Rafter 3D Marine Seismic Survey
Environment Plan Summary

GeoTechnical Operations

Date: June 2012

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TABLE OF CONTENTS

1. INTRODUCTION 6
2. LOCATION OF THE ACTIVITY 6
3. DESCRIPTION OF THE RECEIVING ENVIRONMENT 8
3.1 Physical Environment 8
3.2 Biological Environment 8
3.3 Socio-economic Environment 8
4. DESCRIPTION OF THE ACTION 9
5. MAJOR ENVIRONMENTAL HAZARDS AND CONTROLS 11
6. MANAGEMENT APPROACH 13
7. CONSULTATION 13
8. CONTACT DETAILS 13
9. REFERENCES 14

1. INTRODUCTION

Woodside Energy Ltd (Woodside) proposes to undertake a three dimensional (3D) marine seismic survey (MSS), called Rafter 3D MSS, in the Browse Basin in offshore Commonwealth waters Petroleum Exploration Permit Area WA-275-P, Retention Lease Area WA-28-R, Release Area W11-2 and adjacent vacant acreage (see **Figure 1**).

This document provides a summary of the Environment Plan (EP) that was accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) in accordance with Regulation 11(1) of the *Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 and Amendment Regulations 2011* (Environment Regulations).

This EP summary has been prepared as per the requirements of Regulation 11 (7) and (8) of the referenced Environment Regulations.

2. LOCATION OF THE ACTIVITY

The Rafter 3D MSS survey will occur within an operational area of 2,087 km^2 within Commonwealth waters that are situated mostly within petroleum exploration permit area WA-275-P (**Figure 1**). Parts of the survey area also overlap petroleum retention lease area WA-28-R, release area W11-2 and vacant acreage to south of WA-275-P. The operational area also overlaps exploration permit area WA-397-P and retention lease area WA-29-R (**Figure 1**). The operational area is located approximately 350 km north of Broome in Western Australia and 245 km from the Kimberley coastline. Nearest landfall to the survey location is Sandy Islet, which is part of Scott Reef, located approximately 40 km north-east of the north-east corner of the operational area.

The area referred to as the 'operational area' (**Figure 1**) includes:

- A 'survey acquisition area' (i.e. the area within which seismic acoustic emissions will occur for the purposes of acquiring data), which is approximately 673 km^2; mostly within petroleum exploration permit area WA-275-P, WA-28-R, release area W11-2 and vacant acreage to south of WA-275-P; and
- A surrounding 'buffer' area (of approximately 10 km width) in which the seismic source may be discharged at or below full capacity (power) for the purpose of run-outs, source testing and soft starts (in accordance with the Part A Standard Management Procedures (*EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales*; DEWHA 2008a).

Water depths in the survey acquisition area range from approximately 580 m to 1,700 m and depths over the operational area range from 475 m to over 2,200 m (see **Figure 1**).

Boundary coordinates for the operational area (see **Figure 1**) are provided in **Table 1** below.

Table 1: Boundary coordinates for the Rafter 3D MSS operational area

Latitude (S)			Longitude (E)		
Degrees	**Minutes**	**Seconds**	**Degrees**	**Minutes**	**Seconds**
14	20	36.67	121	31	49.73
14	39	00.63	121	31	42.44
14	52	42.13	121	17	33.79
14	36	15.12	121	00	48.60
14	20	33.26	121	17	16.03
14	20	36.67	121	31	49.73

Datum: GDA94

The Rafter 3D MSS will commence in late June 2012 and will take approximately one month to complete. The actual timeframe is dependent on survey logistics and prevailing weather conditions.

