:** Species or species habitat known to occur within area; **FK:** Foraging, feeding or related behaviour known to occur within area; **FM:** Foraging, feeding or related behaviour may occur within area, **MP:** migratory path may occur in area.

3.2.2 Endangered Ecological communities

One endangered ecological community, the Giant Kelp Marine Forests, was identified on the EPBC Act protected matters database as potentially occurring within the area.

The Giant Kelp Marine Forests is a unique ecological community that extends from the ocean floor to the ocean surface and exhibits a 'forest-like' structure with a diverse range of organisms occupying its benthic, pelagic and upper-canopy layers. The ecological community is characterised by a closed to semi-closed surface or subsurface canopy of *Macrocystis pyrifera*.

The Giant Kelp Marine Forests ecological community occurs on rocky substrate and prefers cold water climates (5 – 20^{0}C) and locations that receive moderate wave energy, typically at depths greater than 8m. Giant Kelp Marine Forests are not present in the Otway offshore operational area due to the water depth, predominately sandy substrate and high energy coast line. The absence of this community has been confirmed by ROV surveys of the pipeline.

3.2.3 Birds

A large number of sea and terrestrial birds utilise the Otway area and may potentially transit through it, resting on islands during their migration. The protected matters search identified 20 bird species potentially occurring in the area. This was made up of 11 albatross species, 4 petrel species, the Australian fairy tern, fork tailed swift, orange bellied parrot and a shearwater.

Although bird species may overfly and forage within the Otway offshore operations area, most are likely to be infrequent visitors. The operational activities are unlikely to have a significant impact on any of the species as these have no direct interaction with the operation due to its remoteness from shore.

3.2.4 Mammals

3.2.4.1 Cetaceans

There were nine cetacean species within the operation area identified in the protected matters search as threatened or migratory. Two species, the blue whale (*Balaenoptera musculus*) and southern right whale (*Eubalaena australis*) are listed as endangered; and one, the humpback whale (*Megaptera novaeangliae*), as vulnerable. These species have been regularly sighted in aerial surveys of the Otway region. Three other whales, the fin (*Balaenoptera physalus*), sei (*Balaenoptera borealis*) and sperm (*Phseter macrocephalus*) are listed respectively as vulnerable and migratory, and have been observed in the Otway region during aerial surveys.

The Bass Strait and the Otway Basin is considered an important migratory path for humpback, blue, southern right, and to a lesser extent, the fin and sei whales. The whales use the Otway region as part of a migratory pathway to and from the north-eastern Australian coast and the sub-Antarctic. Of particular environmental importance in the Otway region is the upwelling of nutrient rich, cool water (the Bonney Upwelling) which supports surface swarms of coastal krill.

Blue whales

Previous observations that the Otway region is an important migratory and feeding corridor for blue whales arriving from and departing to the east have been confirmed by passive acoustic monitoring and aerial surveys. Current sighting data indicates that blue whales are seasonally distributed. They concentrate between the Great Australian Bight and Cape Nelson in November, spread eastwards in December, occur widely in the Otway region from January to April and then decrease between May and June.

Southern Right whales

Southern right whales are typically found in the southern hemisphere between 20°S and 60°S. They are present along the Australian coast at these latitudes from May to October. The species migrates to the relatively warm waters of southern Australia in winter and inhabits sub-Antarctic waters in summer. During winter and spring southern

right whales use coastal waters to breed, rearing calves close to shore, sometimes in waters less than 5m depth.

The closest known calving areas to the Otway offshore operations are off the coast at Warrnambool, Port Fairy and Portland, in shallower water. Information regarding migration is limited, but the whales typically arrive off Warrnambool during May and can remain into November.

Humpback whales

Humpback whales are found along most of the Australian coastline in winter and spring. They undertake an annual migration between summer feeding grounds in cold Antarctic waters to winter breeding and calving grounds in the northern tropics. The northward migration along the south-east coast of Australia starts in April and the southward migration starts around November. Humpback whales are known to use the west coast of Tasmania and Bass Strait for this migration and may therefore pass the Otway offshore operation area. The exact timing of the migration period can change from year to year in accordance with variations in water-temperature, the extent of sea-ice, predation risk, prey abundance, and location of feeding grounds. Generally, feeding occurs where there is a high krill density and during the humpback's migration this occurs primarily in Southern Ocean waters south of 55°S. Victorian waters are not known to be major feeding grounds, although feeding may occur opportunistically where there is a sufficient density of krill.

3.2.4.2 Pinnipeds

The New Zealand and Australian fur-seals breed along the Australian coast (including Tasmania) and near shore islands.

Satellite tagging has shown that seals from shore breeding colonies can feed out to the 200m bathymetric contour. It has also been shown that seals will follow pipeline routes, most likely as a result of the increased marine activity, and therefore food sources, these structures attract.

3.2.5 Reptiles

Three reptile species were identified in the protected matters search as potentially occurring in the area: the loggerhead turtle (*Caretta caretta*), the Green Turtle (*Chelonia mydas*) and the leatherback turtle (*Dermochelys coriacea*).

The loggerhead turtle is distributed globally in near-shore subtropical waters and is rare in Victorian waters. The main breeding areas are generally confined to southern Queensland and Western Australia. Loggerheads will migrate distances greater than 1,000km but show a strong fidelity to both their feeding and breeding areas. No known loggerhead foraging areas have been identified in Victoria waters and the species is only infrequently encountered in southern Australian waters. It is an occasional visitor to the Otway region, and has been sighted on a number of occasions during aerial surveys, particularly in the area to the south-west of Cape Otway.

The leatherback turtle is the most pelagic of all marine turtles, and is found in tropical, subtropical, and temperate waters around the world. It is known to migrate great distances between foraging and breeding areas, and shows fidelity to larger breeding areas or a particular beach type. No major nesting areas have been identified in Australia although isolated nesting occurs in Queensland and the Northern Territory.

Green Turtles nest, forage and migrate across tropical northern Australia. They usually occur between the 20°C isotherms, although individuals can stray into temperate waters as vagrant visitors. Green Turtles spend their first five to ten years drifting on ocean currents. During this pelagic (ocean-going) phase, they are often found in association with drift lines and rafts.

3.2.6 Sharks and ray finned fish

The great white shark, grey nurse shark, short finned mako and porbeagle are identified as potentially occurring in the region. These species would be transient within the operational area.

3.2.7 Fish

Fish species in the Otway offshore operations area include both recreational (tuna, marlin, and Australian salmon) and commercial species (orange roughy, flathead, flake, and trevally). Crustaceans and shellfish are also present in the areas closer to shore, including the commercially important species southern rock lobster and abalone.

