



VENTURE
Off-Bottom Cable Seismic Survey
WA-356-P, WA-192-P(1), WA-323-P
Commonwealth Waters
Environment Plan Summary



May 2008

INTRODUCTION

Apache Energy Limited (Apache) is proposing to undertake an off-bottom cable seismic exploration program within parts of Western Australian Production Exploration Permits WA-356-P, WA-192-P(1), and WA-323-P, covering an area of approximately 372 km² in Commonwealth waters. The project is referred to as the Venture Off-bottom Cable (OBC) seismic survey and the survey area is shown on **Figure 1**.

Apache submitted an Environmental Plan (EP) to the Department of Industry and resources (DoIR) for the project in compliance with the Petroleum Submerged Lands Management of Environment (P(SL)(MoE)) Regulations 1999. The EP has been approved by the DoIR on the 2nd May 2008. Under the P(SL)(MoE) Regulation 11(7), a summary of the EP is to be submitted to the Designated Authority (DPI). This document is a summary EP for public disclosure of the Venture Off-bottom Cable (OBC) seismic survey to be undertaken in the Commonwealth Waters off the Western Australian coast.

TIMING

The OBC seismic survey is scheduled to commence from mid May 2008. The proposed Venture OBC seismic survey schedule will take an estimated 60 days to complete based on a 24 hour a day operation (though data acquisition will not take place all the time). Deployment vessels will retrieve and deploy cables at night. The survey is estimated to conclude by mid to late July 2008, however any delays to the start date of the survey or adverse prevailing sea and weather conditions during the survey could potentially extend the finish date.

LOCATION

The proposed survey area is located within the Carnarvon Basin of Western Australia in predominantly WA Exploration Permit WA-356-P, as well as Exploration Permits WA-192-P(1) and WA-323-P. Exploration Permit WA-192-P, being the easternmost permit area, is located approximately 140 km north northwest of Dampier (see **Figure 1**). The proposed survey covers an area of approximately 372 km² and is located within water depths ranging from 30 m to 80 m. Coordinates of the survey area are listed in **Table 1**.

Table 1: Proposed Venture Off-bottom Cable Seismic Survey Coordinates

Latitude			Longitude		
degrees	minutes	seconds	degrees	minutes	seconds
-20	01	26.01	115	19	37.97
-20	01	29.02	115	25	04.83
-20	05	40.32	115	25	02.31
-20	09	54.74	115	27	35.54
-20	13	09.13	115	25	57.17
-20	13	05.87	115	20	02.72
-20	14	58.72	115	19	05.49
-20	14	56.25	115	14	52.81
-20	10	49.55	115	14	55.57

