



Summary Environment Plan

2011 Otway and Bass Basins 3D Seismic Program Summary Environment Plan

Contact Details

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The Proponent

Origin Energy Resources Limited ("Origin") is the proponent for the proposed Otway and Bass Basins 3D Seismic Program. Origin is a publicly-listed, Australian owned integrated energy company supplying gas and electricity in Australia, New Zealand and other countries in the Pacific. Origin has contracted Petroleum Geo Services ("PGS") to conduct the seismic program on its behalf using the seismic vessel *M/V Ramform Sterling*.

Corporate Environmental Policy and Management System

Origin has a corporate Health, Safety and Environment Policy that provides a public statement of its commitment to minimise adverse effects on the environment and to improve environmental performance.

Origin is focussed on improving its environmental management practices to reduce the impacts that its activities have on the environment. Health, Safety and Environment plans at the business unit and site level are required to include specific strategies for managing energy efficiency and greenhouse gas emissions, waste management, water management and land management where applicable. These systems are designed to capture environmental incidents and non-compliances and report these to management and regulators as required. Where incidents involving regulatory non-compliance are reported, the level of routine auditing of health, safety and environmental procedures is increased.

Origin has the following commitments for its activities:

- Eliminating or managing hazards and practices that could cause accident, injury or illness to people, damage to property or unacceptable impacts on the environment;
- Assisting all employees to meet their health, safety and environment obligations; and
- Conducting all activities mindful that the decisions made should recognise both short and long term economic, environmental and community considerations.

Origin operates under an established Health, Safety and Environment Management System (HSEMS) to minimise and manage the impacts on employees, contractors, the environment and the communities in which the company operates. The HSEMS has been developed in accordance with Australian/New Zealand Standard ISO 14001 Environmental Management Systems. The framework for the HSE management system is based on the continual improvement methodology of *Commit-Plan-Do-Check-Review*.

The Proposal

Survey Area

The Otway and Bass Basins 3D Seismic Program covers three separate areas of Commonwealth waters in Bass Strait over the Otway and Bass Basins and is part of Origin's exploration program for 2011. The survey areas are shown in a map later in this document.

Components of the Otway and Bass Basins 3D Seismic Program:

- **Otway Basin surveys** in exploration permits T/30P and VIC/P43:
 - Astrolabe 3D seismic survey, centred approximately 30 km southwest of Cape Otway;
 - Bellerive 3D seismic survey, centred approximately 95 km southwest of Cape Otway.
- **Bass Basin Survey** in exploration permit T/18P:

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- Chappell 3D seismic survey, centred approximately 110 km southwest of Wilson's Promontory and 140 km east of King Island.

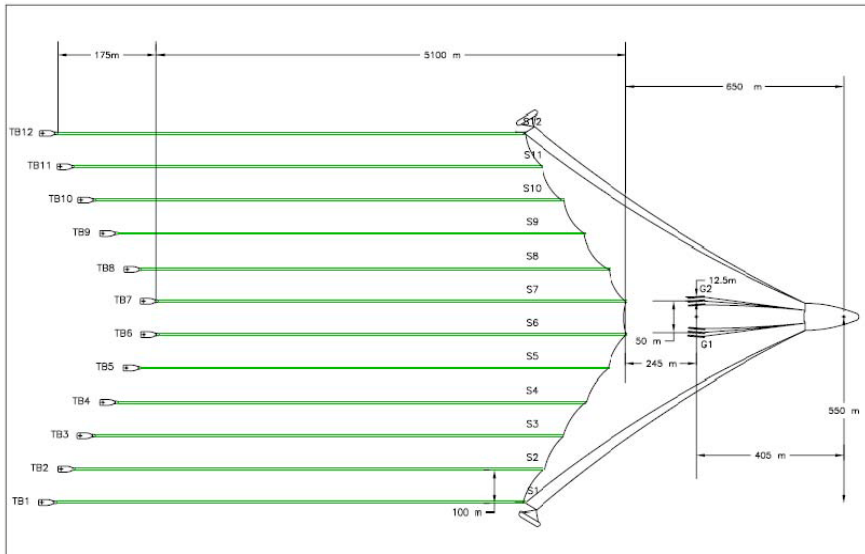
The objective of the Otway and Bass Basins 3D Seismic Program is to collect three-dimensional seismic data that will assist in the definition of drilling targets for hydrocarbon exploration in these areas. The proposed Otway and Bass Basins 3D Seismic Program covers seismic survey areas totalling approximately 1,145 km², exclusive of the buffer zones that are needed for turning and the run in and out of each transect.

