NOPSEMA Rosebud 3D Marine Seismic Survey
Environment Plan Summary

Geotechnical Operations

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1. INTRODUCTION

Woodside Energy Ltd (Woodside) as operator of the Browse Joint Venture, will undertake a three dimensional (3D) marine seismic survey (MSS), referred to as the 'Rosebud 3D MSS' in the waters surrounding North Scott Reef, located 450 km north of Broome. Seismic data acquisition will occur in offshore Commonwealth waters within petroleum retention lease WA-30-R and WA State waters petroleum retention lease TR/5, with some ingress into the vacant graticular blocks 1606 and 1607, north of WA-30-R (**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 Environment Regulations.

2. LOCATION OF THE ACTIVITY

The Rosebud 3D MSS will occur within an operational area of approximately 380 km^2 as shown in **Figure 1**. This area lies mostly within Commonwealth petroleum retention lease WA-30-R with some ingress into two vacant graticular blocks (1606 and 1607) to the north of WA-30-R and within Western Australia state waters retention lease TR/5. The operational area for vessel line turns and run-outs will also ingress into exploration permits WA-302-P and WA-315-P, although no subsurface data will be recorded in these permits.

The area referred to as the 'operational area' includes:

- A 'acquisition area' for the survey (i.e. the area within which seismic acoustic emissions will occur for the purposes of acquiring data), which is approximately 35 km^2 which includes approximately 5 km^2 within WA State waters petroleum retention lease TR/5.
- The 'acquisition area' is surrounded by 'buffer' corridor of 3 km – 5 km width, which provides the total 'operational area' of approximately 380 km^2. Within this zone 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).

The bounding coordinates for the proposed Rosebud 3D MSS 'acquisition area' and the 'operational area' are presented in **Table 1** and **Table 2** below. The acquisition area (shown in yellow on **Figure 1**) consists of a narrow strip of only one to four kilometres width on the eastern, southern and western sides of North Reef outside the approximate 20 m depth contour. The shape of the acquisition area has been designed to infill gaps in data between the recent Tridacna 3D MSS and Maxima 3D MSS conducted by Woodside.

Boundary coordinates for the operational area are provided in **Table 2** below.

Table 1: Approximate boundary coordinates for the Rosebud 3D MSS 'acquisition area'

Location Point	Latitude	Longitude	Location Point	Latitude	Longitude
1	13°54'35.16"S	121°49'44.66"E	**14**	13°58'58.23"S	121°56'56.81"E
2	13°59'10.85"S	121°46'55.59"E	**15**	13°59'27.05"S	121°56'26.91"E
3	14°02'35.88"S	121°52'32.47"E	**16**	14°01'47.93"S	121°53'02.76"E
4	13°59'31.67"S	121°57'10.69"E	**17**	14°01'48.56"S	121°52'32.47"E
5	13°57'43.79"S	121°57'35.29"E	**18**	14°01'22.07"S	121°51'12.35"E
6	13°53'02.42"S	121°53'52.60"E	**19**	14°00'46.74"S	121°50'33.24"E
7	13°53'08.10"S	121°53'46.29"E	**20**	14°00'00.69"S	121°48'56.72"E
8	13°53'47.21"S	121°54'12.15"E	**21**	13°59'23.46"S	121°48'30.22"E
9	13°54'23.17"S	121°54'27.92"E	**22**	13°58'25.42"S	121°48'22.65"E

10	13°55'47.71"S	121°55'27.23"E	**23**	13°57'04.04"S	121°48'47.25"E
11	13°56'37.55"S	121°56'30.31"E	**24**	13°56'31.87"S	121°49'37.72"E
12	13°57'23.60"S	121°57'01.86"E	**25**	13°56'06.00"S	121°50'04.85"E
13	13°58'12.81"S	121°57'08.80"E	**26**	13°55'26.89"S	121°50'11.16"E

Datum: GDA94

- **Table 2: Approximate Boundary coordinates for the Rosebud 3D MSS 'operational area'**

Location Point	Latitude	Longitude	Location Point	Latitude	Longitude
1	13°50'52.76"S	121°48'47.70"E	**19**	13°58'58.23"S	121°56'56.81"E
2	14°00'03.29"S	121°43'09.11"E	**20**	13°59'27.05"S	121°56'26.91"E
3	14°01'10.81"S	121°44'54.36"E	**21**	14°01'47.93"S	121°53'02.76"E
4	14°00'41.68"S	121°46'00.36"E	**22**	14°01'48.56"S	121°52'32.47"E
5	14°00'50.15"S	121°47'26.73"E	**23**	14°01'22.07"S	121°51'12.35"E
6	14°01'38.77"S	121°48'47.41"E	**24**	14°00'46.74"S	121°50'33.24"E
7	14°02'45.88"S	121°49'17.25"E	**25**	14°00'00.69"S	121°48'56.72"E
8	14°03'50.19"S	121°49'19.67"E	**26**	13°59'23.46"S	121°48'30.22"E
9	14°05'50.32"S	121°52'35.28"E	**27**	13°58'25.42"S	121°48'22.65"E
10	13°59'23.09"S	122°02'24.25"E	**28**	13°57'04.04"S	121°48'47.25"E
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14	13°54'23.17"S	121°54'27.92"E	**32**	13°54'04.63"S	121°50'01.15"E
15	13°55'47.71"S	121°55'27.23"E	**33**	13°52'59.08"S	121°50'15.54"E
16	13°56'37.55"S	121°56'30.31"E	**34**	13°52'34.81"S	121°50'38.35"E
17	13°57'23.60"S	121°57'01.86"E	**35**	13°52'16.34"S	121°51'10.66"E
18	13°58'12.81"S	121°57'08.80"E			

Datum: GDA94

The Rosebud 3D MSS is scheduled to be conducted in the period from late September to early November 2012, and have a total survey duration of approximately 35 days, including mobilisation and demobilisation and sailing to and from the port of mobilisation (most likely to be from Darwin).

Of this, the total operational time is scheduled to be approximately 20 days. Seismic acquisition (involving discharge of the acoustic source) at Scott Reef is expected to take between 10 to 20 days. Additional time will be spent, scouting the survey area, deploying and retrieving the in-sea equipment, potentially waiting on bad weather and resolving any equipment or logistical issues. The actual timeframe is also dependent on environmental approvals, contractor availability, survey acquisition production rates and prevailing weather conditions.