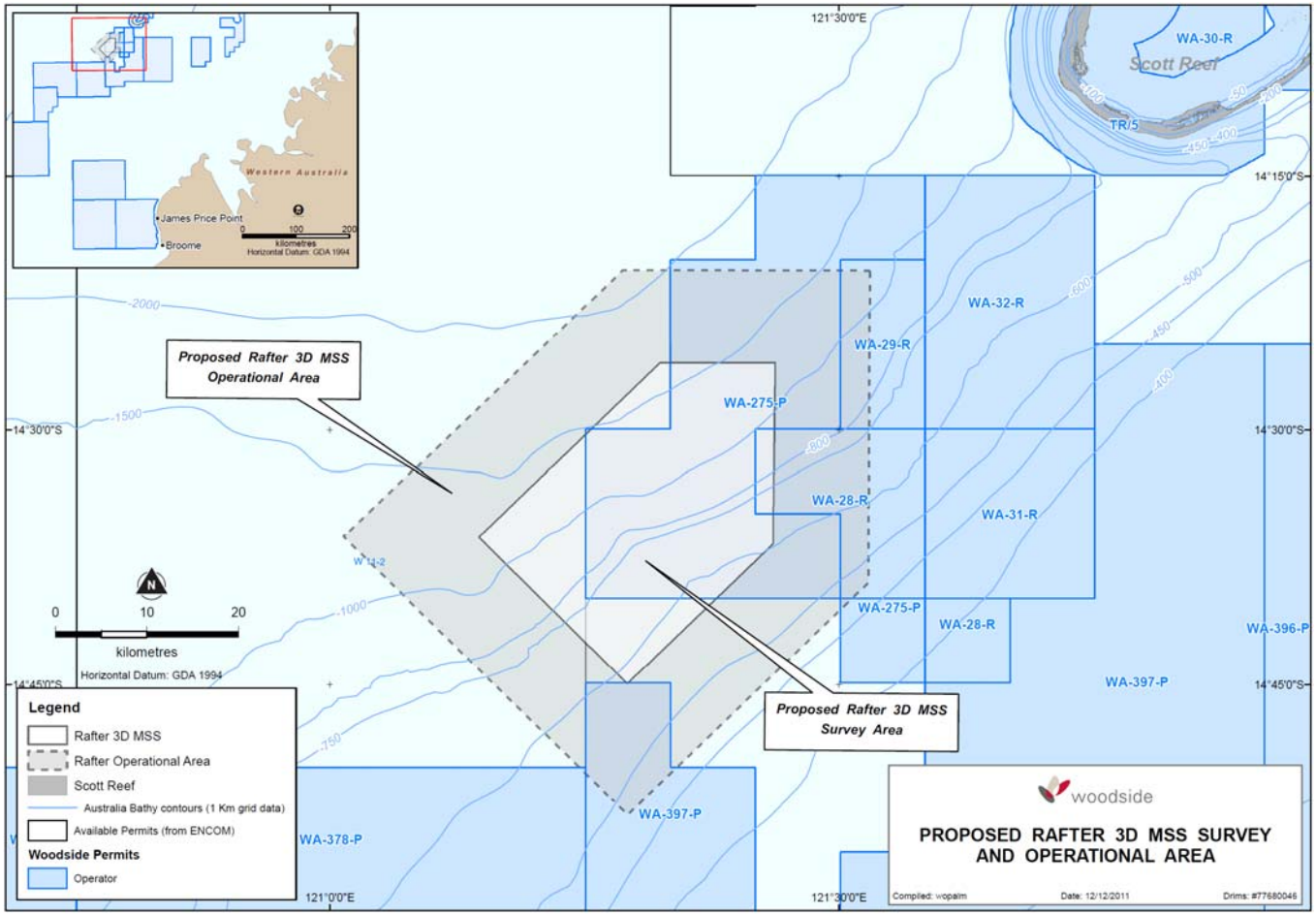


Figure 1: Location of the Rafter 3D MSS showing the survey area and operational buffer area in relation to petroleum exploration permits and Scott Reef

3. DESCRIPTION OF THE RECEIVING ENVIRONMENT

3.1 Physical Environment

The Rafter 3D MSS operational area lies entirely in offshore Commonwealth marine waters within the Timor Province of the North-west Marine Region (NWMR). The operational area is located on the uppper continental slope in water depths from approximately 475 m to over 2,200 m.

Much of the seabed at the survey location is gently sloping covered by a relatively featureless, sandy-mud sediments ranging from coarse to fine loose sand over hard substrates in the upper part of the survey operational area to fine sand and muddy carbonate sediments further down the slope in the deeper parts of the survey operational area.

There a number of reefs and islands in the region including:

- Scott Reef and Seringapatam Reef, located approximately 30 km north-east (to the edge of the intertidal reef) and 90 km north-east of the operational area, respectively.
- Adele Island, located approximately 195 km south-east of the operational area.
- Browse Island, located approximately 218 km east of the operational area.

3.2 Biological Environment

The seabed at the survey location is covered by a relatively featureless, sandy-mud with a sparse covering of sessile organisms dominated by filter-feeding heterotrophs such as gorgonians, sponges, soft corals, echinoderms and detritus-feeding crabs, polychaete worms and echinoderms.

Over 508 fish species have been identified on the North West Slope (which occurs in the Timor Province), and 64 of these species are endemic. The demersal fish communities of the province have been identified as a Key Ecological Feature (KEF) of the NWMR, as they are characterised by high endemism and species diversity.

A review of the EPBC Act database (Protected Matters Search Tool) held by SEWPaC indicates a total of 93 marine species listed under the provision of protection status (nine listed as Threatened; 20 as Cetaceans; 17 as Migratory; and 47 as Listed marine species) that may occur in, or relate to, the Rafter 3D MSS operational area (EPBC Act Protected Matters Report, accessed 12th December 2011, SEWPaC 2011a).

There are no *EPBC Act*-listed threatened ecological communities in the vicinity of the Rafter 3D MSS operational area and the area does not contain habitat that is critical to the survival of any listed species.

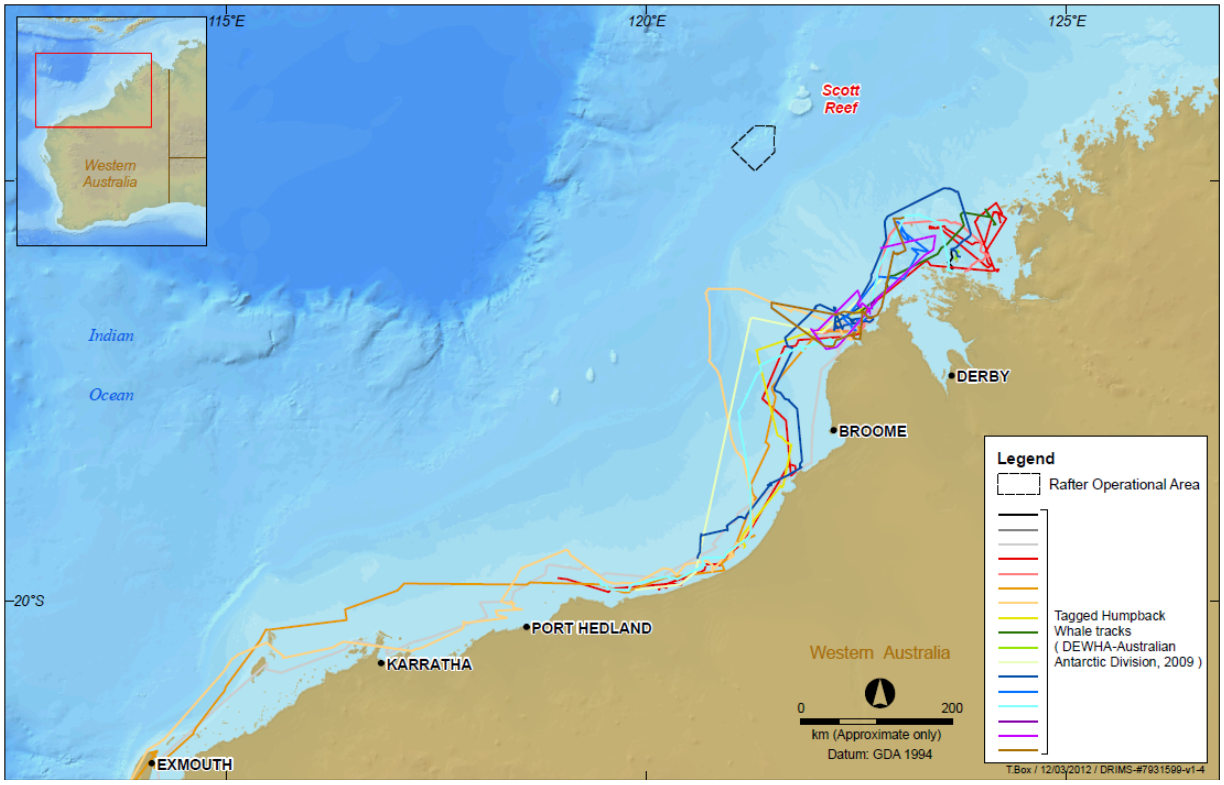
A number of whale species may occur in or migrate through the region, including the humpback whale (*Megaptera novaeangliae*) blue whale (*Balaenoptera musculus*), short-finned pilot whale (*Globicephala macrorhynchus*), false killer whale (*Pseudorca crassidens*), tropical Bryde's whale (*Balaenoptera edeni*), southern minke whale (*Balaenoptera acutorostrata*), killer whale (*Orcinus orca*) and sperm whale (*Physeter macrocephalus*).