Datum: GDA 1994 Zone 50

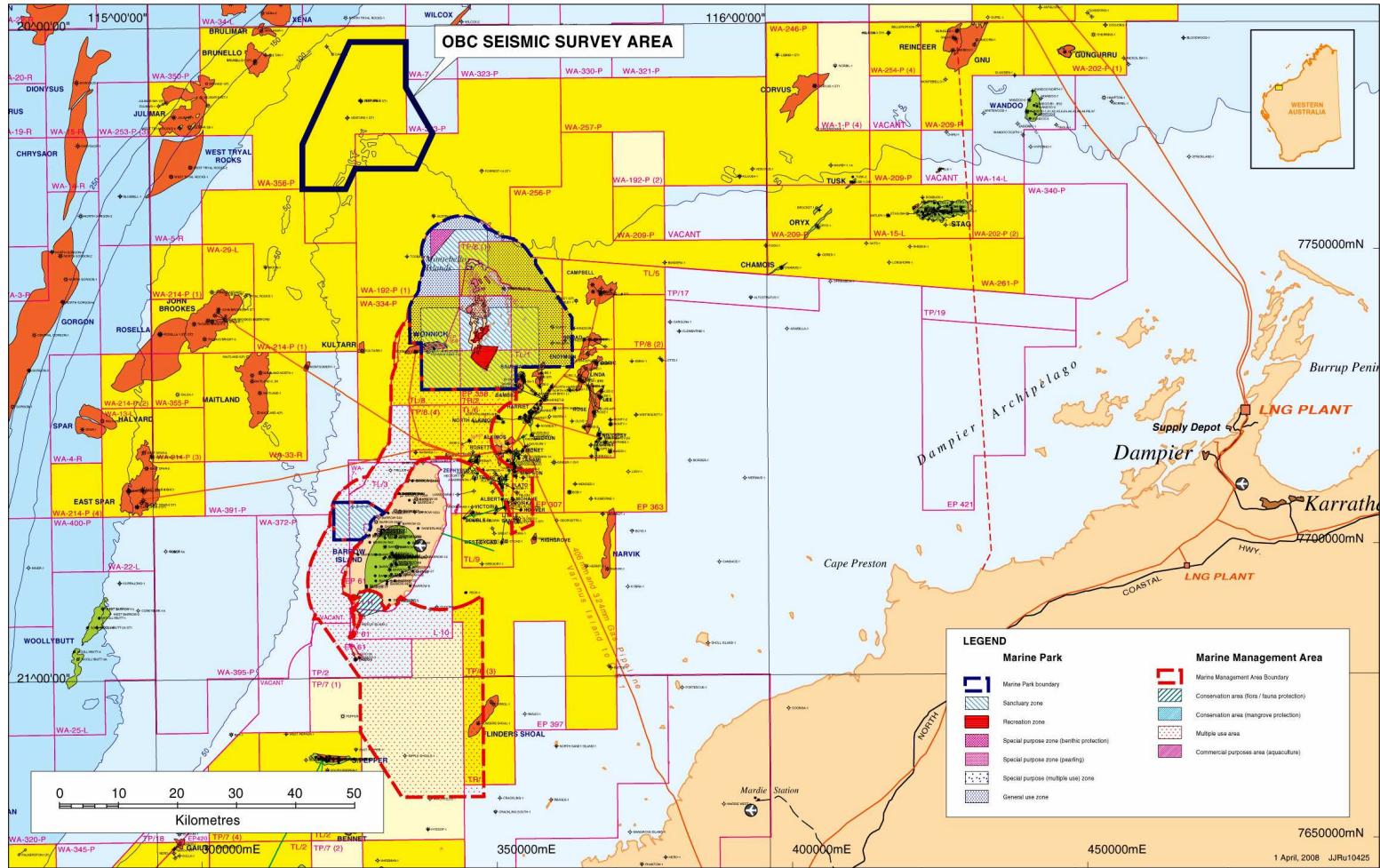


Figure 1: Map showing the location of the proposed Venture OBC survey area

PROJECT DESCRIPTION

Unlike a conventional acoustic seismic survey, the OBC survey will require more smaller vessels, including a large support/accommodation vessel, source vessel, recording vessel and deployment vessel to undertake the proposed OBC seismic survey. Vessel names and operational propose of the vessels are listed below.

1. Swifto Sovereign (*40 metre Monohull*) Source vessel.
2. Miclyn Glory (*54 metre Monohull*) Cable handling vessel.
3. Crest Diamond (*59 metre Monohull*) Recording vessel with accommodation for 40 people.

For an OBC survey the solid core receivers (do not contain any hydrocarbon fluids) are laid out on the bottom of the ocean rather than towed behind the seismic vessel. The three sound wave receiving cables, approximately 9 km in length, will be laid on the seabed in a north to south direction approximately 500 m apart. The cable handling vessel (Miclyn Glory) will be used to deploy and retrieve the recording spread at night once the source vessel has transited over the area during the day.

An acoustic source or air gun array is still used with the source vessel (the Swift Sovereign) transiting over the area perpendicular to where the receivers have been installed. The receivers are connected to a recording vessel (the Crest Diamond) which anchors off to the side of the survey area. The seismic survey source vessel will complete long-axis acquisition transects of the survey area by sailing across approximately three sound wave receiving cables in a east to west direction. Following acquisition of this data, the cables will be recovered and re-laid by the deployment vessel and the process repeated to cover the 372 km² area in approximately 60 days.

The acoustic source will comprise one source array consisting of six air guns with a combined capacity of 900 cubic inches, operating alternately at approximately 15 second intervals. The source generates a pressure wave pulse that travels as a seismic signal down through the geological layers into the underlying seabed and sedimentary strata. The pulse is then reflected back from the boundaries separating the rock layers in the subsurface. The reflected signals travel through the seabed cables to the hydrophones and geophones located within a customised aluminium bronze casting, known as a "flatpack", also placed on the seabed. The cables and flatpack are connected to the stationary seismic recording vessel (the Crest Diamond), returning the signal to the vessels onboard computers for subsequent processing and analysis.

The source vessels speed will be set at approximately 4 knots resulting in a release from the ic source array every 15 seconds. Data acquisition will occur throughout a normal 24 hour working day, acquiring approximately 6-7 km² of data each day. Details of the seismic array are given in **Table 2**.

The seismic source for the proposed OBC survey is small by normal seismic program standards, which means sound penetration impacts on marine biota will be much reduced.

All personnel involved with the survey will be housed on the Crest Diamond fitted with accomodation for 40 persons and workshop facilities. This vessel will be anchored outside the survey area, approximately 2-5 km from the perimeter of the active survey lines.