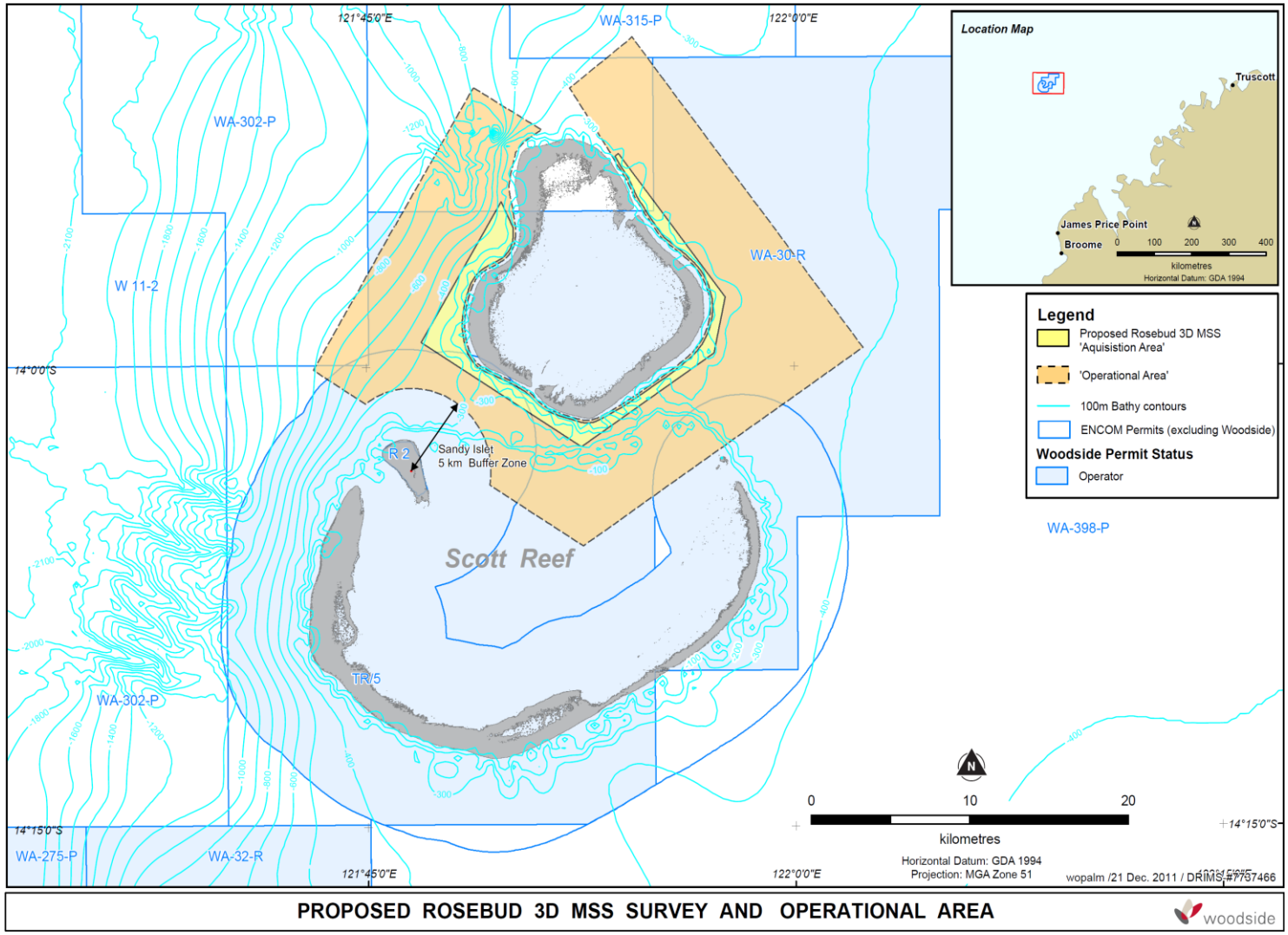

Figure 1: Location of Rosebud 3D MSS illustrating the operational and acquisition areas in relation to petroleum exploration permits, retention leases, release areas and Scott Reef.

3. DESCRIPTION OF ENVIRONMENT

3.1 Physical Environment

The Rosebud 3D MSS operational area is located adjacent to Scott Reef, within the Browse Basin approximately 270 km off mainland northern Western Australia (Cape Leveque) and 450 km north of Broome**.** Scott Reef is a large emergent shelf atoll situated along the 500 m isobath over the outer edge of the continental shelf and is characterised by a combination of physical environmental conditions that result from its position at the edge of one of the widest continental shelves in the world. These conditions include clear deep oceanic water and an unusually large tidal range.

Scott Reef is one of a number of large emergent shelf atolls that occur along the edge of Australia's northwest shelf, and is comprised of two large, coral reefs; North Reef and South Reef, which are separated by a deep (300-400 m) very steep sided channel. North Reef is an annular reef; 17 km long by 16 km wide and encloses a shallow lagoon with a maximum depth of approximately 28 m, and is connected to the ocean by two narrow passages in the north-east and south-west. South Reef is a crescent shaped reef that is approximately 27 km wide and over 50 m deep in the central lagoon.

3.2 Biological Environment

3.2.1 Benthic Habitats

In February 2006, a survey of the benthic communities at Scott Reef was conducted by AIMS to derive a habitat map and determine the extent of recovery following the 1998 mass bleaching event and Cyclone Fay in 2004. Six habitat types were identified at North Reef, with four habitat types unique to North Reef and a further two also found in the adjacent South Reef (AIMS 2006). These habitats were defined by the dominant community of organisms and the substratum type (e.g. sand, rubble, rock) and ranged from those dominated by hard corals to those characterised by subtidal sand.

Sandy Islet Habitat

The only emergent land at Scott Reef, 'Sandy Islet' is a small sand cay located on the north-western side of South Scott Reef (**Figure 1**). Sandy Islet consists of a narrow strip of sand approximately 700 m long, oriented in a north-south direction with approximately 400 m remaining above water at extreme high tide and is approximately 60 m at its widest part (Guinea 2009). Sandy Islet is largely barren with only the metal framework remnants of a disused weather station visible.

The sand of the cay consists of predominately coarse sand with coral rubble, shell fragments and coarse sand at the shoreline. The shoreline and upper intertidal area is expected to support a typical range of burrowing invertebrate fauna including crustaceans, molluscs, echinoderms and polychaetes. The lower sandy intertidal area has been identified as a area for molluscs dominated by cones, terebrids and ceriths, while rocky areas were dominated by thaids and cones (Wells and Slack- Smith 1986; WAM 2006). The Islet is surrounded by a large area of rocky and sand reef flats approximately 2 km wide and over 5 km north to south.

Sandy Islet is also known to support a small population of nesting green turtles.

Seabirds around Scott Reef are predominately associated with Sandy Islet, and occur in small numbers in comparison to other breeding and roosting sites in the region.

3.2.2 Marine Flora

Seagrass

Five species of seagrass have been recorded from Scott Reef: *Thalassia hemprichii*, *Thalassodendron ciliatum*, *Halophila ovalis, Cymodocea* - provisionally identified as *C. rotundata*, and *Halophila* – provisionally identified as *Halophila decipiens* (URS 2006). The species identified are commonly found in the Indo-Pacific region and at present are not considered rare.

Macroalgae

Macroalgae occur predominantly in the intertidal and shallow sub-tidal waters on hard substrates and, in general, the algal cover is low (~5%) (Woodside 2008). The diversity of macroalgae at Scott Reef is also low overall, with a total of 72 species recorded by the WA Museum (WAM 2006) compared with 350 species of macroalgae recorded along the adjacent Western Australian coastline (WAM 2006).

3.2.3 Marine Fauna

Filter Feeders

Sponges were collected at Scott Reef (North and South Reef) in September 2006 as part of the WA Museum survey of Mermaid Reef, Rowley Shoals, Seringapatam Reef and Scott Reef (WAM 2006; Woodside 2008). From this survey, 62 species of sponges were recorded at North Reef.

Coral

Scott Reef coral taxa are predominately widespread Indo-Pacific species with affinities to the coral assemblages of Ashmore Reef and the Indonesian provinces to the north. Studies have recorded a total of 306 species, of which 295 were recorded from shallow water environments (<30 m) and 51 species from deep water habitats (>30 m) (Done *et al*. 1994; McKinney 2007 unpublished data; Veron 1986; Wolstenholme 2004 unpublished data; Woodside 2008). The corals at Scott Reef exhibit well-developed zonation patterns that in some areas can be attributed to the large tidal range and associated periods of emergence/inundation and/or to levels of exposure to strong wave action on the exposed outer slopes versus lower wave energy within the lagoon.

For corals, Scott Reef is a genetically isolated reef system with larval dispersal between Ashmore, Scott and the Rowley Shoals reef systems being extremely rare (Underwood 2007). Two distinct mass spawning events have been identified at Scott Reef, occurring annually between March to April (Autumn – Primary Spawning) and October to November (Spring- Secondary Spawning) (AIMS 2004). Based on previous data, the primary mass spawning event of corals at Scott Reef is in autumn and is likely to follow the full moon in March.

Crustaceans

A total of 118 species of crustacean were recorded from Scott Reef during the WA Museum survey in September 2006 (WAM 2006). Of these, 101 species were recorded at South Reef and 57 at North Reef. The most diverse families were the Xanthidae, Trapeziidae, Majidae, Diogenidae and Portunidae. The frequency of rare, common and abundant species within the Xanthidae were examined and a significant occurrence of rare species (80%) was observed. Only 2% of the crustacean species found at South Reef were found to be unique (i.e. not shared with other reefs surveyed in the region as part of the WA Museum 2006 survey).

Molluscs

A total of 373 mollusc species were recorded from Mermaid, Scott and Seringapatam Reefs during the WA Museum survey in September 2006 (WAM 2006). The composition of mollusc species at these reef systems is consistent with an Indo-Pacific tropical reef in clear oceanic water. The atolls have a greater biogeographic affinity with the Indonesian Archipelago than the Western Australian mainland.

Nautilus pompilius

Nautilus represents one of two extant nautiloids whose distribution is restricted to deep-water tropical habitats of the Indo-Pacific. *N. pompilius*is recorded throughout the Indo-West Pacific, the Philippines, Papua New Guinea to Fiji and north eastern and north Western Australia and inhabits deeper continental shelf and slope waters associated with coral reefs from near the surface to depths of up to 700 m (Dunstan *et al.* 2011, Australian Museum (http://australianmuseum.net.au/Nautilus-pompilius).

