



Origin 2012 Offshore Drilling Campaign, Otway Basin

Environmental Plan Summary

Review Record

Rev	Date	Reason for Issue	Prepared	Checked	Approved
01	12/04/12	Approved for distribution	BM/JA	CB	JL

Once printed, this is an uncontrolled document unless issued and stamped *Controlled Copy* or issued under a transmittal.

1. Introduction

Origin Energy Resources Limited (hereafter “Origin”) is proposing to drill one exploration well, two development wells and potentially a second exploration in the Otway Basin.

An Environment Plan (EP) for this drilling campaign has been prepared in accordance with the requirements of the *Offshore Petroleum & Greenhouse Gas (Environment) (OPGGG (E)) Regulations 2009*. The EP has been reviewed and accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA).

This EP summary document has been prepared to comply with the requirements of Regulation 11(7) and (8) of the referenced OPGGG (E) Regulations.

2. Location of the Activity

The proposed Otway drilling campaign is within Commonwealth waters in the Otway Basin, which covers an area of over 103,300 km². The Commonwealth of Australia has permitted Origin to undertake hydrocarbon exploration and production in an area of over 6,400 km² (6.20%) of the Basin, and the campaign is within an area of less than 115 km² (0.1%) of that, in Vic/P43 and production license Vic/L23 (see Figure 1).

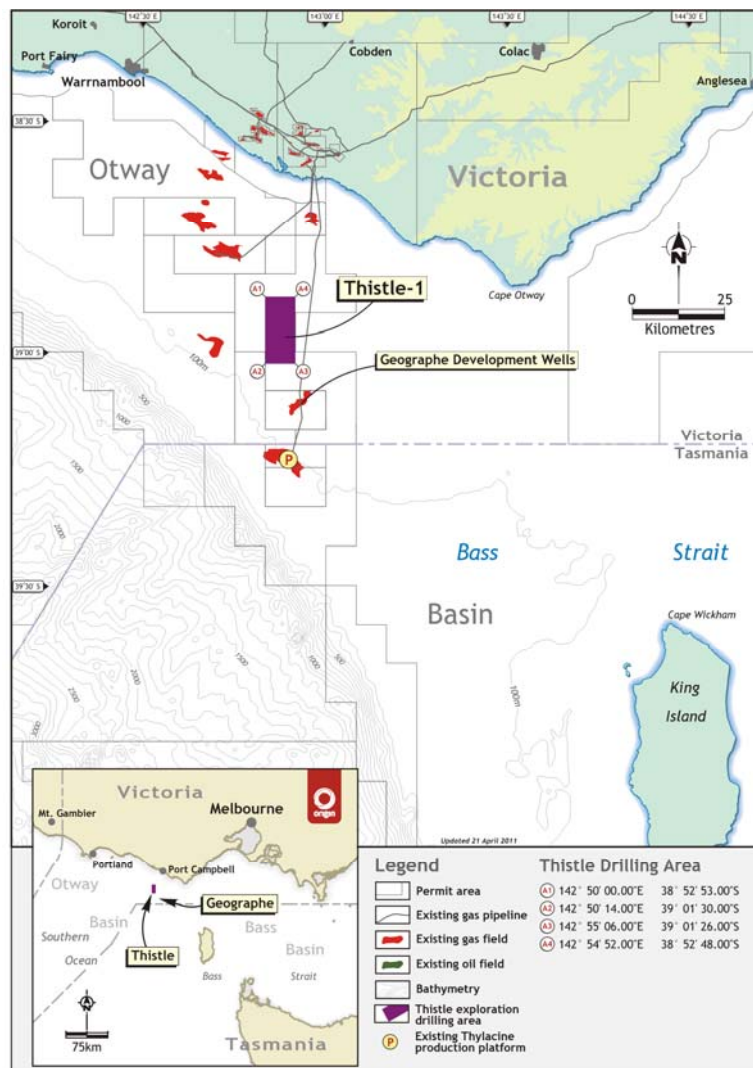


Figure 1: 2012 Otway Drilling Campaign Location

Given that the estimated temporary footprint of each well location is 0.78 km² (0.00075% of the Basin) for 30 for an exploration well and 90 days for a development well, inclusive of operational down time, the impact of campaign activities on the Basin’s biological systems and ecosystem will be not be significant, and consistent with existing commercial operations and those within the development area between the Thylacine Offshore platform and the coastline of Victoria. The well types and relevant permit or licence areas are listed in Table 1, along with distances to key mainland locations.

Table 1: Drilling Campaign area locality and well types

Drilling campaign area	Well type and number	Approximate distance from (in kilometres)				
		King Island (km)	Cape Otway (km)	Port Campbell (km)	Warrnambool (km)	Closest point on mainland (km)
Thistle (Vic/P43)	Exploration	108	53	29	63	28
Geographe (Vic/L23)	Development	99	57	55	90	45

Boundary coordinates for the Thistle exploration drilling areas are presented in Table 2 and surface locations for the Thistle 1, the potential exploration, Geographe 2 and Geographe 3 wells are provided in Table 3.

