Rocket Multi-Client 2D Marine Seismic Survey

Environment Plan Summary

Spectrum Geo Pty Ltd

Revision 1

Issue Date: 18/12/2014

Spectrum Geo Pty Ltd

Tel: +61 8 9322 3700
Fax: +61 8 9322 1844
http://www.spectrumasa.com/

105 St Georges Terrace
Perth
WA 6000
Australia
ABN 90 003 632 166

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1 INTRODUCTION

1.1 OVERVIEW

Spectrum Geo Pty Ltd (Spectrum) proposes to acquire a multi-client two-dimensional (MC2D) marine seismic survey (Rocket MC2D MSS) within the Houtman Sub-basin offshore from Western Australia (WA), between December 2014 and the end of June 2015. The survey will comprise acquisition of approximately (~) 10,839 line kilometres (km) of 2D seismic data in water depths between ~50 and ~4,000 m.

1.2 LOCATION

The survey will be divided into two separate phases – Phase 1 and Phase 2, and acquisition will occur within defined operational areas that are located entirely in Commonwealth waters. The Phase 1 operational area, which is located offshore from Gascoyne region between Ningaloo Reef and Shark Bay, incorporates Exploration Permits WA-492-P and WA-493-P and adjacent open acreage areas (see **Figure 1–1**). The Phase 2 operational area, which incorporates Release Areas W13-19 and W13-20 and adjacent open acreage areas, is located offshore from Kalbarri, between Shark Bay and the Houtman Abrolhos Islands (see **Figure 1–2**). The Phase 2 operational area excludes the Abrolhos Islands.

The areas defined as the Phase 1 and Phase 2 operational areas are the physical areas used for full power data acquisition along the sail lines, plus an additional area for line run-outs (required to obtain full fold coverage), line turns, line run-ins, soft-start procedures and vessel maneuvering.

At the closest points, the eastern boundary of the Phase 1 operational area is located ~7.5 km from the boundary of the Ningaloo Coast World Heritage Property (WHP) offshore from Point Cloates, and ~5 km from the boundary of the Shark Bay WHP, offshore from Dirk Hartog Island. The minimum separation distance from the boundary of the Phase 1 operational area and the nearest land is ~10 km, at Steep Point. The eastern ends of the 2D lines are separated from the boundaries of the Ningaloo Coast WHP and the Shark Bay WHP by a buffer zone of at least 20 km, ensuring that during line run-outs and line turns neither the survey vessel nor any part of the towed array will enter either the Ningaloo Coast or Shark Bay WHP. Similarly, during line run-outs and line turns along the eastern side of the Phase 1 operational area neither the survey vessel nor any part of the towed array will enter WA State waters.

The Phase 2 operational area incorporates an exclusion zone around the Houtman Abrolhos Islands, which encompasses WA State waters around the islands and the Abrolhos Islands Fish Habitat Protection Area (FHPA - the boundary of which is contiguous with the WA State waters boundary around the islands). At the closest point, the boundary of the Phase 2 operational area is located ~8 km from the Abrolhos Islands FHPA boundary, on the western side of the islands. The ends of the 2D lines in the area to the north and west of the Abrolhos Islands are located at least 15 km from the Abrolhos Islands FHPA boundary, ensuring that during line run-outs and line turns neither the survey vessel nor any part of the towed array will enter WA State waters or the Abrolhos Islands FHPA.

Boundary coordinates for the Phase 1 and Phase 2 operational areas are provided in **Table 1-1**.

Table 1-1 - Rocket MC2D MSS Phase 1 and Phase 2 operational areas – boundary coordinates

Phase 1 Operational Area						Phase 2 Operational Area					
Latitude (S)			Longitude (E)			Latitude (S)			Longitude (E)		
Deg.	Min.	Sec.	Deg.	Min.	Sec.	Deg.	Min.	Sec.	Deg.	Min.	Sec.
22	37	00.00	110	40	00.00	26	58	12.76	110	25	51.67
27	14	22.72	110	40	01.18	30	10	10.98	112	54	25.73
27	14	24.05	113	35	24.03	29	47	34.45	113	40	03.12
25	25	04.46	112	40	07.81	29	39	55.66	113	35	05.24
24	25	46.46	112	40	06.70	29	19	55.65	113	35	05.23
23	41	12.57	113	24	41.51	29	19	55.63	114	00	05.23
22	37	00.28	113	24	41.61	29	01	25.62	114	00	05.21
						28	29	55.60	113	53	40.19
						28	30	00.20	114	19	06.26
						28	06	31.51	114	03	00.44
						27	32	07.36	113	54	42.96
						26	32	23.45	113	13	11.73
						26	09	46.54	112	58	21.27
						25	38	42.36	112	45	13.09

Datum: WGS84

Figure 1-1 - Rocket MC2D MSS – Phase 1 operational area

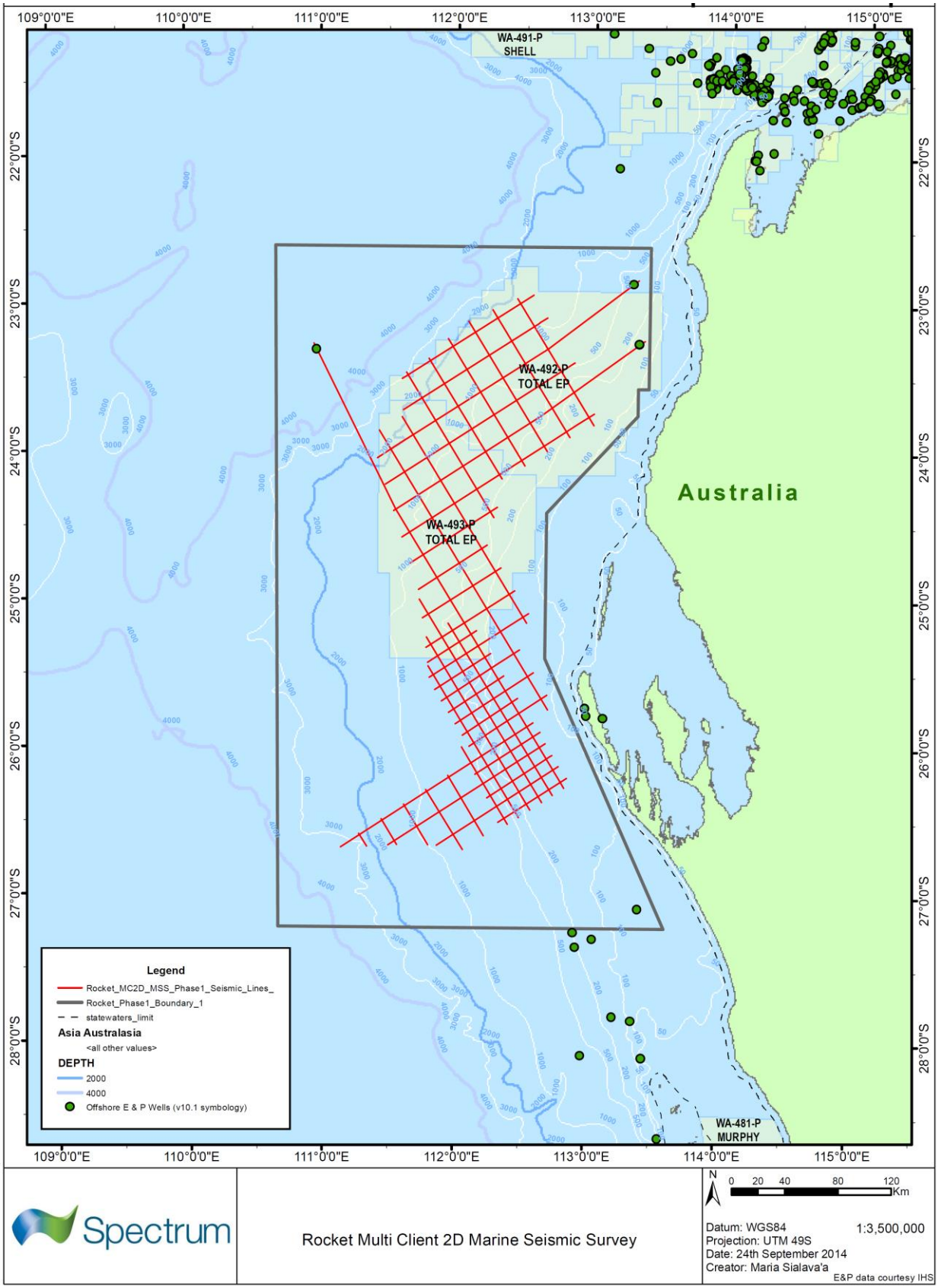
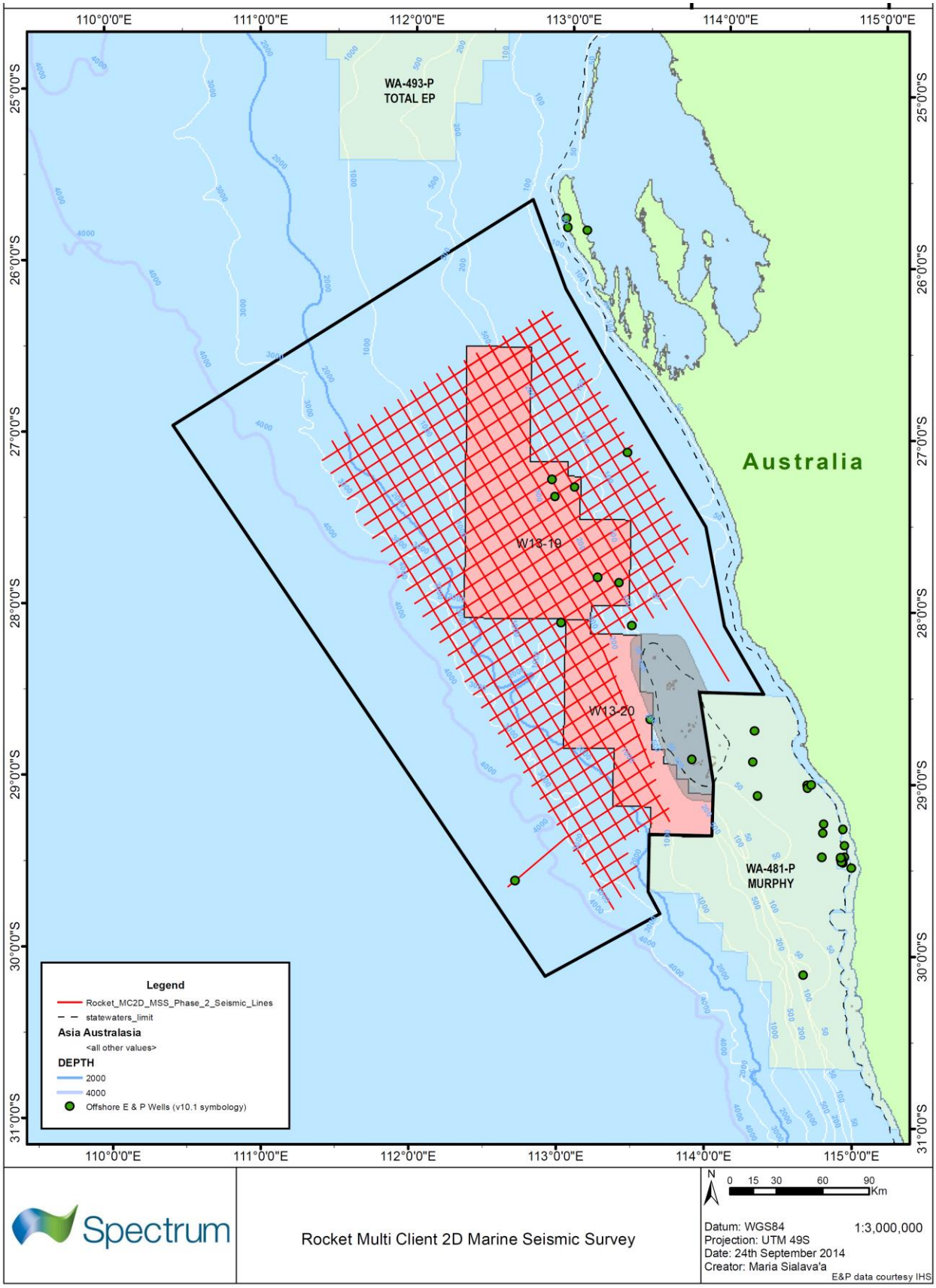


Figure 1-2 - Rocket MC2D MSS – Phase 2 operational area



2 EXISTING ENVIRONMENT

2.1 REGIONAL SETTING

The Rocket MC2D MSS Phase 1 and Phase 2 operational areas cover a large area of Commonwealth waters off WA. The polygons extend from the North-west Marine Region (NWMR) adjacent to Point Cloates, WA to the northern portion of the South-west Marine Region (SWMR) offshore from Geraldton. The NWMR and SWMR include Commonwealth waters, between the WA State waters boundary (3 nm from the territorial baseline) and the Australian Exclusive Economic Zone boundary (200 nm from the low water mark).