A genetically discreet population of the *N pompilius* has been recorded at Scott Reef as part of an Australian study investigating spatial subdivision and genetic diversity in Nautilus populations at sites on the East and West coasts of Australia including Scott Reef, Coral Sea and Northern Great Barrier Reef (Sinclair *et al*. 2011). The upper depth limit of Nautilus appears to be limited to water temperatures of 25°C and below, which at Scott Reef occurs generally below the 100 m depth contour and it is therefore unlikely that they would be found in shallower than this depth (Dunstan *et al.* 2011).

Echinoderms

A 1986 survey of Scott Reef undertaken by the WA Museum, found that the echinoderm fauna of Scott Reef is comprised of Crinoidea (16 species), Asteroidea (21 species), Ophiuroidea (36 species), Echinoidea (19 species) and Holothurioidea (25 species) and consists largely of widespread Indo-West Pacific species, with a few species of more restricted distribution in the north of Australia. Scott and Seringapatam Reefs are richer in echinoderms (117 species with 42 exclusive) than Rowley Shoals (90 species, 15 exclusive), possibly reflecting their closer proximity to the Indonesian archipelago.

Fish

Scott Reef has a diverse fish assemblage in both shallow and deep waters, with a total of 898 species recorded from surveys to date (AIMS 2006).

A search of the EPBC Act Protected Matters database identified various species of pipefish and seahorses as listed marine species that may occur within the operational area. Of these only *Corythoichthys schultzi* (Schultz's pipefish) has been identified in the Scott Reef region (WAM 2006).

The Protected Matters search also identified one listed threatened species of shark, the whale shark (*Rhincodon typus*), that may occur within the area. This species occurs in both tropical and temperate waters, and are known to aggregate seasonally March to July in the coastal waters off Ningaloo Reef, approximately 1,200 km south-west of the proposed operational area, in response to local food availability (Taylor 1996).

Tracking of whale sharks tagged at Ningaloo and at Christmas Island has shown that some do travel through the Browse Basin along the shelf break towards Timor in Indonesia with at least one passing by Scott Reef along the 200 m contour and two passing close to, or through Scott Reef (McKinnon et al. 2002, Meekan and Radford 2010 & Wilson et al. 2006). There have been no documented whale shark sightings within the proposed operational area and they are likely to be encountered very rarely.

Thunnus maccoyii (Southern Blue Fin Tuna)

The Southern bluefin tuna (*Thunnus maccoyii*) population is believed to comprise of a single discrete, highly migratory stock that spawns in the north-east Indian Ocean and migrates south through waters to the west and south of Australia and throughout the temperate southern oceans between September and April. It is a species with a high commercial value that is targeted by a number of international fisheries (discussed below).

Spawning takes place from September to April and studies of planktonic larvae suggest that the main spawning period is from January to February (Caton 1991). Scott Reef lies on the far eastern edge of the spawning grounds, these grounds are a broad area and no significant spawning aggregations are indicated to take place in close proximity to Scott Reef (Caton 1991; *Cox et.al.* 1999; BRS 2004; AFMA 2010; CCSBT 2012).

Reptiles

There are 20 listed marine reptiles (marine turtles and sea snakes) protected under the EPBC Act that may occur within, adjacent to or migrate through the proposed operational area. Of these, six species of marine turtle listed as 'threatened' under the EPBC Act, the loggerhead turtle (*Caretta caretta*), the green turtle (*Chelonia mydas*), the leatherback turtle (*Dermochelys coriacea*), the hawksbill turtle (*Eretmochelys imbricata*), the olive ridley turtle (*Lepidochelys olivacea*) and the flatback turtle (*Natator depressus*), that may occur in the proposed survey area. Of these six species, only two, the green turtle and hawksbill turtle have been recorded and documented at Scott Reef (**Table 3**).

Table 3: Marine Turtles that may be present in the operational area

Scientific name	Common name	EPBC Act status	IUCN Red List status	Present in Scott Reef Area
Chelonia mydas	Green	Vulnerable	Endangered	Yes, nesting at Sandy Islet and feeding in reef habitat
Eretmochelys imbricata	Hawksbill	Vulnerable	Critically Endangered	Low numbers expected feeding in reef habitat
Natator depressus	Flatback	Vulnerable	Data Deficient	Unlikely to occur
Dermochelys	Leatherback	Endangered	Critically	Unlikely to occur

Scientific name	Common name	EPBC Act status	IUCN Red List status	Present in Scott Reef Area
coriacea			Endangered	
Lepidochelys olivacea	Olive ridley	Endangered	Vulnerable	Unlikely to occur
Caretta caretta	Loggerhead	Endangered	Endangered	Unlikely to occur

Green turtle

A nesting population of green turtles is known to occur on Sandy Islet within South Reef lagoon (Guinea 2009). The size of the female green turtle population using Sandy Islet is estimated to be between approximately 380 and 1,500 turtles although these estimates are indicative at best as green turtle nesting in any one year is highly variable (Guinea 2009). The green turtle nesting season on Sandy Islet has been identified as starting in November through to March with peak nesting occurring between December and February (Guinea 2009, Pendoley 2005).

Sightings during the recent Tridacna 3D OBC MSS from July to November 2011 recorded 82 sightings of individual turtles predominantly over the shallow reef flats of North Reef and inside the lagoon indicating that turtles other than breeding female green turtles may be seen throughout the shallow areas of the reef. Of these 82 sightings over four months of the Tridacna survey, only 9 individual turtles were recorded on the outside of North Reef (in the proposed Rosebud 3D MSS operational area), indicating that turtles are more likely to be seen in the lagoon or on reef flats and are only expected to be encountered in low numbers within the proposed operational area of the Rosebud 3D MSS.

Hawksbill turtle

The hawksbill turtle (*Eretmochelys imbricata*) is listed and protected under the EPBC Act as a threatened species and one individual has been observed nesting on Sandy Islet (Guinea 2009; SKM 2009). This would be considered atypical of the regional population, as the major nesting sites for hawksbill turtles in Western Australia occur at Varanus Island and Rosemary Island (Pendoley 2005). Given only one recorded sighting of this species, the abundance of hawksbill turtles at Scott Reef would be considered very low and there are no published records for this species at North Reef.

Leatherback, Flatback, Olive Ridley and Loggerhead turtle

There have been no documented sightings of these species in North Reef or the greater Scott Reef area; however they have been recorded in the coastal waters of all Australian states (Hamann *et al*. 2006; Limpus 2004, Limpus 2008a, Limpus 2008b).

Sea snakes

An EPBC Protected Matters Search for the Rosebud 3D MSS area identified one listed 'threatened' species of seasnake, the Short-nosed Seasnake (*Aipysurus apraefrontalis*), which could potentially occur within the proposed Rosebud 3D MSS operational area at Scott Reef. In addition 13 'listed' species of sea snakes were identified that may occur within the proposed operational area although of these only five species of sea snakes have been recorded in the greater Scott Reef region.

Sea snakes are known to occur inside North Reef although their abundance and diversity has not been described. URS (2006) suggest that sea snake abundance is dependent on habitat, with a greater abundance occurring in the more complex habitats compared to the impoverished or damaged habitats. Considering the degraded habitat within North Reef (from cyclone damage), the abundance of sea snakes may be lower than that recorded in South Reef (URS 2006).

Cetaceans

The EPBC Act Protected Matters search identified 22 cetacean species which may occur within, adjacent to or migrate through the proposed operational area. Two of these were listed as threatened, four were migratory and an additional 16 are listed (all are protected under the EPBC Act.) (**Table 4**).

Table 4 : EPBC Act protected Cetaceans that may be present in the operational area

Scientific name	Common name	EPBC Act status
Megaptera novaeangliae	Humpback whale	Vulnerable ; Migratory
Balaenoptera musculus	Blue whale	Endangered; Migratory
B. bonaerensis	Antarctic minke whale	Migratory
B. edeni	Bryde's whale	Migratory
Orcinus orca	Killer whale	Migratory
Physeter macrocephalus	Sperm whale	Migratory
Globicephala macrorhynchus	Short-finned pilot whale	Listed
Pseudorca crassidens	False Killer Whale	Listed
Feresa attenuata	Pygmy Killer Whale	Listed
Kogia breviceps	Pygmy Sperm Whale	Listed
Kogia simus	Dwarf Sperm Whale	Listed
Delphinus delphis	Common Dolphin,	Listed
Grampus griseus	Risso's Dolphin, Grampus	Listed
Lagenodelphis hosei	Fraser's Dolphin, Sarawak Dolphin	Listed
Peponocephala electra	Melon-headed Whale	Listed
Stenella attenuata	Spotted Dolphin	Listed
Stenella coeruleoalba	Striped Dolphin	Listed
Stenella longirostris	Long-snouted Spinner Dolphin	Listed
Steno bredanensis	Rough-toothed Dolphin	Listed
Tursiops truncatus s. str.	Bottlenose Dolphin	Listed
Mesoplodon densirostris	Blainville's Beaked Whale, Dense-beaked Whale	Listed
Ziphius cavirostris	Cuvier's Beaked Whale, Goose-beaked Whale	Listed

Humpback whale

Humpback whales have a wide distribution, with recordings throughout Australian Antarctic waters and off all Australian states, including Western Australia (Bannister *et al*. 1996). The species migrates north to calve and mate in warm tropical waters (approximately 15–20°S) during June to September and south (approximately 60–70°S) to feed in the colder Southern Ocean during October to November. The Kimberley region is considered particularly important for the Western Australian population of humpback whales whose breeding and calving grounds are in the inshore northern WA waters between the Lacepede Islands and Beagle Bay in the south and Camden Sound in the north (SEWPaC 2011; Jenner et al. 2001). The vast majority of both north- and south-bound humpback whales appear to remain landward of the 100 m isobath (about 300 km from Scott Reef) and they are not commonly seen near Scott Reef (RPS 2010).