Survey Method

The seismic data acquisition will use the purpose-built seismic survey vessel *M/V Ramform Sterling* using two acoustic sources and 12 hydrophone streamers towed at a depth of approximately 6m, with a total length of approximately 5,200m and array breadth of approximately 1100m. The acoustic sources will be towed in front of the streamers with a lateral separation of approximately 50 m.



The Ramform Sterling



Schematic representation of proposed seismic vessel and equipment

The acquisition will be performed by towing the arrays of sources and streamers in parallel, linear transects at approximately 4 to 5 knots over the survey areas. The sources, each approximately 3,090 cubic inches in volume, will alternate releases of energy every 18.75m to produce acoustic pulses that will be reflected from the rock strata below the sea floor. The sources use frequencies up to 250 Hz and an operating pressure of approximately 2,000psi. Hydrophones within the streamer cables will collect the reflected signals and transmit them to the vessel's recording system. The data will be later processed to provide an image of the subsurface.

Due to the clearance between the towed seismic equipment and the seafloor, no physical disturbance to the seabed is expected.

There will be one primary Support Vessel servicing the Ramform Sterling during the entire survey period. The support vessel is a 30m tugboat and will remain to assist in marine faunal observations, carrying supplies, and in the enforcement of the safety zone between the seismic operation and commercial and recreation fishing and shipping operations.

It is likely that a second support vessel (the "Chase boat") will be used to service the operation during the Otway surveys to provide debris removal, fishing equipment clearance and stakeholder notification services, and that a local fishing vessel and crew will be contracted for this purpose. Following feedback during stakeholder consultation about the significant presence of fishing debris and crustacean pots in the Otway survey areas, Origin is in the advanced stages of establishing a contract with a local fisherman with seismic chase boat experience to conduct chase boat activities. The chase boat activities will include scouting well ahead of the seismic vessel and removing debris and fishing equipment from the path of the seismic vessel and communicating with fishermen and other users in the area of the survey to keep them informed of the seismic vessel movement.

Survey Schedule

The Otway and Bass Basins 3D Seismic Program is scheduled between January and March 2011, taking into account uncertainties with the arrival date of the vessel and potential delays from bad weather, whale sightings and temporary cases of equipment failure. In total, it is expected to take around 35 days if the surveys are acquired consecutively and weather and whale prevalence are as expected.

More exact timing of the surveys will be confirmed closer to the survey time following ongoing consultation with stakeholders in the survey area. Full consideration will be given to minimising impact on stakeholders and the marine environment, notably fishing activities and cetacean migration and feeding activities. At the time of writing it is expected that the Bass Basin survey will be conducted at the end of January will avoid shark fishing in the area and the Otway surveys will be conducted in February [provisionally beginning with the Astrolabe survey] to reduce the financial impact on lobster and crab fishing in the lead up to the Chinese New Year on 03 February which is financially significant to crab and lobster fishermen.

Government approvals process

The Environmental Plan (EP) which this document summarises was prepared for the Otway and Bass Basins 3D Seismic Program in accordance with the Commonwealth Petroleum (Submerged Lands) (Management of Environment) Regulations 1999. As the designated authority under the regulations, the EP was submitted to The Tasmanian Department of Infrastructure, Energy and Resources (TDIER) - Mineral Resources Tasmania (MRT) and the Victorian Department of Primary Industry (VDPI), who provided approval in accordance with the Commonwealth Government's *Offshore Petroleum and Greenhouse Gas Storage Act 2006* and the Petroleum (Submerged Lands) (Management of Environment) Regulations 1999. In accordance with a request by the VDPI a single EP was prepared to cover the seismic surveys for both the Otway and Bass Basin survey areas.