2.2 CLIMATE AND METEOROLOGY

The Phase 1 operational area lies mostly in the NWMR and is described as having a monsoonal climatic pattern, characterised by a distinct cyclone season from December-March. The Phase 2 operational area lies mostly in the SWMR and is described as having a Mediterranean climate, characterised by warm dry summers and cool wet winters. Lower rainfall and humidity are typically associated with the Southeast Monsoon, in contrast to the high levels of rainfall and humidity associated with the Northwest Monsoon.

The Phase 1 operational area is predicted to receive wind speeds of ~10-20 knots from a north-westerly direction in summer (January) and ~8-10 knots from a south-westerly direction in winter (July). The Phase 2 operational area is expected to receive wind speeds of ~10-15 knots from a north north-easterly direction in summer, and ~10-20 knots from a south south-easterly direction in winter.

The NWMR has a very high cyclone incidence and these occur primarily between December and March. Typically, cyclones move south-west across the Arafura and Timor Seas. Gale to hurricane force winds are likely to be encountered over an area between 32 km and 240 km wide.

2.3 OCEANOGRAPHY

2.3.1 Currents of the NWMR and Phase 1 Operational Area

Currents within the NWMR include the South Equatorial Current; the Indonesian Throughflow (ITF); the Eastern Gyral Current, and the Leeuwin Current. Seasonal surface currents in the region are the Ningaloo Current, the Holloway Current, the Shark Bay Outflow and the Capes Current. The South Equatorial Current and Eastern Gyral Current intensify during July-September. Similarly, the Leeuwin Current is strongest in autumn, and diminishes during the Northwest Monsoon in summer (December-March). This complex system of ocean currents change between seasons and between years, generally resulting in the surface waters being warm, nutrient poor and of low salinity.

During the southeast tradewinds (April-September), the predominant direction of the ocean current is west-southwest. In the monsoon season (December-March), winds come from the northwest or west, and the direction of the ocean current reverses, becoming east-northeast. The dominant tidal current flows in the NWMR in summer are east-northeast and west-southwest, with speeds generally ranging from 0.1-0.3 m/s.

The region typically receives a persistent swell of around 2 m, generated by low-pressure systems in southern latitudes during winter; strong easterly winds can also generate 2 m seas. Both swell and seas tend to be smaller during summer. Tropical cyclones generate waves propagating out in a radial direction from the storm centre, and generate swells from any direction, with wave heights between 0.5 and 9.0 m.

2.3.2 Currents of the SWMR and Phase 2 Operational Area

The three dominate currents in the SWMR are; the Leeuwin Current, the Leeuwin Undercurrent and the Capes Current. The Leeuwin Current forms near the North West Shelf and transports warm, nutrient deficient waters south along the continental shelf break. The current is approximately 100 km wide and 300 m deep with dimensions differentiating over the seasons. The strength of the current is also seasonal with a weaker summer flow then winter. The flow of the Leeuwin Current is slowed during

summer months as it has prevailing southerly winds moving against it. In winter the speed of the current picks up so much that it extends around the west coast of WA and continues to move east along Southern Australia.

Eddies are another component of the Leeuwin Current that are a significant feature of this region. Meso-scale eddies peel off the Leeuwin Current in predictable locations along the shelf break are hundreds of kilometres in diameter, move in an anti-clockwise direction (e.g. off Shark Bay, Abrolhos Islands, Jurien Bay and Rottnest Island). The Capes Current is a cold water surface current that flows north inside the Leeuwin Current. This coastal current is present mainly during summer months between Cape Leeuwin and Shark Bay. Its cold waters are driven north by strong southerly winds that prevail between December and March. It is thought that the mixing of the Leeuwin Current, the Leeuwin Undercurrent and the Capes Current increases productivity in the SWMR.

2.3.3 Water Temperatures

Historical sea surface temperatures for the Phase 1 operational area in summer are predicted to be from ~24°C-26°C and winter sea surface temperatures to be from ~22°C-24°C. Whereas, the Phase 2 operational area summer sea surface temperatures are predicted to be from ~22°C-24°C and winter sea surface temperatures to be from ~20°C-22°C.

2.4 BIOLOGICAL ENVIRONMENT

2.4.1 Biological Communities

Corals
Coral communities, including patch or fringing reefs occur in shallow water, sub-tidal environments of the NWMR and SWMR as well as around intertidal areas adjacent to islands and other emergent features. Coral reefs are areas of especially high species diversity. Located 60 km offshore from Geraldton at the edge of the continental shelf are the coral reefs of the Abrolhos Islands, which are high-latitude coral reefs and host a diverse mix of temperate and tropical fish, corals and molluscs.

Crustaceans
The NWMR is thought to contain a high diversity of crustaceans across a range of habitats, from intertidal sites to the deeper waters of the slope and the abyss. Dominant species groups include copepods, prawns, scampi and crabs. In the SWMR western rock lobsters can be found north of Cape Leeuwin to a depth of 150 m. The summer hatching of western rock lobster coincides with maximal wind generated offshore transport vectors, dispersing the animals into the Indian Ocean and beyond the influence of the Leeuwin Current. During the next twelve months the larvae actively swim across shelf waters and settle in shallow inshore reefs where spend a considerable period (3-4 years) of its lifecycle on the reef as a juvenile, before migrating to deeper offshore waters to spawn as sub-adults and complete the lifecycle. During the inshore reef period western rock lobster are important prey for a range of commercially and recreational species such as octopus, cuttlefish, baldchin groper, blue groper, dhufish, pink snapper, wirrah cod, breaksea cod and Australian sea lion.

Macroalgae
In the NWMR algae are dominant on shallow sandbars, platforms, reefs and ridges and are thought to be the major primary producer in this system, followed by mangroves and corals in isolated areas. Macroalgae occurs predominantly in the intertidal and shallow sub-tidal waters on hard substrates, inshore of the Phase 1 operational area. In the SWMR, distinct ridges of limestone reefs support diverse communities of macroalgae, with a high species richness and endemism (over 1,000 species of macroalgae are known), many species are also found at much greater depths than usual, for instance some species are far at depths of 120 m. Macroalgae communities (including epiphytic algae) provide foraging areas for the commercially and recreationally important abalone and many other reef species. Macroalgae occurs predominantly in the intertidal and shallow sub-tidal waters on hard substrates, on the reefs of the Abrolhos Islands and inshore of the Phase 2 operational area.

Mangroves
Mangroves are recognised significant habitats as they are productive coastal forest systems, providing habitat and shelter for birds, fish and other marine species and are important nursery sites for juvenile fish, lobsters and prawns. The only significant area of mangroves adjacent to the operational areas are

found on the western side of the Cape Range Peninsula (Mangrove Bay) ~90 km inshore from the Phase 1 operational area.

Seagrasses

Seagrass beds are said to provide critical habitats for fish and dugongs and are important for sustaining many of the fish populations of the North West Shelf. Seagrasses are predominantly found in WA State waters inshore of the Phase 1 and Phase 2 operational areas. In the SWMR, species diversity and endemism of seagrasses is the highest in the world, with fourteen species occurring in water depths of up to 50 m in some parts of the region. Seagrass meadows occur in cooler waters in the SWMR in areas with less exposure and in protected lagoon areas or deep waters between the Abrolhos Islands. The Abrolhos Island lagoons are important areas for benthic productivity and are dominated by seagrasses and epiphytic algae, the meadows provide a sheltered habitat and a breeding and nursery aggregations for many temperate and tropical marine species and epiphytes are one of the main food sources in the lagoonal system.

2.4.2 Key Ecological Features

Seven Key Ecological Features (KEF) within the Rocket MC2D MSS operational areas were identified by a search of the EPBC Act Protected Matters database.

Table 2-1 identifies the KEFs that overlap the Phase 1 and Phase 2 operational areas.

Table 2-1 - KEF vs Rocket MC2D MSS Phase 1 and Phase 2 operational area

No.	Key Ecological Feature	Operational Area
1	Ancient coastline at 90-120m depth	2
2	Commonwealth marine environment within and adjacent to the west coast inshore lagoons	2
3	Commonwealth marine environment surrounding the Houtman Abrolhos Islands	2
4	Meso-scale eddies	
5	Perth Canyon and adjacent shelf break, and other west coast canyons	2
6	Western demersal slope and associated fish communities	1, 2
7	Western rock lobster	2

2.4.1 Biologically Important Areas

There are a number of Biologically Important Areas (BIAs; e.g. breeding, nesting, foraging areas; **Tables 2-2** and **2-3**) for EPBC Act-listed species of marine fauna that overlap the Rocket MC2D MSS operational areas, with seven BIAs overlapping the Phase 1 operational area and 16 BIAs overlapping the Phase 2 operational area.

Table 2-2 - BIA overlapping the Phase 1 operational area

Common Name	Behaviour
Humpback whale	Migration (north and south)
Roseate tern	Breeding area, Foraging
Wedge-tailed shearwater	Breeding area, Foraging
Wedge-tailed shearwater	Foraging (in high numbers)
Sooty tern	Foraging
Bridled tern	Foraging (in high numbers)
Pygmy blue whale	Migration

Table 2-3 - BIA overlapping the Phase 2 operational area

Common Name	Behaviour
Australian lesser noddy	Foraging (provisioning young)
Australian sea lion	Foraging (male only)
Bridled tern	Foraging (in high numbers)
Caspian tern	Foraging (provisioning young)
Common noddy	Foraging (provisioning young)
Fairy tern	Foraging (in high numbers)
Humpback whale	Migration (north and south), Resting,
Little shearwater	Foraging (in high numbers)
Pacific gull	Foraging (in high numbers)
Pygmy blue whale	Migration
Roseate tern	Foraging (provisioning young)
Soft-plumaged petrel	Foraging (in high numbers)
Sooty tern	Foraging
Wedge-tailed shearwater	Breeding area, Foraging, Foraging (in high numbers)
White shark	Foraging
White-faced storm petrel	Foraging (in high numbers)

2.4.2 Protected Marine Fauna

The Protected Matters Search Tool (PMST) from the Commonwealth Department of the Environment was used to determine whether matters of national environmental significance or other matters protected by the EPBC Act were likely to occur in the Rocket MC2D MSS Phase 1 and Phase 2 operational areas. The 31 listed threatened species that may occur, or relate to, the Phase 1 and Phase 2 operational areas are:

1. the sei whale;
2. the blue whale;
3. the fin whale;
4. the southern right whale;
5. the humpback whale;
6. the Australian sea-lion;
7. the short-nose seasnake;
8. the loggerhead turtle;
9. the green turtle;
10. the leatherback turtle;
11. the hawksbill turtle;
12. the flatback turtle;
13. the grey nurse shark;
14. the great white shark;
15. the whale shark;
16. the Australian lesser noddy;
17. the southern royal albatross;
18. the northern royal albatross
19. the Amsterdam albatross;
20. the Tristan albatross;
21. the wandering albatross;
22. the southern giant-petrel;
23. the northern giant-petrel;
24. the soft-plumaged petrel;
25. the Australian fairy tern;
26. the Indian yellow-nosed albatross;
27. the shy albatross;
28. the white-capped albatross;
29. black-browed albatross;
30. Campbell albatross; and
31. painted button-quail.

<u>Humpback Whale</u>
Humpback whales are listed as Vulnerable and Migratory under the EPBC Act and are the most commonly sighted whale in northern WA waters. The Phase 1 and Phase 2 operational areas overlap

the BIA for migrating humpback whales. Humpback whale migration in the region is characterised by three distinct directional phases:

- Northbound phase - starts April, peaks July and tapers off by August. Around the Barrow Island/Montebello Islands area, northerly migrating humpback whale numbers peak during late July/early August, and may extend north to the continental shelf edge at 130 km offshore, generally out to the 200 m depth contour.
- Transitional phase (peak numbers expected at this time) - between late August and early September.
- Southbound phase – usually occurring between late August and early September, although smaller numbers may occur until November (this phase of migration is segmented by 2–3 week delay in appearance of peak numbers of cow/calf pods after the main migratory body has passed). Southerly migration in this area is contracted in a narrower band than the northerly migration, generally occurring closer to the coast in waters less than 100 m deep.

Pygmy Blue Whale

The blue whale is listed as Endangered and Migratory, and may be present in, or adjacent to, the Phase 1 and Phase 2 operational areas. Their migration paths are widespread and do not clearly follow coastlines or particular oceanographic features. The blue whale is rarely present in large numbers outside recognised aggregation areas. In the NWMR, pygmy blue whales migrate along the 500 m to 1,000 m depth contour on the edge of the slope, and are likely to be feeding on ephemeral krill aggregations. The northbound component of this migration takes place from May to mid-August, with a peak in July–August, and the southbound component occurs from late October to November–December, with a few isolated individuals moving south in January. The migration appears to be centred on the 500 m depth contour.