Low numbers of Humpback adults and two calves were observed in the region of Scott Reef during surveys conducted between July and October 2009 (RPS 2010). Six of the sightings were between approximately 5 and 20 kilometres to the west of South Reef, while eight of the sightings were within South Reef lagoon or immediately to the east of South Reef.

Blue whale and Pygmy Blue Whale

Blue whales are also widely distributed. This species has been recorded throughout Australian Antarctic waters and off all states excluding the Northern Territory (SEWPaC 2011). Blue whales are known to feed in Antarctic waters with their diet consisting almost exclusively of euphausiids, particularly krill (*Euphausia superba*) (Bannister *et al*. 1996). It is generally accepted that blue whales (true blue whales), and blue whale subspecies (pygmy blue whales), calve and mate during the southern hemisphere winter in warm tropical open seas at relatively low latitudes (approx 20°S) before migrating to colder water summer feeding areas in higher latitudes (60–70°S) (Branch *et al*. 2007). Although true blue whales (*B. musculus*) have not been recorded in the vicinity of Scott Reef, low numbers of pygmy blue whales (*B. musculus brevicauda*) have been sighted (Jenner et al. 2009).

Based on noise logger records and visual observations from various sources (Jenner et al. 2009; McCauley and Salgado-Kent 2008; McCauley 2009, 2011), there is likely to be a pygmy blue whale

migration route along the North West Shelf in Western Australia. By inference, it is proposed that the area may also be used by true blue whales, although true blue whales are not expected to travel as far north as pygmy blue whales (McCauley et al. 2004).

The Perth Canyon is the only area so far identified off the Western Australian coast where pygmy blue whales aggregate with some predictability and are believed to be animals on their northern migratory route (McCauley 2009, 2011). The Perth Canyon area represents a significant feeding ground for pygmy blue whales between January and April (Jenner et al. 2002; McCauley et al. 2004). Acoustic detections suggest that true blue whales also over-winter around the Perth Canyon and head south in mid-October (McCauley et al. 2004) and consequently true blue whales are not expected at Scott Reef during this time.

Woodside has at least three years of acoustic logger data at Scott Reef that documents the passage of pygmy blue whales past Scott Reef. The logger data indicates that the majority pass in deep water to the west of the reef with a relatively small proportion passing in close proximity to the reef. Pygmy blue whales pass south by the latitude of Scott Reef over late October to late December, with the passage continuing off the Montebello Islands and Exmouth from October to the end of January, peaking in late November to early December and a north-bound pulse passing in June and July each year (McCauley 2011).

Between September 2008 and 2009, two loggers were located to listen into the channel between North and South Reef and to the immediate west of South Reef (McCauley 2011). Pygmy blue whales were detected traversing the channel on at least nine occasions over this period. Five pygmy blue whales were observed in the vicinity of the channel between North and South Reef during vessel surveys in October 2008 (Jenner et al. 2009). Two of the whales traversed the channel from east to west, while the other three individuals were observed at the western entrance of the channel. Loggers located inside the lagoon of South Reef between June 2007 and September 2008 did not record any pygmy blue whales, suggesting that individuals rarely enter the reef lagoon system.

Although pygmy blue whales have been observed in low numbers to pass through the channel between North and South Reef, McCauley and Salgado-Kent (2008) suggest that the preferred pygmy blue whale migratory corridor for animals at the Scott Reef latitude would be offshore to the west of Scott Reef.

Antarctic minke whale

The Antarctic minke whale (dark shoulder) (*B. bonaerensis*) has been recorded in the vicinity of Scott Reef. Noise loggers deployed around Scott Reef between September 2006 and September 2008 have been used to identify signals of Antarctic minke whales (*B. bonaerensis*) and dwarf minke whales (*B. acutorostrata*). The migratory patterns of this species are widespread, with high densities found at feeding grounds in Antarctica. On the west coast of Australia, the extent to which the Antarctic minke whale travels north is currently unknown but could be to a latitude of 8–15° S (SEWPaC 2011). Mating season extends from August to September in open ocean areas in tropical and subtropical latitudes (Reeves *et al*. 2003).

Bryde's whale

The Bryde's whale (*B. edeni)* is found in both temperate to tropical waters, both oceanic and inshore, bounded by latitudes 40°N and 40°S, or the 20°C isotherm (Bannister *et al*. 1996). They have been recorded in all Australian state waters except the Northern Territory (Bannister *et al*. 1996). Bryde's whales that reside inshore appear to breed and calve year round, while those that reside in offshore waters have an extended breeding and calving season over several months during winter (Kato 2002). The larger offshore form exhibits some seasonal movement while the smaller inshore form is usually sedentary, although details of movement patterns are not well described or understood. Although whale calls attributed to Bryde's whales have been recorded year round on noise loggers at Scott Reef, similar calls have also been recorded from north of Darwin to Exmouth with similar patterns and no clear seasonality in presence at any site (McCauley 2011).

Sperm and killer whales

Sperm whales and killer whales have both been identified through the search of the Protected Matters database as possibly occurring within the vicinity of North Reef; however, have not been identified on

noise loggers nor have they been sighted during surveys in the Browse area, including Scott Reef (Woodside 2009 unpublished data).

Short finned pilot whale

Short-finned pilot whales (*Globicephala macrorhynchus*) have a world-wide distribution, in tropical (22–32°C) to temperate (10–22°C) waters and occur throughout Australian offshore oceanic waters and coastal seas (Ross 2006; Bernard & Reilly 1999, SEWPaC 2011). Short-finned pilot whales are thought to be generally nomadic, with no known migration patterns excepting that they prefer deep waters mainly at the edge of the continental shelf, and over deep submarine canyons.

Beaked whales

Both Cuvier's beaked whale (*Ziphius cavirostris*) and Blainville's beaked whale (*Mesoplodon densirostris*) have wide distributions in deep offshore temperate and tropical waters and consequently have been listed as potentially occurring in the survey area. During aerial surveys conducted from the Kimberley coastline and at Scott Reef, in 2009 two individual beaked whales were sighted approximately 10 km to the south west of Scott Reef and in 2010, four unidentified beaked whales were sighted approximately 10 km to the west from Scott Reef (RPS 2010). These sightings were all in very deep waters from approximately 500 m to over 2000 m depth of water; however, one suspected, beaked whale sighting was also recorded closer to the coast, offshore from Pender Bay in 2009 (RPS 2010).

Beaked whales are generally found in very deep waters ranging from 700–1000 m deep, but often adjacent to much deeper waters of 5000 m (Bannister et al. 1996). Blainville's Beaked Whales apparently prefer tropical (22–32 °C) to temperate (10–20 °C) oceanic regions, whilst Cuvier's beaked whales are considered to be widely distributed mostly oceanic species offshore from the 1000 m bathymetric contour but are absent from polar regions (Houston 1991). Despite their wide distribution, beaked whales have been only rarely recorded in deep waters to the west of Scott Reef and are expected to be very rarely encountered in the proposed survey area at Scott Reef.

Other Cetacean species

Of the other cetacean species listed from the search of the Protected Matters database as possibly occurring in the proposed Rosebud 3D MSS operational area, eight have been sighted in the vicinity of Scott Reef, with most found in waters less than 400 m deep. The spinner dolphin (*Stenella longirostris*) is most commonly sighted in large numbers around Scott Reef (AIMS 2004), while pods of Risso's dolphin (*Grampus griseus*) have been sighted in deeper waters. In addition to the 22 cetacean species listed as occurring in the proposed operational area a further two cetaceans, the Indo-Pacific bottlenose dolphin (*Tursiops aduncus*) and long-beaked common dolphin (*Delphinus capensis*), have been recorded in the vicinity of the proposed operational area.