Table 2: Details of the seismic array

Name of Survey	Venture Off-bottom Cable Seismic Survey
Type of Survey	Off-bottom cable
Proposed commencement date of survey	Mid may
Duration of Survey	Expected 55 days
Number of seismic source arrays	1
Total volume of seismic source arrays	900 cui
Operating pressure of seismic source arrays	2,000 psi
Depth of seismic source arrays	3 m
Interval between sound pulses	15 secs
Peak source of sound pulse	Peak to Peak (239 dB re 1 micro Pascal at 1m)
Frequency range	5 - 230 Hz

The three vessels will be serviced by one or more port-based vessels (from Dampier) that will deliver supplies and remove waste from them as required, and possibly conduct crew changes if necessary. This service vessel will not be stationed within the survey area. The service vessel will also be used to refuel other vessels in the field as and if required.

RECEIVING ENVIRONMENT

A general overview of the receiving environment in terms of its physical and biological aspects is provided in the following sections.

Physical Environment

Climate

The climate of the Carnarvon Basin region can be described as arid subtropical with hot summer temperatures, high evaporation, periodic cyclones and associated rainfall. Rainfall in the region is generally low with evaporation exceeding rainfall throughout the year. Intense rainfall may sometimes occur during the passage of summer tropical cyclones and thunderstorms. Mean air temperatures over the neighbouring ocean area range from a minimum of 11°C in winter to a maximum of 37°C in summer.

Extreme wind conditions may be generated in the area by tropical cyclones, strong easterly pressure gradients, squalls, tornadoes and waterspouts. Three to four cyclones per year are typical, primarily between December and March. On average, two cyclones per year have approached within 400 nautical miles (740 km) of Apache's Stag oil platform, about 110 km east-northeast of the proposed seismic survey area, with the highest frequency being over the hottest months of January to March. Tropical cyclones have generated significant swell heights of up to 5 m in this area, although the predicted frequency of swells exceeding 2 m is less than 5%. The survey area is located in a cyclone-prone area based on 10 years of cyclone path measurements by the Bureau of Meteorology.

Oceanography

Surface currents within the proposed survey area are generated by several components, including tidal-forcing, local wind-forcing and residual drift. Tidal and wind forcing are the dominant contributions to local surface currents.

The tides of the NWS have a strong semi-diurnal signal with four tide changes per day. Within the survey area, the tidal flows give an elliptical pattern. Based on measurements at nearby locations, tidal currents are predicted to attain average speeds of approximately 0.25 knots over the survey area during neap tides and up to 0.5 knots during spring tides. Thus, over the six-hourly periods of tide flow, a maximum tidal excursion of 3 nautical miles, or 5.5 km, is predicted.

Local winds will generate stress on the water surface, forcing the surface layer in the general direction of wind movement, but with an offset (15-45%) in an anti-clockwise direction (the Coriolis effect). In the open ocean, sustained winds result in wind-forced currents of approximately 3% of the wind speed. Thus, a sustained wind of 20 knots may force surface currents of up to 0.6 knots. The mean drift or steady currents are predominantly oceanic driven, including the influence of the Leeuwin Current and other broad-scale oceanic flows. They are not correlated to tidal oscillations or local wind forcing. Generally, the net drift is towards the southwest throughout the year, but may periodically swing to the north-east. Residual currents are generally weak in the area, with typical flows of less than 0.2 knots.

Bathymetry

The proposed seismic survey area is located to the west of the Barrow-Lowendal-Montebello Island complex that consists of an elongate, shallow submerged ridge supporting many islands of various size and shapes. This complex supports a wide range of intertidal and shallow subtidal marine habitats.

A detailed bathymetry survey of the Permit Area was completed in 2005 as part of the Joy Seismic Survey. The east section of Permit WA-356-P is situated on the broad, gently northward sloping mid-shelf region in water depths ranging from 30-80 m. The mid continental shelf region (nominally between the 30 m and 100 m isobaths) is characterised by a thick sequence of carbonate rock that is overlain by thin layers of unconsolidated fine to medium grained, carbonate sediments with occasional shell or gravel patches.

Regional surveys on the North West Shelf indicate the seafloor composition is uniform throughout the area, but with spatial variation in the grain size and origin of the surface sediments. Surface sediments in the area are predominantly composed of skeletal remains of marine fauna, with lenses of weathered sands.

Biological Environment

Benthic Flora and Fauna

Benthic flora and fauna diversity and abundance is likely to be comparable to that found over similar substratum and at similar depths over the wider region. The unconsolidated sediments in this habitat support a diverse benthic infauna, consisting predominantly of mobile burrowing species, which include molluscs; crustaceans (crabs, shrimps and smaller related species); polychaete, sipunculid and platyhelminth worms; asteroids (sea stars); echinoids (sea urchins), and other small infaunal animals.