The operational areas overlap the BIA for pygmy blue whales. Consequently, there is the possibility that migrating (and possibly feeding) pygmy blue whales may be encountered in the deeper waters of both the Phase 1 and Phase 2 operational areas.

Fin Whales

Fin whale distribution is known primarily from stranding events and whaling records, and is thought to occur along the west coast of Australia to New South Wales. The migration routes and location of winter breeding grounds are uncertain but their presence in Victorian and southern WA waters has also been detected in summer and autumn months. Fin whales may be present in the Phase 1 and Phase 2 operational areas, however, it is unlikely that they will be present in significant numbers.

Southern Right Whale

Southern right whales are large whales that are known to occur on a seasonal basis within the coastal waters of Australia. Major calving areas are generally restricted to coastal, inshore waters off the southern coastline of WA (east of Albany), South Australia and Victoria. No specific feeding areas are known for southern right whales, as they generally depend on variable prey distribution and abundance and will migrate according to prey location. Although the species is known from nearshore coastal waters in Australia, it is possible for this species to occur within the Phase 1 and Phase 2 operational areas. However, given that major calving areas and aggregations occur in WA in proximity to the Great Australian Bight, southern right whales are unlikely to be present in high numbers within the operational areas.

Sei Whale

The sei whale is a cosmopolitan species, ranging from polar waters to the tropics. They tend to be sighted more frequently from offshore waters in comparison to other species of whales, but the species is not commonly recorded in Australian waters. The species is migratory, moving between Australian waters and Antarctic feeding areas, however their movements are unpredictable and not well documented. Additionally, there are no known mating or calving areas in Australian waters. Sei whales may be present in the deeper waters of the Phase 1 and Phase 2 operational areas, however, it is unlikely that they will be present in significant numbers.

Dugong

There is a BIA for foraging dugong within Shark Bay adjacent to the Phase 1 and Phase 2 operational areas. The Shark Bay dugong population has estimated numbers of ~10,000 individuals. Dugong feed on shallow seagrass habitat and it is unlikely that dugong will be present within the operational areas.

Australian Sea Lion

The Australian sea lion is listed as Vulnerable under the EPBC Act. A BIA for foraging male and female Australian sea lions is located around the Houtman Abrolhos Islands and along the coastline south of Geraldton. The Phase 2 operational area does not overlap this BIA. The species has also been recorded at Shark Bay. The Australian sea lion exhibits high site fidelity with little movement of females between colonies has been observed. There is little or no interchange of females between breeding colonies, even between those separated by short distances. Australian sea lions may be present in the Phase 1 and Phase 2 operational areas, however, it is unlikely that they will be present in significant numbers.

Marine Reptiles

The PMST identified five species of marine turtle that may occur within, or in the waters surrounding, the Phase 1 and Phase 2 operational areas, including the flatback, green and hawksbill turtle, (all listed as Vulnerable and Migratory) and the leatherback and loggerhead turtle (listed as Endangered and Migratory). There is a BIA (internesting buffer) for loggerhead turtles around Point Cloates in the southern part of Ningaloo Reef, at Cape Farquhar south of Gnarloo, and around the northern end of Dirk Hartog Island within Shark Bay. Loggerhead turtles may be present in Phase 1 and Phase 2 operational areas, however, it is unlikely that they will be present in significant numbers.

The short-nosed seasnake is listed as Critically Endangered under the EPBC Act. The species prefers the reef flats or shallow waters along the outer reef edge in water depths to 10 m. It has been reported short-nosed seasnakes tend not move more than 50 m away from reef flats. There are no shallow areas or reefs within the Phase 1 and Phase 2 operational areas, and since the species is not likely to move far from shallow waters or reefs it is not likely to be encountered during the survey.

Whale Shark

The whale shark is listed as Vulnerable and Migratory under the EPBC Act. This species is normally oceanic and cosmopolitan in their distribution occurring in both tropical and temperate waters. They are known to aggregate in the reef front waters adjacent to the Ningaloo Reef between March and July. Preliminary research on the migration patterns of whale sharks has shown that after departing Ningaloo Reef they head north through the NWMR with some individuals passing Scott and Ashmore Reefs. Short-term tags have indicated whale sharks move northwest into the Indian Ocean but may also move directly north towards Sumatra and Java.

The Phase 1 operational area does not represent any critically important areas (migration, breeding or foraging areas) for the whale shark. It is possible that whale sharks may be encountered during the operations within the Phase 1 operational area. However, it is not expected that whale sharks will be encountered in significant numbers and those individuals that are encountered are likely to be transient.

White Shark

There is a BIA for foraging great white sharks around the Houtman Abrolhos Islands, which correlates with the Australian sea lion BIA (sea lions being a key prey species for great white sharks). Great white sharks are listed as Vulnerable under the EPBC Act. The Phase 2 operational area does not overlap the BIA for foraging great white sharks.

Seabirds

A search of the EPBC Protected Matters database listed 38 species of seabird that may occur in the Phase 1 and Phase 2 operational areas. Of these, 13 species are classified as Vulnerable and four are classified as Endangered. There are a number of BIA for breeding and foraging on and surrounding the Houtman Abrolhos Islands. **Tables 2-2** and **2-3** identify the BIA for individual seabird species that overlap the Phase 1 and Phase 2 operational areas.

2.5 SOCIO-ECONOMIC ENVIRONMENT

2.5.1 Commercial Fisheries

State fisheries administered by the WA Department of Fisheries (DoF) that can operate in the Rocket MC2D Phase 1 and Phase 2 operational areas include:

- Roe's Abalone Fishery;
- Abrolhos Islands and Mid West Trawl Managed Fishery;
- West Coast Purse Seine Fishery;
- Gascoyne Demersal Scalefish Fishery;
- Shark Bay Prawn Fishery*;
- Shark Bay Scallop Fishery*;
- Mackerel Managed Fishery;
- West Coast Rock Lobster Fishery;
- West Coast Deep Sea Crustacean Managed Fishery; and
- West Coast Demersal Scalefish Resource.

*Note: Current fishing effort of these fisheries does not overlap the Phase 1 and Phase 2 operational areas.

Commonwealth fisheries administered by the Australian Fisheries Management Authority (AFMA) that can operate in the Rocket MC2D Phase 1 and Phase 2 operational areas include:

- Southern Bluefin Tuna Fishery;
- Western Deepwater Trawl Fishery;
- Western Skipjack Fishery; and
- Western Tuna and Billfish Fishery.

State Administered Fisheries

Roe's Abalone Fishery

The Phase 1 and Phase 2 operational areas overlap Area 8 of the Roe's abalone fishery area. However, the Roe's abalone fishery is a dive and wade fishery, operating in shallow coastal waters along WA's western and southern coasts. The fishery harvest method is a single diver working off a 'hookah' (surface-supplied breathing apparatus) using an abalone 'iron' to prise the shellfish off rocks. It is therefore unlikely that abalone diving would take place within the Phase 1 and Phase 2 operational areas.

Abrolhos Islands and Mid West Trawl Managed Fishery

The Abrolhos Islands and Mid West Trawl Managed Fishery is based on the take of saucer scallops, with a small component targeting the western king prawn in the Port Gregory area. The fishery operates between 27°51´ south latitude and 29°03´ south latitude on the landward side of the 200 m isobath. No scallop fishing occurred in this fishery during 2012 because the annual scallop survey showed scallop abundance below the limit level to commence fishing. The Phase 2 operational area excludes the Abrolhos Islands but overlaps a small part of the area for this fishery.

West Coast Purse Seine Fishery

The West Coast Purse Seine Fishery mainly captures pilchards and the tropical sardine (or scaly mackerel; referred to as sardinella) by purse seine in the West Coast Bioregion. Smaller catches of Perth herring, yellowtail scad, Australian anchovy, maray and other species are also reported. There are three defined fisheries: the Perth metropolitan fishery operates between 31° S and 33° S latitude; the Southern Development Zone covers waters between 33° S and Cape Leeuwin; and the Northern Development Zone covers waters between 22° S and 31° S. The Phase 1 and Phase 2 operational areas fall within the Northern Development Zone of the fishery.

Gascoyne Demersal Scalefish Fishery
The Gascoyne Demersal Scalefish Fishery includes both commercial and recreational (line) fishing for demersal scalefish species in continental shelf waters. Commercial vessels historically focused on the pink snapper oceanic stock. Licensed vessels fish year-round with mechanised handlines .and target a number of other demersal species along with pink snapper, such as; goldband snapper, rosy snapper , ruby snapper, red emperor, emperors, cods, pearl perch, mulloway, amberjack and trevallies. The fishery operates in the waters of the Indian Ocean and Shark Bay between latitudes 23°07'30"S and 26°30'S. There are also a limited number of licensed charter vessels and a large number of recreational vessels that fish out of Denham, Carnarvon and around the Ningaloo area (Coral Bay, Tantabiddi and Exmouth). Recreational fishers are managed using maximum and minimum legal lengths, daily bag and possession limits, and limitations on the use of certain fishing gears.

The Phase 1 and Phase 2 operational areas overlap this fishery. Therefore, it is possible that vessels fishing in this fishery could operate in the vicinity of the survey vessel during the survey.

Mackerel Managed Fishery
The Mackerel Managed Fishery uses near-surface trolling gear from small vessels in coastal areas around reefs, shoals and headlands to target Spanish mackerel. Jig fishing is also used to capture grey mackerel, with other species from other genera also contributing to commercial catches. Permit holders may only fish for mackerel by trolling or handline. The fishery extends from the West Coast Bioregion to the WA/NT border, with most effort and catches recorded north of Geraldton, especially from the Kimberley and Pilbara coasts. The Phase 1 and Phase 2 operational areas overlap Areas 3 (Gascoyne/West Coast) of the fishery. Therefore, it is possible that vessels fishing in this area could operate in the vicinity of the survey vessel during the survey.

West Coast Rock Lobster Fishery
The West Coast Rock Lobster Managed Fishery targets the western rock lobster, on the west coast of WA between Shark Bay and Cape Leeuwin, using baited traps (pots) between Latitudes 21°44´ to 34°24´ S. The fishery is managed in three zones: Zone A – Abrolhos Islands, north of latitude 30° S excluding the Abrolhos Islands (Zone B) and south of latitude 30° S (Zone C). With annual production historically averaging about 11,000 t this has been Australia's most valuable single species wild capture fishery and was the first fishery in the world to achieve Marine Stewardship Council certification.

The Phase 1 operational area overlaps Zone B and the Phase 2 operational area overlaps Zones A and C. Therefore, it is possible that vessels fishing in these areas could operate in the vicinity of proposed survey operations.

West Coast Deep Sea Crustacean Managed Fishery
The boundaries of the West Coast Deep Sea Crab Managed Fishery include all the waters lying north of latitude 34°24'S (Cape Leeuwin) and west of the Northern Territory (NT) border on the seaward side of the 150 m isobath out to the extent of the Australian Fishing Zone. This fishery targets crystal (snow) crabs, giant (king) crabs and champagne (spiny) crabs using baited pots operated in a long-line formation in the shelf edge waters (>150 m) of the West Coast. The fishery is a quota based 'pot' fishery that operates mainly in depths of 500-800 m. No fishing is permitted in depths <150 m, with the only allowable method for capture being baited pots ('traps').

The Phase 1 and Phase 2 operational areas overlap this fishery. Optimal fishing effort occurs in deep offshore waters between 500 and 1,000 m, most of the commercial crystal crab catch is taken in depths between 500 to 800 m on the continental shelf slope. Therefore, it is possible that vessels fishing in these areas could operate in the vicinity of proposed survey operations.

West Coast Demersal Scalefish Resource
The West Coast Demersal Scalefish Resource comprises inshore and offshore suites of demersal scalefish species that are exploited by different commercial fisheries and recreational and charter fishers that operate in the West Coast Bioregion. The West Coast Inshore Demersal suite occurs in waters 20-250 m deep with approximately 100 species of this suite caught by these fisheries. The most important species are the WA dhufish and pink snapper with other species captured including redthroat emperor, bight redfish and baldchin groper. The West Coast Offshore Demersal suite, which occurs in waters >250 m deep, includes eightbar grouper, hapuku, blue-eye trevalla and ruby snapper. The fishery is

managed as the West Coast Demersal Scalefish (Interim) Managed Fishery and encompasses the waters of the Indian Ocean just south of Shark Bay (at 26°30'S) to just east of Augusta (at 115°30'E) and extends seaward to the 200 nm boundary of the Australian Fishing Zone. The Phase 1 and Phase 2 operational areas overlap the area of this fishery.