3.2.8 Invertebrates and plankton

The marine invertebrates in the region include. sponges, jellyfish, corals, anemones, seapens), bryozoans, arthropods (e.g., sea spiders), crustaceans (e.g. rock lobster, brine and fairy shrimps), molluscs (e.g. scallops, sea slugs), echinoderms (e.g. sea cucumbers), and annelids (e.g.polychaete worms).

Studies by the Museum of Victoria found that invertebrate diversity was high in southern Australian waters, but the distribution of species was patchy, with little evidence of any distinct biogeographic regions.

Plankton distribution depends upon prevailing ocean currents such as the East Australia Current, west to east flows from Bass Strait and Southern Ocean masses.

3.3 Cultural and Socio-Economic Environment

3.3.1 Marine protected areas and reserves

The Otway offshore operations are located within 100 km of two Commonwealth marine reserves; Apollo and Zeehan. Apollo is classified as IUCN VI – Multiple Use Zones. Zeehan is divided into two management zones; IUCN VI Multiple Use Zone (933km^2) and IUCN VI - Special Purpose Zone (18,964km^2). Permitted activities in IUCN category VI include recreational fishing and mining.

Other marine parks and reserves in the region are the Twelve Apostles Marine National Park, the Arches Marine Sanctuary and the Marengo Reefs Marine Sanctuary.

The Twelve Apostles Marine Park covers 17km of Victoria's coastline and extends out from the Twelve Apostles rock formations to intertidal and sub tidal invertebrate communities, underwater arches, canyons, fissures, gutters and deep sloping reefs. The park is approximately 7km SE of the HDD shore crossing.

The Arches Marine Sanctuary is located offshore in 20m of water to the south of Port Campbell. The 'Arches' are a series of canyons, arches and tunnels which provide habitat for invertebrate life that is characteristic of deeper Bass Strait waters. This sanctuary is located approximately 2km east of the HDD shore crossing.

The Marengo Reefs Marine Sanctuary is located near Apollo Bay and comprises two small reefs that provide a wide variety of microhabitats. Protected conditions on the leeward side of the reefs allow bull kelps and other seaweed to grow densely. There is an abundance of soft corals, sponges, and other marine invertebrates. The reefs are located approximately 65km northeast of the Otway offshore operational area.

Marine parks, sanctuaries and reserves proximal to the Otway offshore operations are shown in Figure 3-1.

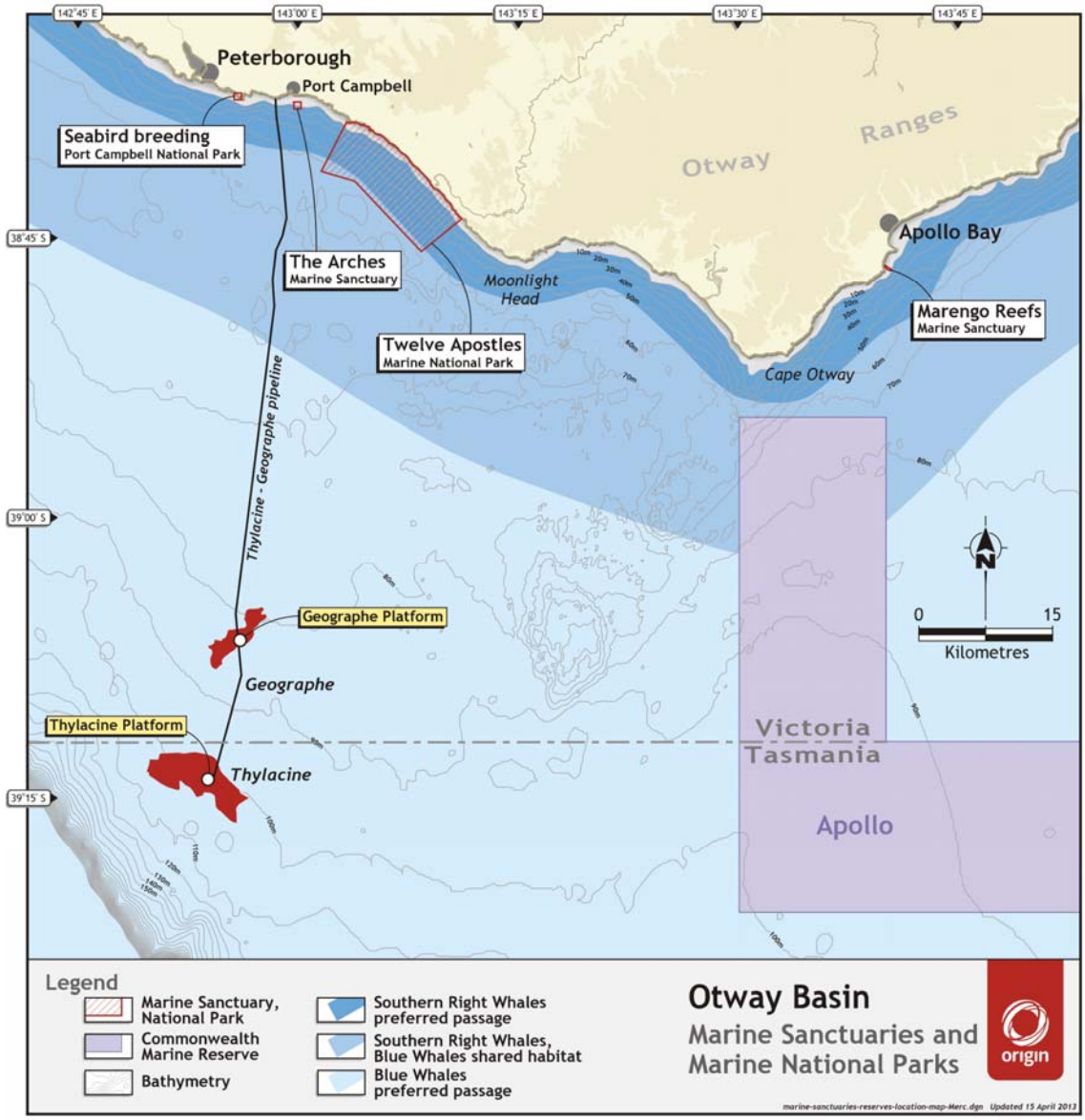


Figure 3-1 Marine sanctuaries and marine national parks

3.3.2 Heritage Values

No sites occurring within the vicinity of the Otway offshore operations are listed or nominated on the Australian Heritage Commission Register.

There are no known historic wrecks within the area of the Thylacine or Geographe well fields or the pipeline route. Known shipwrecks tend to be along the coastlines and islands of Tasmania and Victoria.