Marine Fauna

A review of the Commonwealth Department of Environment and Heritage database indicates that there are a number of listed species identified as potentially occurring within the seismic survey areas.

A brief overview of these listed species and other biota is given under faunal groupings in the following sections: marine mammals, seabirds, fish and sharks and rays and skates.

Marine Mammals

A number of marine mammals (whales, dolphins and turtles) are known to occur in the Carnarvon Basin, some being seasonal visitors while others occur at low densities all year round. Several of these species are discussed below on their potential presence in the survey area.

A number of whale species, including the Blue whale (*Balaenoptera musculus*), Humpback whale (*Magaptera novaeangliae*), Bryde's whale (*Balaenoptera edeni*), Killer whale (*Orcinus orca*) and Minke whale (*Balaenoptera acutorostrata*) may occur infrequently in the project area.

The most commonly sighted whale is the Humpback whale. Humpback whales are known to migrate between the Antarctic waters and the Kimberly region of Western Australia. The peak of the northerly migration occurs around late July, while the southerly return migration peaks around late August to early September, with a peak of cow and calves occurring in early to mid October.

The migratory whale route, where most whales are observed, occurs in deeper waters (> 20 metres), passing to the west and north of Serrurier Island, westward of Barrow Island and north of the Montebello Islands.

The timing of the proposed OBC seismic survey will not coincide with the northerly or southerly migration periods of the humpback whale.

The nationally threatened dugong (*Dugong dugong*) occurs across the tropical coastal waters of Australia from Shark Bay to Queensland. They are herbivorous and are generally associated with seagrass beds, upon which they feed. Dugongs are commonly found in shallow sheltered areas (less than 5 m deep), often near islands or large bays. Recent aerial surveys of dugong distribution have found that the animals occur around Barrow Island, Airlie Island, Lowendal Islands and the Montebello Islands further offshore, with a large population in Exmouth Gulf.

Dolphins are relatively common in the region. Species known to occur in the region are the Spotted Bottlenose Dolphin (*Tursiops aduncus*) Bottlenose dolphin (*Tursiops truncatus*), Risso's Dolphin (*Grampus griseus*), Spotted Dolphin (*Stenella attenuata*) and the Common dolphin (*Delphinus delphis*).

Four species of marine turtle nest on sandy shore sites of the Dampier Archipelago, Montebello Islands, Lowendal Islands, Barrow Island, and other coastal islands in the Exmouth region. These are the green turtle (*Chelonia mydas*), flatback turtle (*Natator depressus*), hawksbill turtle (*Eretmochelys imbricata*), and the loggerhead turtle (*Caretta caretta*). The leatherback turtle (*Dermochelys coriacea*) is also known to visit the open waters of the shelf. All five species are on the National List of Threatened Species. The loggerhead, flatback and leatherback turtles are known to feed on mid-water plankton and benthic animals, and can forage in mid-shelf water depths, so may occur in the survey area.

Seabirds

Eighteen species of seabird have been recorded over the NWS waters. These include petrels, shearwaters, tropicbirds, frigatebirds, boobies and terns, and silver gulls. Of these, eight species occur year round and the remaining 10 are seasonal visitors.

Only one endangered marine bird, the Southern Giant-Petrel, may occur in the project area. As this bird species is migratory and may overfly the project area, it is highly unlikely that it will be impacted by the survey.

Fish and Sharks

The demersal habitat of the NWS hosts a diverse assemblage of fish, with up to 1,400 species known to occur, with a great proportion of these occurring in shallow coastal waters. Many of these are commercially exploited by trawl and trap fisheries. Pelagic fish in this area include tuna, mackerel, herring, pilchard and sardine, and game fish such as marlin and sailfish.

Twenty nine species of pipefish and pipehorses may occur in the project area. A further 5 species of seahorses and twelve species of sea snakes may also occur, however little is known of the distribution of individual species, population sizes or aspects of their ecology.

Whale sharks (*Rhincodon typus*), the world's largest fish (growing up to 12 m in length), are oceanic and cosmopolitan in their distribution, however, they do aggregate in and near the waters of the Ningaloo Marine Park during autumn, approximately 200 km south of the survey area.

Rays and Skates

The filter-feeding devil rays (manta ray, *Manta birostris* and mobulid ray, *Mobula eregoodootenkee*) congregate in the same areas at the same times as whale sharks. Devil rays are widely distributed throughout the world's tropical waters and can weigh up to 2 tonnes. Most devil rays are recorded in waters less than 100 m deep, though they are known to occur in deeper waters. Skates are a common and widespread demersal species of deepwater environments.