The humpback whale is the most commonly sighted whale in north Western Australian waters, as they make their seasonal migration to the Camden Sound area of the west Kimberley following a migratory path mostly within the continental shelf boundary (200 m depth contour).

Given the proposed location of the Rafter 3D MSS it is unlikely that the survey will overlap with the peak migration paths for humpback whales in the region. Most pods are found in much shallower water depths (<200 m) than the deeper, offshore waters of the operational area (475-2,200 m). At the closest point, the operational area for the Rafter 3D MSS is located approximately 170 km north-west of the nominal boundary of the humpback whale calving grounds (**Figure 2**).

Other species whose broad distributions include the wider region include whales that are infrequently observed, including: the blue and pygmy blue whale, sperm, killer and Bryde's whales. Consequently, individuals of these species may be encountered in the area during the survey, although they are not expected in significant numbers.

There are no known breeding, calving or feeding grounds for any listed threatened or migratory cetacean species within, or in the immediate vicinity of the Rafter 3D MSS operational area and the abundance of animals is expected to be low in the area during the survey.



Source: modified from Double *et al.* (2010).

Figure 2: Tracks from satellite-tagged humpback whales in relation to the Rafter 3D MSS.

Six marine turtle species may occur in the operational area and adjacent waters - the green turtle (*Chelonia mydas*), leatherback turtle (*Dermochelys coriacea*), loggerhead (*Caretta caretta*), hawksbill turtle (*Eretmochelys imbricata*), olive ridley turtle (*Lepidochelys olivacea*), and the flatback turtle (*Natator depressus*).

Adult and juvenile green turtles and hawksbill turtles are likely to feed in the Scott Reef region. Sandy Islet at Scott Reef (located approximately 40 km north-east from nearest point of the Rafter 3D MSS operational area) is an important breeding site for the green turtle. A single hawksbill has also been sighted nesting at Sandy Islet.

No know turtle feeding areas are present in the Rafter 3D MSS operational area, as the area does not include any shallow shoals or banks (**Figure 1**), consequently there is only a low likelihood that turtles may migrate through the Rafter 3D MSS operational area.

Migratory shorebirds are likely to be present in, or overfly the region between July and October and again between March and April. The operational area is located approximately 245 km from the nearest mainland coastline, the distributions of many common seabirds overlap the region and may occur in the operational area.

