



Silvereye 3D Seismic Survey Bass Strait, Australia

Summary Environment Plan

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1. Introduction

Origin Energy Resources Limited (Origin Energy) is planning to conduct the Silvereye 3D marine seismic survey primarily in the Tasmanian Permit T/44P in the Bass Basin, Tasmanian Bass Strait (Figure 1.1). The survey is scheduled to be conducted by the PGS Pacific Explorer vessel during 4th quarter 2007 - 1st quarter 2008.

This document summarises the Environmental Plan (EP) that has been prepared to meet the requirements of the Petroleum (Submerged Lands) (Management of Environment) Regulations 1999, in accordance with Commonwealth regulatory requirements.

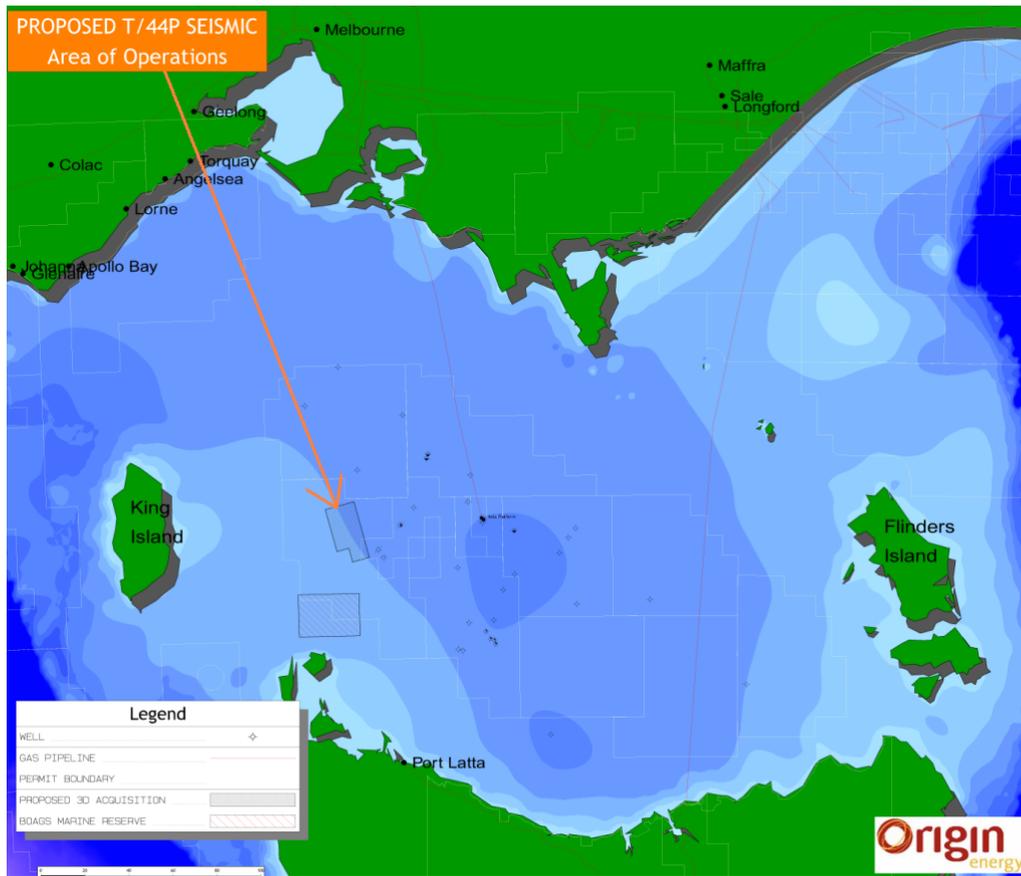
Origin Energy is committed to protecting the environment and consequently manages HSE matters as a critical business activity. Origin Energy has developed corporate environmental policies that provide a public statement of the corporate commitment to protecting the environment during offshore exploration operations, including seismic surveys. The corporate environmental policy forms part of Origin Energy's HSE Policy, which is presented in Appendix A.