Table 2: Boundary coordinates for the proposed Thistle drilling campaign area

Location point	Longitude (E)			Latitude (S)		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
A1	142	50	0	38	52	53
A2	142	50	14	39	1	30
A3	142	55	6	39	1	26
A4	142	54	52	38	52	48

Table 3: Surface coordinates for Thistle1, proposed exploration well, Geographe 2 & 3

Location	Longitude (E)			Latitude (S)		
	Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
Thistle 1	142	53	27	38	57	59
Potential exploration well*	142	52	26	39	1	16
Geographe 2	142	57	6	39	6	29
Geographe 3	142	57	6	39	6	29

* Coordinates for the Potential Exploration well may change but will be within the Thistle drilling area

3. Description of the Activity

Origin has contracted the Stena Clyde, a semi-submersible mobile offshore drilling unit (MODU) to undertake the drilling campaign. The Stena Clyde will be operated by Stena Drilling. The Stena Clyde is supported by large pontoon-like structures that are ballasted, partly below the sea surface. The operating decks are elevated some 20 m to 30 m above the pontoons on large steel columns. The semi-submersible drilling rig will be held in place by eight anchors.

The rig will operate under a NOPSEMA accepted Vessel Safety Case (VSC) and has operated in Australian waters since 1999.

The drilling rig will be supported permanently by two Farstad support vessels: Far Fosna and the Lady Sandra. There will be at least one vessel on location at the drill site at any time. A third support vessel will be hired as needed. These vessels will operate out of Geelong Port and will supply all consumables to the drilling rig, including food, water, bulk materials, hardware, drilling mud material and diesel fuel. Refuelling of support vessels will occur at Geelong Port and all transfer of material to the rig from the support vessel is governed by Stena’s and Farstad’s bulk

material transfer procedures. The equipment and procedure used to transfer material and the procedure have been reviewed and the risk of an environmental incident is considered to be low.

During drilling operations an estimated four to six helicopter trips per week will be needed to ferry personnel and equipment to the Stena Clyde. Bristow has been contracted to provide the two helicopters that will be used, one primary and one backup, which will be based at and refuelled from Essendon or Warrnambool.

Fixed wing aircraft are only engaged when regional visual inspections are required, for instance for activities associated with the environmental research programs or in the event of unplanned discharges or other emergency situations.

4. Description of Receiving Environment

4.1 Regional Setting

The Otway drilling site lies within the Western Bass Strait Provincial area as defined in the Interim Marine and Coastal Regionalisation for Australia (IMCRA). The Western Bass Strait area extends from Cape Jaffa to slightly North of Apollo Bay, including King Island. It is a high wave energy environment with steep to moderate gradients. The currents on average are moderately strong through the entrance to Bass Strait with cold temperate waters that are subject to nutrient rich upwelling.

Climate and Meteorology

Winds in the eastern Otway and western Bass Strait are generally strong, exceeding 13 knots (more than 23.4 km/h) for 50% of the time. Winds contribute to the generally moderate to high wave-energy environment of area. Winds are predominantly south-westerly to north-westerly, with September being the windiest month, when speeds average 29 km/hr (BOM, 2011). Waves are also predominantly south-westerly to westerly and the largest occur during winter months when mean heights range from 3.1 m to 3.7 m and maximum heights are between 7.6 m and 10.3 m. Wave heights in the summer months average between 2.5 m and 3.0 m, and maximum heights range between 5.6 m and 7.7 m (BOM, 2011).

The waters of the Otway are cool-temperate, with mean sea surface temperatures ranging from 14°C in winter to 19°C in summer. Intrusions of cooler nutrient rich water occur along the seafloor during mid to late summer, although this is usually masked in satellite images by a warmer surface layer. The boundary with cooler 15°C water occurs at a depth of 30 m in December, and moves to 100 m in May. It is then rapidly destroyed when mixing occurs during winter months (Gill, 2003). The cooler water is an extension of the regional Bonney Upwelling system, which is an eastward flow of nutrient rich water across the continental shelf of the southern coast of Australia during the summer months. It is a result of south-east winds pushing surface water layers offshore with a compensatory intrusion of colder nutrient rich water along the bottom.

Geomorphology

Mainland Tasmania and the Bass Strait islands belong to the same continental landmass as mainland Australia. The continental shelf is narrow along the east coast of Tasmania but broadens in the northwest, underlying Bass Strait and the Otway and Gippsland basins. The Bassian Plain is the main seafloor feature of Bass Strait; a ridge along the western edge of this plain extends from King Island to northwest Tasmania (Jennings, 1959).

The Western Bass Strait Shelf Transition has a sloping offshore gradient, dominated by bio-clastic carbonate sediments. Adjacent to King Island, Palaeozoic granite and associated sediments dominate the offshore environment. The seabed sediment in the drilling area consists of calcarenite, limestone, sandstone, marl and granite, with areas of sand of varying grain size.

Bathymetry

The proposed drilling campaign area's seabed bathymetry is a gently sloping plane situated at the edge of the continental slope and ranges in depth from approximately 70 - 200 m. The regional topography in the area is described as a perched valley, with the eastern and western margins of Bass Strait being slightly raised granite ridges (NOO, 2002).

Conservation Areas

There are no outstanding natural geomorphologic features present within the proposed survey area; however the Apollo Bay and Zeehan Marine Reserves are within 100km of the drilling area. Both are listed as International Union for Conservation of Nature (IUCN) VI, protected area with sustainable use of natural resources.

Fauna

The Otway drilling campaign is located in South East Marine Region (SEMR), which is reported to have a high degree of diversity as well as some of the highest levels of endemism in the world (NOO, 2002). The fish fauna in the region consists of an estimated 600 species, with 85% believed to be endemic. Additionally, SEMR has diverse marine benthic flora, with 62% of its macro algae thought to be endemic (NOO, 2004).