3.3.3 Commercial fisheries

Victorian and Commonwealth managed fisheries are conducted along the continental shelf and slope of the Otway region. The Victorian and Commonwealth fisheries management areas which overlap the Otway offshore operations area are the:

- Victorian Western Zone Rock Lobster Fishery
- Victorian Giant Crab Fishery
- Victorian Abalone Fishery
- Commonwealth Southern Squid Jig Fishery
- Commonwealth Southern and Eastern Scalefish and Shark Fishery (SESSF)

Fishing industries are an important direct and indirect employer in the coastal towns of the Otway region. Historical maps of fishing activity in the area show that there are enduring spatial relationships, since fishing activity is linked to natural features that support fish, shellfish, and crustacean populations.

These fisheries are described in Table 3-2.

Table 3-2: Commercial Fisheries in Bass Strait

Description	Location	Target Species	Technique
Abalone Fishery	Restricted to rocky substrates of near shore areas	Blacklip and Greenlip abalone	Diving
Rock Lobster Fishery	Restricted to hard rocky substrates of the continental shelf	Southern rock lobster	Baited pots
Demersal longline fishery	Widely distributed generally in the deeper zones of the otway basin over rougher ground.	Pink ling and blue eyed trevalla comprise most of the catch.	Pelagic longline and minor line
Squid fishery	widespread	Squid	Jig
SESSF - Commonwealth Trawl Sector (comprises South East Trawl Fishery)	Generally continental shelf and upper slope	Blue grenadier, tiger flathead, pink long and spotted warehou	Otter trawl and Danish seine
SESSF - Gillnet, Hook and Trap Sectors	Generally continental shelf	34 species	Scalefish hook, shark hook, gillnets, fish traps and automatic longlines
Southern Squid Jig Fishery	Generally continental shelf	Arrow squid	Squid jigging
Giant Crab Fishery	Generally continental shelf and upper slope	Giant crab	Baited pots

3.3.4 Shipping

Bass Strait is a well-known shipping route. Agricultural products and woodchips are transported from the port of Portland to receiving ports in the Gulf of St Vincent, South Australia, and through Bass Strait to Melbourne and Sydney. There are also numerous minor shipping routes in the area, such as those that service King Island. Active shipping routes exist to the north of the TAWHP.

4. Environmental Risks, Impacts and Controls

Origin has undertaken an environmental risk assessment for the Otway Project using the Origin risk assessment process which is consistent with the *Australian Standard for Risk Management: AS/NZS ISO 31000:2009 Risk management – Principles and Guidelines*.

The process of environmental impact and risk assessment used for the Otway EP is as follows:

- Identify the hazard under consideration
- Identify the consequence rating corresponding to the maximum reasonable impact associated with the hazard (Figure 4-1). The assessment of impacts is limited to this step
- Identify the likelihood rating (Figure 4-2) based on an assessment of probability and exposure
- Identify risk rating based on the consequence rating and likelihood rating using the Origin risk toolkit matrix (Figure 4-2).

No environmental impacts were assessed to have a consequence greater than minor. Note that no likelihood rating and therefore risk rating is calculated for environmental impacts.

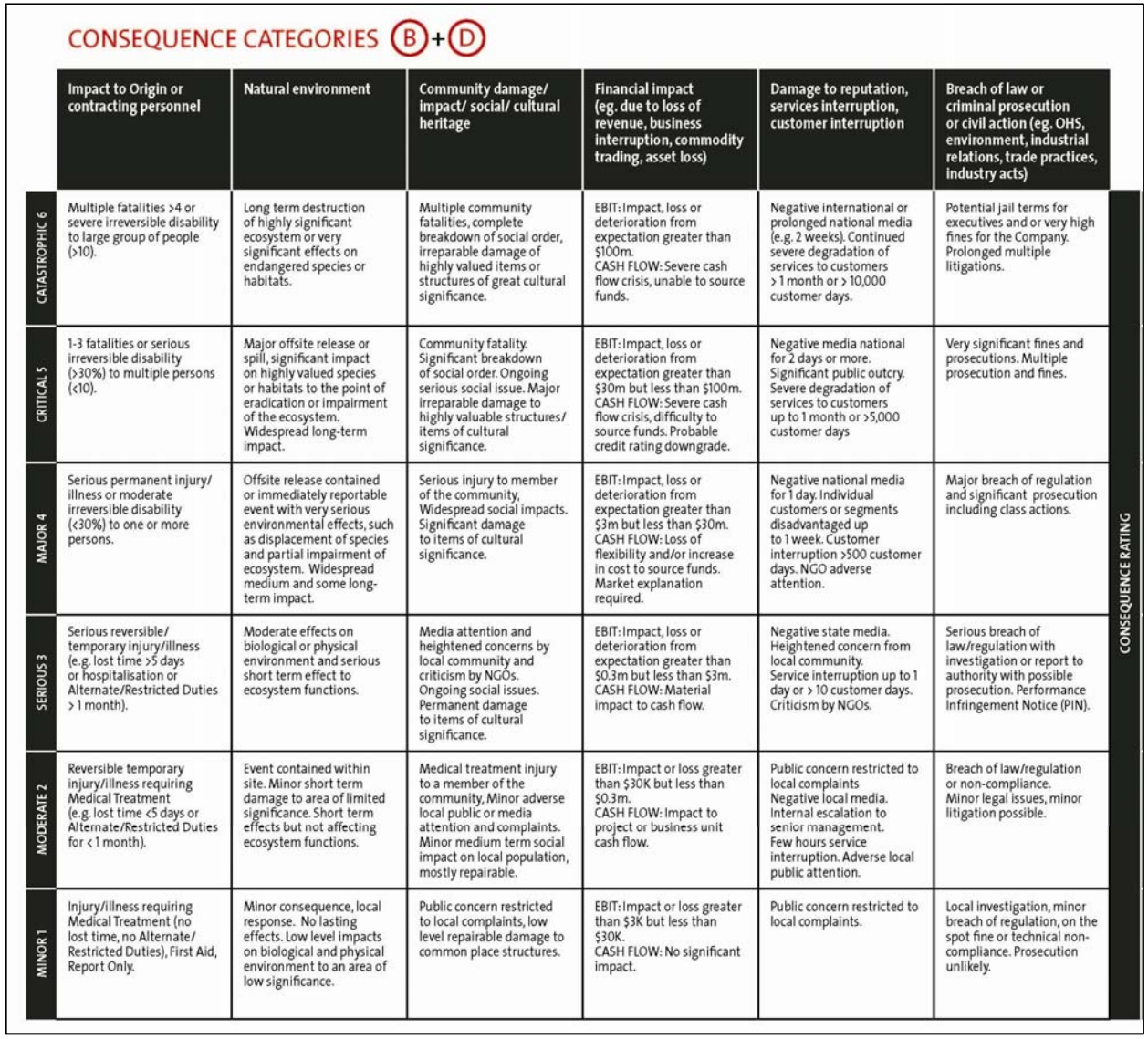
Three environmental risks were assessed to be medium, should they occur. These risks are listed below:

- Uncontrolled release from wells and production equipment
- Uncontrolled pipeline release – condensate
- Introduction of marine pests

All other environmental risks were assessed as low. Consequence and likelihood ratings for all identified environmental impacts and risks are presented in Table 4-1.