2. Proposed Seismic Program

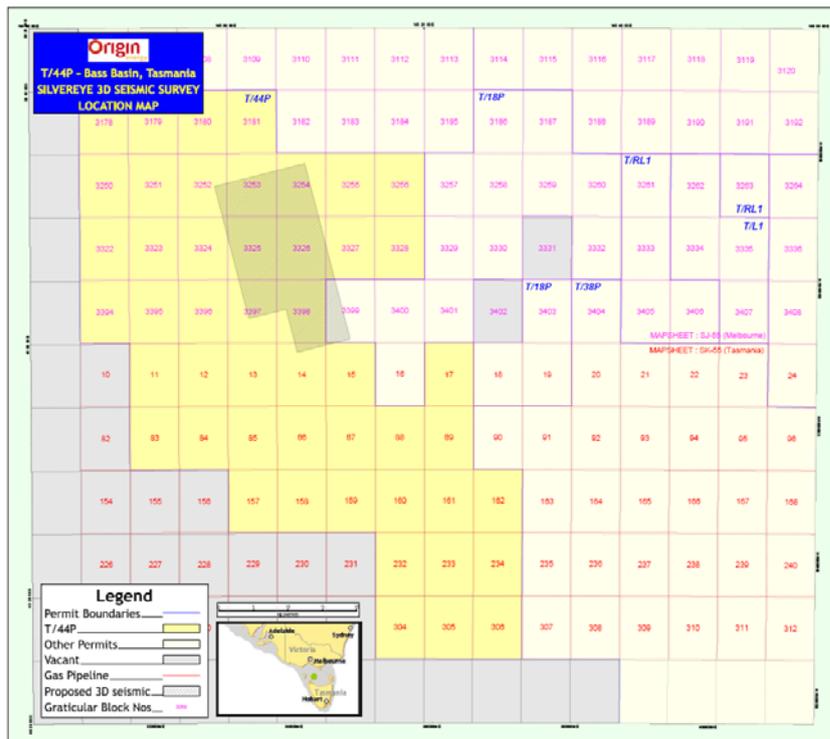
Permit T/44P is in the offshore Bass Basin, Tasmanian Bass Strait, approximately 80 km north north-west of Port Latta, 90 km east of King Island and 300 km west of Flinders Island (Figure 1.1). The permit is in Commonwealth waters and is bordered to the east by Permits T/18P and T/38P, and to the north by T/45P. The permit is on the continental shelf with an average water depths of approximately 75 m. The proposed 320 km² Silvereye 3D Seismic Survey lies predominantly within Permit T/44P but ingresses 15km² into permit T/18P (Figure 2.2). The coordinates listed in Table 2.1 are the corners of the proposed survey area:

Corner Point #	Latitude (S)	Longitude (E)
1	39 45 44.67	145 07 56.57
2	39 59 32.93	145 12 29.93
3	40 00 36.23	145 07 06.09
4	39 57 16.38	145 06 00.22
5	39 57 59.36	145 02 13.15
6	39 47 31.83	144 58 47.59
<i>Projection System: UTM (Southern Hemisphere) Zone 55, Spheroid: GR80, Datum: GDA 94</i>		

■ Table 2.1: Silvereye 3D Seismic Survey coordinates



■ Figure 1.1: Proposed Survey Location Map



■ Figure 1.3: Location of Survey Area in T/44P

The survey is expected to commence in 4th quarter 2007 - 1st quarter 2008 with a scheduled duration of 15 - 30 days. The proposed seismic vessel to acquire the survey data is the *Pacific*

Explorer (Figure 2.3), owned and operated by PGS. The *Pacific Explorer* was built in 1983, refitted in 1994 and has an overall length of 91.4 m. During survey, the vessel will operate at approximately 5 kts. The vessel will mobilise to the survey area directly from the preceding job in the southeast Australia region. A supply vessel will be used to provide equipment, provisions and fuel to the vessel during operations.



■ Figure 1.3: The *Pacific Explorer*

The 3D seismic equipment to be used during the course of the survey will comprise six hydrophone streamer cables each 6000 m in length separated 100m apart, with two air gun source arrays each with a total volume of 3090 cubic inches, towed at a depth of 6m. Airgun sources will be activated every 37.5m during the survey.

3 Existing Environment

Bass Strait is a shallow basin and water depths in the 3D survey area are between 40-85m with seabed sediments composed of fine sands and muds.