Commonwealth Administered Fisheries

Western Deepwater Trawl Fishery

The Western Deepwater Trawl Fishery operations in WA extend from 115°08' E in the south to 114° E in the north. The fishery catches more than 50 species in waters exceeding 200 m depth in habitats ranging from temperate-subtropical in the southern region to tropical in the north region. Catches in the fishery were dominated historically by six main commercial finfish species including orange roughy, oreos, boarfish, eteline snapper, apsiline snapper and sea bream. Between 2000 and 2005, deepwater bugs emerged as the most important target species. However, there has been a large reduction in effort and catch over the past three years. The Phase 1 and Phase 2 operational areas overlap the area of this fishery, therefore, it is possible that vessels fishing in these areas could operate in the vicinity of proposed survey operations.

Southern Bluefin Tuna Fishery

The Southern Bluefin Tuna Fishery targets juvenile southern bluefin tuna (2–3 years old) in the Great Australian Bight using purse-seine gear, mainly from December to April. These operations are concentrated in shelf and upper slope waters of the eastern Bight, with the maximum fishing intensity in 2012 being concentrated on a relatively small area just north of the shelf break. Throughout the rest of its range, southern bluefin tuna is targeted by pelagic longliners, with the focus being on domestic longliners operating along Australia's east coast. Although the fishery area covers the Phase 1 and Phase 2 operational areas, activities in the fishery are primarily confined to the waters off South Australia with smaller areas along the south east coastline, such as northeast of Eden in New South Wales. Therefore, activity in this fishery does not overlap the operational areas.

Western Skipjack Tuna Fishery

The Western Skipjack Tuna Fishery is not active in continental shelf waters of the Carnarvon Basin. The skipjack tuna is the only target species in the fishery and in recent years, activities in the fishery have largely been confined to waters in the Great Australian Bight and northeast of Eden in New South Wales. Therefore, activity in this fishery does not overlap the Phase 1 and Phase 2 operational areas.

Western Tuna and Billfish Fishery

The Western Tuna and Billfish Fishery extends from Cape York westwards around the NT and WA coast and across to the Great Australian Bight, out to the limit of the Australian Fishing Zone. The fishery primary targets broadbill swordfish, yellowfin tuna, bigeye tuna and albacore tuna. The majority of catch and effort in the fishery occurs in Commonwealth waters off the central west coast of WA, with fishing effort in the northwest located north of Broome in the Kimberley, west of Scott Reef with the majority of effort concentrated south of Geraldton (~30°S) and there was no activity at all in the fishery during the 2010-2011 season. Activity in this fishery is unlikely to overlap the Phase 1 and Phase 2 operational areas to any substantial extent.

2.5.2 Petroleum Exploration and Production

The Phase 1 and Phase 2 operational areas overlap exploration permits WA-492-P and WA-493-P, and the 2013 Round 2 Acreage Releases W13-20 and W13-19. There are a number of petroleum wells within the operational areas. There are three abandoned wells within the Phase 1 operational area, and nine in the Phase 2 operational area. There are no petroleum production facilities or pipelines within the operational areas.

2.5.3 Commercial Shipping

There is significant amount of commercial shipping activity within the Phase 1 and Phase 2 operational areas. The main commercial shipping traffic route for the west coast of WA is located within the operational areas, and is associated with entry to the Port of Geraldton and the Port of Fremantle. Therefore, heavy commercial bulk shipping traffic will be encountered within the operational areas, as follows:

- international bulk freighters/tankers arriving and departing from Port of Geraldton and Port of Fremantle, including mineral ore, hydrocarbons (LNG, liquefied petroleum gas, condensate) and salt carriers;
- commercial fishing vessels;
- construction vessels/barges/dredges; and
- offshore survey vessels.

2.5.4 Tourism and Recreation

There are a number of recreational activities, such as recreational fishing, boating, diving and marine-based tourism, which occur near the coast and the islands off Ningaloo Reef, and from Shark Bay to Geraldton and the Abrolhos Islands. However, the Abrolhos Islands (located in an exclusion zone within the Phase 2 operational area) do have limited visitation, with the most visits occurring between the months of August and November.

A range of fishing activities are available to recreational fishers in the Gascoyne and West Coast bioregions regions of WA. In the Gascoyne bioregion, most of the recreational boat fishing is undertaken in embayments and shallow-water boat angling in Shark Bay, Exmouth Gulf and Ningaloo lagoons. Offshore boat angling for demersal and larger pelagic species is undertaken offshore from Ningaloo and Exmouth. The West Coast bioregion contains the State's major population centres and therefore is the most heavily used recreational fishing area. Recreational boat fishing opportunities occur mostly in either in estuaries and embayments or offshore for demersal and pelagic/game species often around islands and out to the edge of the continental shelf.

The Abrolhos Islands also attracts seasonal marine-based tourism attractions that offer interactions with marine wildlife, including whale watching with humpback whales, Australian sea lion encounters and fishing charter expeditions.

2.5.5 Cultural Heritage

There are no current or pending Native Title Determinations for the waters and seabed within or immediately adjacent to the Phase 1 and Phase 2 operational areas.

A search of the National Shipwrecks Database indicates that there are forty-three listed historic shipwrecks located within and in the vicinity of the Phase 1 and Phase 2 operational areas, with the majority of these located around the Abrolhos Islands.

The wreck sites of HMAS *Sydney II* and HSK *Kormoran* (located ~22 km apart at a distance of ~290 km west south-west of Carnarvon) were wrecked after a battle in 1941 during Second World War. Both shipwreck sites are protected and are located within the Phase 1 operational area, ~55 km from the western boundary. Both wreck sites have a protected or no-entry zone with a radius of 800 m around the location.

2.5.6 National Heritage

There is one heritage place listed on the Commonwealth Heritage List and the National Heritage List within the Phase 1 operational area—the HMAS *Sydney II* and HSK *Kormoran* Shipwreck Sites – Carnarvon. The *Batavia* Shipwreck Site and Survivor Camps Area 1629 - Houtman Abrolhos national heritage site is located in the Abrolhos Island exclusion zone in the Phase 2 operational area.

2.5.7 Marine Parks and Reserves

The Phase 1 and Phase 2 operational areas overlap the following proposed Commonwealth Marine Reserves (CMR):

<u>Phase 1 Operational Area</u>

- Carnarvon Canyon CMR*
  - Habitat Protection Zone (IUCN IV)
- Gascoyne CMR*
  - Habitat Protection Zone (IUCN IV)
  - Marine National Park Zone (IUCN II)
  - Multiple Use Zone (IUCN VI)
- Shark Bay CMR*

    - Multiple Use Zone (IUCN VI)
- Abrolhos CMR*
    - Marine National Park Zone (IUCN II)
    - Multiple Use Zone (IUCN VI)

Phase 2 Operational Area

- Abrolhos CMR*
    - Marine National Park Zone (IUCN II)
    - Multiple Use Zone (IUCN VI)
    - Special Purpose Zone (IUCN VI)

***Transitional arrangements**: Until management plans come into effect for the new proposed CMR in the NWMR and SWMR (which was scheduled to occur in July 2014 but did not take place) transitional arrangements apply and there are no changes on the water for users of the new proposed reserves—i.e. seismic surveys are permitted to take place within any zone of the proposed CMR.

2.5.8 Other Protected Areas

There are no World Heritage Properties (WHP) or Ramsar Wetlands of International Importance located within the Phase 1 and Phase 2 operational areas or immediate vicinity. The nearest WHP to the operational areas are the Ningaloo Coast WHP and the Shark Bay WHP, At the closest points, the eastern boundary of the Phase 1 operational area is located ~7.5 km from the boundary of the Ningaloo Coast WHP offshore from Point Cloates, and ~5 km from the boundary of the Shark Bay WHP, offshore from Dirk Hartog Island.

The Phase 2 operational area incorporates an exclusion zone around the Abrolhos Islands, which encompasses WA State waters around the islands and the Abrolhos Islands Fish Habitat Protection Area (FHPA - the boundary of which is contiguous with the WA State waters boundary around the islands). At the closest point, the boundary of the Phase 2 operational area is located ~8 km from the Abrolhos Islands FHPA boundary, on the western side of the islands.

2.5.9 Defence Activities

The RAAF Learmonth Airspace R859A, R859B, R859C, R860A, R860B, R860C, R861A, R861B, R862A and R862B components are located adjacent to the northern boundary of the Phase 1 operational area. These components make up the Learmonth Air Weapons Range. When activated by a Notice to Airmen (NOTAM), the restricted airspace can operate down to low altitudes including sea level.

3 DESCRIPTION OF THE ACTIVITY

3.1 LOCATION

The Rocket MC2D MSS Phase 1 and Phase 2 operational areas lie entirely in Commonwealth waters within the southern part of the NWMR and the northern part of the SWMR. The Phase 1 operational area incorporates Exploration Permits WA-492-P and WA-493-P and adjacent open acreage areas (**Figure 1–1**), and the Phase 2 operational area incorporates Release Areas W13-19 and W13-20 and adjacent open acreage areas (**Figure 1–2**).

Boundary coordinates for the Phase 1 and Phase 2 operational areas are provided in **Table 1–1**.

At the closest points, the eastern boundary of the Phase 1 operational area is located ~7.5 km from the boundary of the Ningaloo Coast World Heritage Property (WHP) offshore from Point Cloates, and ~5 km from the boundary of the Shark Bay WHP, offshore from Dirk Hartog Island. The minimum separation distance from the boundary of the Phase 1 operational area and the nearest land is ~10 km, at Steep Point (**Figure 1–1**). The eastern ends of the 2D lines are separated from the boundaries of the Ningaloo Coast WHP and the Shark Bay WHP by a buffer zone of at least 20 km, ensuring that during line run-outs and line turns neither the survey vessel nor any part of the towed array will enter either the Ningaloo Coast or Shark Bay WHP. Similarly, during line run-outs and line turns along the eastern side of the Phase 1 operational area neither the survey vessel nor any part of the towed array will enter WA State waters.

The Phase 2 operational area incorporates an exclusion zone around the Houtman Abrolhos Islands, which encompasses WA State waters around the islands and the Abrolhos Islands Fish Habitat Protection Area (FHPA - the boundary of which is contiguous with the WA State waters boundary around the islands) (**Figure 1–2**). At the closest point, the boundary of the Phase 2 operational area is located ~8 km from the Abrolhos Islands FHPA boundary, on the western side of the islands. The ends of the 2D lines in the area to the north and west of the Abrolhos Islands are located at least 15 km from the Abrolhos Islands FHPA boundary, ensuring that during line run-outs and line turns neither the survey vessel nor any part of the towed array will enter WA State waters or the Abrolhos Islands FHPA.

Water depths in both the Phase 1 and Phase 2 operational areas range from ~50 m to ~4,000 m, with the deepest water depths occurring along the western edges of both operational areas.

3.2 TIMING

The Rocket MC2D MSS is planned to commence in December 2014, dependent on the availability of the survey vessel for conducting the survey, client data requirements, fair sea state conditions suitable for marine seismic acquisition, and granting of necessary statutory approvals. The survey is planned to have a maximum duration of ~120 days, with Phase 1 and Phase 2 each having a scheduled duration of ~50 to 60 days. Phase 2 (~5,639 line km of 2D acquisition) will commence after the completion of Phase 1 (~5,200 line km of 2D acquisition) of the survey, and all seismic acquisition will be completed by the end of June 2015.

3.3 SEISMIC PROGRAMME

3.3.1 Survey Parameters

The marine seismic survey proposed is a typical 2D 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. The survey will be conducted using a purpose-built seismic survey vessel.

During the proposed activities, the survey vessel will traverse a series of pre-determined sail lines within the Phase 1 and Phase 2 operational areas at a speed of ~8-9 km/hour (~4.5 knots). As the vessel travels along the survey lines a series of noise pulses (every 8-12 seconds) will be directed down through the water column and seabed. The released sound is attenuated and reflected at geological boundaries and the reflected signals are detected using sensitive microphones arranged along a single hydrophone cable (streamer) towed behind the survey 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.

There are a total of 49 lines the Phase 1 operational area, with a total length of 5,200 line km and a minimum separation distance of ~5 km and a maximum separation distance of ~20 km (**Figure 1–1**). There are a total of 26 lines in the Phase 2 operational area, with a total length of 5,639 line km and a separation distance of ~20 km (**Figure 1–2**).