The region supports a number of marine species, which includes:

- Sixteen bird species identified as threatened and/or migratory in the EPBC Act database search. The threatened birds include 12 albatross species (4 endangered, 8 vulnerable) and 4 petrel species (1 endangered and 3 vulnerable).
- Nine cetaceans identified as threatened and/or migratory within the proposed drilling area. Among these are two species listed as endangered, the blue and southern right whales; and one species, the humpback whale, listed as vulnerable under the EPBC Act.
- Two additional whales, the fin and sei whale, are both listed under the EPBC Act as vulnerable and migratory and have been observed in the Otway region during aerial surveys.
- Two reptile species listed as endangered and migratory may potentially occur in the drilling campaign area, the loggerhead turtle and leatherback turtle.
- Listed shark species such as the great white shark are known to frequent the seal colonies in the area. Furthermore, migratory shark species such as the shortfin mako and the porbeagle are known to be distributed throughout the southern waters of Australia.
- Two seal species, the New Zealand and Australo-African fur-seals have been known to forage in the area.
- Up to 26 different ray-finned fish (20 pipefish species, 2 seahorse species, 2 seadragon species and 1 pipehorse species).
- A high diversity of marine invertebrates including sponges, cnidarians (jellyfish, corals, anemones, seapens), crustaceans, molluscs, echinoderms, and marine worms (e.g., polychaetes).

Socio-Economic Environment

The Victorian and Commonwealth fisheries known to overlap the Otway drilling campaign area are the:

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

Total commercial fishing catch effort in the drilling area for the most part is low (i.e., ≤ 50 kg/ sq km/ yr). A 500 m exclusion zone will be established around the rig, with the vessel providing Australian Maritime Safety Authority (AMSA) a "Notice to Mariners" outlining the area of operations and a request that all other vessels provide clearance around the drilling rig, Anchor Handling Support Vessel (AHSV) and equipment.

Commercial Shipping

Bass Strait is a well-known shipping route with 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 (NOO, 2004). The drilling area had more than 1000 vessels moving through it from 1999 - 2000. In addition to the deployment of a support vessel, a "Notice to Mariners" will be provided to AMSA to limit interaction with shipping vessels in the area.

5. Major Environmental Hazards and Controls

For the Otway drilling campaign risks have been qualitatively assessed using the Origin risk assessment process and this is consistent with the *Australian Standard for Risk Management: AS/NZS ISO 31000:2009 Risk management - Principles and guidelines*.

The environmental risks associated with the Otway drilling campaign have been identified from these sources:

- previous drilling environment plans and risk assessments;
- use of environmental experts;
- campaign specific HAZID workshops; and
- campaign specific environment risk assessment and as low as reasonably practicable (ALARP) workshops.

The latest workshop to support this specific EP update was held on 4 March 2012 with representatives from Stena, Farstad, and Origin's drilling, South Australian Asset Operations and Environment team. The overall results of the Risk Assessments are provided in Appendix A.

6. Overall Management Approach

Origin is committed to protection of the environment in all activities it undertakes. Activities are undertaken in accordance with relevant legislated standards and where legislated standards do not exist, responsible standards are adopted. Successful environmental outcomes are achieved by understanding how proposed activities interact with the environment, identifying possible and foreseeable impacts, and implementing management controls which eliminate or reduce the environmental risk to ALARP.

Origin is responsible for assuring that the proposed drilling campaign is managed in accordance with this accepted EP. The drilling contractor (Stena Drilling) will undertake the operations on Origin's behalf and, under contractual arrangements with Origin, will implement and comply with all environmental constraints and procedures nominated in the accepted EP. Specific responsibilities identified with respect to environmental management arrangements (i.e. control implementation) are assigned in the accepted EP's implementation schedule. This ensures that the environmental risk associated with the survey is maintained at a level which is ALARP.

Environmental performance objectives are defined for each environmental aspect. These objectives are monitored and reviewed to ensure environmental outcomes are achieved during the campaign. Origin adopts a philosophy of continuous improvement. Learnings from the drilling campaign, incident investigations and field activity reviews are documented and incorporated as improvement actions for future drilling activities.

7. Stakeholder Consultation

In accordance with the requirements of the OPGGS (E) Regulations, a consultation strategy has been developed, focussing on consultation between Origin and the relevant regulatory entities, and key interest and industry groups.

The consultation program has been designed to meet the following key objectives:

- outline the objectives of and the work program for the proposed drilling campaign;
- inform stakeholders of the potential environmental risks associated with the project activities;
- explain how Origin (as operator for the drilling program) intends to manage potential risks;
- listen to and address concerns of key stakeholders;
- seek further information on sensitive ecological values and socio-economic usage of the area;
- build a long-term relationship with key stakeholders to mitigate any concerns; and

- minimise disruption to third party activities occurring concurrently with the drilling.

A program of engagement with stakeholders is in place to ensure adequate consultation with:

- government regulators and other decision making authorities;
- research institutions and scientific advice;
- relevant commercial enterprises;
- community; and
- non-government organisations, environmental or conservation groups.

Briefings have been provided to officers of key Government Departments and peak industry associations identified below.

Lead Regulatory Entities:

- Commonwealth DSWEPC, and
- NOPSEMA

Additional Regulatory Entities:

- Victorian Department of Primary Industries, and
- Victorian Department of Sustainability and Environment (Biodiversity- SW Region)

Technical and Scientific Entities:

- Peter Gill and Margie Morrice, Blue Whale Study Inc.;
- Robert McCauley - Curtin University of Technology, Centre for Marine Science and Technology; and
- Andrew Levings - A & C Levings Marine and Natural Resource Consultants.