Previous biological studies indicate a high diversity and species richness of benthic communities, and a wide distribution of species across Bass Strait (Poore *et al.*, 1985; Wilson and Poore, 1987). There appeared to be a strong influence of sediment types on species assemblage, with distinct differences between the shelly sediments on the shelf, the finer sediments of the central basin, and the terrigenous sands of the coastline (Wilson and Poore, 1987).

The marine fauna of temperate southern Australia is characterised by relatively low diversity and very high species endemism (Wilson and Allen, 1987). Pelagic, reef and sandy seabed species that may occur in the permit area are listed in Table 3.1 (LCC, 1993).

■ Table 3.1: Fish Species That May Occur in Permit Area T/44P

Common Name	Scientific Name
Pelagic Species	
Anchovy	<i>Engraulis australia antipodum</i>
Barracouta	<i>Thyrsites atun</i>
Jack Mackerel	<i>Trachurus declivis</i>
Pilchard	<i>Sardinops neopilchardus</i>
Silver Trevally	<i>Pseudocaranx dentex</i>
White shark (or white pointer)	<i>Carcharodon carcharias</i>
Blue Warehou	<i>Seriolaella brama</i> .
Spotted Warehou	<i>Seriolaella punctatu</i>

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Common Name	Scientific Name
Reef Species	
Barber's Sea Perch	<i>Caesioperca rasor</i>
Barracouta	<i>Thyrsites atun</i>
Bastard Trumpeter	<i>Latridopsis forsteri</i>
Beardie	<i>Physiculus barbata</i>
Blue-throat Wrasse	<i>Notolabrus tetricus</i>
Butterfly Sea Perch	<i>Caesioperca lepidoptera</i>
Common Bullseye	<i>Pempheris multiradiata</i>
Draughtboard Shark	<i>Cephaloscyllium laticeps</i>
Globefish	<i>Diodon nichthemerus</i>
Leatherjackets	Family <i>Monacanthidae</i>
Long-finned Pike	<i>Dinolestes lewini</i>
Magpie Morwong	<i>Cheilodactylus nigripes</i>
Old Wife	<i>Enoplosus armatus</i>
Port Jackson Shark	<i>Heterodontus portusjacksoni</i>
Red Mullet	<i>Upeneichthys lineatus</i>
Saddled Wrasse	<i>Pseudolabrus fucicola</i>
Sea Sweep	<i>Scorpius aequipinnis</i>
Senator Wrasse	<i>Pictilabrus laticlavus</i>
Shaw's Cowfish	<i>Aracana aurita</i>
Silver Sweep	<i>Scorpius lineolatus</i>
Southern Gobbleguts	<i>Vincentia conspersa</i>
Southern Hulafish	<i>Trachinops caudimaculatus</i>
Southern Red Scorpion Cod	<i>Scorpaena papillosa</i>
Varied Catshark	<i>Parascyllium variolatum</i>
Benthic Species	
Eastern Stargazer	<i>Kathetostoma laeve</i>
Elephant Shark	<i>Callorhynchus milii</i>
Greenback Flounder	<i>Rhombosolea taparina</i>
Gummy Shark	<i>Mustelus antarcticus</i>
Long-snouted Flounder	<i>Ammotretis rostratus</i>
Saw Shark	<i>Pristiophorus nudipinnis</i>
Southern Sand Flathead	<i>Platycephalus bassensis</i>
Southern School Whiting	<i>Sillago bassensis</i>

Twenty-seven cetacean and seal species have been recorded in Bass Strait (Menkhorst (1995), Atlas of Victorian Wildlife database search, Dames & Moore (1992)). Of this total, eight are known to occur in or near to the permit area. These include:

- Southern right whale (*Eubalaena australis*);
- Humpback whale (*Megaptera novaeangliae*);
- Blue whale (*Balaenoptera musculus*);
- Pygmy blue whale (*Balaenoptera musculus brevicauda*);
- Pygmy right whale (*Caperea marginata*);
- Killer whale (*Orcinus orca*);
- Common dolphin (*Delphinus Delphis*);
- Bottlenose dolphin (*Tusiops truncatus*);

- New Zealand fur seal (*Arctocephalus forsteri*); and
- Sub-Antarctic fur seal (*Arctocephalus tropicalis*).