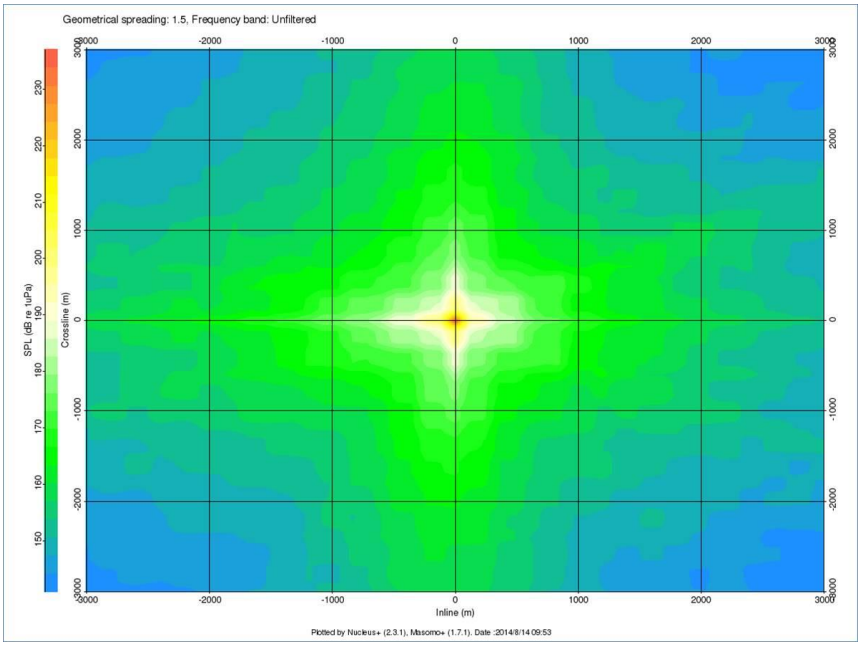
A summary of the parameters for the Rocket MC2D MSS is provided in **Table 3-1**. The seismic array will comprise of a single solid streamer, with a maximum length of 8,100 m. Line spacing in both the Phase 1 and Phase 2 operational areas will be ~20 km. The source (airgun array) tow depth will be 6 m (+/- 1 m) and the streamer tow depth will be 12 m (+/- 1 m). The operating pressure for the airgun array will be ~2,000 psi. The airgun array will have a maximum volume of 4,280 cui. This array will be fired at a shotpoint interval of 37.5 m horizontal distance, and will produce at source (i.e. within a few metres of the airgun array) sound pulses in the range of 237-262 dB re 1 µPa-m (sound pressure level - SPL), at frequencies extending up to ~150 Hz.

Table 3-1 - Rocket MC2D MSS acquisition parameters

Parameter	Value
No. of streamers	1 (solid)
Streamer length	max. 8,100 m
Streamer tow depth	12 m (+/- 1 m)
Size of airgun array	4,280 cui
Operating pressure	2,000 psi
Source interval	37.5 m
Source depth	6 m (+/- 1 m)
Line spacing	~20 km
Peak source sound pulse (SPL)	237-262 dB re 1 µPa-m (at 1 m)
Frequency range	0-~150 Hz

Based on internal source signature modelling conducted for this 4,280 cui airgun array the sound pulses from this airgun array are expected to decrease to SPL in the order of 180 dB re 1µPa-m within 1 km of the source and approximately 165 dB re 1µPa-m within 2 km, dependent on the sound propagation characteristics of the area (**Figure 2–3**).

Figure 3-1 - Modelled SPL for the 4,280 cui array



The survey will be conducted in water depths ~50 m to ~4,000 m. Therefore, it is unlikely that any of the towed equipment will make contact with the seabed or benthic communities.

3.3.2 Survey Vessels

Spectrum proposes to conduct the survey using a purpose-built seismic survey vessel, the MV *Duke*, which is owned and operated by Gardline CGG, a Joint Venture between Gardline and CGG. The MV *Duke* has all necessary certification/registration and is fully compliant with all relevant MARPOL and SOLAS convention requirements for a vessel of this size and purpose. The vessel will travel within the Phase 1 and Phase 2 operational areas at an average speed of 8-9 km per hour.

No support vessel will be used during the survey, as the MV *Duke* will refuel and re-supply in port during the course of the survey. All crew changes will be carried out in port as well. A dedicated chase vessel will be utilised during the survey for all seismic acquisition operations in the Phase 2 operational area. The purpose of the chase vessel will be to manage interactions with commercial fishing vessels and shipping during acquisition and movements of the survey vessel in the Phase 2 operational area. A specific chase vessel for Phase 2 of the Rocket MC2D MSS has not yet been identified or contracted by Gardline CGG, but it will a vessel sourced from within WA, most likely a cray fishing vessel from a local port such as Geraldton, Port Denison or Kalbarri.

No at sea refuelling of the survey vessel will occur during the Rocket MC2D MSS. The MV *Duke* will be re-supplied and refuelled in port, probably in the Port of Geraldton.

4 ENVIRONMENTAL IMPACTS AND RISKS

An Environmental Risk Assessment (ERA) has been undertaken to understand and manage the environmental impacts and risks associated with the Rocket MC2D MSS. This ERA is designed to provide:

- details of the environmental impacts and risks for the survey;
- an evaluation of all the impacts and risks, appropriate to the nature and scale of each impact or risk; and
- details of the control measures that will be used to reduce the impacts and risks of the activity to as low as reasonably practicable (ALARP) and to an acceptable level.

4.1 METHODOLOGY

The risk assessment has been undertaken to identify the sources of risk (aspects) and potential environmental impacts associated with the activity and to assign a level of significance or risk to each impact. The environmental risks associated with the survey have been assessed by a methodology that:

- identifies the activities and the environmental aspects associated with them;
- identifies the values/attributes at risk within and adjacent to the operational areas;
- defines the potential environmental effects of the activities;
- identifies the likelihood of occurrence and potential consequences; and
- determines overall environmental risk levels using a likelihood and consequence matrix.

Risks were identified during the ERA for both planned (routine and non-routine) and unplanned (accidents/incidents) activities. Potential environmental impacts are then determined based on the stressor type. Risk evaluation further develops the understanding of a risk by defining the impacts and assessing appropriate controls. Risk evaluation for the Rocket MC2D MSS considered previous risk assessments for similar activities, review of relevant studies, review of past performance, external stakeholder consultation feedback and review of the existing environment and key sensitivities/values.

The following key steps were undertaken for each identified risk during the risk assessment:

- identification of decision type in accordance with a decision support framework;
- identification of appropriate control measures (preventative and mitigation) aligned with the decision type; and
- determination of the residual risk rating.

4.2 RISK EVALUATION

Environmental risks cover a wider range of issues, multiple species, persistence, reversibility, resilience, cumulative effects and variability in severity. The degree of environmental risk and the corresponding threshold for acceptability has been adapted to include principles of ecological sustainability, the precautionary principle and the corresponding environmental risk threshold decision-making principles used to determine acceptability.

4.2.1 Demonstration of ALARP

For the evaluation of all environmental impacts and risks associated with the Rocket MC2D MSS impacts and risks are considered to be reduced to ALARP where:

- The residual risk is **LOW**:
  - good industry practice or comparable standards have been applied to control the risk, because any further effort towards risk reduction is not reasonably practicable without sacrifices grossly disproportionate to the benefit gained.
- The residual risk is **MEDIUM** or **HIGH**:
  - good industry practice is applied for the situation/ risk; or
  - alternatives have been identified and the control measures selected to reduce the impacts and risks to ALARP.

4.2.2 Demonstration of Acceptability

The following process has been applied to demonstrate acceptability:

- **LOW** residual risks are 'Broadly Acceptable', if they meet legislative requirements, industry codes and standards, regulator expectations, the Spectrum HSE Policy and industry guidelines.
- **MEDIUM** and **HIGH** residual risks are 'Broadly Acceptable' if ALARP can be demonstrated using good industry practice, risk based analysis, if societal concerns are accounted for and the alternative control measures are disproportionate to the benefit gained.
- **SEVERE** residual risks are 'Intolerable' and therefore 'Unacceptable'. Risks will require further investigation and mitigation to reduce the risk to a lower and more acceptable level. If after further investigation the risk remains in the severe category, the risk requires appropriate business sign-off to accept the risk.

4.3 RISK EVALUATION SUMMARY

The ERA for the Rocket MC2D MSS indicates that the residual environmental impacts and risks associated with the activity will be reduced to ALARP and are of an acceptable level. The ERA identified 17 sources of environmental risk, including 11 planned and six unplanned types, which are all assessed as having a **Low** or **Medium** residual risk following implementation of identified control measures (**Table 4-1**).

The ERA identified a number of environmental impacts and risks that were assessed as not being applicable (not credible) to normal acquisition operations within the Phase 1 and Phase 2 operational areas. These impacts and risks were not included in the detailed risk evaluation. All of these impacts and risks were determined to have a **Low** level of residual risk.

A summary of the risk evaluation for the Rocket MC2D MSS, and the control measures that will be implemented reduce impacts and risks to ALARP and acceptable levels, is provided in **Table 4-1**.

Table 4-1 - Summary of environmental impacts and risks, potential impacts and control measures

Aspect	Source of Risk	Key Potential Environmental Impacts	Risk Rating			Control Measures
			Consequence	Likelihood	Resdiual Risk	
PLANNED (ROUTINE AND NON-ROUTINE) ACTIVITIES						
Physical presence of survey vessel	Vessel noise emissions (excluding seismic acoustic emissions)	Short-term localised disturbance to marine fauna, such as alteration of behaviours and localised displacement	Slight	Unlikely	**Low**	Interaction between survey and chase vessels and cetaceans, turtles, Australian sea lions and whale sharks within operational areas will be consistent with EPBC Regulations 2000 – Part 8 Division 8.1 (Regulation 8.04) – Interacting with cetaceans: • during periods when survey vessel is transiting operational areas without seismic array deployed, or during process of deployment or retrieval of array, the vessel will not travel at speeds greater than 6 knots within 300 m of a cetacean, turtle, Australian sea lion or whale shark (caution zone), and will not approach closer than 100 m from an animal (with exception animals bow riding) These interaction procedures will apply for chase vessel for duration of activities in the Phase 2 operational area
	Interaction with commercial fisheries and shipping	Disruption to fishing vessels Potential direct and indirect noise impacts on target species Restriction of access to fishing grounds, loss/damage to gear Recreational take of finfish Temporary disruption / exclusion of shipping traffic	Minor	Possible	**Medium**	Operations of survey vessel must comply with COLREG; STCW Convention; Marine Orders Part 21; Marine Orders Part 30; Marine Order 28
						Operations of survey vessel will be in accordance with Marine Notice 21/2013, and with Marine Notice 4/2012
						AMSA RCC will advised of survey prior to mobilisation to ensure that NAVAREA X and AUSCOAST warnings can be issued and kept up to date. AMSA RCC will also be notified of survey completion
						AHS is advised of survey details not less than two weeks prior to mobilisation so that AHS can then issue a NTM
						Survey vessel will have an AIS tracking device installed and operating to aid identification by other vessels
						Fishermen and other mariners will be alerted of survey vessels' presence and extent of towed array
						Further notification of activity details to relevant commercial fisheries management agencies, fishing industry bodies and individual companies and licence holders, three weeks prior to the survey commencing
						Provision of seven to ten day forecasts of operations within Phase 2 operational area to WRLC, GFC, GPFA, KPFA, UMWPFA. These key stakeholders will also be provided with notification of completion of activities in Phase 2 operational area, and overall completion of the survey
						Further notification of acquisition operations within Phase 2 operational area to Geraldton Port Harbour Master prior to mobilization, so that Harbour Master can inform Pilots, Agents and owners of any shipping using shipping fairway during survey operations to be further advised of survey details
						Use of dedicated chase vessel to manage interactions with commercial fishing vessels and shipping, during seismic acquisition operations in Phase 2 operational area
						Use of smallest possible seismic source - lowest possible total capacity for airgun array
						Lost towed equipment will be relocated and recovered where safe and practicable to do so
						Recreational fishing from survey vessel will be prohibited
						Adherence to relevant Gardline CGG shipboard safety procedures, as described in Shipboard Safety Procedures Manual (SSPM) and Safety Operations Manual (SOM)