Commercial and Recreational Fishing Groups:

- Australian Fisheries Management Authority,
- Seafood Industry Victoria,
- VRFish Victoria,
- South East Trawl Fishing Industry association,
- Local giant crab and lobster fishermen, and
- Other Peak Fishing groups

Local Emergency Response Services:

- Rescue Coordination Centre (RCC) (AusAR),
- Australian Marine Oil Spill Centre,
- Australian Maritime Safety Authority (AMSA), and
- Local Media.

It is recognised that during the ongoing planning and implementation phases of the Otway drilling campaign additional stakeholders to those nominated above may be identified. Accordingly these stakeholders will be consulted in the relation to their specific area of interest of the project. A record of consultation with any additional stakeholders will be included in the project consultation log.

Origin is committed to continuing the consultation process throughout the operational phases of the project. Relevant authorities, interested person(s) and organisation will be consulted with at key milestones during the project schedule.

Origin will ensure that delivery of current project information to stakeholders occurs in a timely manner and in a way which is appropriate for the stakeholder audience. Engagement with external stakeholders will be recorded on the Otway drilling campaign consultation log for the duration of the project.

8. Contact Details

Further details on the 2012 Otway Drilling campaign can be obtained from:

Contact: Mr Robert Meagher
Position: Principle Exploration Operations QHSE Advisor
Organisation: Origin Energy
Postal Address: GPO Box 148 Brisbane, QLD, 4001
Phone: 07 3867 0095
Email: Robert.meagher@originenergy.com.au
Website: www.originenergy.com.au

Appendix A Environmental Risk Assessment for the Otway drilling campaign

Aspect	Risk ID	Hazard	Potential Impact	Consequence	Likelihood	Inherent Risk	Control Measures and other considerations	Consequence	Likelihood	Residual Risk
Routine Impacts										
Site survey	R1	Vessel collision	<ul style="list-style-type: none"> Loss of fuel oil into the marine environment Shoreline hydrocarbon impacts 	3/Serious	2/Highly Unlikely	Medium	<ul style="list-style-type: none"> Vessels will be equipped with navigation aids and Automatic Identification System on vessels and rig Competent crew maintaining 24 hour visual, radio and radar watch for other vessels Notice to Mariners Pre-drilling fisheries notification and consultation Emergency Response Procedures Oil Spill Contingency Plan (ref: OEUP-V9000-PLN-ENV-004) Fit for purpose size of vessel selected (dependent on vessel availability) 	3/Serious	1/Remote	Low (ALARP)
	R2	Noise	<ul style="list-style-type: none"> Impact on cetaceans 	Not Applicable			<ul style="list-style-type: none"> Survey equipment will not produce sound considered to be within cetacean hearing frequencies Interaction with marine fauna guidelines 	Not Applicable		
Physical presence of rig and vessels (quarantine, lighting and noise)	R3	Intake and discharge of ballast water and biofouling.	<ul style="list-style-type: none"> Introduction of invasive marine species causing negative impacts on biodiversity. 	3/Serious	3/Unlikely	Medium	<ul style="list-style-type: none"> AQIS certification Stena Ballast Water Management Procedure (ref: L4 -DOC-CLY-0445) Supply vessels mobilised from SE Asia (Tropical species very unlikely to colonise Temperate Otway Basin) <i>Stena Clyde</i> has been stacked in Portland 	3/Serious	1/Remote	Low (ALARP)

Aspect	Risk ID	Hazard	Potential Impact	Consequence	Likelihood	Inherent Risk	Control Measures and other considerations	Consequence	Likelihood	Residual Risk
	R4	Artificial Lighting at night	<ul style="list-style-type: none"> Disturbance of migration of seabirds and other marine life that may be attracted to lighting from the rig and support vessels. 	2/Minor	2/Highly Unlikely	Low	<ul style="list-style-type: none"> Lights on the drilling rig and AHSV vessels will be kept on for 24 hours a day while drilling at each well location due to safety regulations Drilling rig and AHSV to maintain minimum lighting required for navigation and safety Light survey conducted Induction training will be provided to all crew and visitors on the <i>Stena Clyde</i> not to disturb wildlife and report any sightings to the HSE adviser 	1/Minor	2/Highly Unlikely	Low (ALARP)
	R5	Light from flaring	<ul style="list-style-type: none"> Marine life may be attracted to lighting from the rig and support vessels. 	2/Minor	2/Highly Unlikely	Low	<ul style="list-style-type: none"> Minimum flaring duration to meet operational requirements Specialist well testing contractor to be engaged Flaring equipment will be serviced accordance with Original Equipment Manufacturer standards Bring first hydrocarbons to surface during daylight hours Induction training will be provided to all crew and visitors on the <i>Stena Clyde</i> not to disturb wildlife and report any sightings to the HSE adviser 	1/Minor	2/Highly Unlikely	Low (ALARP)
	R6	Marine anthropogenic noise from drilling rig (excluding VSP)	<ul style="list-style-type: none"> Behavioural change in marine fauna (localised avoidance/attraction) Hearing impairment and pathological damage to marine fauna Increase stress levels in marine fauna Disruption to marine fauna underwater acoustic cues 	2/Moderate	3/Unlikely	Medium	<ul style="list-style-type: none"> All equipment will be serviced according to the Stena maintenance management standard The <i>Stena Clyde</i> has noise assessments, noise maps and has noise control in plans to minimise excessive noise generation Timing of drilling outside of blue whale peak aggregation and migration period Use of moored semi-submersible reduces noise propagation into the marine environment 	2/Moderate	2/Highly Unlikely	Low (ALARP)