The Commonwealth Department of Sustainability, Environment, Water, Population and Communities (DSEWPC) has assessed referrals for the Otway and Bass Basins 3D Seismic Program under the *Environment Protection and Biodiversity Conservation Act (1999)* (EPBC Act). The Ministers approval for all surveys was provided in December, but with several conditions to further reduce the scope of the proposed activities on the marine environment (EPBC referrals 2010/5700 and 2010/5701).

Survey Rationale

As the permit operator over the 3 survey areas, Origin has an obligation to investigate the petroleum potential of the exploration permit areas. Seismic surveying will be conducted to determine the presence and economic viability of potential hydrocarbon in the following permit areas:

- Otway Basin exploration permit areas VIC/P43 and T/30P (Astrolabe 3D seismic survey), and T/30P (Bellerive 3D seismic survey), with ingress into exploration permit T/34P (Bellerive 3D seismic survey) and production license areas T/L2, T/L3 and VIC/L23 (Astrolabe 3D seismic survey);
- Bass Basin exploration permit areas T/18P (Chappell 3D seismic survey), with ingress into adjacent exploration permit T/47P and retention lease area T/RL1.

The programs extend in to small areas of open acreage and other exploration permits. Applications for offshore access authority and offshore special prospecting authority have been made to the Tasmanian and Victorian governments for the respective surveys.

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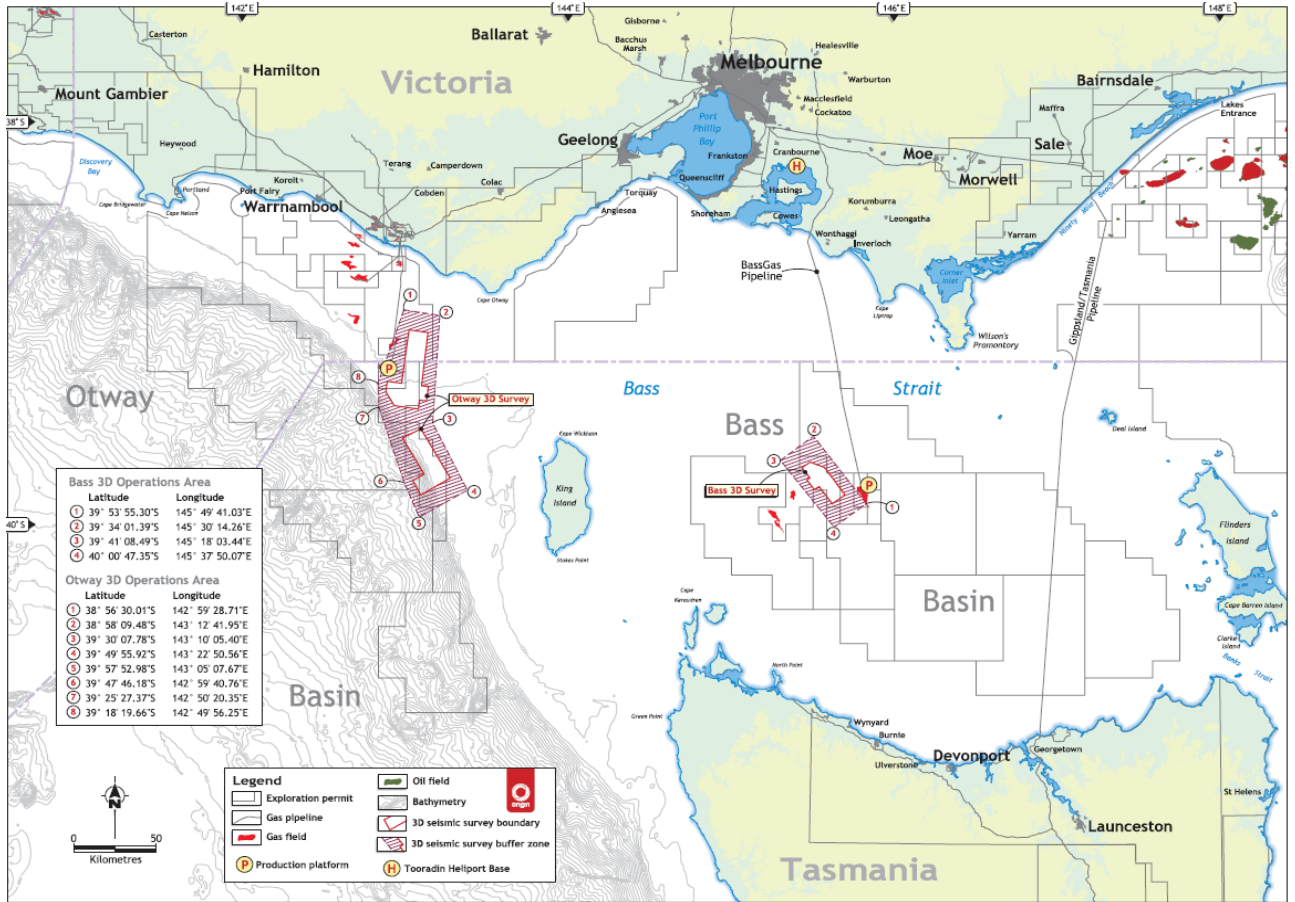