Aspect	Source of Risk	Key Potential Environmental Impacts	Risk Rating			Control Measures
			Consequence	Likelihood	Resdiual Risk	
	Biofouling of vessel hull, other niches and immersible equipment	Introduction and establishment of IMS and displacement of native marine species	Slight	Highly Unlikely	**Low**	Whilst in Australian waters, survey vessel must operate in accordance with conditions detailed in "Approval to Berth" issued by AQIS
						Risks of introducing IMS via biofouling into WA waters and ports will be managed in accordance with marine pest management guidelines (as enforced under WA *Fish Resources Management Act 1994*; and Fish Resources Management Regulations 1995)
						Application of guidelines detailed in National Biofouling Management Guidance for the Petroleum Production and Exploration Industry, and in IMO *Guidelines for the Control and Management of Ships' Biofouling to Minimize the Transfer of Invasive Aquatic Species*
						Survey vessel will have had a recent dry dock, IMS inspection and antifoulant application prior to mobilising to Australian waters
						Survey vessel will have only operated in Australian waters between arriving in WA in August 2014 and commencement of Rocket MC2D MSS
						If survey vessel has to leave Australian waters before completion of survey, it will be required to undergo a further IMS inspection and cleaning (if required), prior to re-entering Australian waters to complete survey
						Chase vessel that will be utilized for activities in Phase 2 operational area will be local fishing vessel sourced from Geraldton or another local port, which does not represent an IMS risk
Seismic acoustic emissions	Underwater noise emissions from discharge of airgun array	Disturbance to marine fauna, particularly whales, marine turtles and pinnipeds, involving potential physiological and behavioural effects	Slight	Unlikely	**Low**	Operation of seismic source within Phase 1 and Phase 2 operational areas at all times during survey must comply with all requirements of EPBC Act Policy Statement 2.1 - Interactions between offshore seismic activities and whales Part A Standard Management Procedures, including: • precaution zones (Observation zone: 3 km+; Low power zone: 2 km; and Shut-down zone: 500 m) All of Part A Standard Management Procedures will be applied for whale sharks as well as for whales
						Operation of seismic source within Phase 1 and Phase 2 operational areas at all times during survey must comply with following Part B Additional Management Procedures: • two dedicated Marine Fauna Observers (MFO) on survey vessel for duration of survey
						Operation of seismic source within Phase 1 and Phase 2 operational areas during peak period for northbound migration of pygmy blue whales in region (1 April to 31 May) must comply with following Part B Additional Management Procedures: • application of increased precaution zones (Observation zone: >3 km; Shut-down zone: 2 km) • application of an increased Pre Start-up Visual Observation of 45 minutes, rather than 30 minutes • if acoustic source is required to power-down / shutdown three or more times during preceding 24-hour period as a result of sighting pygmy blue whales, then seismic operations must not be undertaken thereafter at night-time or during low visibility conditions. Seismic operations cannot resume at night-time or during low visibility conditions, until there has been a 24-hour period, which included seismic operations during good visibility conditions, during which no power-downs / shut-downs have occurred for pygmy blue whale sightings
						Use of smallest possible seismic source - lowest possible total capacity for airgun array
						Survey vessel personnel (seismic crew) provided with pre-survey briefing on EPBC Act Policy Statement 2.1 requirements
						No discharge of seismic source will occur outside of Phase 1 and Phase 2 operational areas
						Communication with any geophysical contractors operating other seismic survey vessels in Phase 1 and Phase 2 operational areas during Rocket MC2D MSS to agree upon, and implement, a minimum separation distance of 60 km between their survey vessel and MV *Duke*

Aspect	Source of Risk	Key Potential Environmental Impacts	Risk Rating			Control Measures
			Consequence	Likelihood	Resdiual Risk	
Routine discharges	Discharge of ballast water	Introduction and establishment of IMS and displacement of native marine species	Slight	Highly Unlikely	**Low**	Ballast water discharges from survey vessel must comply with requirements of Australian Ballast Water Management Requirements The Ballast Water Management Plan for the MV *Duke* must comply with: • Regulation B-1 of International Convention for the Control and Management of Ship's Ballast Water and Sediments 2004 and should have been prepared in accordance with: • IMO Guidelines for Ballast Water Management and the Development of Ballast Water Management Plans (IMO Resolution MEPC.127(53) Application of AQIS guideline that ballast exchanges be conducted as far as possible away from shore and in water at least 200 m deep
	Discharge of bilge water, sewage and food wastes	Localised eutrophication of the water column; and localised adverse effect to marine biota	Slight	Unlikely	**Low**	Bilge water discharges (machinery space bilges) from survey and chase vessels must comply with requirements of: • MARPOL Annex I – Oil • *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* - Section 9 Survey vessel – bilge water discharges can occur only if: • vessel has an IMO approved / MARPOL compliant oily water separator (International Oil Pollution Prevention Certificate [IOPPC]) • vessel is proceeding en route (i.e. is not stationary); and oil content less than 15 parts per million (ppm); and • oil discharge monitoring and control system and oil filtering equipment are operating Chase vessel: • oil and all oily mixtures must be retained aboard for onshore disposal • or: - vessel is proceeding en route; and has in operation an IMO approved / MARPOL compliant oily water separator that ensures oil content less than 15 ppm Sewage discharges from survey and chase vessel must comply with requirements of: • MARPOL Annex IV – Sewage • *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* - Section 26D • Marine Order 96 Sewage will be comminuted and using an IMO approved / MARPOL compliant sewage treatment plant, and can be discharged if: • vessel is >3 nm from nearest land; and • sewage originating from holding tanks is discharged at a moderate rate (as defined in Marine Order 96) while vessel is proceeding en route at a speed not less than 4 knots Sewage that is not comminuted or disinfected can be discharged if: • vessel is >12 nm from nearest land; and • sewage originating from holding tanks is discharged at a moderate rate (as defined in Marine Order 96) while vessel is proceeding en route at a speed not less than 4 knots Food waste discharges from survey and chase vessels must comply with requirements of: • MARPOL Annex V – Garbage • *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* - Section 26F • Marine Order 95 Food wastes can be discharged from survey and chase vessel if: • it is comminuted or ground to a particle size <25 mm; the vessel is en route; and • the discharge takes place as far as practicable from the nearest land, but in any case, ≥3 nm from the nearest land Food wastes that are not comminuted or ground can be discharged from survey and chase vessel if: • the vessel is en route; and the discharge takes place as far as practicable from the nearest land, but in any case, ≥3 nm from the nearest land Operations of survey and chase vessel will be in accordance with Marine Notice 6/2012 Adherence to relevant Gardline CGG shipboard safety procedures, as described in Shipboard Safety Procedures Manual (SSPM)

Aspect	Source of Risk	Key Potential Environmental Impacts	Risk Rating			Control Measures
			Consequence	Likelihood	Resdiual Risk	
UNPLANNED ACTIVITIES (ACCIDENTS / INCIDENTS)						
Physical presence of survey vessel and towed array	Collision between survey vessels / towed array and marine fauna	Injury or fatality to protected marine fauna (cetaceans, turtles, Australian sea lion, whale shark)	Minor	Highly Unlikely	**Low**	Any incidents of vessel or towed array collision with cetaceans, turtles, Australian sea lions and whale sharks must be reported as reportable incidents for the activity, in accordance with: • Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 – Regulation 26
						Interaction between survey and chase vessels and cetaceans, turtles, Australian sea lions and whale sharks within operational areas will be consistent with EPBC Regulations 2000 – Part 8 Division 8.1 (Regulation 8.04) – Interacting with cetaceans: • during periods when survey vessel is transiting operational areas without seismic array deployed, or during process of deployment or retrieval of array, the vessel will not travel at speeds greater than 6 knots within 300 m of a cetacean, turtle, Australian sea lion or whale shark (caution zone), and will not approach closer than 100 m from an animal (with exception animals bow riding) These interaction procedures will apply for chase vessel for duration of activities in the Phase 2 operational area
						Operations of survey and chase vessel will be in accordance with Marine Notice 12/2011
	Equipment dragging or loss	Localised physical damage to benthic habitats	Slight	Unlikely	**Low**	Adherence to relevant Gardline CGG shipboard safety procedures, as described in Safety Operations Manual (SOM)
						Streamer equipped with pressure-activated, self-inflating buoys designed to bring equipment to surface if lost accidentally
						Use of a solid streamer, rather than a fluid-filled streamer
						Lost towed equipment will be relocated and recovered where safe and practicable to do so
						Streamer deployment and recovery will only take place within Phase 1 and Phase 2 operational areas
Waste management	Accidental release of hazardous or non-hazardous waste	Pollution and contamination of the environment and secondary impacts of marine fauna (e.g. ingestion, entanglement)	Slight	Unlikely	**Low**	Handling of hazardous wastes aboard survey and chase vessels must comply with requirements of: • MARPOL Annex III – Harmful Substances • *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* - Section 26AB • Marine Order 94
						Handling of non-hazardous wastes (garbage) aboard survey and chase vessels must comply with requirements of: • MARPOL Annex V – Garbage • *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* - Section 26F • Marine Order 95
						Operations of survey and chase vessel will be in accordance with Marine Notice 6/2012
						Adherence to relevant Gardline CGG shipboard safety procedures, as described in Shipboard Safety Procedures Manual (SSPM)
						Application of garbage, solid and liquid wastes handling and disposal requirements: • No discharge of plastics or plastic products of any kind from survey or chase vessel • No discharge of domestic wastes or maintenance wastes from survey or chase vessel • All waste receptacles aboard survey and chase vessel covered with tightly fitting, secure lids to prevent any solid wastes from blowing overboard • All solid, liquid and hazardous wastes (other than bilge water, sewage and food wastes) will be incinerated or compacted (if possible) and stored in designated areas and sent ashore for recycling, disposal or treatment • Hydrocarbons located above deck stored with some form of secondary containment to contain leaks or spills (e.g. bund, containment pallet, transport packs) • Correct segregation of solid and hazardous wastes

Aspect	Source of Risk	Key Potential Environmental Impacts	Risk Rating			Control Measures
			Consequence	Likelihood	Resdiual Risk	
Non-routine/ accidental hydrocarbon release	Hydrocarbon release caused by topsides (vessel) loss of containment	Localised and temporary reduction in water quality due to hydrocarbon contamination Toxic effects on marine fauna and flora Direct and indirect effects on commercial and recreational fisheries	Slight	Unlikely	**Low**	Control measures to prevent release of hydrocarbons to sea resulting from spill to deck aboard survey and chase vessels must comply with requirements of: • MARPOL Annex I – Oil • *Protection of the Sea (Prevention of Pollution from Ships) Act 1983* - Section 9 • Marine Order 91
						Survey vessel must have a Shipboard Oil Pollution Emergency Plan (SOPEP) that complies with requirements of: • Regulation 37 of MARPOL Annex I • Marine Order 91
						Survey vessel must have valid International Oil Pollution Prevention Certificate (IOPPC]) applicable to vessel class
						Storage: • Any hydrocarbon storage on deck of survey vessel must be designed and maintained to have at least one barrier (i.e. form of bunding) to contain and prevent deck spills entering sea. This can include containment lips on deck (primary bunding) and/or secondary containment measures (bunding, containment pallet, transport packs, absorbent pad barriers) in place
						Equipment: • Equipment located on deck utilising hydrocarbons (e.g. cranes, winches or other hydraulic equipment) will have as a minimum primary bunding (i.e. deck edge lips or up-stands) to prevent loss of hydrocarbons to the sea • Equipment located on deck utilising hydrocarbons (e.g. cranes, winches or other hydraulic equipment) will be maintained to reduce risk of loss of hydrocarbon containment to the sea. Ongoing maintenance will be accordance with the planned maintenance system (PMS) for survey vessel – Section 10 of SSMM
						Spill Response: • Survey vessel SOPEP will be in prescribed format described in Guidelines for the Development of Shipboard Oil Pollution Emergency Plans, adopted by IMO as Resolution MEPC.54(32) • SOPEP drill was conducted in Australian waters between survey vessel's arrival off WA coastline (August 2014) and commencement of survey • Further two SOPEP drills will be conducted during course of survey • All drills will be reported as per MARPOL Annex I (Regulation 15) requirements and reviewed as part of ongoing monitoring and improvement of emergency control measures • Spill response bins/kits are maintained and located in close proximity to hydrocarbon storage areas and deck equipment / bunkering areas for use to contain and recover deck spills
	Hydrocarbon release caused by loss of structural integrity from vessel collision between survey vessel and third-party vessel	Localised and temporary reduction in water quality due to hydrocarbon contamination Toxic effects on marine fauna and flora Direct and indirect effects on commercial and recreational fisheries	Moderate	Highly Unlikely	**Medium**	Operations of survey vessel must comply with COLREG; STCW Convention; Marine Orders Part 21; Marine Orders Part 30; Marine Order 28
						Prevention of vessel collisions: • Good industry practice measures to minimise the likelihood of vessel collision
						Immediate actions: • In event of vessel-to-vessel collision, implementation of measures described in Section 4 – Ship Collision, of Gardline CGG Emergency Contingency Manual (ECM)
						Survey vessel must have Shipboard Oil Pollution Emergency Plan (SOPEP) in place that complies with requirements of: • Regulation 37 of MARPOL Annex I • Marine Order 91
						Reporting of any spills of hydrocarbons to sea from survey vessel must comply with requirements of: • Marine Order 91

Aspect	Source of Risk	Key Potential Environmental Impacts	Risk Rating			Control Measures
			Consequence	Likelihood	Resdiual Risk	
						Reporting: • When a fuel/oil spill to sea occurs survey vessel Master will inform RCC Australia using POLREP form. RCC Australia, in turn, will notify AMSA and/or WA DoT • Any diesel spills to sea >80 L will be reported to NOPSEMA and WA DMP as reportable incidents
						Response strategy: The primary response strategy in the event of a diesel spill to sea from the survey vessel will be to: • Immediate notification to RCC Australia • Allow small diesel spills to disperse and evaporate naturally, and monitor position and trajectory of any surface slicks
						Spill monitoring: • In event of major diesel spill from survey vessel to sea, Gardline CGG and Spectrum will implement relevant Type I "Operational Monitoring" implemented for spill surveillance and tracking • If there is likelihood of diesel spill impacting any protected areas (e.g. Ningaloo Coast and Shark Bay WHP, Abrolhos Islands FHPA) Spectrum will work with relevant stakeholders to develop and implement appropriate Type II "Scientific Monitoring" to understand effects of spill and any response activities on the marine environment
						Stakeholder consultation: • Pre-survey consultation with AMSA and WA DoT to ensure agreement in place for SOPEP interface with NATPLAN, WestPlan-MOP and WA DoT OSCP • Consultation in event of major diesel spill - relevant stakeholders (apart from Combat Agencies) will be contacted in event of a large diesel spill occurring in Phase 1 and Phase 2 operational areas during survey
						Insurances: • Gardline CGG has public liability insurance that covers any pollution that could result in environmental damage, specifically pollution emanating from their vessels. As such, this insurance would cover cost of environmental monitoring or clean-up post spill

4.4 POTENTIAL ENVIRONMENTAL IMPACTS FROM UNDERWATER NOISE EMISSIONS

4.4.1 Disturbance to Benthic Invertebrates

Few marine invertebrates have sensory organs that can perceive sound pressure, but many have organs or elaborate arrays of tactile 'hairs' that are sensitive to hydro-acoustic disturbances. These sensory hairs or organs are collectively known as mechanoreceptors, and crustaceans are particularly well endowed with them. Close to a seismic source, the mechano-sensory system of many benthic crustaceans will perceive the 'sound' of airgun pulses, but for most species such stimulation would only occur within the near-field or closer, perhaps within distances of several metres from the source.