Aspect	Risk ID	Hazard	Potential Impact	Consequence	Likelihood	Inherent Risk	Control Measures and other considerations	Consequence	Likelihood	Residual Risk
	R7	Marine anthropogenic noise from Support Vessels	<ul style="list-style-type: none"> • Behavioural change in marine fauna (localised avoidance/attraction) • Hearing impairment and pathological damage to marine fauna • Increase stress levels in marine fauna • Disruption to marine fauna underwater acoustic cues • Secondary ecological effects - alteration of predator prey relationship 	2/Moderate	3/Unlikely	Medium	<ul style="list-style-type: none"> • Supply vessels will be maintained utilising the vessel preventive maintenance system • Timing of drilling outside of blue whale peak aggregation and migration period • Vessels will comply with Cetacean interaction guidelines for vessels (DEH 2006), i.e. avoid travelling within 300 m of a whale • Logistics planning to minimise supply vessel activity 	2/Moderate	2/Highly Unlikely	Low (ALARP)
	R8	Marine anthropogenic noise from Helicopters	<ul style="list-style-type: none"> • Behavioural change in marine fauna (localised avoidance/attraction) • Hearing impairment and pathological damage to marine fauna • Increase stress levels in marine fauna • Disruption to marine fauna underwater acoustic cues • Secondary ecological effects - alteration of predator prey relationship 	2/Moderate	3/Unlikely	Medium	<ul style="list-style-type: none"> • Helicopters will comply with the Interaction with marine fauna guidelines (DEH 2006) as it refers helicopters, i.e. no flying lower than 500 m within a 500 m radius of a whale or dolphin • Flight paths - use of most direct routing to and from rig and flight height will minimise any impact on the marine environment during flights • Maintained aircraft in accordance with CASA standards • Minimise time on rig deck (no refuelling on rig) 	2/Moderate	2/Highly Unlikely	Low (ALARP)

Aspect	Risk ID	Hazard	Potential Impact	Consequence	Likelihood	Inherent Risk	Control Measures and other considerations	Consequence	Likelihood	Residual Risk
Vertical Seismic Profiling (only for Thistle-1 and the potential exploration well)	R9	VSP acoustic sources	<ul style="list-style-type: none"> • Behavioural change in marine fauna • Hearing impairment and pathological damage • Localised avoidance • Attraction • Increase stress levels • Disruption to underwater acoustic cues • Secondary ecological effects - alteration of predator prey relationship 	3/Serious	3/Unlikely	Medium	<ul style="list-style-type: none"> • Zero offset VSP technique • Timing of drilling outside blue whale peak aggregation and migration period • Implement and comply with requirements in the EPBC Referral Decision notice (Ref 2011/6125): <ul style="list-style-type: none"> ○ From 1 Nov to 31 May three dedicated and suitably trained crew members and from 1 June to 31 Oct one dedicated and suitably trained crew, will conduct visual observations for whales onboard the drilling rig when VSP is undertaken • The suitably trained crew will observe in accordance with Referral under the EPBC Act decision notice the following: <ul style="list-style-type: none"> ○ 3 km precautionary zone ○ 30 minute pre-start-up visual observation ○ 20 minute soft start ○ Continual fauna watch throughout the period when the VSP is operating ○ 500m shut down zone 	2/Moderate	2/Highly Unlikely	Low (ALARP)
Anchoring	R10	Deployment and recovery of anchors.	<ul style="list-style-type: none"> • Physical disturbance to significant benthic habitats 	1/Minor	3/unlikely	Low	<ul style="list-style-type: none"> • Site survey to confirm seabed bathymetry • Site specific anchor plan/mooring analysis • Site specific drilling rig anchoring procedure • Use of one anchor pattern for both Geographe wells 	1/Minor	3/unlikely	Low (ALARP)

Aspect	Risk ID	Hazard	Potential Impact	Consequence	Likelihood	Inherent Risk	Control Measures and other considerations	Consequence	Likelihood	Residual Risk
Drilling fluids, Completion fluids and drilling cuttings	R11	Discharge of drilling fluids, completion fluids and drilling cuttings.	<ul style="list-style-type: none"> Smothering of benthic organisms Temporary and localised increases in turbidity in the marine environment Temporary and localised increases in concentrations of drilling additives to the marine environment 	3/Serious	3/Unlikely	Medium	<ul style="list-style-type: none"> Use of Water Based Mud's and brines Use of shakers and centrifuges to ensure maximum retention of fluids within the active mud system for re-use, thereby minimising total mud volumes Reduced Volume Mud Usage Use CHARM and OCNS rating for selection of drilling and completion fluids Batch drilling at Geographe wells Recording of discharges in daily logs High dilution rates - dilutions of >1:100 within 20 m of the discharge are predicted during all sea conditions (Swan et al, 1994) 	2/Moderate	2/Highly Unlikely	Low (ALARP)
Solid and liquid wastes	R12	Sewage and grey water	<ul style="list-style-type: none"> Temporary and localised increase in nutrient loading 	2/Minor	3/Unlikely	Medium	<ul style="list-style-type: none"> Compliance with MARPOL 73/78 - sewage treated prior to discharge Use of MARPOL 73/78 Compliant sewage system Compliance with the Operators Waste Management Plan Sewage treatment system maintained to maintained to Original Equipment Manufacturers standards Grey water is comprised of potable water, soap and detergents. None of these components are inherently toxic High energy marine environment will ensure any wastewater streams are rapidly diluted and any effects on marine biota will be highly localised 	1/Minor	1/Remote	Low (ALARP)
	R13	Putrescible waste	<ul style="list-style-type: none"> Temporary increase in food sources and nutrient loading Localised increase in the abundance of marine species 	1/Minor	3/Unlikely	Low	<ul style="list-style-type: none"> Compliance with the Operators Waste Management Plan Compliance with MARPOL 73/78 - all food waste macerated to <25 mm prior to disposal Macerators maintained to original equipment manufacturers standards Rig and support vessel HSE induction High Energy marine environment will rapidly disperse and consume any putrescibles food wastes and nutrients 	1/Minor	1/Remote	Low (ALARP)