Figure 1: Map showing Otway and Bass Basins 3D Seismic Program location

Description of the Existing Environment

Biodiversity

The DSEWPC EPBC Online Database (DSEWPC 2010b) lists 22 threatened species and 27 threatened species that may occur within 5 km of the Bass and Otway survey areas respectively. 26 migratory and 31 migratory species were also listed that may occur within the same areas.

The DSEWPC EPBC Online Database (DSEWPC 2010b) lists nine cetacean species that are threatened and/or migratory under the EPBC Act that may occur in the Otway survey area and seven cetacean species that may occur in the Bass survey area. Among these are three whales which are listed as threatened under the EPBC Act: the humpback whale (*Megaptera novaeangliae*), blue whale (*Balaenoptera musculus*) and southern right whale (*Eubalaena australis*). These threatened species may occur in both project areas and are discussed in Section 1.5. With the exception of blue whales and possibly sei (*Balaenoptera borealis*) and fin (*Balaenoptera physalus*) whales, no other whales are likely to be present in the Otway or Bass seismic survey areas as the project activities will occur outside their normal migration periods.

Bird species may overfly and forage within the proposed survey area; however, the proposed seismic activities are unlikely to have a significant impact on any of the species as they have no direct interaction with seismic operations.

The proposed Otway survey area is within a Commonwealth Marine Protected Area, with the southern extent of the survey area overlapping a small portion of the Zeehan Marine Reserve. Exploration for minerals by marine seismic survey is permitted to occur within the marine reserve, as approved by the Director of National Parks under the EPBC Act. The Zeehan Marine Reserve is one of thirteen marine reserves that comprise the Southeast Commonwealth Marine Reserve (SE CMR) Network. The SE CMR were established to represent the various seafloor features (canyons and seamounts) of the southeast marine region. There is a relatively poor knowledge of the plants and animals of the deepwater parts of the southeast; however, it is known that biology and ecology varies with changes in seafloor geomorphology (DSEWPC 2009a). Establishing marine reserves in areas that cover geomorphic features representative of the southeast marine region has been used by the Commonwealth Government as a surrogate to more direct protection of animals and plants associated with the seafloor (DSEWPC 2009a). Five other Commonwealth marine reserves are located within 100 km of the survey area.

The region also contains a number of species of high commercial and conservation value including a number of species of importance to commercial fisheries.

The project area does not reside in a known world heritage, national heritage place. There were no threatened ecological communities listed within 5 km of the survey areas.

Socio-economic Environment

The main economic activities in the project area include recreational fishing and tourism, hydrocarbon exploration and production, commercial shipping and commercial fishing. Hydrocarbon exploration has been undertaken within Bass Strait and the offshore Otway since the early 1960s.