A number of breeding colonies of rare and endangered seabirds are located in the vicinity of the permit area (Environment Australia, 1999). These include the little penguin (*Eudyptula minor*), short-tailed Silvereye (*Puffinus tenuirostris*), hooded plover (*Thinornis rubicollis*), fairy tern (*Sterna nereis*), little tern (*Sterna albifrons sinensis*), white-fronted tern (*Sterna striata*) and the shy albatross (*Thalassarche cauta*). Details of the conservation status, breeding location, and habits of these species are available from the Australian Coastal Atlas database search (Environment Australia, 1999).

The closest marine reserve to the Permit T/44 is the Kent Group Marine Reserve, located approximately 300 km east of Permit T/44P. The north east corner of the proposed Boags Marine Reserve lies in the south west corner of the T/44P but outwith the area of the Silvereye 3D survey.

4 Socio-Economic Environment

A variety of fisheries operate in the Bass Strait. The limited fishing activity in the Permit T/44P area is normally restricted to shark fishing by both Victorian and Tasmanian fisheries. Planning for the Silvereye 3D survey involves consultation with these fisheries. The coast of King Island is popular for crayfishing, abalone diving and harvesting of bull kelp from the shore.

The Bass Strait is one of the busiest shipping routes in Australia with more than 3,000 vessels transiting through the area each year (National Oceans Office, 2005b). Commercial shipping in the Bass Strait area includes passenger shipping such as ferries, freight shipping and transit shipping.

The north-west coast of Tasmania and King Island offer many popular tourist destinations. There are numerous coastal tourist activities in the area including camping, bush walking, swimming, boating and fishing.

Phone and email correspondence (end of August 2007) with the Acting Assistant Director of the Maritime and Moveable Heritage Section, Heritage Division, DEW concluded that there are no known historic shipwreck sites or protected shipwreck zones in the area of the Silvereye 3D survey.

The South-East Marine Region contains large oil and gas deposits. In 1996, the Gippsland Basin, located at the eastern end of the Bass Strait, produced over 40% of Australia's total crude oil and nearly half of Victoria's natural gas requirements (National Oceans Office, 2005b).

The T/44P permit area lies close to the BassGas Project, which has developed the Yolla, Trefoil and White Ibis fields. The BassGas Project is located in close proximity to the proposed survey area. The project includes the extraction of natural gas, LPG, condensate and water from the Yolla field and transport to an offshore platform (Yolla A).

5 Summary of Marine Mammal Observations for 2005 Shearwater Seismic Surveys

Between 13th November to 9th December 2005, Origin Energy operated the Shearwater 2D and 3D seismic surveys in permit T/18P, just to the east of the proposed Silvereye 3D survey. The Shearwater surveys were carried out at a similar time of year to that the Silvereye survey is expected to take place. Therefore, it is felt that the Marine Mammal Observation results from the Shearwater surveys will provide a good prediction of the marine activity for the Silvereye survey.

During the 27-day Shearwater surveys the Marine Mammals Observer made 67 sightings of cetaceans (c.400 individuals) comprising at least 3 mammal species. Common dolphins (*Delphinus delphis*) were the most frequently recorded marine mammal, accounting for 55% of all encounters and 88% of total numbers observed from the seismic survey vessel, and 26% of all encounters and 96% of total numbers observed from the scout vessel.

Only once during the Shearwater surveys was mitigation action required, when one adult humpback whale (*Megaptera novaeangliae*) was encountered within critical range during seismic operations.

The vessel used to record the Shearwater surveys had a 2-streamer capability and therefore the Shearwater survey took a lot longer to acquire than the 6-streamer PGS Pacific Explorer is expected to take for the Silvereye 3D survey. The Shearwater surveys took 27 days to record. The Silvereye 3D survey is estimated to take 16 days to record (including an estimated 25% weather downtime). Based on this data, an prediction of the marine mammal activity is provided in Table 5.1. Table 5.2 is a listing of the other marine fauna sighted during the Shearwater surveys.