Decapod crustaceans have a variety of external and internal sensory receptors that are potentially responsive to sound and vibration. Many of these resemble vertebrate receptors that respond to hydrodynamic stimulation, particle motion and possibly pressure. However, the exoskeleton and body plan of aquatic decapods are more capable of responding to particle displacement components of an impinging sound field than pressure changes. The limited acoustic sensitivity of decapods is also related to their lack of any gas-filled spaces such as those associated with pressure detection in fishes. However, many decapods have extensive arrays of hair-like receptors both on and inside their exoskeleton that most probably respond to water- or substrate-borne displacements, and they also have many proprioceptive organs that may perceive vibrations.

An extensive and thorough review, published in 2004, provides a summary of impacts of seismic airguns on marine invertebrates based on literature reviews. It concludes that "very limited numbers of experiments were scientifically and reasonably conducted" but the results of nine quantitative studies showed five cases of immediate (lethal or physical) impacts of seismic airguns on invertebrate species and four cases of no impacts (**Table 4-2**). One study showed physiological impacts and another showed no physiological impact. Three cases showed behavioural impacts and one study showed no impact on behaviour.

Table 4-2 - Summary of impacts of seismic airguns on marine invertebrates based on literature reviews

	Lethal / physical	Physiological / pathological	Behavioural	Catch rate
Negative impacts observed	*Loligo vulgaris* *Chionoecetes opilio* (eggs) *Chlamys islandicus* Sea urchins *Architeuthis dux*	*Bolinus brandaris*	*Alloteuthis sublata* *Sepioteuthis australs* *Architeuthis dux*	*Bolinus brandaris*
No impacts observed	*Chionoecetes opilio* *Mytilus edulis* *Gammarus locusta* *Crangon crangon*	*Chionoecetes opilio*	*Chionoecetes opilio*	*Crangon crangon* *Penaeus blebejus* *Nephrops norvegicus* *Illes coindetti* *Squilla mantis* *Paphia aurea* *Anadara inaequivalvis*

In the winter of 2003 and spring of 2004, the Canadian Department of Fisheries and Oceans (DFO) conducted a study on the effects of seismic on snow crab in conjunction with a seismic survey off the western coast of Cape Breton. Crabs were caged at water depths of 63 and 73 m (experimental site) and 85 m (control site). The seismic survey involved 132 hours of survey time with a low volume (1,310 cui) airgun array. Maximum sound pressure levels (rms SPL) received at the test and control sites were 174 dB re 1µPa and 118 dB re 1µPa, respectively. The caging experiment examined short (12 days) and medium (five months) term differences in the morphology and physiology of snow crab at test and control sites. Snow crabs from both groups were also observed under laboratory conditions for differences in mortality, morphology, physiology, feeding and orientation (turnover rate) over a five month period. This seismic survey did not cause any acute or mid-term mortality of the crab, nor was there any evidence of changes to feeding in the laboratory. Survival of embryos being carried by female crabs, and locomotion of the resulting larvae after hatch, were unaffected by the seismic survey. In the short term, gills, antennules and statocysts (balance organs) were soiled in the test group but they were found to be completely cleaned of sediment when sampled five months later.

In this study, some differences were reported between the test and control animals. There was indication of some slight histological differences in the control and test groups but the differences can reasonably be attributed to natural variability associated with the different oceanography/feeding regimes at the locations where the control and experimental animals were collected and held in the environment.

A number of studies have examined the potential effects of seismic surveys on catch levels in fisheries targeting benthic crustaceans such as prawns and rock lobster. One study investigated the effect of seismic surveys on prawn fisheries in relatively shallow waters (2-15 m) in Camamu Bay, north-western Brazil. Catch rates of various shrimp species were measured before and after use of a four airgun array with a source peak pressure of 196 dB re 1µPa at 1 m. Catch rates were found to be unaffected. The experiment was carried out over a period of a few days whereby in-migration would not be a confounding factor. It is also noted that the authors carried out histopathological studies on gonadal and hepatopancreatic tissue and reported that there was no damage that could be associated with exposure. This study did not detect any significant deleterious impacts of seismic airgun noise on various penaeid species, suggesting that prawn stocks are resilient to the disturbance by airguns under the experimental conditions applied.

The findings of this study are supported by pilot observations carried out by the DFO on commercially important northern shrimp where no “flight or fright” reactions were found in animals exposed to relatively high sound levels in the laboratory. Thus, although crustaceans can be expected to detect the particle motion component of sound as revealed by sensitive electrophysiological or other techniques, this does not mean that they would be “scared” and subsequently move away from a seismic operation, thereby causing ramifications for catchability.

Another study investigated the effect of seismic airgun discharges on southern rock lobster via statistical analysis of the coincidence between seismic surveys and changes in commercial catch rates in western Victoria between 1978 and 2004. There was no evidence that catch rates of rock lobsters in western Victoria were affected by seismic surveys in the weeks or years following the surveys. However, most seismic surveys occurred in deep water, where impacts would be expected to be minimal. The apparent lack of impact of seismic surveys on catch rates of rock lobsters is consistent with the limited information available on the physiological effects of seismic surveys on invertebrates, including rock lobsters.

The majority of benthic crustaceans will only exhibit a behavioural response to airgun pulses at extremely close range, which means that only surveys run in very shallow water will have any effect. A conservative figure for the minimum depth for a response would be at 15 m from the array. Any disturbance to benthic crustaceans immediately beneath an airgun array would be extremely short-lived as they would be only exposed to one or two pulses before the source moves out of the potential range within which any disturbance may occur. The response of benthic crustaceans, such as rock lobster, at close range to an airgun array discharge may be little more than a ‘tail flip’ response.

4.4.2 Disturbance to Planktonic Organisms

Except for fish eggs, larvae and other minute planktonic organisms within a few meters of an airgun, no planktonic organisms are likely to be affected significantly by airgun array discharges. Data presented in **Table 4-3** indicates that the range of pathological effect on fish eggs and larvae is likely to be restricted to less than approximately 2 m. Calculations show that less than 0.02% of plankton in the area would be affected. Any effect on the planktonic organisms from the seismic discharge is insignificant compared with the size of the planktonic population in a survey area or natural mortality rates for planktonic organisms.

Table 4-3 - Observed seismic noise pathological effects on fish eggs and larvae

Species	Source	Source level (dB re 1 µPa @ 1m)	Distance from source (m)	Exposure level (dB re 1 µPa)	Observed effect
Cod (larvae 5 days)	Single airgun	250	1	250	Delamination of the retina
Cod (larvae 2-10 days)	Single airgun	222	1	222	No injuries detected
			10	202	No injuries detected
Fish eggs (Anchovy)	Single airgun	230 (estimated)	1	230	7.8% of eggs injured relative to control
			10	210	No injuries detected
Fish eggs (Red Mullet)			1	230	No injuries detected
			10	210	No injuries detected
Dungeness Crab (larvae)	Seven airgun array	244 (estimated	1	233.5	No significant difference in survival rate relative to controls
			3	230.9	
			10	222.5	

4.4.3 Disturbance to Fish

Studies with caged fish have shown that some fish species that are caged, and therefore unable to swim away from the noise source, can suffer physiological damage to eyes and hearing. Conditions that could result in fish being trapped and unable to move more than a few metres from the noise source as the survey vessel traverses the area do not exist in the proposed survey area (indeed it is difficult to conceive of any vessel-based seismic survey causing fish to be trapped within a few metres of the noise source). Therefore, it is considered that the risk of physiological effects on fish is negligible.

For some fish, strong 'startle' responses have been observed at sound levels of 200 to 205 dB re 1µPa, indicating that sounds at or above this level may cause fish to move away from the vessel. Sound levels of this intensity are likely to occur approximately 100 to 300 m from an airgun array. Based on this an approximate range of 200 m is given as the minimum distance at which fish may move away from an operating array and below which physical effects may occur. More recent studies have found that active avoidance may occur in some fish species at sound levels of approximately 161–168 dB re 1µPa rms, which corresponds to a distance of approximately 1 km from the survey vessel.

Based on existing information, significant impacts on fish populations resulting from seismic survey noise are likely to be restricted to the following:

- short ranges and high sound intensities (i.e. <200 m range from source);
- populations that cannot move away from operating arrays (e.g. site-attached reef species);
- surveys that take place over protracted periods close to areas important for the purposes of feeding, spawning or breeding; and
- surveys that take place over protracted periods close to areas that constitute narrow, restricted migratory paths.

Available evidence suggests that behavioural changes for some fish species may be no more than a nuisance factor. For example, the temporary, short range, displacement of pelagic or migratory fish populations may have insignificant repercussions at a population level.

There is a high likelihood that seismic airgun noise could cause the following effects in some finfish:

- avoidance;
- startle/alarm response;
- changes in swimming patterns (including change in swimming speed and direction); and
- changes in vertical distribution.

These effects are expected to be short-lived, with duration of effect less than or equal to the duration of exposure, are expected to vary between species and individuals, and be dependent on the properties of received sound. The ecological significance of such effects is expected to be low, except where they influence reproductive activity.

The threshold received sound exposure levels (SEL) that could result in various behavioural effects in fish outlined above are:

Low level behavioural effects:

- avoidance at >140 dB re 1µPa^2.s (pelagic species and the more nomadic demersal species);
- startle/alarm at >160 dB re 1µPa^2.s (species with limited home ranges or site-attached and/or territorial strategies).

High level behavioural effects:

- fright/flight at >180 dB re 1µPa^2.s (species with limited home ranges or site-attached and/or territorial strategies).

There are no documented cases of fish mortality upon exposure to seismic airgun noise under field operating conditions.

The threshold received SELs that could result in various sub-lethal and/or physiological effects are:

- onset of short term reversible loss in hearing sensitivity (temporary threshold shift - TTS) at >180 dB re 1µPa^2.s (site-attached species);
- onset of longer term loss in hearing sensitivity (TTS/permanent threshold shift – PTS) at >187 dB re 1µPa^2.s (site-attached species); and
- TTS onset but no injury to non-auditory tissues to ~1 kg sized fish at >200 dB re 1µPa^2.s (site-attached species).

The potential effects of marine streamer seismic surveys have been summarised as part of a detailed environmental assessment of geophysical exploration for mineral resources on the Gulf of Mexico outer continental shelf. This assessment concluded that negligible to potentially adverse effects on fish may occur from seismic surveys. However, these effects were not considered biologically significant due to the following factors:

- seismic survey noise may disturb fish and may produce temporary or permanent hearing impairment in some individuals, but it is unlikely to cause death or life-threatening injury;
- seismic surveys are not expected to cause long term or permanent displacement of any listed species from critical/preferred habitat; and
- seismic surveys are not expected to result in destruction or adverse modification of critical or essential fish habitat.

4.4.4 Disturbance to Baleen Whales

Baleen whales produce a rich and complex range of underwater sounds ranging from about 12 Hz to 8 kHz but with the most common frequencies below 1 kHz. This combined with studies of their hearing apparatus suggests that their hearing is also best adapted for low frequency sound. Baleen whales make individual sounds that may last for up to 16 seconds and humpback whales are known to “sing” for long periods. These sounds are thought to be used in social interactions and communication between individuals and groups.