The Otway and Bass Basins 3D Seismic Program will occur within Commonwealth and state fishery zones. There is high fishing activity in the Bellerive survey area for Giant Crab (*Pseudocarcinus gigas*) and lesser activity for Southern Rock Lobster (*Jasus edwardsii*) in the Bellerive 3D and Astrolabe 3D areas. Each of these areas are also subject to demersal trawl and longline for upper slope fish species. The Chappell 3D area is periodically fished for shark, primarily Gummy shark (*Mustelus antarcticus*).

To improve understanding of the fishing landscape in the survey areas, Origin has conducted an extensive consultation process with commercial fishermen in the region under the guidance of a devoted Fisheries Liaisons consultant with expert knowledge of the fishing activities in the region. Through this process, Origin has established a

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knowledge base of possible fishing activities in its proposed survey areas. In addition Origin has established an ongoing program of consultation with the fishing community and industries.

Commercial fishermen report there are no recreational fishing activities in the vicinity of the proposed Otway and Bass Basins 3D Seismic Program areas. Nevertheless, to mitigate any risk, Origin will consult with local recreational charter fishing vessels in the lead up to the survey to inform them of the survey activities.

Stakeholder Consultation

In the course of planning the proposed seismic surveys, Origin consulted relevant stakeholders in the region to identify the applicable regulatory processes, potential environmental issues and preferred management methods. Consultation with these groups will continue through to the conclusion of the Otway and Bass Basins 3D Seismic Program.

Origin will continue its stakeholder consultation using the following methods:

- Periodic communication with key stakeholders that may be affected by the project, including fisherman, recreational users, scientific experts and government agencies;
- Periodic updates to key regulators and stakeholders in relation to changes in project scope and timing;
- Reporting incidents or events to the VDPI and MRT in a timely manner.

In addition to this, an Origin representative will be on board the vessel to liaise with any stakeholders present in the project area as required.

Origin will ensure that current project information is provided to key stakeholders in a timely manner and in a format appropriate to the audience. For the duration of the project, consultation with external stakeholders will be recorded in a consultation log.

Environmental Risk Assessment

The potential environmental risks and impacts of the proposed seismic program have been determined in a risk assessment based on Origin's previous survey experience in the region, the environmental risks outlined in the EP and literature related to acoustic disturbance. The main environmental risks, hazards and potential impacts are summarised below.

The risk assessment determined that the principal environmental risks were noise generated by the seismic source arrays, collision with another vessel resulting in fuel spill and marine biofouling. All residual risks (risks after mitigation measures are implemented) were reduced from major to high, medium or low with the implementation of the management and mitigation measures listed. A summary of the current understanding of Environmental Risks for the Otway and Bass Basins 3D seismic program is provided below.

Risk/Hazard	Potential Impact	Residual Risk
Noise disturbance	High intensity pulses of noise reflected from geological structures back to recorders on the seismic vessels are considered to most likely impact on marine species, particularly cetaceans.	High