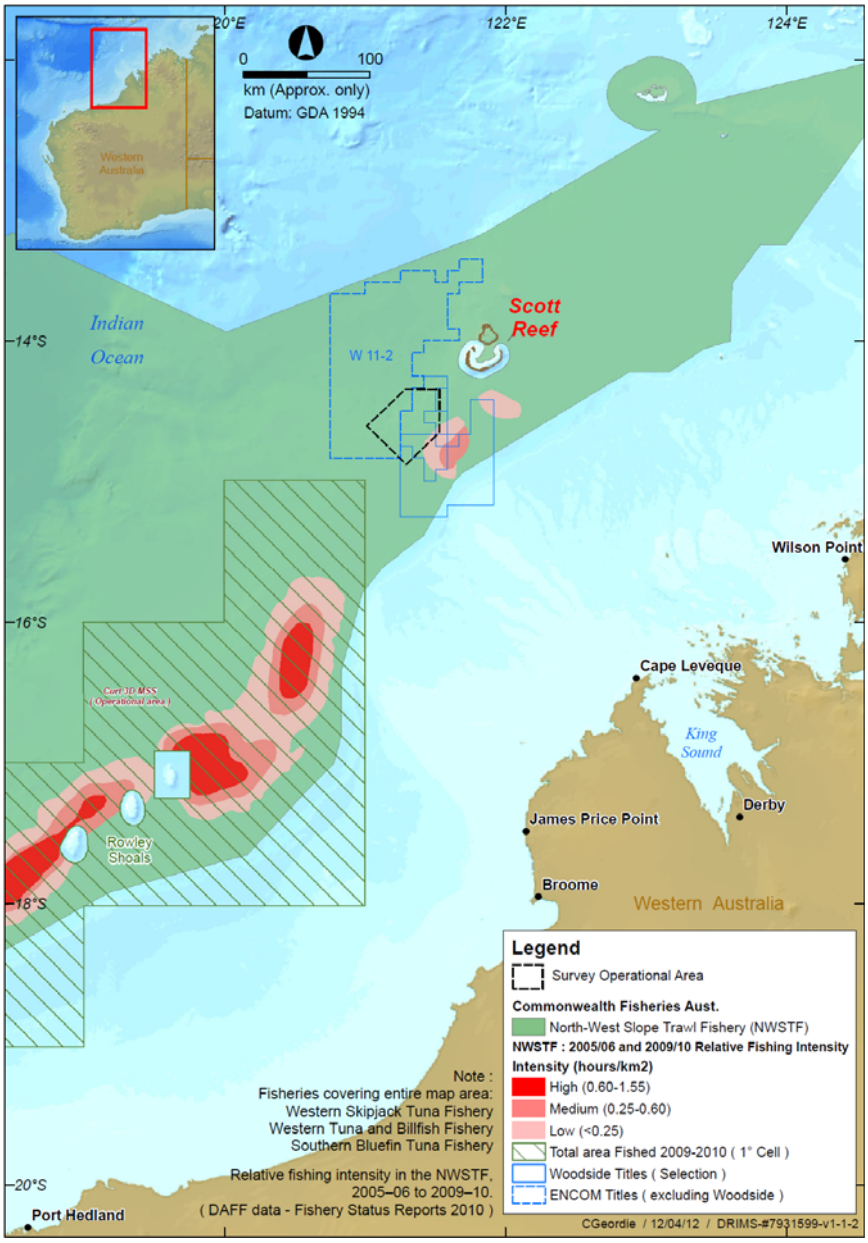
3.3 Socio-economic Environment

Commercial Fisheries

The Rafter 3D MSS operational area is located in waters that constitute part of four Commonwealth managed commercial fisheries. Of four Commonwealth commercial fisheries in the region, only the North West Slope Trawl Fishery (NWSTF) is active in the deeper continental slope waters of the region. The NWSTF has traditionally targeted scampi and deepwater prawns.

While the Rafter 3D MSS operational area overlaps the area available to the NWSTF, it is apparent that most of the effort and catch within the fishery in the recent years (2009-2010) occurs in shallower, upper slope waters (350-600 m) to the south-west of the operational area, nearer the Rowley Shoals and a smaller area has also been targeted to the SSW of South Scott Reef (Woodhams *et.al.* 2011, **Figure 3**). Although this fishing area is immediately adjacent (east) of the Rafter 3D MSS 'operational (buffer) area', the survey 'acquisition area' will not overlap this fishing area and fishing activity is expected to be low.

The Rafter 3D MSS operational area is also located in an area available to the Northern Demersal Scalefish Managed Fishery (NDSF), which is administered by the WA Department of Fisheries (DoF). It is highly unlikely that any vessels from these fisheries will be operating in the deep offshore waters of the survey area.



Source: modified from Fisheries status report 2010 (Woodhams *et al.* 2011).

Figure 3: Commonwealth Fisheries operating in the Rafter 3D MSS Area.

Traditional Fisheries

Traditional Indonesian fishing practices - referring exclusively to non-motorised sailing craft, are permitted in the region including Scott Reef, Seringapatam Reef, Browse Island and Cartier Island (Skewes *et al*. 1999). Traditional Indonesian fishing targets a range of species, including: trepang (beche-de-mer or sea cucumber); various molluscs, particularly trochus shell and clams; seabirds (particularly frigate birds) and eggs; sharks; and marine turtles predominantly around Scott Reef and the shoals to the north east.

Although the Rafter 3D MSS operational area extends just into the south-western corner of the MOU 74 Box, where traditional fishing is allowed, traditional sailing vessels are known to approach from and depart to the north of Scott Reef and it is very unlikely that traditional vessels will sail so far south of the reef and into the operational area.

4. DESCRIPTION OF THE ACTION

The Rafter marine seismic survey is a typical 3D survey similar to most others conducted in Australian marine waters (in terms of technical methods and procedures). No unique or unusual equipment or operations are proposed. Seismic data will be collected using a purpose built seismic survey vessel towing dual air-powered acoustic source arrays (airguns) and hydrophone cables (also known as streamers). The acoustic emissions from the airguns will be detected by the streamers and then recorded onboard the seismic vessel. The reflected sound is then processed to provide information about the structure and composition of geological formations below the seabed in an attempt to identify hydrocarbon reservoirs.

The seismic vessel will traverse the survey area in a series of pre-determined lines at a speed of approximately 7–9 km/h. The operating pressure for the source arrays (airguns) will be approximately 13,800 kPa (2,000 psi). The airguns will consist of two sub-arrays, each with a maximum volume of approximately 0.067 m^3 (4,070 cui). Airguns will be towed at a depth of 6 m (+/- 1 m). These sub-arrays will be fired alternately, with a shotpoint interval of 18.75 m horizontal distance.

The vessel will tow 10 hydrophone cables (solid streamers), which will be up to 6 km long, at a depth of 9 m (+/- 1 m).

The noise measure used to characterise the source output sound pressure level (SPL) is measured in decibels (dB) relative to 1 micro Pascal: dB re 1µPa (SPL).

The airguns produce sound pulses within a few meters in the order of 265-275 dB re 1µPa (SPL) at frequencies extending up to approximately 100 Hz. These sound pulses decrease to levels in the order of 201 dB re 1µPa (SPL) within 1 km of the source and approximately 181 dB re 1µPa (SPL) within 10 km, dependent on the sound propagation characteristics of the area.

Recent advances in cable technology have led to a new generation of seismic streamers, moving away from the traditional fluid filled cable to a solid cable. Solid cables are constructed from extruded polymer foam where the requirement for fluid or gel fill has been significantly reduced.

Survey Vessels

The Rafter 3D MSS will be conducted by a geophysical contractor, using a 3D capable vessel (the Geo Atlantic (**Figure 4**)), a principal support vessel (Cassandra 6) and a secondary support vessel.

Figure 4 Seismic vessel Geo Atlantic and principle support vessel Cassandra 6

The seismic vessel, Geo Atlantic will remain on site during standard operations for the duration of the survey (i.e. not intending to return to port). If required, the support vessel will be used to re-supply the seismic vessel, however, due to the short duration of this survey (1 month), it is expected that re-supply, including at sea refuelling (diesel), will not be required or will only need to occur once during the survey depending on logistics. In the event crew changes are also required, transfers will likely be undertaken via helicopter operating out of the Broome heliport.

The support vessel Cassandra 6 will accompany the seismic survey vessel to maintain a safe distance between the towed array and other vessels, and also to manage interactions with shipping and fishing activities, if required. The support vessel will also re-supply the survey vessel with fuel and other logistical supplies, if required.

When the primary support vessel needs to return to port to re-supply, a secondary support vessel will travel to the survey location, to maintain continuous support during operations.

The Rafter 3D MSS will be conducted in accordance with all relevant Commonwealth Acts and regulations, with procedures in place to govern the survey activities that involve potential environmental impacts, including cetacean interaction, refuelling operations, streamer handling and maintenance, and vessel encounters.