Species	Column 1: Actual number of sightings during 2005 Shearwater surveys from the seismic vessel	Column 2: Actual number of individuals during 2005 Shearwater surveys from the seismic vessel	Predicted number of sightings from Pacific Explorer (Column 1 * anticipated duration of Silvereye3D/ duration of 2005 Shearwater) surveys)	Predicted number of individuals to be sighted from Pacific Explorer (Column 2 * anticipated duration of Silvereye3D/ duration of 2005 Shearwater surveys)
Humpback whale	4	6	2 (nearest whole number (n.w.n.))	4 (n.w.n.)
Common dolphin	22	146-156	13 (n.w.n.)	87-92 (n.w.n.)
Fur seal sp.	14	14	8 (n.w.n.)	8 (n.w.n.)

Table 5.1. Actual marine mammals sighted during the 2005 Shearwater 2D and 3D surveys and prediction of marine mammal sightings on the proposed Silvereye 3D survey (as a function of Shearwater sightings * Shearwater duration / anticipated Silvereye duration).

Marine Fauna	Occurrence*
<p>Aves</p> <p>Shy Albatross (<i>Diomedea cauta</i>)</p> <p>Wandering Albatross (<i>Diomedea exulans</i>)</p> <p>Fleshy-footed Shearwater (<i>Puffinus carneipes</i>)</p> <p>Sooty Shearwater (<i>Puffinus griseus</i>)</p> <p>Short-tailed Shearwater (<i>Puffinus tenuirostris</i>)</p> <p>White-faced Storm Petrel (<i>Pelagodroma marina</i>)</p> <p>Little Penguin (<i>Eudyptula minor</i>)</p> <p>Silver Gull (<i>Larus novaehollandiae</i>)</p> <p>unidentified Tern (<i>Sterna sp.</i>)</p> <p>Little Black Cormorant (<i>Phalacrocorax sulcirostris</i>)</p> <p>Little Pied Cormorant (<i>Phalacrocorax melanoleucos</i>) - juvenile</p> <p>Sacred Kingfisher (<i>Halcyon sancta</i>) - male</p> <p>Reptilia</p> <p>Leatherback sea turtle (<i>Dermochelys coriacea</i>)</p> <p>Chondrichthyes</p> <p>unidentified shark</p>	<p>frequently</p> <p>rarely</p> <p>frequently</p> <p>frequently</p> <p>frequently</p> <p>intermittently</p> <p>intermittently</p> <p>rarely</p> <p>rarely</p> <p>once</p> <p>once</p> <p>once</p> <p>twice**</p> <p>once</p>

* frequently = sighted everyday; intermittently = seen every few days, usually weather dependent; rarely = sighted >3 occasions; twice = two sightings; once = one sighting only during survey.

Table 5.2. Other marine fauna sighted during the Shearwater 2D and 3D seismic surveys.

6 Assessment of Environmental Risks and Effects

An environmental risk assessment had been done for the Silvereye seismic survey, and is provided as Table 4.1. The methodology for the risk assessment can be obtained from the main Silvereye 3D Environmental Plan

■ Table 4.1. Summary of Risk Assessment of Potential Environmental Effects

RISK EVENT	CONSEQUENCE	INHERENT CONSEQUENCE	EXISTING CONTROLS	CONSEQUENCE	LIKELIHOOD	RISK RANKING	RISK LEVEL
Discharge or 'firing' of the airguns (Silvereye3D EP)	Sonic disturbance to marine mammals.	MAJOR	Environmental Plan - Mmo and mitigation procedures as per <i>EPBC Act Policy Statement 2.1</i> .	MAJOR - 4	At least once in 20 years - 3	High	Tolerable
Whale or other cetacean interference / interaction due to inadequate MMO procedure or incompetent MMO and timing of survey	Delays Damage to vessel / equipment Reputation Possible regulatory breach Impact to cetacean	MAJOR	Environmental Plan - cetacean management. Start-up meeting procedure. Contractor management procedure. Environmental planning procedure. Timing of survey.	SERIOUS - 3	At least one in 200 years - 2	Medium	Acceptable
Accidental / Incident disposal of hazardous wastes or empty hazardous wastes containers may have toxic effects / damage / destruction of marine environment	Damage to marine / coastal environment Damage / loss of fauna Reputation Delays Prosecution	MAJOR	Seismic Vessel Audit Reporting from field procedure. Environmental / waste management plan. Contractor Management Procedure.	SERIOUS - 3	At least one in 200 years - 2	Medium	Acceptable
No/incorrect / non compliance with EPBC Act application. Causes: - Third Party intervening - Inadvertent or wilful non-compliance	Extreme delay in survey Third Party intervention Prosecution	MAJOR	Experience. Planning Checklist. Environmental Planning Procedure.	SERIOUS - 3	At least once in 200 years - 3	Medium	Acceptable