Seabirds and Migratory Shorebirds

The seabirds around Scott Reef are predominately associated with Sandy Islet and occur in small numbers in comparison to other breeding and roosting sites in the region. Many species roost at the islet at night, and forage during the day. All species recorded from Scott Reef are also previously known from northern Australian waters.

The migratory little tern (*Sterna albifrons*) is listed under the CAMBA, JAMBA and ROKAMBA agreements. The EPBC Protected Matters Search for the Rosebud 3D MSS area listed the presence of the little tern as a "congregation or aggregation known to occur within area" and although the species has been recorded nesting near Broome and may congregate on islands in the region (SEWPaC 2011), it has thus-far not been recorded at Scott Reef. It is likely that this species may overfly and forage in the Scott Reef area or possibly congregate to roost at night on Sandy Islet (SEWPaC 2011).

It is likely that upon commencement of the survey, any birds in the immediate vicinity to the seismic vessels may exhibit avoidance or attraction behaviour; however, this will be limited to only the immediate vicinity of the vessels operating within the proposed aquisition area and will not affect birds on Sandy Islet or South Reef.

3.3 Socio-economic Environment

Traditional Fisheries

Traditional Indonesian fishing using 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.

The predominant anchoring and fishing grounds for these fisherman are within the sheltered shallow locations inside the North Reef and South reef lagoons. No anchoring or diving for trepang is expected to take place in the deep waters outside North Reef although some line fishing (trolling) may take place as vessels move outside North Reef. Although, the vessels are known to sail from North to South Reef lagoons and consequently will cross through the proposed Rosebud 3D MSS operational area, this is expected to take place during daylight hours due to the lack of navigational equipment and night lighting on these very basic traditional fishing vessels.

Commonwealth Managed Fisheries

The Rosebud 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.

North West Slope Trawl Fishery (NWSTF)

The North West Slope Trawl Fishery (NWSTF) operates off north-western Australia from 114°E to 125°E, roughly between the 200 m isobath and the outer boundary of the Australian Fishing Zone. The three main commercially important species of scampi targeted by the NWSTF are taken from areas with depth distributions between 260 m to 500 m.

Historically, catch and effort for all species in the NWSTF has been concentrated along the contour lines just outside of the 200 m isobath, which is the inner edge of the North West Slope boundary (Wilson et. al 2010, **Figure 2**). Although there has been low to medium trawling activity recorded in an area approximately 20 to 50 km to the south of Scott Reef, trawl fishing vessels are not expected to operate in the area of the proposed Rosebud 3D MSS operational area at Scott Reef due to the very shallow reef of North Reef and unsuitable deep (300 to 500 m) narrow channel.

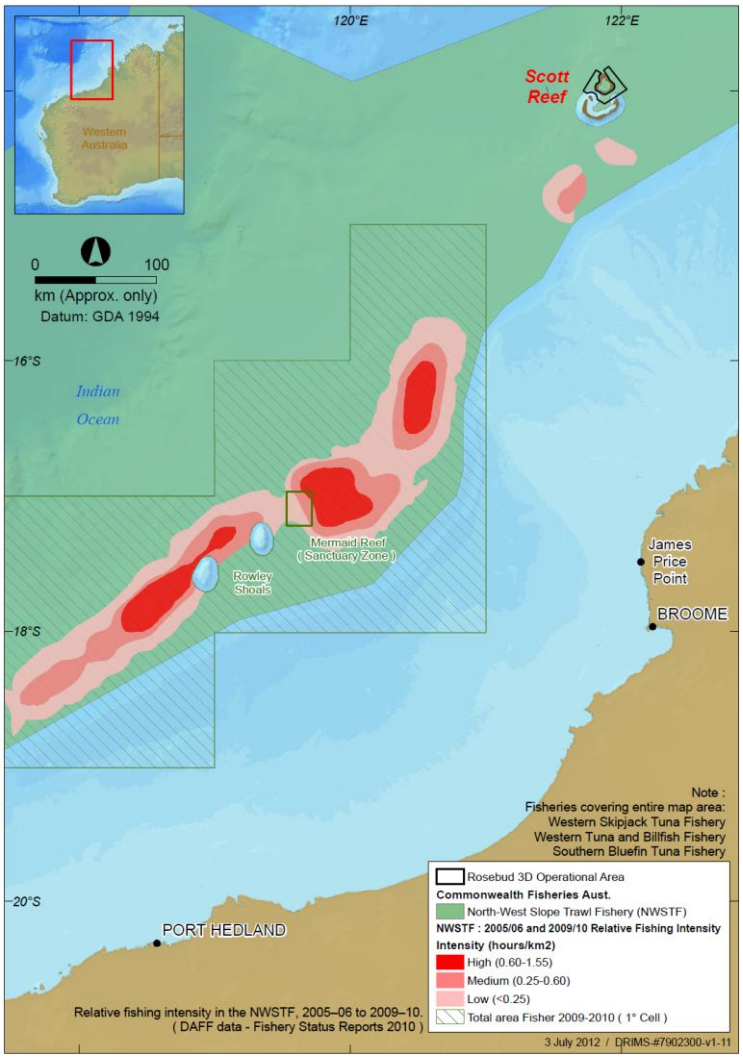

Figure 2: Relative Fishing Intensity from 2005 to 09 for the NWSTF *(Adapted from Wilson et. al 2010).*

State Managed Fisheries

The Rosebud 3D MSS operational area is located in waters that constitute part of three State managed commercial fisheries, of which, the Northern Demersal Scalefish Managed Fishery and Mackerel Fishery may potentially active in the deeper continental slope waters of the region.

Northern Demersal Scalefish Managed Fishery Management Area (NDSF)

The NDSF rarely operates in water depths greater than 100 m; however, during consultation the Department of Fisheries did highlight that the NDSF had reported fishing efforts within the operational area of the of the Rosebud 3D MSS within the last 5 years. Consequently it is possible that this fishery may be operating within this area during the survey; however, given the short duration of the survey disturbances to these operations would be expected to be minimal.

Mackerel Fishery

The main target species in the WA mackerel Fishery is Spanish mackerel (*Scomberomorus commerson*). Spanish mackerel and the majority of the catch is taken in the Kimberly region, which reflects the tropical distribution of mackerel species (DoF 2010). The Mackerel Fishery operates in coastal areas around reefs, shoals and headlands, given the short duration of the survey any disturbances to these operations would be expected to be minimal.

4. DESCRIPTION OF THE ACTION

Woodside will utilise a seismic contractor with experience in marine seismic survey operations to undertake the Rosebud 3D MSS. The Rosebud 3D MSS will use a small seismic source and short shallow towed marine streamer/s (receivers), which have been selected to minimise risks to the environment and to meet operational constraints of a small survey area adjacent to a shallow reef environment. Similar seismic methodologies were successfully used by Woodside during the 2007 Maxima 3D MSS.

As with conventional marine seismic surveys, the proposed Rosebud 3D MSS will utilise a seismic source array consisting of several air powered sources to generate acoustic pulses by periodically discharging compressed air into the water column. These pulses travel through the water column and into the seafloor. Energy from these pulses reflect from the boundaries between geological layers in the sub-surface and the reflected energy of seismic traces are recorded by a series of receivers located in a towed streamer.

The proposed Rosebud 3D MSS will use two source arrays with a total volume of up to 2,500 in^3 (nominal approximately 2,000 in^3 dependent on final configuration chosen) that are towed behind the seismic vessel at a depth of approximately 5 m and discharged alternately at intervals of approximately 7 to 10 seconds. The intensity of the seismic sources will be in the order of 220-240 dB re 1µPa at 1 m (at source sound pressure levels (SPL), peak-to-peak), with most of the spectral energy contained in the low frequencies range (10-110 Hz).

This is comparable to the 2,055 in^3 (total capacity) source array used successfully during the 2007 Maxima 3D MSS (Woodside 2007a). The use of a similar sized source array permits the environmental risk assessment, acoustic modelling and environmental research/monitoring conducted as part of the Maxima 3D MSS to be utilised to assist in assessing impacts associated with the Rosebud 3D MSS.

The proposed Rosebud 3D MSS will use a seismic vessel to tow up to two hydrophone streamers, each of which will be up to 3 km in length. The streamer/s will be towed at a depth of approximately 5 m to 8 m and where two streamers are used they will be towed approximately 100 m apart. The intention is to configure the seismic vessel to tow two sources, and two 3 km long streamers for the outer lines (furthermost from the reef).