In the event at sea refuelling is required, this activity will be subject to controls (procedural and equipment) and will not take place less than 12 nautical miles from any emergent land or shallow water features (e.g. Sandy Islet, South Scott Reef). In addition appropriate oil spill contingency planning, trained personnel and equipment will be available in the unlikely event of a fuel spill.

5. MAJOR ENVIRONMENTAL HAZARDS AND CONTROLS

The environmental risks and potential environmental impacts of the Rafter 3D MSS have been determined on the basis of Woodside's previous seismic survey experience in the region and the outcomes of the environmental risk assessment.

An environmental risk assessment has been undertaken by Woodside to understand and manage the environmental risks associated with the Rafter 3D MSS to ensure that risks are reduced to As Low As Reasonably Practicable (ALARP) and will be of an acceptable level using a method consistent with the *Australian/New Zealand Standard AS/NZS ISO 31000:2009 Risk Management* and *HB 203:2006 Environmental Risk Management – Principles and Process*.

The key environmental hazards and details of control measures to be applied to the Rafter 3D MSS are shown in **Appendix A**. These are consistent with Woodside corporate and project-specific objectives, standards and criteria. All commitments associated with these hazards will be used to reduce environmental risk to ALARP and will be of an acceptable level to meet the established performance objectives, standards and measurement criteria specified in the accepted EP.

A summary of the key sources of environmental risk (hazards) for the environmental aspects of the Rafter 3D MMS include:

- Physical presence of vessel [Aspect] - noise, movement, anchoring, grounding, lighting, and transport of invasive marine species [Hazard]
- Use of seismic equipment [Aspect] - acoustic noise, loss of streamers, loss of streamer fluid [Hazard]
- Vessel engines and machinery [Aspect] - Atmospheric emissions [Hazard]
- Solid and liquid waste management [Aspect] - non-compliant operational discharge, accidental loss/discharge [Hazard]
- Use of fuel and hazardous chemicals [Aspect] - loss of hydrocarbons/chemicals due to deck spill, spill during refuelling, spill due to breach of vessel hull tanks [Hazard]

6. MANAGEMENT APPROACH

The Rafter 3D MSS will be managed in compliance with the *Rafter 3D MSS Environment Plan* accepted by NOPSEMA under the Environment Regulations, other relevant environmental legislation and Woodside's Management System (e.g. Woodside Environment Policy).

The objective of the EP is to ensure that potential adverse impacts on the environment associated with the Rafter 3D MSS, during both routine and non-routine operations, are identified, and will be reduced to ALARP and will be of an acceptable level.

The Rafter 3D MSS EP details for each environmental aspect (identified and assessed in the Environmental Risk Assessment – *Section 5 of the Environment Plan*) specific performance objectives, standards and identifies the range of controls (controls available in **Appendix A** of this Summary) to be implemented (consistent with the standards) to achieve the performance objectives and identifies the specific measurement criteria used to demonstrate that these performance objectives are achieved.

The implementation strategy detailed in the Rafter 3D MSS EP identifies the roles/responsibilities and training/competency requirements for all personnel (Woodside and its contractors) in relation to implementing controls, managing non-compliance, emergency response (oil spills) and meeting monitoring, auditing, and reporting requirements during the activity. The EP details the types of monitoring and auditing that will be undertaken and the reporting requirements for environmental incidents and reporting on overall compliance of the survey with the EP.

7. CONSULTATION

Consultation and stakeholder engagement activities conducted for the Rafter 3D Marine Seismic Survey builds upon the extensive and ongoing program of stakeholder engagement undertaken throughout Woodside's long history of working in the region.

Prior to submitting the Rafter 3D MSS EP to NOPSEMA for assessment and approval a number of groups and organisations were consulted on the Rafter 3D MSS. These groups and organisations were selected based on the potential for impact or their high level of interest in the survey activity.

Consultation did not identify any material issues that would impact the completion of the survey. Woodside will continue to accept feedback from stakeholders during the seismic survey program.

8. CONTACT DETAILS

Further information about the Rafter 3D MSS can be obtained from:

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Stakeholder Relations
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E: stephen.munday@woodside.com.au

9. REFERENCES

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APPENDIX A: Summary of Key Environmental Hazards and Control Measures to be applied to the Rafter 3D MSS

Source of Risk (Hazard)	Potential Environmental Impact	Control/Mitigation Measures
Physical Presence of Survey Vessels Timing and location of survey activity	Disturbance to marine fauna in critical habitat (breeding, feeding, resting, migratory corridors)	• Seismic survey acquisition will not be undertaken outside the accepted boundaries of the 'survey area' and 'operational area', or outside the accepted time period for the survey (See **Section 2** and **Figure 1**). • The interaction of the survey/support vessels and helicopters with cetaceans will be consistent with *Part 8 of the EPBC Regulations (2000)* which: - requires that a vessel will not travel greater than 6 knots within 300 m of a whale (caution zone) and not allow the vessel to approach closer than 100m of a whale; and - requires that helicopters shall not operate lower than 1 650 ft (<500 m) or within the horizontal radius of 500 m of a cetacean known to be present in the area. • All members of crew will be briefed on environmental requirements and particularly crew responsible for vessel or helicopter operation and navigation will be aware of cetacean interaction regulations/ guidelines. • Activity of support vessels will adhere Tier 1 requirements of the Australian National Guidelines for Whale and Dolphin Watching http://www.environment.gov.au/coasts/publications/pubs/whale-watching-guidelines-2005.pdf • Reports of all marine mega fauna (including turtles, cetaceans and whale shark) sightings will be recorded and reported within the final survey Cetacean Sighting Compliance Report. Reports of all turtle and whale shark sightings will be recorded and reported within the final survey compliance report.
	Interference with fishing operations	• As detailed in Stakeholder Consultation Plan (*Section 9 of the Environment Plan*) a "Consultation Fact Sheet" (*Appendix E of the Environment Plan*) has been sent out to stakeholders that may operate in the area. • The seismic vessel will provide the required information (e.g. vessel location, duration of survey, etc.) to Australian Maritime Safety Authority (AMSA) which will issue Maritime Safety Information (MSI) notifications (coastal warnings and NAVAREA X). Details will also be provided to the Australian Hydrographic Service which will issue a Notice to Mariners. • The use of standard maritime safety procedures (radio contact, display of appropriate navigational beacons and lights) and adherence to Australian Maritime Safety Authority, Marine Orders Part 30: (*Prevention of collisions, Issue 8*). • The vessels will undertake continuous surveillance of marine traffic in the area of the seismic activity and warn off any vessels attempting to transit near the seismic vessel or streamers. • Use of support vessels (to approach commercial fishing vessels if required). • Strict adherence to contractor's equipment handling and acquisition procedures – these procedures will be reviewed and approved by Woodside prior to commencement of the activity. • Vessels with experienced operators and crew will be used to minimise the risk of equipment dragging or loss. • Where practicable in-water equipment lost will be recovered and when unable to be recovered detailed records of equipment lost overboard will be maintained.
	Interference with commercial shipping	
	Interference with traditional	• The vessels will undertake continuous surveillance of marine traffic in the area of the seismic activity. • Use of a support vessel (to approach traditional fishing vessels if required).