The risk assessment process undertaken for the Otway Offshore operations is an ongoing process. Risks are regularly assessed and if necessary new controls implemented to reduce potential risks to As Low as Reasonably Possible (ALARP). This process of continual assessment is integral to Origin's risk management process.

After taking into consideration the control measures proposed, the likelihood of the event occurring and the environmental conditions at the site all residual risks were considered to be reduced to ALARP and acceptable levels. A summary of risks, potential environmental hazard and controls for the Otway offshore Project is presented in Appendix B.



CONSEQUENCE CATEGORIES (B)+(D)

	Impact to Origin or contracting personnel	Natural environment	Community damage/ impact/ social/ cultural heritage	Financial impact (eg. due to loss of revenue, business interruption, commodity trading, asset loss)	Damage to reputation, services interruption, customer interruption	Breach of law or criminal prosecution or civil action (eg. OHS, environment, industrial relations, trade practices, industry acts)
CATASTROPHIC 6	Multiple fatalities >4 or severe irreversible disability to large group of people (>10).	Long term destruction of highly significant ecosystem or very significant effects on endangered species or habitats.	Multiple community fatalities, complete breakdown of social order, irreparable damage of highly valued items or structures of great cultural significance.	EBIT: Impact, loss or deterioration from expectation greater than $100m. CASH FLOW: Severe cash flow crisis, unable to source funds.	Negative international or prolonged national media (e.g. 2 weeks). Continued severe degradation of services to customers > 1 month or > 10,000 customer days.	Potential jail terms for executives and or very high fines for the Company. Prolonged multiple litigations.
CRITICAL 5	1-3 fatalities or serious irreversible disability (>30%) to multiple persons (<10).	Major offsite release or spill, significant impact on highly valued species or habitats to the point of eradication or impairment of the ecosystem. Widespread long-term impact.	Community fatality. Significant breakdown of social order. Ongoing serious social issue. Major irreparable damage to highly valuable structures/ items of cultural significance.	EBIT: Impact, loss or deterioration from expectation greater than $30m but less than $100m. CASH FLOW: Severe cash flow crisis, difficulty to source funds. Probable credit rating downgrade.	Negative media national for 2 days or more. Significant public outcry. Severe degradation of services to customers up to 1 month or >5,000 customer days	Very significant fines and prosecutions. Multiple prosecution and fines.
MAJOR 4	Serious permanent injury/ illness or moderate irreversible disability (<30%) to one or more persons.	Offsite release contained or immediately reportable event with very serious environmental effects, such as displacement of species and partial impairment of ecosystem. Widespread medium and some long-term impact.	Serious injury to member of the community, Widespread social impacts. Significant damage to items of cultural significance.	EBIT: Impact, loss or deterioration from expectation greater than $3m but less than $30m. CASH FLOW: Loss of flexibility and/or increase in cost to source funds. Market explanation required.	Negative national media for 1 day. Individual customers or segments disadvantaged up to 1 week. Customer interruption >500 customer days. NGO adverse attention.	Major breach of regulation and significant prosecution including class actions.
SERIOUS 3	Serious reversible/ temporary injury/illness (e.g. lost time >5 days or hospitalisation or Alternate/Restricted Duties > 1 month).	Moderate effects on biological or physical environment and serious short term effect to ecosystem functions.	Media attention and heightened concerns by local community and criticism by NGOs. Ongoing social issues. Permanent damage to items of cultural significance.	EBIT: Impact, loss or deterioration from expectation greater than $0.3m but less than $3m. CASH FLOW: Material impact to cash flow.	Negative state media. Heightened concern from local community. Service interruption up to 1 day or > 10 customer days. Criticism by NGOs.	Serious breach of law/regulation with investigation or report to authority with possible prosecution. Performance Infringement Notice (PIN).
MODERATE 2	Reversible temporary injury/illness requiring Medical Treatment (e.g. lost time <5 days or Alternate/Restricted Duties for < 1 month).	Event contained within site. Minor short term damage to area of limited significance. Short term effects but not affecting ecosystem functions.	Medical treatment injury to a member of the community, Minor adverse local public or media attention and complaints. Minor medium term social impact on local population, mostly repairable.	EBIT: Impact or loss greater than $30K but less than $0.3m. CASH FLOW: Impact to project or business unit cash flow.	Public concern restricted to local complaints Negative local media. Internal escalation to senior management. Few hours service interruption. Adverse local public attention.	Breach of law/regulation or non-compliance. Minor legal issues, minor litigation possible.
MINOR 1	Injury/illness requiring Medical Treatment (no lost time, no Alternate/ Restricted Duties), First Aid, Report Only.	Minor consequence, local response. No lasting effects. Low level impacts on biological and physical environment to an area of low significance.	Public concern restricted to local complaints, low level repairable damage to common place structures.	EBIT: Impact or loss greater than $3K but less than $30K. CASH FLOW: No significant impact.	Public concern restricted to local complaints.	Local investigation, minor breach of regulation, on the spot fine or technical non-compliance. Prosecution unlikely.