Aspect	Risk ID	Hazard	Potential Impact	Consequence	Likelihood	Inherent Risk	Control Measures and other considerations	Consequence	Likelihood	Residual Risk
	R14	Cooling water	<ul style="list-style-type: none"> Temporary and localised increases in sea water temperatures. Impact on marine biota (attraction or avoidance behaviour, stress or potential mortality) 	1/Minor	2/Highly Unlikely	Low	<ul style="list-style-type: none"> Cooling water system design (temperature differential is small) and discharge location (water spills to sea surface) The cooling water system is a segregated system, with no hydrocarbons or chemical content Stena Preventative Maintenance System, Farstad Planned Maintenance System, Stena Maintenance System Principe (ref: L2-PR-ENG-0098) and Stena Maintenance Management Strategy (ref L2-DOC-ENG-0097) for engine cooling system Temperature alarms on cooling water discharge (designed to protect equipment but will give an indication of higher than anticipated discharge temperatures) High energy marine environment will lead to high dilution rates. Any effects from heat would be highly localised 	1/Minor	1/Remote	Low (ALARP)
	R15	Cement discharge at seabed	<ul style="list-style-type: none"> Temporary and localised increases in pH. Impact on marine biota (attraction or avoidance behaviour, stress or potential mortality) 	1/Minor	2/Highly Unlikely	Low	<ul style="list-style-type: none"> Selection of cementing chemicals with OCNS rating E or CHARM rating Gold Prevent discharge of cement to seabed for subsequent casing strings ROV monitoring of cement operation at seabed At Thistle-1 and the potential exploration well the recovery of wellhead to surface and conjoining cement on abandonment of well High energy marine environment will disperse chemicals rapidly 	1/Minor	1/Remote	Low (ALARP)
	R16	Cement discharges at surface	<ul style="list-style-type: none"> Temporary and localised increases in pH Impact on marine biota (attraction or avoidance behaviour, stress or potential mortality) 	1/Minor	2/Highly Unlikely	Low	<ul style="list-style-type: none"> Excess cement onboard to be returned to shore at end of well for disposal 	Not Applicable		

Aspect	Risk ID	Hazard	Potential Impact	Consequence	Likelihood	Inherent Risk	Control Measures and other considerations	Consequence	Likelihood	Residual Risk
	R17	Solid wastes	<ul style="list-style-type: none"> Persistent in the marine environment and can negatively impact on marine fauna (e.g. plastic ingested by marine fauna) 	2/Moderate	3/Unlikely	Medium	<ul style="list-style-type: none"> Comply with MARPOL 73/78 (no discharge of solid wastes) Comply with operator Waste Management Plans Good Housekeeping Practices such as waste segregation Return solid wastes to mainland for appropriate onshore disposal Recycle onshore all viable materials i.e. metal, glass, plastics Approved and licensed waste transport contractors Rig and support vessel HSE induction HSE Advisor onboard, regular checks and environment audits Induct all crew and visitors in <i>Stena Clyde</i> waste segregation process 	Not Applicable as routine activity refer to Non-routine Unplanned discharges		
	R18	Hazardous Wastes	<ul style="list-style-type: none"> Temporary and of localised marine contamination of marine environment. 	2/Moderate	3/Unlikely	Medium	<ul style="list-style-type: none"> Comply with MARPOL 73/78 (no discharge of hazardous wastes) Segregate and dispose onshore, Identify and label waste clearly and segregate and contain (in skips or sealed drums) Store hazardous wastes in appropriate containers, segregate from non-hazardous wastes label and transfer hazardous wastes in accordance with Material Safety Data Sheet (MSDS) instructions Comply with Operators Waste Management Plan Contractor management process Approved and licensed waste transport and disposal contractors Bund storage areas for used oil and other liquid hazardous waste Waste Tracking Records Rig and support vessel HSE induction HSE Advisor onboard, regular checks and environment audits 	Not Applicable as routine activity refer to Non-routine Unplanned discharges		
	R19	BOP discharges	<ul style="list-style-type: none"> Temporary and of localised marine contamination of marine environment. 	2/Moderate	1/Remote	Low (ALARP)	<ul style="list-style-type: none"> Minimise number of chemicals used during BOP function test Select testing chemicals with OCNS rating E or CHARM rating Gold Minimise volumes of testing chemical required Sample BOP test fluid to ensure chemical are within specifications Function test BOP as per American Petroleum Institute regulations 	1/Minor	1/Remote	Low (ALARP)