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RISK EVENT	CONSEQUENCE	INHERENT CONSEQUENCE	EXISTING CONTROLS	CONSEQUENCE	LIKELIHOOD	RISK RANKING	RISK LEVEL
Non compliance with regulations - no/incorrect survey application.	Delay in commencing survey Regulator action	MAJOR	Experience. Planning Checklist - EPOMS. Environmental Planning Procedure. Government Interaction. Reporting Procedure.	SERIOUS - 3	At least once in 200 years - 3	Medium	Acceptable
Collision with fishing craft or other vessel	Delays Damage to vessels / equipment Reputation Possible litigation Injuries / Fatalities	CATASTROPHIC	Scout Boat Selection. Stakeholder interaction procedure. SMP (ERP). Contractor Management Procedure. Seismic vessel audit procedure.	MAJOR - 4	Not in 200 years - 1	Medium	Acceptable
Interference with offshore oil and gas facilities	Damage to Vessel / equipment Damage to Rig Capsize - loss of life Fuel / Oil spill	CATASTROPHIC	Seismic Vessel Audit Procedure. SMP (ERP). Reporting from field procedure. Scout boat selection procedure. Scout boat vessel audit procedure. Start-up meeting Procedure.	MAJOR - 4	Not in 200 years - 1	Medium	Acceptable
Waste discharge from the survey vessels (Silvereye3D EP)	Elevated nutrients may cause phytoplankton bloom	MINOR	Sewage and putrescibles waste discharge will conform to MARPOL, not discharged within 12 nautical miles of land. Solid wastes will be segregated and retained for onshore disposal or onboard incineration	MINOR - 1	At least once in 2 years - 4	Medium	Tolerable
Accidental loss of streamers and associated equipment (e.g. "birds" or tail buoys) (Silvereye3D EP)	Disturbance to benthic habitats	MINOR	Closest sensitive marine resource is Tasmanian coastline, more than 50 km South of survey area	MINOR - 1	At least once in 2 years - 4	Medium	Acceptable

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RISK EVENT	CONSEQUENCE	INHERENT CONSEQUENCE	EXISTING CONTROLS	CONSEQUENCE	LIKELIHOOD	RISK RANKING	RISK LEVEL
Delays in survey due to inadequate stakeholder consultation e.g. fishing; leisure; shipping	Delay of survey significantly - cost - risk missing Government commitments Third Party aggravation Reputation	MAJOR	Planning checklist (to keep on schedule). Environmental Plan. Timing of survey. Stakeholder consultation.	SERIOUS - 3	At least once in 200 years - 3	Medium	Acceptable
Operation of the seismic vessel anchor (Silvereye3D EP)	Damage to benthic habitats	MODERATE	Vessel will not anchor, except in an emergency	MINOR - 1	Not in 200 years - 1	Low	Acceptable
Towing of the airgun and streamer array through the survey area (Silvereye3D EP)	Disruption to commercial fishing operations	SERIOUS	Direct communication with fishing industry groups and individual commercial fisheries operators. Standard maritime safety procedures (display beacons & lights, radio contact with approaching vessels etc) Operations carried out to minimise navigational interference	MINOR - 1	At least once in 20 years - 3	Low	Acceptable
Accidental fuel spill or oil spill during re-fuelling (Silvereye3D EP)	Damage to marine life and environments - Marine mammals - Marine parks, nature reserves and marine features - Fish populations	MAJOR	Spill response procedures and equipment will localise and minimise impact, and fuel likely to evaporate and disperse readily.	MODERATE - 2	At least once in 200 years - 2	Low	Acceptable

7 Environmental Hazards, Controls and Reporting

Based on previous experience as well as the existing baseline environmental conditions in the vicinity of T/44P, the components of the proposed Silvereve Survey that could represent key potential sources of impact to the surrounding environment include:

- Noise generation from vessel;
- Noise generated from activation of the airgun seismic source, which sends sonic waves through the water column and below the seabed into the rock below;
- Pacific Explorer operation and towing of the airgun and streamer (geophone) array;
- Waste discharges from the Pacific Explorer;
- Accidental loss of equipment; and
- Accidental fuel and oil spills from the seismic or other vessels.