Areas of Environmental Significance

There are no known areas of regional environmental significance within the proposed seismic survey area.

There are currently 3 Marine Conservation Reserves in the North West Shelf region:

- Ningaloo Marine Park and Muiron Islands Marine Management Area;
- Montebello/Barrow Islands Marine Conservation Reserves (18 km southeast); and
- the Dampier Archipelago Marine Park and Cape Preston Management Area (140 km east southeast).

Marine Conservation Reserves are vested or legally entrusted to the Marine Parks and Reserves Authority (MPRA). The MPRA is a community-based body established by the State Government in 1997 to oversee the state-wide system of Marine Conservation Reserves. Thus, the MPRA is a statutory body reporting to the Minister for the Environment. The Department of Environment and Conservation is the primary day-to-day manager of Marine Conservation Reserves.

The Montebello and Lowendal Islands have similar habitats and biota diversity as those of the Dampier Archipelago, with nearshore marine habitats consisting of subtidal sediments, intertidal and subtidal reefs, macroalgal and seagrass beds, intertidal sand shoals and beaches, mangroves, and mud flats.

Deeper subtidal reefs support a luxuriant and diverse assemblage of filter feeding animals, comprising mostly of sponges, gorgonians, whip corals, bryozoans, ascidians and hydroids.

Socio-economic Environment

Population Centres

The proposed seismic survey area is located approximately 140 km offshore from the Port of Dampier. Smaller coastal fishing and tourism settlements occur at Onslow, approximately 160 km to the south.

Dampier and Karratha are the main service and population centres for the region. Although developed initially for the iron ore industry, these towns have expanded to service the oil and gas industry located on the NWS.

Aboriginal History

There is no evidence of archaeological or heritage sites having been observed within the survey area. There are also no known registered archaeological sites for the area and no records of aboriginal occupation having been recorded for the surrounding marine waters of the nearby Montebello and Lowendal Islands.

Recreation

Local people seeking aquatic recreation such as boating, diving and fishing use the coast and islands of the Pilbara. These activities are concentrated in the vicinity of the population centres such as Dampier, Onslow, Point Samson and Port Hedland. The open waters of the Commonwealth permit areas do not support significant recreational or tourist activity.

Commercial Fisheries

Several commercial fisheries are active along the Pilbara coast, however fishing effort in the open Commonwealth waters is low, with operators favouring the inshore areas. Pearling is the key industry in the region. Live pearl shell for subsequent use in the pearl culture phase is harvested by divers from several areas off the Pilbara coast, with pearl culture leases located in the Montebello Islands and the Dampier

Archipelago. Prawn trawling activities occur near Onslow and Nickol Bay, the major target species being the tiger, western king and banana prawns.

Commercial shipping

The survey site is located east of the main north/south coastal shipping lane paralleling the WA coastline then heading north to SE Asia, but is partially located within the Dampier inbound and outbound route and is associated with vessel movements to and from the ports of the NWS, in particular Dampier. Consequently there is the possibility that the seismic vessel could encounter minor merchant vessel traffic during its data acquisition.

ENVIRONMENTAL HAZARDS, MANAGEMENT APPROACH AND CONTROLS

The main aspects or activities associated with the operations of the seismic program that have the potential to result in environmental risks and effects are:

- Operation of the seismic source, recording and deployment vessels and towing of the airgun and cables through the survey area;
- Discharge of the air source arrays in the survey area;
- Cable placement, anchoring or grounding;
- Routine waste discharges from support vessels where recording personnel will be housed;
- Accidental fuel and oil spills from the support vessels; and
- Collision with another vessel.

The environmental and social issues potentially resulting from these activities are:

- Disturbance to marine fauna – disruptions to populations of cetaceans (dolphins and whales), fish, reptiles, benthic invertebrates and plankton from the discharge of the airgun array.
- Disturbance to benthic habitats – damage and/or destruction of seafloor habitats and palaeo-environments from cable placement, anchoring, grounding.
- Interference with shipping and boating in the area – disruption to vessels.
- Interference with commercial and recreational fishing – disruption to fishing vessels, disruption to commercial/recreational catches, hazard to professional abalone divers.
- Waste disposal impact on marine environment – sewage, putrescible waste, chemicals and solid and hazardous wastes.
- Fuel spill impact on marine environment – spillage from the support vessels.
- Interference with existing oil and gas production infrastructure (existing or under construction).
- Introduction of exotic marine species.
- Recreation – interference to boating, surfing, diving, snorkelling, swimming activities.
- Loss of tourism-related values from any oil spills and waste discharges, (if these were to occur).