CONSEQUENCE RATING

Figure 4-1 Consequence rating

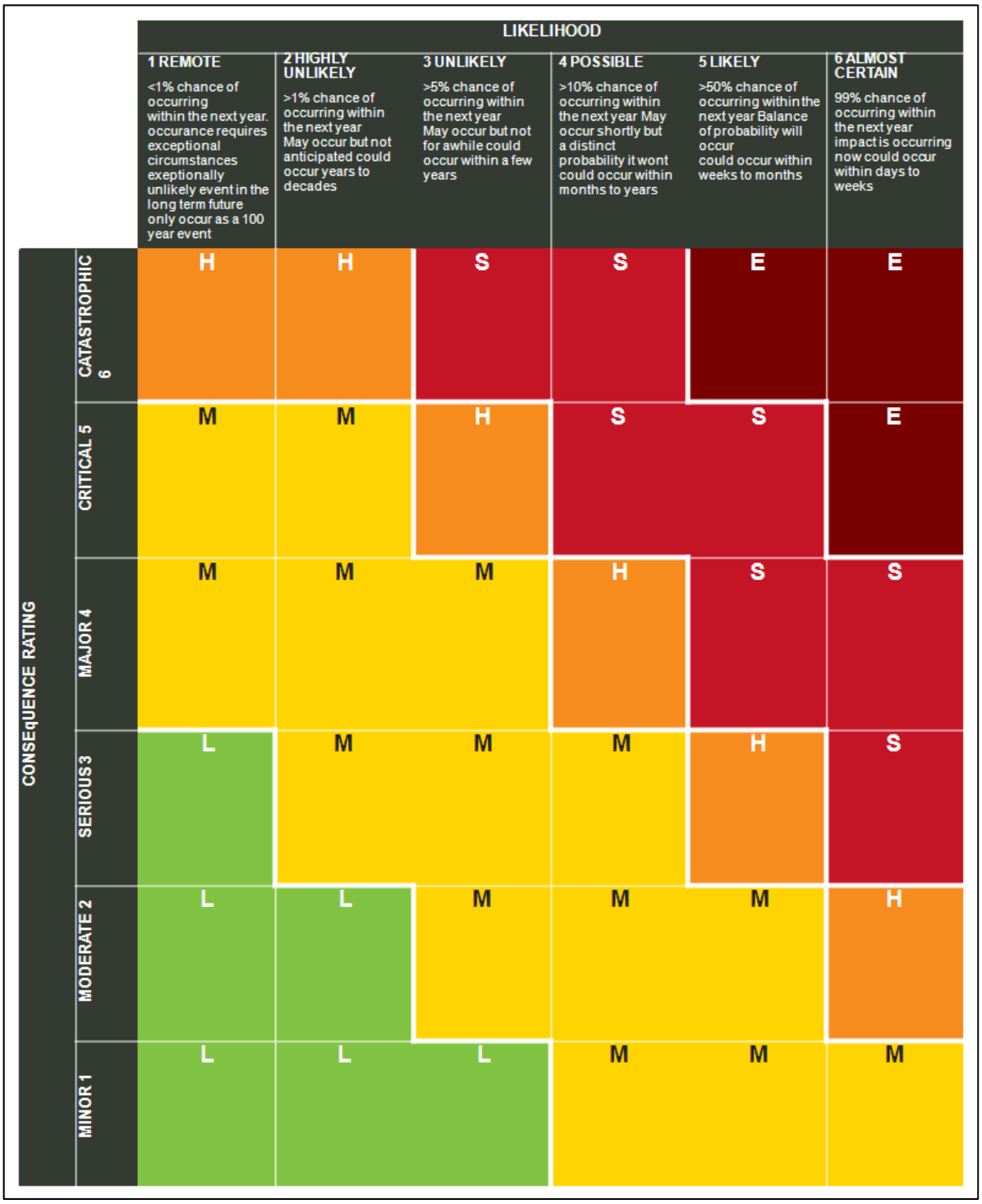


Figure 4-2 Risk rating

Table 4-1 Consequence and risk rating for identified routine and non-routine impacts.

Impacts	Consequence rating		
Physical presence of the platform.	1		
Light levels from Platform/Support vessel operations.	1		
Noise levels from platform/supply vessel/helicopter operations.	1		
Discharge of hydraulic fluid through subsea valve operations.	1		
Discharge of wastes - (liquids, solids and litter) offshore.	1		
Operational activity reduces air quality (GHG emissions).	1		
Risks	**C**	**L**	**R**
Uncontrolled release from wells and production equipment – condensate.	5	1	M
Uncontrolled pipeline release – condensate.	5	1	M
Loss of containment of MEG (Mino Ethylene Glycol).	1	2	L
Loss of containment of methanol.	1	3	L
Loss of containment of hydraulic fluid.	1	1	L
Physical presence of vessel (collision with marine fauna).	3	1	L
Loss of marine diesel - supply vessel collision or sinking.	3	1	L
Introduction of marine pests.	3	3	M
Deck Drainage - High concentrations of oil /chemicals in deck drainage.	1	1	L
Sea bed disturbance.	1	1	L
Environmental impacts of relief well drilling.	2	1	L

Note; **C** = consequence, L = likelihood, R = risk rating.

5. Management and monitoring

Origins overall environmental objective for the Otway offshore operations is to avoid or reduce environmental risks to as low as reasonably practicable (ALARP). Specific environmental performance objectives, standards and measurement criteria have been developed for each environmental impact or risk identified for the Otway offshore operations. Environmental performance will be measured and reported against these objectives and standards.

Management of the Otway offshore operations is undertaken in accordance with the Origin Health, Safety and Environment Management System (HSEMS). The HSEMS includes the Origin HSE Policy and 20 HSEMS Standards which provide performance requirements for all Origin operations that are aligned with commitments made in the HSE Policy. The HSEMS provides a management framework to achieve HSE objectives systematically while allowing flexibility to effectively target impacts and risks.

The Origin HSE Policy can be accessed at:
http://www.originenergy.com.au/files/HSEPolicy.pdf

The Origin HSEMS can be accessed at:
http://www.originenergy.com.au/1780/files/HSEManagementsystem.pdf

The Otway offshore operations are also managed to comply with the relevant State and Commonwealth Acts and Regulations.

Audits will be undertaken to determine compliance with the requirements of the EP as part of Origins HSE auditing program under the HSEMS. Audits will assess and report against the performance outcomes, standards and measurement criteria for the Otway offshore operations.

If any new or increased risks are identified during the life of the Otway offshore operations, an assessment of the risk and review of the EP will be undertaken. If it is determined that any new or increased risks are significant the revised EP will be submitted to NOSPEMA for approval prior to the commencement of the activity causing the risk. Revision of the EP will also occur on an annual basis in addition to any reviews triggered by new or increased risks.

All environmental incidents and non-conformances are managed in accordance with Origin incident management processes including reporting, classification, investigation and close out. Reporting of incidents and non-conformances to NOPSEMA will be undertaken in accordance with the OPGGS (E) Regulations 2009.

Monthly reporting to NOPSEMA will be undertaken detailing performance against environmental performance objectives and standards. An annual environmental performance report for the Otway offshore operations will also be submitted to NOPSEMA. The annual report will summarise environmental performance over the reporting period.

Origin will also store and maintain environmental documents and records from the Otway offshore operations for the period of 5 years, as required by the OPGGS (E) Regulations 2009.

6. Consultation

The TAWHP was installed in 2006, with start-up and first gas flows in 2007 and commercial production in late February 2008. As part of this development process the then operator of the Otway Gas Project undertook significant consultation with the community, non-government organisations and Government departments throughout all phases of design and construction. A technical reference group was initiated during 2002-03 to guide the planning of the project and a community reference group (CRG) has been in place since April 2004. CRG meetings have been conducted on a regular basis (bimonthly) in Port Campbell to provide feedback to Origin on current Project issues and also to review and provide input into construction and operational environmental issues.