If left uncontrolled, each of these activities could result in detrimental impacts on the physical, biological and socio-economic environment of the T/44P permit and surrounding areas. The key potential environmental impacts associated with the proposed seismic survey in Permit T/44P are identified as:

- 1) *Disturbance to marine life.*
- 2) *Interference with commercial fishing.*
- 3) *Interference with shipping.*
- 4) *Interference with recreational vessels.*
- 5) *Waste disposal.*
- 6) *Fuel and oil spills.*

A number of key control and mitigation measures will be implemented to either eliminate potential environmental risks associated with the hazards or to reduce them to as low as reasonably practicable. These measures include:

- responding to whale encounters as per the *EPBC Act Policy Statement 2.1 - Interaction between offshore seismic exploration and whales*,
- adopting standard measures to eliminate or minimise potential impacts on fishing boats and other vessels, including the use of a scout boat,
- Standard maritime safety procedures (AusCoast warnings via the Australian Maritime Safety Authority, radio contact, display of appropriate navigational beacons and lights).
- Onboard incineration or controlled onshore disposal of sewage and putrescible material
- Segregation and controlled movement of chemical and hazardous wastes,
- Oil spill mitigation measures for refuelling at sea, including hoses with dry break coupling, and only undertaking refuelling in good weather.

A reportable incident is defined as “an incident arising out of operations for the activity that is not within the parameters of the environmental performance standards in the environment plan

in force for the activity". The Designated Authority (DA) will be notified of all reportable incidents, according to the requirements of Regulation 26 of the *Petroleum (Submerged Lands)(Management of Environment) Regulations 1999*. Origin will:

- report all reportable incidents verbally within 2hrs of them occurring,
- a summary written report will be submitted to the DA within 3 days, and
- a detailed written report will be submitted to the DA within 15 days.

8 Origin Energy Contact Details

Further correspondence regarding the Silvereye 3D survey can be directed to;

Contact	Neil Millar, Geophysical Operations Manager
Phone	+61 7 3858 0667 / 0409 891 391
Email	neil.millar@originenergy.com.au
Mailing Address	Origin Energy, GPO Box 148, Brisbane QLD 4001, Australia

9 References

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Appendix A Corporate Environmental Policy



Policy

Health, Safety & Environment

At Origin Energy, we value the wellbeing of our employees, contractors, customers, the communities in which we operate and the environment. We are committed to responsible management practices that minimise any adverse health, safety or environmental impacts arising from our activities, products or services.

We have in place a Health, Safety and Environmental management system for all our activities that drives continual improvement. The HSE Management System outlines HSE accountabilities to implement this Policy and requires that we:

- Identify and manage risks to as low as reasonably practicable where they have the potential to cause an accident, injury or illness to people, or unacceptable impacts on the environment or the community;
- Provide safe work places and systems of work, empower employees and contractors to address unsafe or hazardous situations and carry out their work in a manner that does not present a risk to themselves, others or the environment;
- Support the recovery and rehabilitation of employees in the event of work related injury or illness;
- Set objectives and targets which promote the efficient use of energy and resources, the minimisation of wastes and emissions and the prevention of pollution;
- Ensure compliance with relevant HSE legal requirements and other commitments;
- Require Contractors to manage HSE using standards and practices that accord with this Policy;
- Regularly review and report HSE performance.

In implementing this Policy we will engage with our employees, contractors, suppliers, business partners, customers and Government and communicate expectations to all persons working with or on behalf of Origin Energy.

Accountabilities

The Board is responsible for establishing and overseeing the Company's commitment to manage HSE in accordance with this Policy and for monitoring the performance of the Company with respect to its implementation.

The Managing Director is responsible for the implementation of the HSE Management System to ensure the commitments made in this Policy are being met.

Grant King
Managing Director
September 2007
Review date September 2009