For passes closest to North Scott Reef the vessel will either be reconfigured to tow two shorter 1.5 km streamers towed approximately 100 m apart or a single 1.5 km streamer; the array to be used will be determined based on operational constraints. The closest vessel pass (based on planned pre-plotted lines) will be 200 m outboard from a smoothed 20 m LAT bathymetric contour. The nominal outermost pass will be approximately 1000 m from the reef edge; passes 200-500 m out from the reef will utilise a reduced spread configuration and will be regarded as ‘close passes’ and have special operational conditions attached to this activity.

During data acquisition the source arrays and streamers will be towed behind the seismic vessels (at a depth approximately 5 to 8 m respectively and at a speed of approximately 5 to 10 km per hour) survey lines spaced approximately 100 m apart and total approximately 686 linear kilometres. The source array will be discharged at intervals of approximately 18.75 m along the survey lines. Testing of the source array, soft start up procedures and turning of the vessel at the end of lines may also require the source array to be discharged at irregular spacing and away from planned survey lines. The survey will involve 24 hour operations.

Survey Vessels

The Rosebud 3D MSS will be conducted using the Gardline-CGGV JV vessel MV Duke (**Figure 3**) which is a 2 source, 2 streamer 3D seismic vessel. It is relatively small (~2000 tons), has an endurance duration of 45+ days (so no bunkering will is planned for the duration of the Rosebud 3D MSS), is ‘ice class’ (which means significantly stronger hull), has multiple propulsion redundancy and multiple small fuel tanks (which reduces the total quantity of fuel in any one tank).

The proposed support vessel is the Offshore ‘Limitless’ (or a vessel of similar specifications). This vessel has been used by Woodside previously, is fast (hence can act in an emergency response role if required), has multiple redundancy (twin engines), multiple fuel tanks (for reduced spill risk), is relatively small and manoeuvrable and it is capable to take the seismic vessel under tow (in case of emergency).

A smaller work boat or tender will also be required as a run-about and may be needed for transfers between vessels, onsite liaison with traditional fishers and other logistical activities.

Figure 3: The Seismic Vessel – MV Duke and Primary Support Vessel – Limitless

Vessels used during the Rosebud 3D MSS are required to have passed a Woodside Marine Assurance Inspection Audit and will operate in accordance with Woodside's HSE policies.

The primary support vessel's function will be to act as an escort for the seismic survey vessel, to scout ahead of the seismic vessel, maintain a safe distance between the towed array and other vessels, to manage interactions with shipping and fishing activities and, if required, to mitigate against risks associated with vessel grounding. The primary support vessel will also act in an emergency response capacity (i.e. assisting with spill response, tow recovery and medical evacuation in the event of an emergency) and may also re-supply the seismic vessel with logistical supplies when not performing its primary functions.

5. MAJOR ENVIRONMENTAL HAZARDS AND CONTROLS

Woodside undertook an environmental risk assessment to understand the potential environmental risks associated with the Rosebud 3D MSS to ensure they are reduced to As Low As Reasonably Practicable (ALARP) and will be of an acceptable level using a method consistent with Woodside standards.

The key environmental hazards and control measures to be applied to the Rosebud 3D MSS activities are shown in **Appendix A**. These are consistent with Woodside corporate and project-specific objectives, standards and criteria. All control measures associated with the hazards will be used to reduce environmental risk to ALARP and will be of an acceptable level.

6. MANAGEMENT APPROACH

The Rosebud 3D MSS will be managed in compliance with the *Rosebud 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 Rosebud 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 Rosebud 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 and 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 Rosebud 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 and meeting monitoring, auditing, and reporting requirements during the activity. The Rosebud 3D MSS EP details the types of monitoring and auditing that will be undertaken, 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 Rosebud 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 Rosebud 3D MSS EP to NOPSEMA for assessment and approval a number of groups and organisations were consulted on the Rosebud 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

For further information about this activity, please contact:

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APPENDIX A: Summary of Major Environmental Hazards and Control Measures to be applied to the Rosebud 3D Marine Seismic Survey

Source of Risk (Hazard)	Potential Environmental Impact	Control/Mitigation Measures

Physical Presence of Survey Vessels Timing and location of survey activity	Disturbance to protected marine fauna in critical habitat	• The interaction of the survey/support vessels with cetaceans will be consistent with Part 8 of the EPBC Regulations (2000) which requires that:
		  o a vessel will not travel at greater than 6 knots within 300 m (caution zone) of a whale known to be in the area
		  o a vessel will not approach closer than 100 m of a whale known to be in the area
		• Adherence to Tier 1 of the Australian National Guidelines for Whale and Dolphin Watching (DEWHA 2005) which requires that:
		  o The survey vessels apply caution when within 300m of a whale and 150 metres of a dolphin (caution zone)
		  o The survey vessels shall not approach closer to the cetacean than 50m for a dolphin and/or 100 metres for a whale (with the exception of bow riding)
		• All personnel involved in the activity to understand their environmental responsibilities and requirements through an environmental induction
		• Seismic acquisition will not be undertaken outside the accepted (agreed) time period for the survey
		• Seismic acquisition will not be undertaken outside the accepted boundaries of the 'acquisition area' and discharge of the seismic source array will not be undertaken outside the accepted boundaries of the 'operational area' for the survey
		• All members of crew will be briefed on environmental requirements and particularly crew responsible for vessel operation and navigation will be aware of interaction regulations or guidelines for minimising disturbance to endangered, vulnerable or listed migratory species within critical habitat (breeding, feeding, resting or migratory corridors)
		• Fauna Observation Kits will be available on survey vessels to ensure crew have the necessary equipment available to record observations
		• A trained SEA/MFO or experienced bridge crew members will be on watch aboard the survey or support vessel to undertake observations for listed marine fauna in the vicinity of the survey vessels activities during daylight hours

	Impacts on the values of heritage listed places	• A referral under the *EPBC Act* has been submitted to SEWPaC; and any 'Particular Manner Conditions' handed down by the Minister under the 'EPBC Referral Decision' will be complied with, in order to minimise risk of impacts to Matters of NES including protected species, protected habitat and the values of Scott Reef as a 'Listed Place' on the Commonwealth Heritage List. • *Historic Shipwreck Act 1976*. It is an offence to destroy, damage, cause interference with or the disposal of a historic shipwreck or relic, or cause a historic shipwreck or relic to be removed without a permit. • The Rosebud 3D MSS will not operate over these shallow reef flats and will not interfere with the wreck. • The acoustic source will not be discharged within a radius of 5 km from Sandy Islet weather station tower (located at 121º 46'34"E, 14º 03'23"S, datum GDA94) • There will be no access of survey personnel, vessels or crew to Sandy Islet (WA reserved land), unless in an emergency

Source of Risk (Hazard)	Potential Environmental Impact	Control/Mitigation Measures
Physical Presence of Survey Vessels Vessel movement and noise	Disturbance to marine fauna - from Vessel Movements and Noise	• Whist at Scott Reef vessel speed will be limited to operational requirements only, unless in an emergency
	Injury/mortality to marine fauna	• Report any collision or suspected injury/mortality to marine fauna to the Woodside Representative, who will report externally as required within Section 8 • Vessel master and/or crew will make appropriate efforts to avoid or prevent collision with sighted marine fauna likely to be in collision course (i.e. reduce speed or change direction) where it is necessary and safe for the vessel to do so
	Damage to marine habitats from anchoring	• The survey and support vessel will not anchor at Scott Reef during the survey unless in the case of an emergency • The decision to anchor in case of an emergence is solely up to the discretion of the vessel Master or officer in charge if is required in order to maintain the safety of the vessel and crew. The preferred emergency anchoring location is located at: South Reef, northern edge: 14° 02’ 30.34” S - 121° 54’ 01.14” E
	Damage to marine habitats from grounding	• Adherence with Standard maritime safety/navigation procedures including: o Australian Maritime Safety Authority, Marine Orders - Part 21: Safety of navigation and emergency procedures Issue 7 o Marine Orders Part 30: (Prevention of collisions) • Fatigue of crew will be managed through the contractors HSEMP which will be aligned with Woodside’s Fatigue Management Procedure (WM1040PF7242248). • Detailed close-pass work procedures including: o Manual of permitted operations defining sea state, visibility, weather conditions necessary for close pass operations o Detailed daily planning of survey operations taking into account all local conditions and experience gained to date • Vessel has advanced accurate, dual redundant, navigation systems i.e. navigation aids, radar, depth sounders, vessel GPS tracking, chart plotting and vessel management systems (VMS) and competent crew to maintain safe navigation of survey lines • Detailed bathymetry and tidal information will be available and used to plan the daily vessel operational schedule to ensure that shallow obstacles are avoided • Survey lines will be planned (pre-plot lines) to maintain a minimum planned sail line distance of 200 m offset from the shallow 20 m (LAT smoothed depth contour) of North Scott Reef - In no locations will the seismic survey vessel plan to operate the towed equipment in less than 20 m water depth • The survey support vessel will be equipped and tested to be capable of taking the seismic survey vessel under tow if there were a failure of propulsion or steerage • Seismic and support vessels will transit along pre-planned routes both within the survey operational area, where practicable, to avoid navigation hazards