Membership of the CRG reflects respective stakeholder interests or concerns that may arise from the operation of the Otway Gas Plant, as well as providing appropriate communications channels to disseminate information about the Project to the community. Current participants of the CRG include various government regulators, non-government organisations and community representatives.

As part of the formation of this transitional EP for the Otway offshore facilities Origin has notified all relevant stakeholders and provided them with a fact sheet and an opportunity to provide comment. Stakeholders consulted include;

- Victorian Department of Environment and Primary Industries.
- Australian Marine Oil Spill Centre (AMOSC).
- Australian Maritime Safety Authority (AMSA).
- Border Protection Command.
- Department of State Development, Business and Innovation (DSDBI).
- Department of Primary Industries, Parks, Water and Environment (DPIPWE).
- Australian Hydrographic Office (AHO).
- Australian Fisheries Management Authority (AFMA).
- Defence Support Group Department of Defence (DoD).
- Parks Victoria.
- Department of Resources, Energy and Tourism (now the Department of Industry).
- Toll ANL Bass Strait Shipping.
- Victorian National Parks Association.
- Warnambool Volunteer Coast Guard.
- Flagstaff Hill Maritime Museum
- South East Management Advisory committee (SEMAC).
- Apolllo Bay Fishermans Cooperative.
- Sustainable shark fishing inc.
- Portland professional fisherman's association.
- Port Campbell fisherman's association.
- Relevant individual Commercial Fishermen.
- Port Campbell boat charters.
- Seafood industry Victoria.
- South East Trawl Fishing Industry Association (SETFIA).

- Victorian Recreational Fishing Peak Body (VRfish).
- Commonwealth Fisheries Association (CFA).
- International Fund for Animal Welfare (IFAW).
- Directorate of property acquisition, Mining and Native title.
- Department of Environment (DoE).
- BHP Billiton.
- Corangamite Shire Council.
- Warrnambool Council.
- Moyne Shire Council.
- Various relevant MPs.
- Various contractors.

The Otway offshore facilities are an ongoing operation and the purpose of this consultation was to address regulatory requirements that require consultation to be undertaken in the development of an environment plan. Stakeholders are well informed of the project due to its ongoing operations and as such any comment on the project were limited and addressed appropriately.

Concerns raised by commercial fishery stakeholders over a number of years relate to presence of subsea structures, safety exclusions zones and compensation for lost catch. Origin has consistently responded to these concerns by explaining the regulatory framework and the reasons why is it is in the interest of all stakeholders to maintain safety exclusion zones around the Otway offshore infrastructure. It has also been communicated that a process for all claims of compensation for lost catch or displacement can be initiated through the Origin fisheries liaison officer.

Origin also provides regular project briefings and updates to local State and Federal Members of Parliament as well as local government councillors and executives.

Communication on the ongoing operation of the Otway offshore facilities will continue through the established CRG. The CRG provides an opportunity for issues related to Otway offshore operations to be raised by CRG members and allows for Origin to provide updates on ongoing offshore operations.

7. Contact details

The nominated liaison person for this activity is:

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Appendix A Oil Pollution Emergency Plan

Origin has developed an Oil Pollution Emergency Plan (OSCP) for the Otway offshore facilities. The OSCP outlines the response arrangements to be undertaken in the unlikely event of a spill and the responsibilities of Origin, contractors and response agencies. The OSCP recognises the divisions of responsibility as defined under the terms of the "National Plan", which have been incorporated into this plan.

The responsibility for an oil spill is dependent on the location and the nature of the spill. The National plan for Maritime Environmental Emergencies sets out the division of responsibility for an oil spill response. For offshore petroleum exploration and production activities Origin is responsible for spills emanating from its offshore facilities. For vessel spills including those associated with the maintenance and support activities for the Otway offshore operations, the Australian Maritime Safety Authority (AMSA) is the designated Control Agency for spill emanating from commonwealth waters.

Origin has consulted with AMSA in the development of the OSCP. and under existing agreements AMSA will take over control of a spill originating from vessels for all spill volumes, Origin will provide support to AMSA in this response.

Vessels used for Origin activities at the Otway offshore facilities will have a vessel specific Shipboard Oil Pollution Emergency Plan (SOPEP) in accordance with the requirements of MARPOL 73/78 Annex I. These plans outline responsibilities, specify procedures and identify resources available in the event of an oil or chemical spill from a vessel.

Response Actions

The objectives of any hydrocarbon spill response are to minimise the risks to human life, environmental and socio-economic resources and property. In addressing strategies for oil spill response Origin have focused on the identification of vulnerable habitats located within the trajectory of the oil spill modelling for the operation rather than focusing on the open water environment. These strategies are specifically tailored to the light, highly evaporative condensate produced from the operation and the receiving environment comprised of a highly energetic marine environment with remote shorelines.

Oil spill modelling undertaken as part of the EP has indicated that impacts from a large scale loss of marine diesel or condensate would be limited to the open ocean surrounding the infrastructure. Shore line impacts would be highly unlikely and localised and minor in scale. Origin has also developed well relief plans in line with best practice guideline developed through the Oil and Gas UK industry body, to bring a well under control in the highly unlikely event of loss of well control.

Origin have determined through a net environmental benefits analysis (NEBA) that in the event of a large scale diesel or gas condensate spill that given the nature of the product (highly evaporative condensate and diesel), distance from shore and nature of the environment (highly energetic sea with remote and highly energetic coast lines) the only viable response option would be natural degradation and monitoring and evaluate. This NEBA assessment would be revisited in the case of an incident and updated if required based on the actual characteristics of the spill and metocean conditions.

The nature of the hydrocarbons potentially released from the site makes then unsuitable or undesirable for dispersant application. The high rates of evaporation, physical dispersion into the water column and physical weathering of these products, combined with the typical sea conditions in the area and distance from sensitive shoreline or shallow water environments (modelling predicts no or very minimal contact with these environments) make the deployment of booms and skimming techniques unnecessary and unfeasible.

With respect to deflection techniques and shoreline clean up, modelling results predict that no hydrocarbons from the site would reach the near shore environment at concentrations or thicknesses that would make these response options either feasible or desirable. Additionally over 90 % of the Victoria coastline which could be impacted by a petroleum activity are vertical

sandstone cliffs in excess of 20 meters in height and subjected to high energy wave action 365 days per year.

Primary response strategies that may be employed in parallel with monitor and evaluate in a worst case spill scenario include operational and scientific monitoring programs.