A qualitative risk assessment has been carried out using a risk assessment matrix based on managing risks to as low as reasonably practical.

Risks and Effects of Routine Operations

Marine seismic surveying involves the discharge of compressed air to create sound pulses that are reflected from layers under the sea floor and recorded back at the surface. Interpretation of these reflections is a key step in exploration for hydrocarbons. There is currently no other method that has sufficient resolution to identify rock structure beneath the surface.

There are a range of potential impacts to marine animals from sounds emanating from a seismic source. These impacts vary with seismic release intensity, distance from the source, species and mitigation measures. Potential impacts range from mortality or pathological damage from close exposure to high sound levels to avoidance and temporary or permanent shifts in hearing thresholds and associated interference with acoustic signals.

A review of the marine impacts from seismic surveys, as part of an independent scientific review commissioned by the Australian Petroleum Production and Exploration Association (APPEA), concluded the following:

- The response of Australian marine animals to marine seismic survey sounds will range from no effect to various behavioural changes;
- Except for plankton and larvae at close range, few species are likely to be killed outright;
- The sound intensities required to produce pathological changes in marine mammals probably occur at <100 m and at < 200 m for fish;
- Most invertebrates, dugong and small toothed whales have poor hearing at low frequencies (e.g. the range of seismic discharges);
- Some fishes, baleen whales and possibly sea turtles may hear seismic sounds well and behavioural changes may occur at greater distances;
- It is possible that animals will habituate to sound;
- Behavioural impacts can include flight response, displacement, dispersal, and disruption of feeding or breeding activity;
- Operating seismic vessels for protracted periods across narrow, restricted migratory paths may hinder the passage of migrating animals;
- The greatest risk from marine seismic surveys to marine animals appears to be during breeding or spawning periods;
- Provided that seismic surveys are avoided at locations and times of particular sensitivity, and given the relatively small scale of seismic activity, the often large scales over which biological events occur, the low probability of encounter between seismic surveys and 'at risk' populations at an appropriate time and place, then the wider implications of disruption by seismic surveys appear to be small for most species.

The proposed OBC survey airgun array will produce at source (i.e., within a few metres of the airguns) sound pulses in the order of 220-240 dB re 1 μ Pa-m at frequencies extending up to approximately 110 Hz. These levels will decrease to levels in the order of 170–180 dB re 1 μ Pa-m within 1 km of the source and approximately 160 dB re 1 μ Pa-m within 10 km, dependent on the sound propagation characteristics of the area.

Impacts on Cetaceans

Baleen whales such as blue, southern right and humpback whales, communicate by low frequency sounds and are therefore considered to be the most sensitive of the marine mammals to specific low frequency sounds. The hearing of baleen whales is thought to overlap with the energy output of seismic related noise. The proposed

timing of the Venture OBC seismic survey does not coincide with the northerly or southerly migration of the Humpback whale.

Marine seismic surveys do not necessarily constitute a threat to marine mammals if care is taken to avoid situations that could potentially harm the animals (JNCC, 1998). The proposed OBC survey covers a relatively small area (up to 372 km²), will use a significantly smaller source array (900 cui) compared to conventional seismic arrays (2,500-3,000 cui). As mitigation for this, the guidelines on the application of the EPBC Act Policy Statement 2.1 to interactions between offshore seismic operations and whales (May 2007) will be applied.

Given the timing and location of the seismic program and the adherence to DEW cetacean Policy Statement, the risk of effects to cetaceans from the proposed seismic program is considered negligible.

Impacts on Fish and Sharks

Direct physical damage to fish may occur within 1 to 2 m of a seismic source and is species dependent. For instance, species with swim bladders closely connected to the inner ear are more susceptible to seismic pulses than those without; e.g. elasmobranchs (sharks and rays), scombrids (mackerel and tuna) and many flatfishes and flounder do not possess a swim bladder and so would be less susceptible to seismic pulses.

For the proposed seismic program, it is considered highly unlikely that mortality of fish due to close proximity to the seismic source would occur because the proposed survey areas are in deeper water with predominantly featureless sandy seabed and highly mobile fish fauna. In addition, the seismic operational procedures include soft starts which would allow fish to move out of close range.

Over reef areas, the most likely response of fish is to seek refuge in the reef, where they would be beyond the harmful exposure distance from the airgun source. During this time, catchability may be reduced but fish would not disperse away from the reef area. While this may be of temporary inconvenience for some fishermen, it is unlikely to be of lasting harm to fish populations as the behavioural changes in fish are species dependent, localised and transient in nature and are unlikely to have an impact at the population level.