	fishing	• Adherence to standard maritime safety and navigation procedures (e.g. Australian Maritime Safety Authority, Marine Orders Part 30: *Prevention of collisions, Issue 8*).
	Impacts to Marine Conservation Reserves or Heritage listed places	• No access of survey or support vessels under normal operations will be permitted within Marine National Nature Reserves or within 12 nm of sensitive environments (ie Scott Reef or Adele Island). • Boundaries of the Marine Parks, reserves, and surrounding islands and reefs will be included on vessel navigation systems.
Physical Presence of Survey Vessels Vessel movement and noise	Acoustic disturbance to marine fauna – behavioural Injury/mortality of marine fauna	• Adherence to Tier 1 requirements of the Australian National Guidelines for Whale and Dolphin Watching http://www.environment.gov.au/coasts/publications/pubs/whale-watching-guidelines-2005.pdf. • The interaction of the survey/support vessels and helicopters with cetaceans will be consistent with Part 8 of the EPBC Regulations (2000) which: - requires that a vessel will not travel greater than 6 knots within 300 m of a whale (caution zone) and not allow the vessel to approach closer than 100m of a whale; and - requires that helicopters shall not operate lower than 1 650 ft (<500 m) or within the horizontal radius of 500 m of a cetacean known to be present in the area, if required. • All members of crew will be briefed on environmental requirements. In particular crew responsible for vessel or helicopter operations and navigation will be aware of cetacean interaction regulations/ guidelines requirements. • Dedicated Survey Environmental Adviser/Marine Fauna Observer (MFO) will be present on seismic vessel. • Records of interactions with marine fauna (cetaceans, whale sharks and turtles) will be maintained during the survey. • Detailed reports of all cetacean sightings will be recorded using the SEWPaC Cetacean Sightings Application (CSA - Version 3 - BETA) (http://data.marinemammals.gov.au/csa/). • Reports of all marine mega fauna (including turtles, cetaceans and whale shark) sightings will be recorded and reported within the final survey Cetacean Sighting Compliance Report. Reports of all turtle and whale shark sightings will be recorded and reported within the final survey compliance report.
	Vessel Anchoring – damage to subsea habitat	Survey vessels are not operationally required or able to anchor in the 475-2,200 m water depth at the Rafter 3D MSS site and on this basis there will be no impacts/risks to benthic habitat from anchoring and therefore mitigation measures are not considered to be required.
	Vessel Grounding – damage to subsea habitat	• Survey is located in deep waters (475 to over 2,200 m). • Seismic and support vessels will transit along pre-planned routes both within the survey operational area and from the survey location to port, where practicable, to avoid navigation hazards. • Vessels will utilise Navigation systems i.e. navigation aids, radar, depth sounders, vessel GPS tracking, chart plotting and vessel management systems (VMS) and competent crew. • Fatigue of crew will be managed through the contractors HSEMP which will be aligned with Woodside's Fatigue Management Procedure (WM1040PF7242248). • Adherence to standard maritime safety/navigation procedures. • Vessels will not pass within 12 nm from Scott Reef or other sensitive locations (Seringapatam Reef), under normal operations.
	Vessel Lighting – disturbance to	• At the closest point, the Rafter 3D MSS survey area is located approximately 40 km away from the nearest

	fauna	emergent land that is used as turtle breeding habitat (Sandy Islet in South Scott Reef). • The survey timing will be outside of the green turtle breeding season and there are no expected impacts on nesting beaches. Light spill from vessels therefore is not expected to impact on marine turtle populations due to the timing and distance from Scott Reef Consequently there are no identified applicable environmental performance standards in regards to the seismic and support vessel lighting for offshore waters. All vessel lighting will be maintained as required for vessel navigation, vessel safety and safety of deck operations.
Introduction of Invasive Marine Species	Transport/introduction of invasive marine species in vessel ballast water	• Adherence to the AQIS Australian Ballast Water Management Requirements. (If survey vessels are mobilised from international waters, then assessment and management of their ballast water is required in accordance with the AQIS requirements); - Discharge of high risk ballast water is prohibited within Australian territorial seas (within 12 nautical miles of Australian territories) including Australian ports. - Should ballasting be required, the exchange(s) will be conducted as far as possible away from shore and in water at least 200 m deep, greater than 50 nm from land. • Ballast water exchange records shall be maintained.
	Transport/introduction of invasive marine species on hull, internal niches and in-water equipment	• Woodside's IMS risk assessment process will be applied to all vessels and submersible equipment planning to enter and operate within nearshore waters around Australia. Nearshore areas include all waters within 12 nautical miles of land and in all waters less than 50 m deep at LAT. - Based on the outcomes of each IMS risk assessment, management measures commensurate with the risk will be implemented to minimise the likelihood of new IMS being introduced, or established IMS being spread within Australian waters.
Use of Seismic Equipment Generation of acoustic signals	Acoustic disturbance to marine fauna – behavioural or physiological Disturbance to marine fauna in critical habitat "breeding, feeding, resting, migratory corridors	• Adherence to EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales (DEWHA 2008a) and the following (additional) mitigation measures: Precaution zones including to the following: - Observation zone: 3km + horizontal radius from the acoustic source. - Low power zone: 2 km horizontal radius from the acoustic source. - Shut-down zone: 500 m horizontal radius from the acoustic source. Start-up Procedure will comply with EPBC Act Policy Statement 2.1 including - pre start observations; - soft-start procedure; - Stop work procedures; - Regular observations; - Sightings of marine fauna and interactions recorded; and - Night time operations procedures. • Dedicated Survey Environmental Adviser (SEA) (whose duties will involve the tasks of a Marine Fauna Observer (MFO) and additional environmental management) or suitably trained crew member on seismic vessel to conduct observations on the seismic vessel; and • Survey personnel (marine and seismic) provided with pre-survey induction on EPBC Act Policy Statement 2.1.