Source of Risk (Hazard)	Potential Environmental Impact	Control/Mitigation Measures
	Disturbance to marine fauna from vessel lighting	• Vessels will not be anchored over night within 5 kilometres of Sandy Islet weather station tower located at 121º 46'34"E, 14º 03'23"S (datum GDA94), except in the case of an emergency • Light levels on the survey vessels will be maintained to meet optimum lighting safety requirements
Introduction of Invasive Marine Species	Introduction and establishment of invasive marine species from ballast water	• Adherence the AQIS Australian Ballast Water Management Requirements (as defined under the Quarantine Act (1908)) will be implemented: o As a minimum, all vessels mobilised from outside of Australia must undertake ballast water exchange > 50 nautical miles from land and >200 m water depth o If ballast water exchange is to be undertaken en route to Scott Reef then: it must occur at least > 50 nautical miles outside the outer boundaries of North and South Scott Reef, and must be in water of > 200 m depth
	Introduction and establishment of invasive marine species from biofouling	• Adherence to the National Biofouling Management Guidelines Guidance for the Petroleum Production and Exploration Industry (Commonwealth of Australia 2009) • Woodside's IMS risk assessment process will be applied to all vessels and immersible 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 metres deep at Lowest Astronomical Tide • Based on the outcomes of each IMS risk assessment, management measures commensurate with the risk will be implemented to minimise the likelihood of IMS being introduced and establishing in Australian waters • The Department of Fisheries will be notified within 24 hours of any known or suspected introduced marine pests detected in Western Australian State waters, in accordance with the *Fish Resources Management Act 1994* • All vessels which come within the Scott Reef IMS Management Zone (12 nautical miles) and stay within this region for a period of time greater than 48 hours will be inspected by a suitably qualified and Woodside approved IMS Inspector prior to mobilisation to Scott Reef. (as outlined in Woodside *Doc No. A3000AH4345570, Appendix S*). *Inspections will be verified against the Commonwealth and State Invasive Marine Species lists,*
Use of Seismic Equipment	Acoustic disturbance to marine fauna – behavioural and physical injury	• All seismic acquisition will be compliant with EPBC Act policy Statement 2.1- Interactions between offshore seismic activities and whales (DEWHA 2008) – applying Part A Standard Management Procedures, including to the following: o Pre start observation procedures o A continuous visual observation procedure o Application of 30 minute 'soft start' procedures o Start up delay and stop work procedures o Observation zone: 3 km + horizontal radius from the acoustic source o Low power zone: 2 km horizontal radius from the acoustic source

Source of Risk (Hazard)	Potential Environmental Impact	Control/Mitigation Measures
		○ Shut-down zone: 0.5 km horizontal radius from the acoustic source • Use of Survey Environmental Advisers / Marine Fauna Observer (MFO) or suitably trained crew member on the source vessel • Training provided to relevant crew (observers, instrument technicians) on Policy Statement 2.1- Interactions between offshore seismic activities and whales (DEWHA 2008) requirements • In conjunction with the marine mammal mitigation measures, the following measures will be implemented for whale sharks and marine turtles: ○ Continual observations for whale sharks and turtles will be undertaken during acquisition with a focus on the 500m shut-down zone ○ A start-up delay and stop work procedure will be implemented if whale sharks and turtles are observed in the 500m shut-down zone ○ During the pre start observation period, observations for whale sharks and turtles will be undertaken during the final 10 minutes of the observation period with a focus on the 500m shut-down zone ○ Following a whale shark and turtle initiated start-up delay or stop work procedure operations will only recommence after the whale shark or turtle is observed to either move outside the 500m shut-down zone or after 10 minutes has passed since the last sighting ○ The MFO will provide detailed records and reports of all turtle and whale shark sightings • The source array will not be intentionally discharged over shallow coral reef areas with water depth of less than 20 m along a continuous survey line • The coral specialist and/or the SEA shall monitor for surface slicks during daylight from the operating source vessels or support vessel, vessel, during daylight hours between the dates of 6th to 13th October and 4th to 11th November – providing the survey vessels are at Scott Reef. (Monitoring would not be conducted prior to arrival of survey vessels at Scott Reef or when the source discharge has ceased and vessels are still at Scott Reef at the completion of the survey) • If a coral spawn slick is observed and verified in the operational area (to the level detailed in the Coral Spawn Monitoring Procedures), the seismic source will be shut down (i.e. no acquisition) – and not discharged for a period of 5 days. • After the 5 day period mentioned above: ○ If coral spawn slicks are still visible, the seismic source array must not be discharged within five metres of observed coral spawn slick during the day ○ Discharges of the source may only resume at night once coral spawn slicks have not been observed during the preceding day. • Coral spawn slick monitoring must be undertaken in accordance with a Coral Spawn Monitoring Procedure and will be subject to the following requirements: ○ The final coral spawning monitoring/shutdown procedure to be developed in consultation with the coral specialist and endorsed by AIMS; ○ Compliance monitoring based on any observations from a survey vessel of a surface slick. Subsequent sampling of the observed slick will be undertaken by the coral specialist to confirm presence of coral spawn. ▪ Surface slick defined as *any mass of floating organic material > 5m^2 in area*

Source of Risk (Hazard)	Potential Environmental Impact	Control/Mitigation Measures
		▪ Coral spawn slick defined as *slick with an minimum egg density of > 30 per 30 ml sample in its densest part* ▪ Slicks will be sampled and egg density quantified using a dissection microscope o Compliance monitoring will be undertaken by the coral specialist and documented o Photographic records of spawn slicks to be maintained
	Damage to seabed habitat from loss or grounding of towed equipment	• Seismic vessel has highly accurate, real time, redundant navigation systems, so the vessel and all in-sea equipment positions are known at all times. • Seismic vessel is steered to compensate for steamer feather to maintain a minimum separation (between the towed streamer and reef) of 100m horizontal offset from the 20 m (LAT smoothed depth contour) of North Scott Reef. • Seismic and support vessel will not operate within or enter North Reef lagoon • Any lost equipment will be relocated and recovered where possible • A register of lost equipment will be maintained
	Toxic effects to marine biota from streamer fluid release	• Protection of the Sea (Prevention of Pollution from Ships) Act 1983 - Part II: and Marine Orders - Part 91: Marine Pollution Prevention – Oil o Report any major loss of fluid greater than 80 L as required o Record any minor loss of fluid up to 80 L • Operational procedures will be in-place on board the survey vessels for deployment and retrieval of the streamer array and for monitoring of the streamer to detect leaks or damage resulting in loss of fluid • Damaged or leaking sections of streamer (when detected) will be recovered as soon as is practical and repaired or replaced to prevent further leakage
Marine Pollution from Routine Discharges	Reduced localised air quality from atmospheric emissions (BTEX, NOx, SOx)	• Compliance with Protection of the Sea (Prevention of Pollution from Ships) Act 1983, MARPOL 73/78 Annex VI (Regulations for. the Prevention of Air Pollution from Ships) and Marine Orders – Part 97 (Marine Pollution Prevention – Air Pollution), in particular: o Seismic survey vessel will hold a valid International Air Pollution Prevention Certificate (IAPP) • Compliance with Commonwealth Protection of the Sea (Prevention of Pollution from Ships) Act 1983). In particular Part IIID-Prevention of air pollution: o Use of low sulphur fuel when it is available to minimise emissions from combustible sources • Implementation of a preventative maintenance system (PMS) to confirm diesel powered equipment is operating efficiently • Vessels will run on marine diesel (MGO) and not use heavy fuel oil

Source of Risk (Hazard)	Potential Environmental Impact	Control/Mitigation Measures