Monitor and evaluate

Understanding the behaviour and trajectory of hydrocarbon slicks is required in all spill scenarios to confirm the potential for environmental harm from the spill. There are a number of methods that can be used to monitor and evaluate hydrocarbon spills including;

- Direct observation (surveillance by air, vessel or tracking buoys);
- Manual calculations; and
- Computer modelling with real time metocean inputs from direct observations.

Operational and Scientific monitoring

Operational monitoring studies are undertaken to help guide and support operational spill response activities. These studies provide information on the extent and characteristics of the spill, the predicted fate of the spilled hydrocarbon and its immediate consequences, and assess the efficacy of response activities that are being undertaken.

Triggers associated with the operational monitoring program are designed to comply with Australian and New Zealand Environment Conservation Council (ANZECC) guidelines on water quality. Associated with the operational monitoring program is a scientific monitoring program that will be implemented (if triggered by the operational monitoring program).

The operational monitoring programs include;

- Condensate distribution and fate studies;
- Shoreline assessment surveys; and
- Oiled wildlife surveys.

The scientific monitoring program includes;

- Monitoring hydrocarbon fate and distribution in waters and sediments;
- Assessment of subtidal ecological effects;
- Assessment of intertidal ecological effects; and
- Wildlife impact and monitoring studies.

Baseline information against which the results of environmental monitoring will be considered will come from various sources including;

- Previous extensive studies of the Otway basin and Victorian coastal environments;
- Published biological information and data from research institutions;
- Equivalent ecological studies of suitable reference sites, selected in consultation with local experts; and
- Sampling from outside potentially impacted areas.

In all cases of sourcing baseline information, advice would be obtained from credible scientific experts (e.g. academics from independent research institutions) and sources of detailed local knowledge (e.g. Parks Victoria, local fishing and dive operators).

Appendix B Risk assessment tables

Impact Register

Hazard	Potential environmental impact	Activity / Environmental Context	Controls / Mitigation measures
Physical presence of platform and pipeline	The subsea infrastructure is considered to impart a positive impact on the marine environment during the operational phase as the structure provides new habitat for marine life. Exclusion of fishing industry from safety zone and impact on fishing gear from pipeline.	The physical structures associated with the Otway development will largely be static in relation to the marine environment, save for the occasional operation of associated valves. The safety exclusion zone for the platform and Geographe facilities is not in an area of high fisheries activity and is small in comparison to the overall fishing area available in the Otway.	• Platform and pipeline co-ordinates are clearly marked on navigational maps. • Fisheries management process to address claims for loss of catch or dispute resolution. • Records of inspection and maintenance of navigational lights are maintained in CMMS.
Light levels from Platform/Support vessel operations	Aggregations of marine life, sea birds and or migrating birds on the platform.	The light levels from the vessels are not considered to be significantly different from the light levels from passing merchant vessels and from fishing vessels, particularly squid fishing vessels that operate within the area. Vessel activities associated with operations are considered to comply with normal marine practice. There are no turtle breeding sites in the Otway basin that could be affected. The TWHP is normally unmanned and all non navigation lighting is not normally activated. The use of navigation lighting is required for safety during 24hr operations and to comply with navigation regulations.	• Origin vessel induction includes reporting requirements of wildlife sightings and clear requirements not to disturb wildlife.
Noise levels from platform/supply vessel/helicopter operations	Impact on marine life, sea birds and or migrating birds on or around the platform.	Birds appear little affected by noise as they are known to roost on the helideck and other areas. The facility has been operating since 2008 and seals have been noted to haul themselves out on the jacket trusses and marine fauna are noted in the vicinity of the operating facility indicating they are habituated to any noise produced. The Otway offshore environment is high energy and subject to high levels of natural noise from wave and wind action. Gas engines and generators on the platform are enclosed.	• Vessels and helicopters will comply with Cetacean interaction guidelines for vessels (DEH 2006).
Discharge of hydraulic fluid through subsea valve operations.	Localised reduction in water quality and localised toxic impacts from hydrocarbon discharge.	Discharged hydraulic fluid will rapidly mix and disperse in the marine environment to levels that are not expected to have any impact.	• Selected hydraulic fluid is a category D OCNS chemical, readily biodegradable and with a low potential for bioaccumulation. • Volume of hydraulic fluid released is small and will be recorded and monitored and compared with the predicted hydraulic fluid loss.

Hazard	Potential environmental impact	Activity / Environmental Context	Controls / Mitigation measures
Discharge of wastes (liquids, solids and litter) offshore.	Regulatory non- compliance. Localized increase in nutrient levels	The Otway facilities where operations will be undertaken is remote from shore and any releases will quickly be diluted in the marine environment.	• Putrescibles will be macerated to <25mm in compliance with MARPOL regulations • Preventative maintenance processes are in place to maintain pollution control devices • Offshore petroleum activities and vessel must comply with MARPOL 73/78 annex V. • Barrels are verified sealed prior to transport.
Operational activity reduces air quality (GHG emissions)	Venting of hydrocarbons into the environment.	Minor/normal operating releases from machinery. Vent purge is very small.	• Low sulfur diesel. • Vent tip is designed to ensure minimal gas disposal to the environment. • Equipment Maintenance • Origin Contracted Vessels have certification demonstrating compliance with MARPOL Annex VI- Prevention of Air Pollution from Ships as relevant to their class of vessel.

Risk Register

Risk	Potential Environmental Impact	Activity / Environmental Context	Controls / mitigation measures
Uncontrolled release from wells and production equipment	Air and water pollution, potential loss of fisheries income, potential mortality of marine life	A catastrophic failure has a remote likelihood. The release would be light highly evaporative condensate and predominantly gas. Weathering predictions for the Otway indicate rapid dissipation through weathering and evaporation of a condensate slick.	• The wells and facility have been designed to extract hydrocarbons from the reservoir under pressure. The wells are fitted with fail closed subsea valves to mitigate against and uncontrolled release of the well reservoir. • Regular maintenance and inspection programs are undertaken. • Personal undergo regular training to ensure that they are competent to operate the offshore facilities. • Process control, alarms and trips including low pressure shutdowns and isolation valves at the wells (including SSCV) and at the SVS are subject to regular testing and documented. • Relief well plan has been developed in line with Oil & Gas UK guidelines.
Uncontrolled pipeline release – condensate	Air and water pollution, potential loss of fisheries income, potential mortality of marine life	A catastrophic failure has a remote likelihood. The pipeline will contain a limited amount of liquid that could be released to the environment. The release would be light condensate. Weathering predictions in the Otway indicate rapid dissipation of a condensate slick. The pipeline will only hold a limited volume of gas and condensate.	• The pipeline has been designed for the transportation of gas and condensate. The design has taken into consideration the environment it is operating in, is abrasive resistant and designed to withstand dropped objects and physical impact. • Maintenance and inspection programs are undertaken • Isolation valves will fail safe • Personal undergo regular training to ensure that they are competent to operate the offshore facilities. • Process control, alarms and trips including low pressure shutdowns and isolation valves at the wells (including SSCV) and at the SVS are subject to regular testing.