		• Detailed reports of all cetacean sightings will be recorded using the SEWPaC Cetacean Sightings Application (CSA - Version 3 - BETA) (http://data.marinemammals.gov.au/csa/). Additional measures for turtles and whale sharks include the following; • In conjunction with the marine mammal mitigation measures the SEA/MFO will (during daylight hours): - maintain continuous visual observations for marine turtles and whale sharks within a 500 m horizontal radius of the seismic source; - if marine turtles and whale sharks are sighted within 500 m horizontal radius of seismic source, the source will be shut down; and - undertake visual observations for marine turtles and whale sharks for at least 10 minutes prior to the commencement of soft start, focusing on a 500 m horizontal radius of the seismic source. • Detailed reports of all turtle and whale shark sightings will be recorded and reported.
Physical Loss of Streamers	Damage to subsea habitat	• Strict adherence to contractor's equipment handling and acquisition procedures – these procedures will be reviewed and approved by Woodside prior to commencement of the activity. • Where possible in-water equipment lost will be recovered, where recovery does not occur records of equipment lost overboard will be maintained.
Atmospheric Emissions Use of Vessel and Machinery Engines	Reduced localised air quality from atmospheric emissions	• Compliance with MARPOL 73/78 Annex VI (as implemented in Commonwealth Waters by the *Commonwealth Protection of the Sea (Prevention of Pollution from Ships) Act 1983*); AMSA Marine Orders – *Part 97 Marine Pollution Prevention – Air Pollution. In particular*: - use of low sulphur fuel when it is available to minimise emissions from combustible sources; and - emissions managed by the implementation of a preventive maintenance system.
Solid and Liquid Waste Management	Routine Discharge of Sewage, Putrescible Waste and Bilge Water to the Marine Environment Non-compliant operational discharge of waste to marine environment – Nutrient enrichment in surface waters – Toxic effects to marine biota	• All sewage and putrescible wastes will be managed and disposed of in accordance with MARPOL 73/78 (as implemented in Commonwealth waters by the Protection of the Sea (Prevention of Pollution from Ships) Act 1983); AMSA Marine Orders - Part 96: Marine Pollution Prevention – Sewage and Part 91 Marine Pollution Prevention – Oil, including: - discharge of sewage and putrescibles waste will be of short duration with high dispersion and biodegradability; - all sewage and putrescible waste treatment systems and holding tanks are to be fully operational prior to survey commencement; and - operational onboard sewage treatment plant approved by the International Maritime Organisation (IMO) and will hold a valid International Sewage Pollution Prevention (ISPP) certificate. • Sewage and putrescible wastes macerated where practicable prior to disposal. • Discharge of sewage which is not comminuted or disinfected will only occur at a distance of more than 12 nautical miles (nm) from the nearest land or Scott Reef. • Discharge of sewage which is comminuted or disinfected using a certified approved sewage treatment plant will only occur at a distance of more than 3 nm from the nearest land. • Discharge will occur at a moderate rate while vessel is proceeding, with no visible floating solids or discolouration of the surrounding water. • Vessels unable to treat/store grey water (i.e. wastewater from sinks and showers) will where practicable use biodegradable soaps and detergents. • A Vessel Waste Log or Garbage Log will be maintained to record waste management practices.

		• The vessel will hold a valid International Oil Pollution Prevention (IOPP) certificate. • Bilge water will be treated and disposed in accordance with MARPOL 73/78 (as implemented in Commonwealth waters by the *Protection of the Sea (Prevention of Pollution from Ships) Act 1983*). - Bilge water contaminated with hydrocarbons must be contained and disposed of onshore, except if the oil content of the effluent without dilution does not exceed 15 ppm or an IMO approved oil/water separator is used to treat the bilge water - Bilge water contaminated with chemicals must be contained and disposed of onshore, except if the chemical is demonstrated to have a low toxicity (as determined by the relevant Material Safety Data Sheet (MSDS). - Discharge of treated bilge water (<15 ppm oil) only at a distance of more than 12 nm from land or Scott Reef. The following mitigation measure applies in the event of non-compliance with the above regulations: • Discharges will be ceased, and the waste stream accumulated for disposal onshore. • Corrective maintenance will be conducted as soon as practicable (depending on the cause of the non-compliance).
	Non-compliant operational discharge of waste to marine environment – Nutrient enrichment in surface waters Loss of waste to marine environment – Toxic effects to marine biota	• Vessel Waste Management Plan developed and approved by Woodside detailing wastes generated and disposal requirements. • No discharge of plastics or plastic products of any kind from vessels in accordance with MARPOL requirements. • No discharge of domestic wastes (i.e. cans, glass, paper or other wastes from living areas) and no maintenance wastes (i.e. paint sweepings, rags, deck sweepings, oil soaks, machinery deposits, will be disposed of overboard) from vessels. • All solid, liquid and hazardous wastes (other than sewage, grey water and putrescible wastes) will be incinerated or compacted (if practicable) and stored in designated areas and sent ashore for recycling, disposal or treatment. • Correct segregation of solid and hazardous wastes. • All waste receptacles aboard the survey and support vessels will be covered with tightly fitting, secure lids to prevent any solid wastes from blowing overboard. • Incinerators used are compliant with MARPOL and IMO requirements. • Incinerators will be operated in accordance with established operating procedures that align with manufacturers specifications by trained personnel. • All storage facilities and handling equipment will be in good working order and designed in such a way as to prevent and contain any spillage as far as practicable. • A Vessel Waste Log or Garbage Log will be maintained to record quantities of wastes transported to shore. • Detailed records of waste accidentally discharged will be maintained.
Use of fuel and hazardous chemicals	Loss of hydrocarbons/chemicals to marine environment leading to: - Toxic effects to marine biota - Oiling of marine mammals, reptiles and seabirds Oiling of coastlines/islands/coral	• Chemicals located above deck will be stored with the adoption of secondary containment measures to contain leaks or spills e.g. bund, containment pallet, transport packs etc. • Woodside approved Vessel Waste Management Plan in place detailing wastes generated and disposal requirements. • All chemical and hazardous wastes will be segregated into clearly marked containers prior to onshore disposal. • All storage facilities and handling equipment will be in good working order and designed in such a way as to prevent and contain any spillage as far as practicable.