Aspect	Risk ID	Hazard	Potential Impact	Consequence	Likelihood	Inherent Risk	Control Measures and other considerations	Consequence	Likelihood	Residual Risk
	R20	Reverse Osmosis (RO) discharges	<ul style="list-style-type: none"> • Temporary and localised increases in sea water salinity. • Impact on marine biota (attraction or avoidance behaviour, stress or potential mortality) 	1/Minor	1/Remote	Low (ALARP)	<ul style="list-style-type: none"> • Daily inspection of RO plant • Stena drilling preventative maintenance as per OEM recommendations • Back flushing procedures as the automated logic system 	1/Minor	1/Remote	Low (ALARP)
Deck Drainage	R21	Deck drainage	<ul style="list-style-type: none"> • Release of contaminants into the marine environment from deck drainage water. 	2/Moderate	3/Unlikely	Medium	<ul style="list-style-type: none"> • Machinery spaces and engine room areas have enclosed drainage systems • Drip trays and bunding in use • Spill kits are installed at all machinery points on the main deck • Compliance with MARPOL 73/78 (oil water discharges <15 ppm) • Use of MARPOL 73/78 Compliant oil water separator and monitor • Rig and support vessel HSE induction • HSE Advisor onboard, regular checks and environment audits • Crew experienced and trained in offshore drilling • Drain covers and bungs in use during operations with an elevated risk of spill i.e. fuel transfer • High energy marine environment will disperse chemicals rapidly 	2/Moderate	2/Highly Unlikely	Low (ALARP)

Aspect	Risk ID	Hazard	Potential Impact	Consequence	Likelihood	Inherent Risk	Control Measures and other considerations	Consequence	Likelihood	Residual Risk
Well clean-up and testing systems	R22	Flaring	<ul style="list-style-type: none"> Deterioration of the local air shed Brine/water discharges to the marine environment Condensate leaks to the marine environment Loss of visual amenity for communities and stakeholders Increased water temperature 	2/Moderate	3/Unlikely	Medium	<ul style="list-style-type: none"> Well test equipment design and certification Independent validation of well test equipment Specialist well testing contractor employed Use high efficiency flaring equipment Limit flaring duration to meet operational requirements Ensure any water/brine produced complies with OSPAR produced water limits First hydrocarbons brought to surface during daylight Potential sources of condensate leaks fully bunded Flaring equipment will be serviced according to the Original Equipment Manufacturers standards Operation conducted in accordance with NOPSEMA approved WOMP Stakeholder consultation Duration of flaring reduced to the minimum required to achieve the technical objectives of the project 	1/Minor	3/Unlikely	Low (ALARP)
Atmospheric emissions	R23	Emissions from combustion engines	<ul style="list-style-type: none"> Deterioration of the local air shed 	2/Moderate	3/Unlikely	Medium	<ul style="list-style-type: none"> All equipment will be serviced according to Original Equipment Manufacturers standards Low Sulphur content Diesel Diesel use will be recorded and monitored Unnecessary equipment will be turned off/put on standby subject to safety and operational requirements MARPOL 73/78: Air pollution prevention certificate Supply vessel and helicopter movements planned 6 days in advance to minimise activity 	1/Minor	3/Unlikely	Low (ALARP)

Aspect	Risk ID	Hazard	Potential Impact	Consequence	Likelihood	Inherent Risk	Control Measures and other considerations	Consequence	Likelihood	Residual Risk
Non- routine Impacts										
Hydrocarbon spills	R24	Loss of well control	<ul style="list-style-type: none"> Loss of gas and condensate into the marine environment Shoreline hydrocarbon impacts 	5/Critical	3/Unlikely	High	<ul style="list-style-type: none"> Well design will be created in accordance with Origin’s Drilling Management System policies and procedures Casing design will be reviewed and approved prior to start of well Minimum mud weight selected for reservoir section to be in accordance with Origin’s Well Control Standard (ref: OEUP-INT1000-STD-DRL-001) Offset well data to be utilised to provide anticipated reservoir pressure Shallow gas review to be conducted by Origin subsurface department and approved BOP to be run and in place prior to drilling of any hydrocarbon zones BOP to be routinely tested in accordance with Stena Well Control manual Rig selection based on drilling capability and presence of BOP that complies with Origin’s Well Control Standard (ref: OEUP-INT1000-STD-DRL-001) Origin have reviewed and will implement Stena’s Well Control Manual (ref: L2-DOC-OPS-3531) Drilling Programme to be reviewed and approved as per Origin Drilling Management System Reserve drilling fluid to be maintained onboard for the event of losses scenario Well Operations Management Plan to be submitted to and approved by NOPSEMA Oil Spill Contingency Plan (ref: OEUP-V9000-PLN-ENV-004) to be in place Senior Origin and Stena Well site personnel to hold valid International Well Control Forum certificates Oil Spill Response training drills 	5/Critical	1/Remote	Medium (ALARP)