	Routine discharges of sewage and putrescibles wastes leading to Reduction in water quality due to nutrient enrichment	• 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) including:
		  o Onboard sewage treatment plant approved by the International Maritime Organisation (IMO) (MARPOL MEPC.2 (IV) or MEPC.159 (55)), and operational prior to survey commencement.
		  o Sewage and putrescible wastes macerated prior to disposal.
		• Surveys vessel will hold a valid International Sewage Pollution Prevention Certificate (ISPP)
		• Survey vessels will hold a valid International Oil Pollution Prevention (IOPP) certificate
		• Treated sewage, any waste or bilge water must not be discharged internal to three nautical miles from the outer boundaries of North and South Scott Reef
		NOTE- "any waste" is taken to include: treated sewage, grey-water from sinks and showers, comminuted/macerated food scraps, putrescible waste and treated bilge water.
		• Untreated sewage must not be discharged internal to twelve nautical miles from the outer boundaries of North and South Scott Reef
		• Discharge of sewage and any waste will only be conducted while the vessel is underway
		• Compliance with MARPOL 73/78 Annex V: Garbage (as implemented in Commonwealth waters by the Protection of the Sea (Prevention of Pollution from Ships) Act 1983), Marine Orders - Part 95: Marine Pollution Prevention – Garbage including:
		  o Current Garbage Management Plan in place detailing wastes generated and disposal requirements – this plan will be approved by Woodside and detail waste generation and disposal requirements
		• Vessels will be provided with a map and coordinates for the applicable discharge zone boundaries (i.e. three and twelve nautical miles from the outer boundaries of North and South Scott Reef)

	Reduction in water quality - due to Bilge Water discharge	• 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): • Oil Record Book maintained which details how, when and where any waste oils/oily effluents are disposed • 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 (vessels >30 m in length) is used to treat the bilge water • Discharge quality automatically monitored with an alarm • Bilge water contaminated with chemicals must be contained and transported to shore for appropriate disposal, treatment or recycling, except if the chemical is demonstrated to have a low toxicity (as determined by the relevant Material Safety Data Sheet (MSDS) • Bilge water must not be discharged internal to three nautical miles from the outer boundaries of North and South Scott Reef or within State waters or in less than 20m water depth • Vessels will be provided with a map and coordinates for the applicable discharge zone boundaries (i.e. three and twelve nautical miles

Source of Risk (Hazard)	Potential Environmental Impact	Control/Mitigation Measures
		from the outer boundaries of North and South Scott Reef)
	Toxic or physical effects to marine biota – from Unplanned Discharge of Solid and Other Waste	• Discharges of other wastes 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): o No discharge of plastics or plastic products of any kind from vessels in accordance with MARPOL and P(SL)A requirements o 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 (if appropriate) or compacted (if possible) and stored in designated areas and sent ashore for recycling, disposal or treatment • 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
	Unplanned loss of hydrocarbons/chemicals to the marine environment – from Deck Spills	• All survey vessels where relevant will comply with MARPOL 73/78 Annex I requirements to prevent oil pollution, as implemented in Protection of the Sea (Prevention of Pollution from Ships) Act 1983 - Part IIIB and Australian Maritime Safety Authority, Marine Orders Marine Orders - Part 91: Marine Pollution Prevention – Oil; including: o Shipboard Oil Pollution Emergency Plans (SOPEP) will be prepared and kept onboard the vessels in accordance with requirements of MARPOL o For vessels not subject to MARPOL, a pollution response plan, spill response kit and training will be in place as appropriate • Spill response bins/kits located in close proximity to hydrocarbon storage / bunkering areas and kits to be appropriately stocked, replenished if required. 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 • Personal Protective Equipment (PPE) appropriate to the nature and volume of spilled material • Operational procedures will be in-place on board the survey vessels for all operations that involve handling environmentally hazardous materials, oil and oily effluents/ waste during routine/ maintenance activities • All hazardous substances (as defined in NOHSC:1008(2004) – Approved Criteria for Classifying hazardous substances) will have an Material Safety Data Sheet (MSDS) in place that is readily available on board • Spills response will be undertaken in accordance with the Shipboard Oil Pollution Emergency Plan, the Woodside's Corporate Oil Spill Response Plan (WEL Doc No. W0000AV0003.0001) and the Rosebud 3D Marine Seismic Survey Oil Spill Action Plan (Appendix C). o The Rosebud 3D Marine Seismic Survey Oil Spill Action Plan relates specifically to the management of this potential emergency condition. • Chemicals and/or hydrocarbons located above deck will be stored with some form of secondary containment to contain leaks or spills e.g. bund, containment pallet, transport packs etc. • All chemical and hazardous wastes will be segregated into clearly marked containers prior to onshore disposal

Source of Risk (Hazard)	Potential Environmental Impact	Control/Mitigation Measures
		• Records of any unplanned loss of hydrocarbons/chemicals to the marine environment recorded and reported as required • Refuelling of the work boat/tender will only occur within a bunded area aboard the deck of the support vessel.
	Toxic effects to marine biota oiling of fauna or habitat from fuel or oil spill due to – Vessel Grounding or Collision	• All survey vessels where relevant will comply with: o MARPOL 73/78 Annex I requirements to prevent oil o pollution, as implemented in Protection of the Sea (Prevention of Pollution from Ships) Act 1983 - Part IIIB o Australian Maritime Safety Authority, Marine Orders Part 30: Prevention of collisions o Marine Orders - Part 21: Safety of navigation and emergency procedures, Issue 7 o Australian Maritime Safety Authority, Marine Orders Marine Orders - Part 91: Marine Pollution Prevention – Oil • Survey vessels are equipped with navigation aids, radar, vessel GPS tracking and vessel management systems, depth sounders and competent crew maintaining 24 hour radio and radar watch for other vessels • Survey vessels apply standard maritime safety procedures (radio contact, display of navigational beacons and lights)
Social Impacts	Interference with and displacement of Indonesian Traditional Fisherman	• In order to maintain a safe operating distance from Indonesian fishermen who may be fishing or diving: o Pre start visual observation (as used for cetaceans, turtles and whale sharks) will include observations for Indonesian fishing vessels and particularly with the aim of determining if divers may be in the water on the outside of the reef o Shut-down zone: 500 m from the acoustic source if it is observed or suspected, that divers may be in the water on the outside of the reef when the seismic acoustic source is operational • A survey information 'fact sheet' including safety warnings of the vessel activity will be translated into Bahasa Indonesia and distributed to traditional fishers in the area to alert them of the survey vessel activity and the towed equipment behind the vessel • The tender/work boat may be used to approach traditional vessels to provide information and explanations will be communicated through the use of a Bahasa Indonesia speaking liaison member • The tender/work boat may be used to approach traditional vessels where there is a risk of collision with the seismic survey vessel or the towed streamer array • Provision of navigational safety items to traditional fishers (radar reflector and beacon light)

Source of Risk (Hazard)	Potential Environmental Impact	Control/Mitigation Measures

	Interference with and displacement of Commercial Shipping Operations	• Compliance with Section 4.7 Marine Vessel Assurance of the Woodside Marine Operations Operating Standard (WM6070SV7193964):
		  ○ Marine Vessel Inspection undertaken by a Woodside approved inspector prior to mobilisation to confirms the survey vessels are equipped with standard maritime safety procedures (radio contact, display of navigational beacons and lights) to meet the mandatory requirements for class
		• AMSA Marine Orders Part 30: Prevention of Collisions (Issue 8) and Marine Orders Part 21: Safety of navigation and emergency procedures:
		  ○ Use of standard maritime safety procedures (radio contact, display of navigational beacons and lights)
		• The location and timing of the survey will be forwarded to the Australian Maritime Safety Authority (AMSA) and warnings will be broadcast to shipping in the region
		• Activities reported to AMSA and Australian Hydrographic Office 2 weeks prior to mobilisation
		• Notification of survey timing and activities via factsheet distributed to relevant commercial fishing organisations prior to commencement of the survey

	Interference with and displacement of Recreational Fishing Operations	• Distribution of survey fact sheets to Kimberley Marine Tourism Association and operators of fishing charters to Scott Reef explaining the proposed timing of seismic operations at Scott Reef, communications and other key survey information
	Interference with shipping	Performance standards already identified in other parts of **Appendix A**.
	Interference with Monitoring and Research Activities	• Consultation with the appropriate research organisations (for example AIMS and WA Museum) to consider the concurrent nature of any operations at Scott Reef • Distribution of survey fact sheets to research organisations likely to conduct work at Scott Reef explaining the proposed timing of seismic operations at Scott Reef, communications and other key survey information • Co-current operations plan to be developed in consultation with the AIMS to ensure operations at Scott Reef by both organisations can co-exist • To ensure roles and responsibilities regarding co-current operations are understood – requirements will be outlined to crew in topic specific briefing