Impacts on Benthic Invertebrates and Plankton

Marine invertebrates lack sensory organs that are used to perceive sound pressure and do not have gas spaces such as swim bladders within their bodies. Some have organs or tactile hairs which are sensitive to hydrostatic disturbances. Because of this it has been postulated that crustaceans, molluscs and most other invertebrates can only detect seismic survey sounds at close range, less than 15 m away from the source.

Research on scallop mortality / muscle strength and on plankton abundance indicated no difference between the area subject to seismic surveys and the control.

In principle, the vessel's distance from shore (in Commonwealth waters) and minimum operating depth of 30 m will avoid possible disturbance to the seabed and benthic environment. Cables will also be deployed and retrieved following procedures, limiting potential damage to the seabed.

Effects of Acoustic Discharges to Divers

The Venture OBC seismic survey will operate in Commonwealth waters and the risk is considered low that the acoustic energy discharged during the survey may be harmful to recreational and commercial (abalone) divers. Risk is also very low for other water activities that have a lesser degree of submerged activity such as swimming and bathing, surfing and snorkelling.

Due to the location and depth of the survey it is highly unlikely diving operations will be encountered.

Interference with Commercial and Recreational Fisheries

Operation of the seismic vessel conducting the survey may cause some inconvenience to the planning of charter fishing, diving and tourism trips, which may need to change locations at short notice depending on vessel movements on any particular day.

Potential impacts on commercial fisheries are largely due to navigational conflicts, given that seismic vessels tow long streamers and fishers often deploy trawl nets or long lines over the same areas. For the Venture OBC which has its streamers or receivers on the ocean floor potential conflict with fishing activity is significantly reduced. In addition, effective communication and up to date notification of the location of the seismic vessel to commercial fishermen in the region will further assist in avoiding any impacts.

Changes to the behaviour of fish have the potential to affect their catchability and as such could affect commercial fisheries. However, reports have been variable on impacts to commercial fisheries (positive impact, negative impact or neutral impact). Some of the variability in reported findings is thought to be due to differences in the behaviour of species and sizes of fish in response to seismic surveys and the duration or intensity of seismic surveys.

Boat-based recreational fishing occurs mainly out of Dampier as there are few other access areas. Boat anglers principally catch reef fish and mostly operate reasonably close to the shore. Given that the survey area is approximately 140 km from Dampier, it is considered that there would be minimal, if any effect on recreational fishing.

All vessel operations will be conducted in compliance with the Australian Maritime Safety Authority (AMSA) Offshore Support Vessel Code of Safe Working Practice (OSV Code), which includes standards for radar monitoring and vessel communications.

Disposal of Wastes

All wastes generated on the vessels will be managed in accordance with the P(SL)A clause 222 (Housekeeping) and MARPOL 73/78 regulations.

The risk of adversely affecting water quality within any of the survey areas is considered negligible based on the constant movement of the vessel, the short duration of the survey, the highly dynamic and extensive receiving water and the small quantity and concentration of pollutants within waste-waters discharged from the support vessel.

A quantitative waste tracking log will be maintained in accordance with regulatory requirements for all relevant wastes.

Anchoring

Anchoring will only be required for the support and recorder vessels in nominated mooring locations away from any petroleum sub-sea equipment and in areas of sandy seafloor.

Refuelling

Refuelling at sea is likely to be required during the OBC seismic program. The support vessel will refuel on an expected cycle of every 35 days in the Port of Dampier and will be used to refuel other vessels in the field as and if required.

In the extremely unlikely event of an accidental oil spill to the ocean, the contractor vessel's approved Shipboard Oil Pollution Emergency Procedure (SOPEP) would be immediately activated, in conjunction with the Emergency Procedures Manual if necessary. All spills must be logged and reported to the Vessel Master. Any spills greater than 80L must also be immediately reported to the DoIR.

Onboard Storage and Handling of Materials

All oils or chemicals used or stored onboard the survey vessels will be contained and managed to prevent damage to the containers or leakage/spillage onto the deck or into the ocean. These materials will be stored in bunded areas such that any spills or leaks can be contained and recovered. Deck drains and bunds will be inspected to ensure their integrity prior to the commencement of operations. Sufficient absorbent materials will be held onboard to mop up possible leaks.

Should onboard spills or leaks occur, they would be cleaned up immediately using absorbent materials held on the vessel. Recovered oils or chemicals and used absorbent materials will be placed in appropriately marked drums for recycling or onshore disposal.

Exhaust Emissions

The combustion of fossil fuels in vessel engines and onboard power generators will contribute to exhaust emissions including the greenhouse gas CO₂. Emissions will be minimised by ensuring that all engines and generators are serviced to manufacturers specifications.