Risk	Potential Environmental Impact	Activity / Environmental Context	Controls / mitigation measures
Loss of containment of (Mono Ethylene Glycol)	Direct toxic impacts on marine species	Any MEG discharge will be to a large and high energy receiving environment and will be rapidly diluted and dispersed. Hydrostatic pressure within the lines would rapidly equalize reducing the volume lost to the environment.	• Process control alarms and trips including low pressure shutdown and isolation valves at the SVS and onshore are inspected and maintained and will fail safe • MEG consumption and quantity of MEG injected is carefully monitored, a loss of MEG supply would result in a production shutdown and stoppage of the onshore MEG pumps. • MEG is a category D OCNS chemical, readily biodegradable and low potential for bioaccumulation. • Training and competency of personnel to operate and maintain the facilities appropriately, including monitoring of MEG rates and the ability to stop MEG pumping.
Loss of control of methanol	Localized impact to the marine environment	Methanol is a category E OCNS chemical, readily biodegradable and with low potential for bioaccumulation.	• Process controls, alarms and trips including low pressure shutdown and isolation valve at the SVS which will fail safe. • Stored in a dedicated double skinned tank on top of the equipment room • Transported in sealed containers which have been verified sealed. Personal are trained and competent in the handling of chemicals. Crane operators are trained and competent. • Records of inspection and maintenance documented in CMMS electronic log

Risk	Potential Environmental Impact	Activity / Environmental Context	Controls / mitigation measures
Loss of containment of hydraulic fluid	Localized impact to marine environment	Fluid would rapidly mix and disperse in the marine environment to levels that are not expected to have any impact. Limited volume of fluid stored on Thylacine.	• Selected hydraulic fluid is readily biodegradable with a low potential for bio accumulation. • Process controls, alarms and trips including low pressure shutdown and isolation valve at the SVS which will fail safe. • The quantity of hydraulic fluid is carefully monitored and a loss of fluid would result in a production shutdown and stoppage of the hydraulic fluid pumps. • Regular testing of the valves is undertaken and preventative maintenance programs are in place that include the hydraulic system. • Otway Training and induction for Otway operations include chemical and management and discharge requirements.
Physical presence of vessel collision with marine fauna.	Potential wounding or mortality	Some marine fauna exhibit avoidance behavior, removing themselves from the area of potential impact. Whales do not frequent the area all year round.	• Vessels and helicopters will comply with the DEH 2005 guidelines on minimum approach distances to marine mammals. Guidelines held by Vessel master • Otway Training and induction for Otway operations include Origin fauna interaction guidelines. • Reports of Whale and vessel interactions recorded in OCIS

Risk	Potential Environmental Impact	Activity / Environmental Context	Controls / mitigation measures
Loss of marine diesel from vessels	Pollution of the marine environment from hydrocarbon discharge.	There is a limited quantity of fuel that can be lost (Maximum spill of 1 bunker of fuel (190m^3) has been modeled). Standard operating procedures under the ship board oil pollution plan (such as pumping fuel from the damaged tank to an uncompromised tank) will result in minimal fuel being lost to the environment. High evaporation rates of marine diesel.	• Vessels equipped with navigation lights and navigation aids. • Vessels will be equipped with (dynamic positioning) DP if operating close to the platform. • Vessel fuel tanks are bunkered to reduce potential loss of fuel. • Vessels working on the Otway operations will be audited prior to engagement against IMCA M 189/s 004, working under a permit to work system. • Vessels will be working with in the petroleum safety exclusion zone when attending the Thylacine or Geographe wells.
Introduction of marine pests	Impacts to marine ecology. Impacts to fisheries.	Vessels are likely to be mobilized from tropical/ warm waters and hence there is little risk from introduction of marine species that could take hold in the Otway environment. Support vessels utilized for support will be sourced from the local area.	• Vessels engaged in support activities for Otway operations will be required to have valid Australian Quarantine Inspection Service (AQIS) certification issued prior to commencing activities in Australian waters. • Ballast water discharge logs are maintained • Biofouling management guidance available and biofouling record book current
Deck Drainage – Environmentally harmful levels of oil/ chemicals in deck drainage.	Localized pollution of marine environment.	Vessels utilized will meet international conditions under MARPOL for pollution from ships and all class requirements.	• Otway facilities designed consistent with the pipeline safety case and validated in accordance with the NOPSEMA scope of validation requirements. • Oils will be separated from water on vessels and returned to shore for treatment and water discharge will be monitored. • Oils separated on Thylacine platform will be injected back into the production pipeline.
Disturbance to the sea floor impacting the marine environment	Localized disturbance to the sea floor	The Otway facilities are largely static and benthic life has been noted to quickly re-colonize structures and thrive due to the new habitat presented by the operation.	• DP enabled vessels • ROV footage will be assessed to pre and post replacement operations.

Risk	Potential Environmental Impact	Activity / Environmental Context	Controls / mitigation measures
Environmental impacts of relief well drilling: Physical presence of MODU Light and noise emissions Discharge of drilling muds, fluids, cuttings and cement Discharge of liquid and food wastes Introduction of marine pests	Localized disturbance to the sea floor Behavioral change in marine fauna due to increased noise Hearing impairment to marine fauna Localized increase in nutrient levels and reduction in water and sediment quality Impacts to marine ecology and fisheries. Localized smothering of benthic fauna.	Environmental impacts of relief well drilling are localised and temporary Standard industry requirements for biosecurity, waste management and pollution control will apply to any MODU mobilsed for relief well drilling. Impacts from disposal of discharged muds and cuttings are localised and short lived. Also relief well drilling will only be considered if there is an uncontrolled release that can only be contained by relief well drilling. The environmental impacts of allowing the well to flow freely outweigh potential environmental impacts of drilling a relief well to bring the well under control.	• All equipment onboard the MODU will be maintained via a preventative maintenance system (or equivalent), which will assist avoidance of excessive light and noise emissions. • Use of solids control equipment to maximize retention of drilling fluids and muds. • Putrescibles will be macerated to <25mm in compliance with MARPOL regulations • Notice to Mariners to be issued regarding the presence of the MODU • Selection of drilling and cementing products with the lowest environmental risk ranking practicable, based on CHARM and OCNS, whilst meeting operational requirements • Compliance with MARPOL Annex IV and V pollution control requirements. • Valid Australian Quarantine Inspection Service (AQIS) certification, anti-fouling certificate and ballast water discharge log.