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Risk/Hazard	Potential Impact	Residual Risk
Vessel collision	Vessel activity for the Otway and Bass Basins 3D Seismic Program is considered to be comparable to that currently operating in the area. However, vessel collision with marine mammals is conceivable. Survey vessels working within and travelling to and from the Otway and Bass Basins 3D Seismic Program area may present a potential physical hazard (e.g. animal displacement or vessel strike) to marine fauna. Those at higher risk are individuals that are resting and feeding, and to a lesser extent migrating. This may lead to short-term behavioural changes or wounding and/or mortality in the event of vessel strike.	Medium
Accidental fuel and oil spills and waste	Vessel collisions may also result in accidental release of fuel or oil to the marine environment; however, this risk is no greater than for any other commercial shipping operating in Bass Strait. No onshore impacts are expected as the project area is in excess of 80 km from land.	Low
	Toxic effects on marine fauna as a result of a fuel or oil spill from the survey vessel due to leaking hydraulic hoses, leaking oil drums or an unexpected accident, or spillages.	Low
	Non-hazardous wastes have the potential to damage the marine environment if accidentally discharged.	Low
Interference with fishing operations	The proposed activities are likely to impact on commercial fishing interests in the Bellerive survey area and have a lesser impact in the Astrolabe and Chappell survey areas. Principal risks arise from the displacement of fishing operations which use gear that is an entanglement hazard.	High
Marine pests	Seismic vessels have the potential to accumulate marine organisms on the hull, rudder, water and intake pipes. The hull of the seismic survey vessel was last treated in November 2010 in dry dock in Singapore under inspection by Origin Energy Project Manager and Origin Energy Shipping Manager. The vessel will travel to the survey areas via Papua New Guinea and is expected to stop in port in Brisbane en route. The risk of pest range extension is considered to be very low due to the hull being recently treated.	Low
Entanglement	The main risk to marine mammals and other marine fauna species from accidental loss of equipment is entanglement in the towed array. The equipment most likely to cause entanglement would be towing gear for the airgun array and debris lost from the vessel. As identified earlier, species most at risk from entanglement (in order from most at risk to least at risk) are: humpback whales, southern right whales, seal and dolphin species and blue whales. Other marine fauna may also be susceptible to entanglement of drifting streamers. There has never been a reported case of a marine mammal becoming entangled in seismic equipment so the risk is considered to be very low.	Low

Table showing a summary of the current understanding of Environmental Risks for the Otway and Bass Basins 3D seismic program.

Environmental Risk Management and Mitigation

Origin's management of the potential environmental impacts that may arise from this survey is subject to its corporate Health, Safety and Environment Management System (HSEMS). Origin corporate policies set the principles and objectives of its HSE management practices and are implemented under the guidance of its environment policy and

corporate environment standards. All survey activities shall be undertaken in accordance with Origin's HSEMS.

With due attention to the standards in Origin's HSEMS, a series of practices and procedures will be implemented to avoid, reduce and mitigate the environmental risks identified in this EP. The implementation strategy for the risk management determined in this EP includes:

- Systems, practices and procedures;
- Specific roles and responsibilities;
- Employee training;
- Monitoring, auditing and recording requirements;
- Emergency response planning; and
- Consultation with government and stakeholders.

In order to ensure all mitigation measures and management commitments made in the EP are implemented and all activities are compliant with legislative requirements, inspections and audits will be conducted and records of meetings, inductions, inspections and audits will be maintained.

Below, summaries of the mitigation measures being used to address risks to whales and fisheries are summarised and the environmental emergency response flowchart is provided.

Seismic-whales risk mitigation

In addition to the risk mitigation measures specified in the *EPBC Act Policy Statement 2.1 - Interaction between offshore seismic exploration and whales*, Origin is to implement the following additional measures to mitigate the risk of seismic-whale interaction:

- Employment of local whale experts to provide monitoring for whales using regular spotter plane flights;
- Employment of additional Marine Mammal Observers on board the seismic vessels (provisionally Origin will employ 4 Marine Mammal Observers on board the vessels);
- Origin is planning to deploy ocean bottom acoustic loggers to try to monitor the movement of whales in the vicinity of its Otway surveys.

Seismic-fisheries risk mitigation

A number of mitigation measures in addition to standard measures are to be implemented to minimise the impact of the surveys on commercial fishing activities:

- The management of fisheries for this program is consolidated in a Fisheries Management Plan, which has the following principals for impact mitigation: Consultation; Communication; Co-operation; Remediation; Compensation; Dispute Resolution; Research.
- Origin has employed a Fisheries Liaison to make sure that fisheries are kept up-to-date with the operation and that their concerns are incorporated into the project planning and operation.
- Origin plans to employ a local fishing operator to conduct chase boat activities during the Otway surveys.

Environmental Emergency Response flowchart

Below is provided a flowchart which summarises the emergency response process for an environmental incident.

Table 1: PGS - Otway and Bass Basins marine seismic survey emergency response flow chart