Risks and Effects from Unplanned Events

Vessel Collision

The majority of the shipping activity occurs to the west, east and north of the survey area and as such poses little risk for collision with the seismic vessels resulting in the possible release of diesel fuel. However there is the potential for vessel traffic transiting from and to the Port of Dampier to pass through the survey area. The potential for a hydrocarbon spill resulting from the collision of the seismic vessels with another ocean going vessel is considered negligible for the following reasons:

- Radio communication will be maintained with any vessels observed transiting the area.
- Information on the location and timing of the seismic program will be communicated to vessels via AMSA through a Notice to Mariners.
- Notification of the position of the seismic vessels and the area proposed to be working in will be communicated to fishing industry representatives and

forwarded to respective members (vessel owners). This will ensure no fishing vessels are operating within the nominated daily run line of the survey.

Oil spill modelling indicated that spills generated during the winter season (April-August) are most likely to drift westward or to the northwest and thus away from the Montebello and Barrow islands. A small percentage of spills (up to 7 %) were predicted to drift to the south/southeast and could reach the nearest shoreline within 6 to 12 hours. As a first line of response to a small and localised oil spill event, all vessels used for the OBC seismic survey will contain adequate oil spill response kits. Furthermore, Apache's Emergency Response Procedures are in place which covers response strategies and actions for accidental oil spills.

Introduction of Marine Pests

The introduction of marine pests may occur through the discharge in Australian waters of ballast water taken up overseas. Australia has mandatory ballast water requirements to reduce the risk of introducing harmful aquatic organisms into Australia's marine environment through ship's ballast water. Australia's new ballast water management requirements have legislative backing and will be enforced under the *Quarantine Act 1908*. These requirements are consistent with International Maritime Organisation (IMO) Guidelines for minimising the translocation of harmful aquatic species in ship's ballast water.

The majority of vessels proposed to be used for the survey will be sourced from Dampier where they currently operate within Western Australian waters and pose no risk from the introduction of marine pests. Should a vessel be required to be sourced from outside WA waters (such as the support/accommodation vessel), it will be required to comply with the Australian Ballast Water Management Requirements. This will involve a full ballast water exchange at sea (Option 4 of the Requirements) prior to entering Australian waters. The seismic source array and receivers will be cleaned prior to their deployment.

Management Controls

Controls to be implemented during the seismic program to safeguard against the potential environmental risks and effects identified, consist of both procedural and operational practices that will be undertaken during the seismic survey to protect against any adverse environmental impact. Such controls are recognised as additional measures to further manage environmental risks.

The following table summarises the key environmental risks associated with the surveys and the control measures to be implemented to reduce the risk to as low as practicable.

Objective	Management Control
Minimise risk of adverse effect to marine biota and the marine environment.	Environmental audit verifies adherence to EP. AEL Site Rep validating compliance with DEWHA Policy Statement for avoiding interference with cetaceans. Submission to DEWHA of Whale and Dolphin Sighting Records if seen.
Maintain marine water quality.	Environmental audit verifies adherence to EP, such that these standards are being met. Environmental audit verifies that vessel procedures comply with requirements of MARPOL, e.g. oil record book sighted and kept up to date.

Objective	Management Control
Maintain air quality	Environmental audit verifies adherence to EP, such that these standards are being met. Environmental audit verifies that Vessel procedures comply with requirements of MARPOL.
Minimise risk of adverse effect to environment from hydrocarbons.	Environmental audit verifies adherence to EP, such that these standards are being met, e.g. designated containment areas for storage of oils, chemicals and streamer fluids. Environmental audit verifies that vessel procedures comply with requirements of MARPOL, e.g. oil record book sighted and kept up to date. Any spills >80 L reported to the designated authority.
Maintain abundance and diversity of benthic flora and fauna.	Environmental audit verifies adherence to EP, such that these standards are being met.
Minimise disturbance to other users.	Advice given to stakeholders with regard to location and timing of seismic surveys.
Minimise risk of introducing marine pests into Australian waters	Vessel log book records a full ballast water exchange at sea prior to entry into Australian waters.

Consultation

Consultation with stakeholder groups, primarily representatives of commercial fishermen, concerning the proposed seismic program has commenced.

The following organisations have been contacted and informed of Apache's proposed seismic program:

- Western Australian Fishing Industry Council (WAFIC).
- Department of Fisheries WA.
- Commonwealth Fisheries Association.
- Australian Fisheries Management Authority.
- Marine and Coastal Community Network.

Further Details

For further information on the Seismic Surveys please contact:

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