Aspect	Risk ID	Hazard	Potential Impact	Consequence	Likelihood	Inherent Risk	Control Measures and other considerations	Consequence	Likelihood	Residual Risk
	R25	Refuelling	<ul style="list-style-type: none"> Loss of diesel fuel into the marine environment 	3/Serious	3/Unlikely	Medium	<ul style="list-style-type: none"> Equipment design and certification Dedicated operators providing continual monitoring from vessel and rig during refuelling Refuelling will be carried out under the Permit-To-Work system Refuelling to be conducted in line with Stena's refuelling procedure and <i>Farstad's</i> bunkering procedure (Stena ref: L5-DOC-CLY-3973 and <i>Farstad</i> ref: 034-50-010 and EROP-024) Bunker hoses to be routinely inspected and replaced as per <i>Stena Clyde's</i> refuelling procedure Bunker hose type and couplings to comply with <i>Stena Clyde's</i> refuelling procedure Bunkering operations to be supervised by authorised Stena personnel Buoyancy aids to be present on all bunkering hoses Oil Spill Contingency Plan (ref: OEUP-V9000-PLN-ENV-004) in place Oil Spill Response training drills 	2/Moderate	2/Highly Unlikely	Low (ALARP)
	R26	Vessel Collisions	<ul style="list-style-type: none"> Loss of fuel oil into the marine environment Shoreline hydrocarbon impacts 	4/Major	3/Unlikely	Medium	<ul style="list-style-type: none"> Rig control room and supply vessel's bridge manned at all times Rig and supply vessels equipped with Automatic Identification System (AIS) Rig and navigation lighting in place as per class certification Position of rig gazetted and notice to mariners provided Local stakeholders informed of rig location Standby vessel to be present at rig at all times Multiple fuel tanks in place on rig and supply vessels to minimise impact of collision Compliance with Stena Vessel Safety case (ref: L4-DOC-CLY-3088) for all vessel entering 500m petroleum safety zone Emergency ballast control system on rig to prevent capsizes in result of collision Emergency Response Plans and arrangements Oil Spill Contingency Plan (ref: OEUP-V9000-PLN-ENV-004) in place Oil Spill Response training drills 	4/Major	1/Remote	Medium (ALARP)

Aspect	Risk ID	Hazard	Potential Impact	Consequence	Likelihood	Inherent Risk	Control Measures and other considerations	Consequence	Likelihood	Residual Risk
Unplanned discharges	R27	Solid wastes	<ul style="list-style-type: none"> Persistent in the marine environment and can negatively impact on marine fauna (e.g. plastic ingested by marine fauna) 	2/Moderate	3/Unlikely	Medium	<ul style="list-style-type: none"> HSE and rig induction. Crew experienced and trained in offshore drilling. MARPOL 73/78 (no discharge of solid wastes). Segregate and dispose onshore. Compliance with Stena Management of Waste Offshore (ref: L2-DOC-LPD-0201). Approved and licensed waste transport contractors Lifting procedures 	2/Moderate	1/Remote	Low (ALARP)
	R28	Hazardous wastes	<ul style="list-style-type: none"> Temporary and localised contamination of marine environment. 	2/Moderate	3/Unlikely	Medium	<ul style="list-style-type: none"> Compliance MARPOL 73/78 (no discharge of hazardous wastes) Segregate and dispose onshore. Clear waste identification, segregation, containment (in skips or sealed drums) and labelling Compliance with the Stena Management of Waste Offshore (ref: L2-DOC-LPD-0201) Contractor management process Approved and licensed waste transport and disposal contractors Bund storage areas for used oil and other liquid hazardous waste Waste Tracking Records Rig and support vessel HSE induction 	2/Moderate	1/Remote	Low (ALARP)
	R29	Bulk cement and barite	<ul style="list-style-type: none"> Temporary and localised increases in pH. Impact on marine biota (attraction or avoidance behaviour, stress or potential mortality) 	2/Moderate	3/Unlikely	Medium	<ul style="list-style-type: none"> Excess cement and barite to be returned to shore at the end of the campaign or as required 	Not applicable		
	R30	Air conditioner leaks	<ul style="list-style-type: none"> Release of ozone depleting gases 	3/Serious	3/Unlikely	Medium (ALARP)	<ul style="list-style-type: none"> Stena drilling preventative maintenance as per OEM recommendations Daily inspection Leak detections 	3/Serious	1/Remote	Low (ALARP)

Aspect	Risk ID	Hazard	Potential Impact	Consequence	Likelihood	Inherent Risk	Control Measures and other considerations	Consequence	Likelihood	Residual Risk
	R31	ROV hydraulic system leak	• Temporary and localised contamination of marine environment	1/Minor	3/Unlikely	Low	<ul style="list-style-type: none"> Pre-dive checks Hose management Stena drilling preventative maintenance as per OEM recommendations 	1/Minor	1/Remote	Low (ALARP)
Socio-economic Impacts										
Commercial fishing	R32	Petroleum safety zone and vessel transit	<ul style="list-style-type: none"> Loss of fishing areas Rig transit impact on fishing areas (e.g. loss of equipment) 	2/Moderate	3/Unlikely	Low	<ul style="list-style-type: none"> Fisheries consultation shows minimal direct impact on fishermen or access to grounds Communication to relevant fishing operators on location and activity of the rig Engagement of a Fisheries Liaisons Officer with practical and academic fisheries experience in the region to consult with fishermen and provide them with co-ordinates of facilities Fisheries Management Plan with formal grievance procedure for genuine/validated losses incurred Senior Otway Drilling Campaign team members are a part of the APPEA Environmental Affairs Committee Steering Committee on fisheries interaction 	1/Minor	3/Unlikely	Low (ALARP)
Shipping	R33	Petroleum safety zone	• Loss of navigable waters	1/Minor	3/Unlikely	Low	<ul style="list-style-type: none"> Notice to mariners Automatic Identification System on vessels and rig Area taken up by the petroleum safety zone is small in comparison to the available area for safe transit 	1/Minor	2/Highly Unlikely	Low (ALARP)
Third Party interaction	R34	Interaction with activist		1/Minor	3/Unlikely	Low	<ul style="list-style-type: none"> hazard is not considered to pose an environmental risk in its own right Campaign Emergency Response Plan contains a Security Plan and arrangements to limit the impact of activists 	Not Applicable		