	reefs Loss of hydrocarbons to marine environment – Deck spill	• Shipboard Oil Pollution Emergency Plan will be prepared and kept onboard the vessels. • All hazardous substances (as defined in NOHSC: 1008 (2004) – Approved Criteria for Classifying Hazardous Substances) will have a Material Safety Data Sheet (MSDS) in place that is readily available on board. • Identified personnel will be trained in use of spill response equipment, including spill response exercises. • Spill response bins/kits will be located in close proximity to hazardous material storage areas for prompt response in the event of a spill or leak. The kits will be checked for their adequacy and replenished as necessary prior to the commencement of activities and on a regular basis thereafter. Identified personnel will be trained in use of this equipment. In the event of a spill to deck the following mitigation measures will be implemented: • Spills response in accordance with the Shipboard Oil Pollution Emergency Plan, the Woodside's Corporate Oil Spill Response Plan (WEL Doc No. W0000AV0003.0001) and the Rafter 3D Marine Seismic Survey Oil Spill Action Plan (*Appendix D of the Environment Plan*). • The Rafter 3D Marine Seismic Survey Oil Spill Action Plan relates specifically to the management of this potential emergency condition. • Environmental performance objective, standards and measurement criteria related specifically to a response to this potential emergency condition are provided in Table 10.2 of the Environment Plan.
	Loss of hydrocarbons to marine environment – Refuelling	• Bunkering at sea must be undertaken in accordance with a Vessel Bunkering Procedure, which has been developed and approved by Woodside prior to use. This procedure will be subject to the following requirements, as a minimum: - at sea bunkering will not take place within a distance of 12 nm from any emergent land or shallow water features (e.g. Scott Reef or Seringapatam Reef); - refuelling will occur during daylight hours only and when sea conditions are appropriate - - Swells <2 m : Refuelling permitted; - Swells >2 m and <4 m : Decision to be discussed between Vessel Master and Party Manager; - Swells >4 m : Refuelling not permitted; - Wind speed >30 knots : Vessel Master must be in agreement with Party Manager ; - JHA in place and reviewed before each fuel transfer; - refuelling procedure approved by Woodside; - crew undertaking refuelling will be suitably trained; - spill kits will be well stocked and readily available with personnel trained in their use; - refuelling is a manned operation with constant visual monitoring of gauges, hoses, fittings and sea surface; - radio communication between seismic and support vessel; - all valves and flexible transfer hoses checked for integrity prior to use; and - dry break couplings (or similar) in place for all flexible hydrocarbon transfer hoses. • If bunkering is required, it will most likely be conducted on the southern side of the operational area, increasing the distance between sensitive environments and the bunkering activity. • Shipboard Oil Pollution Emergency Plan will be prepared and kept onboard the vessels. In the event of a spill during bunkering following mitigation measures will be implemented: • Spills response in accordance with the Shipboard Oil Pollution Emergency Plan, the Woodside's Corporate Oil

		Spill Response Plan (WEL Doc No. W0000AV0003.0001) and the Rafter 3D Marine Seismic Survey Oil Spill Action Plan (*Appendix D of the Environment Plan*). • The Rafter 3D Marine Seismic Survey Oil Spill Action Plan relates specifically to the management of this potential emergency condition.
	Loss of hydrocarbons to marine environment – breach of vessel tanks due to vessel collision/grounding	• In accordance with good marine practices seismic and support vessels are equipped with navigation aids, radar, vessel GPS tracking and management systems (VMS), depth sounders and competent crew maintaining 24 hour visual, radio and radar watch for other vessels. • Adherence to standard maritime safety / navigation procedures i.e. Australian Maritime Safety Authority, Marine Orders Part 30: Prevention of collisions, (Issue 8). • Seismic and support vessels will transit along pre-planned routes both within the survey operational area and between the survey location and port where practicable to avoid navigation hazards. • In the unlikely event bunkering is required at sea, this activity must be undertaken in accordance with a Vessel Bunkering Procedure, which has been developed and approved by Woodside prior to use. This procedure will be subject to the following requirements, as a minimum: - at sea bunkering will not take place within a distance of less than 12nm from any emergent land or shallow water features (e.g. Scott Reef and Seringapatam Reef); - bunkering will occur during daylight hours only and when sea conditions are appropriate; - If required, bunkering it will most likely be conducted on the southern side of the operational area, increasing the distance between sensitive environments and the bunkering activity. • Fenders on seismic and support vessels gunwales that are shock absorbing to reduce/ buffer vessel impacts. • Vessel operating at slow speeds (<6 knots) when in close proximity. • Seismic and support vessel will undertake a tow test during mobilisation to ensure the support vessel has the capacity to pull the seismic vessel in a loss of power event. In the event of a spill from vessel collision or grounding following mitigation measures will be implemented: • Shipboard Oil Pollution Emergency Plan (SOPEP) will be prepared and kept onboard the vessels (as per MARPOL 73/78 Annex 1) for managing spills aboard. • Hydrocarbon spill risks will be managed in accordance with Woodside's Corporate Oil Spill Response Plan (OSRP) (WEL Doc No. W0000AV0003.0001) (Rev 2) and the Rafter 3D Marine Seismic Survey Oil Spill Action Plan (*Appendix E of the Environment Plan*). • In the event of a hydrocarbon spill, priority actions are to make the area safe and to stop the leak so that further spillage is not possible. Deployment of absorbent booms and other materials will be undertaken so as to maximise recovery of spilled material.