Table 4-4 lists the estimated source levels, frequency ranges and dominant frequencies of baleen whale calls for species that may be encountered during the proposed survey. It can be seen that some species produce quite high sound levels. Likewise, other studies report humpback whale song components

reaching 192 dB re 1µPa^2 (pk-pk) as well as levels of 180 to 190 dB re 1µPa^2 (pk-pk) for humpback pectoral fin slapping and breaching sounds.

Physical damage to the auditory system of cetaceans may occur at noise levels of about 230 to 240 dB re 1µPa, which is equivalent to a distance of about one to two metres from the energy source. Because of the good swimming abilities of marine mammals and their avoidance of either the vessel or the airgun array, it is highly unlikely that any marine mammals will be exposed to levels likely to cause pathological damage.

Table 4-4 - Sounds produced by baleen whales that may be encountered during the proposed survey

Species	Frequency (Hz)	Dominant frequency (Hz)	Estimated source level (dB re 1µPa.m)
Blue	12-31,000	16-25, 6,000–8,000	130–188
Humpback	25–8,200	25–4,000	144–192
Minke	60-20,000	60-12,000	151-175
Bryde's	70–950	700-900	152-174

Noise associated with airguns used during seismic surveys can cause significant behavioural changes in whales. Behavioural responses to airgun noise include swimming away from the source, rapid swimming on the surface and breaching. The level of noise at which response is elicited varies between species and even between individuals within a species. Some evidence suggests that different groups of cetaceans adopt different strategies for responding to acoustic disturbance from seismic surveys with baleen and killer whales displaying localised avoidance, pilot whales showing few effects and sperm whales showing no observed effects.

A comprehensive study carried out in the Exmouth Gulf region of WA monitored the effects of seismic survey noise on humpback whales. The following conclusions were drawn from this research:

- only localised avoidance was seen by migrating whales during the seismic operation, indicating that the 'risk factor' associated with the seismic survey was confined to a comparatively short period and small range displacement;
- coupled with the fact that humpback whales were seen to be actively utilising the 'sound shadow' near the surface, then it is unlikely that animals will be at any physiological risk unless at very short range from a large airgun array, perhaps of the order of a few hundred metres; and
- upper levels of noise at 1.5 km from the seismic survey array are in the order of 182 dB re 1µPa^2, which is still well below the source levels of the highest components of humpback whale song (192 dB re 1µPa^2). Thus at 1.5 km the received airgun signal is still well within the range which humpback whales would be expected to cope with physiologically, since it would be difficult to argue that humpback whale song can cause physiological problems to the animals.

With regards to avoidance behaviour by baleen whales, it is known that baleen whales will avoid operating seismic vessels and the distance over which the avoidance occurs seems to be highly variable between species and even within species. It is considered that this avoidance behaviour represents only a minor effect on either the individual or the species unless avoidance results in displacement of whales from nursery, resting or feeding areas, at an important period for the species. The survey area and adjacent waters are not known critical habitats for any cetacean species.

The study conducted in Exmouth Gulf found that migrating humpback whales show a general avoidance of an operating seismic source at 157 to 164 dB re 1µPa (rms). Resting cow pods show avoidance at somewhat lower levels—for example, a mean sound level for avoidance of 140 dB re 1µPa (rms) and a mean standoff range at 143 dB re 1µPa (rms).

4.4.5 Disturbance to Toothed Whales

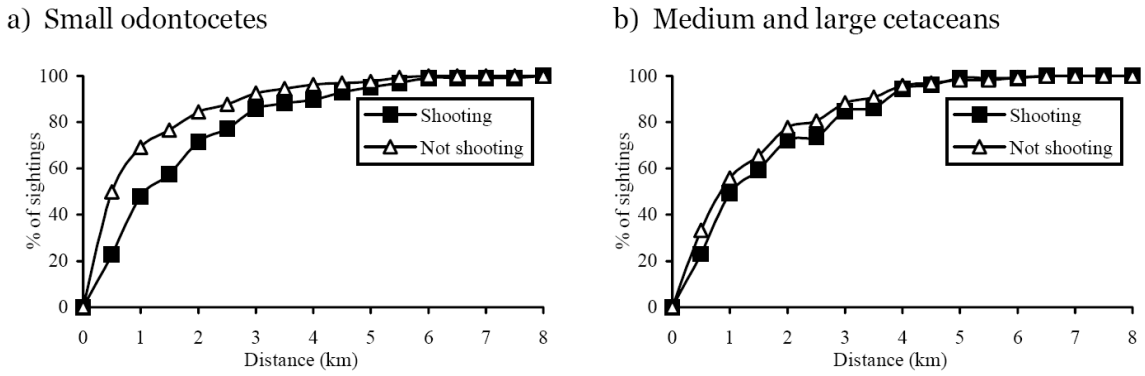
Toothed whales produce a wide range of whistles, clicks, pulsed sounds and echolocation clicks. The frequency range of toothed whale sounds excluding echo location clicks are mostly <20 kHz with most of the energy typically around 10 kHz, although some calls may be as low as 100 to 900 Hz. Source levels range from 100 to 180 dB re 1 µPa. The sounds produced, other than echo location clicks, are very complex in many species and appear to be used for communication between members of a pod in socialising and coordinating feeding activities.

For toothed whales exposed to single short pulses, the TTS threshold appears to be in the range of 186 to 202 dB re 1 µPa. Seismic pulses with received levels of 186 dB re 1 µPa or more are usually restricted to a radius of no more than about 300 m around a seismic airgun array, therefore the potential for TTS is extremely low as it would be necessary for the whale to be less than one kilometre from the airgun array and remain within this range as the vessel traversed a distance of four to five kilometres.

There is little systematic data on the behavioural response of toothed whales to seismic surveys. One study reported that sperm whales appeared to react by moving away from surveys and ceasing to call even at great distances from a survey. However, in a study supported by the US Minerals Management Service two controlled exposure experiments were carried out (including one with three simultaneously tagged whales) to monitor the response of sperm whales to seismic source. The whales were exposed to a maximum received level of 148 dB re 1µPa. There was no indication that the whales showed horizontal avoidance of the seismic vessel nor was there any detected change in feeding rates of the tagged sperm whales.

Smaller toothed cetaceans have poor hearing in the low frequency range of airgun array noise (10 to 300 Hz) and seismic operators sometimes report dolphins and other small toothed whales near operating airgun arrays. However, there is a component of seismic pulses in the higher spectrum and in general most toothed whales do show some limited avoidance of operating seismic vessels. One study examined the effects of 3D seismic surveys on common dolphins in the Irish Sea. The results indicated that there was a local displacement of dolphins around the seismic operation. This observation is consistent with other data from marine mammal observers aboard seismic vessels in the North Sea that shows small toothed whale species tend to move away from operating airguns (see **Figure 4–1**).

Figure 4-1 - Proportion of marine mammal sightings occurring within specified distances of the airguns during seismic surveys



The hearing capability of larger toothed whales (such as the killer whale) is unknown, but it is possible that they can hear better in the lower frequencies than the smaller toothed cetaceans. If this is the case, in lieu of any other information, their reactions to seismic survey vessels may be akin to those of the baleen whales.

It is considered that the potential adverse effect on toothed whales would only occur if the whale is within close range (i.e. less than a few hundred metres).

4.4.6 Disturbance to Marine Turtles

Electro-physical studies have indicated that the best hearing range for marine turtles is in the range 100 to 700 Hz, which overlaps with the frequency range of maximum energy in the horizontally propagating component of a seismic array 'shot'. Studies indicate that marine turtles may begin to show behavioural responses to an approaching seismic array at received sound levels of approximately 166 dB re 1 µPa (rms), and avoidance at around 175 dB re 1 µPa (rms). This corresponds to behavioural changes at approximately two kilometres, and avoidance from approximately one kilometre.

Marine turtles may possibly be exposed to noise levels sufficient to cause physical damage if airgun arrays start suddenly with turtles nearby (less than 30 m). In circumstances where arrays are already operating, (i.e. as a vessel moves along an acquisition line), individuals would be expected to implement avoidance measures before entering ranges at which physical damage might take place.

Based on current information, it would appear that significant impacts on marine turtle populations resulting from seismic survey noise are likely to be restricted to:

- short ranges and high sound intensities (perhaps less than 30 m range from source);
- surveys that take place over protracted periods close to areas important for feeding, breeding and nesting; and
- surveys that take place over protracted periods close to areas that constitute narrow, restricted migratory paths.

Feeding areas and migratory paths of turtles traverse both shallow and deep-water areas, and therefore individuals of all sizes may be encountered in a seismic survey area. It has been speculated that migrating turtles may use various acoustic cues and that acoustic disturbances might interfere with their navigational ability. The auditory sensitivity of marine turtles is reported to be centred in the 400 to 1,000 Hz range, with a rapid drop-off in noise perception on either side of this range. This auditory range matches their weak vocalisation abilities, which are also in the low frequency range (100 to 700 Hz).

From airgun exposure tests on a caged green turtle and a loggerhead turtle (see **Table 4-5**), that were extrapolated to response levels for a typical airgun array operating at full power in 100 m water depth, it can be concluded that turtles would, in general, probably show behavioural responses at two kilometres and avoidance behaviour at one kilometre from such operations. However, they also noted that such rules of thumb for acoustic sources with frequencies within the range of turtle hearing (<1 kHz), cannot be reliably applied to shallow coastal waters near reefs, islands and nesting beaches, where transmission losses are typically much higher than in deeper, open water areas.

There is no evidence implying that turtles actively avoid or are attracted to close range (less than 500 m) encounters with operating airgun arrays. However, one study tested if hearing sensitivity of caged loggerhead turtles altered after exposure to several hundred pulses within 30-65 m of a single airgun (pulse numbers and received sound levels not stated). Hearing was tested before, within a day, then two weeks after exposure. Approximately 50% of the exposed individuals indicated altered hearing sensitivity when tested within a day of their exposure, but none provided any sign of altered hearing two weeks later, compared to the pre-exposure tests.

Table 4-5 - Results of airgun exposure to marine turtles

Species	Received level (dB re 1 µPa rms)	Effect
Loggerhead turtle	175-176	Avoidance response
One green and one loggerhead turtle	166	Noticeable increase in swimming behaviour, presumed avoidance response
One green and one loggerhead turtle	175	Behaviour becomes increasingly erratic, presumed alarm response

4.4.7 Disturbance to Pinnipeds

Pinnipeds are divided into two families: Phocidae and Otariidae. Based on a review of the literature, phocid species (true seals) have consistently demonstrated an extended frequency range of hearing compared to otariids, especially in the higher frequency range. This is believed to be because phocid ears are anatomically distinct from otariid ears in that phocids have larger, more dense middle ear ossicles, inflated auditory bulla, and larger portions of the inner ear (i.e. tympanic membrane, oval window, and round window), which make them more adapted for underwater hearing.

Australian sea lions are otariids (sea lions and fur seals). Based on a review by NOAA the functional hearing range of phocid pinnipeds has been estimated as 75 Hz to 100 kHz, and the functional hearing range of otariid pinnipeds has been estimated as 100 Hz to 40 kHz. The airgun array proposed for the Rocket MC2D MSS will produce pulses across a frequency range of 0-150 Hz – i.e. largely below the functional hearing range of otariids such as the Australian sea lion, which are better adapted to detecting higher frequency underwater sounds.

Underwater audiograms for some sea lions and fur seals indicate that their greatest sensitivity lies in the range 2-32 kHz and these pinnipeds are therefore likely to be less sensitive to low frequency (<1 kHz) sounds than to higher frequency (>1 kHz) sounds. The low frequency sounds (10-300 Hz) produced by seismic airgun arrays appear to fall below the range of otariid pinniped greatest hearing sensitivity. This interpretation must be treated with caution, as little data exists for low frequency thresholds and hearing sensitivities of Australian pinnipeds. However, it is recognised that seismic activity will only be a threat to pinnipeds if it take place close to critical habitats.

Australian sea lions make underwater sounds including barks, whinnies and buzzing associated with social interactions. It has been measured that the projected energy for these sounds is between 0.25 and 2 kHz frequency, and their hearing range is approximately between 0–4 kHz, in comparison to the airgun array proposed for the Rocket MC2D MSS, which will produce pulses in the range of 0-150 Hz.

One study reported that an airgun caused an initial startle reaction among South African fur seals, but was ineffective in scaring them away from fishing gear. Gray seals exposed to noise from airguns reportedly did not react strongly. Seals in both water and air sometimes tolerate strong noise pulses from nonexplosive and explosive scaring devices, especially if attracted to the area for feeding or reproduction. Monitoring studies conducted in 1996–97 for an open-water seismic programme in the Alaskan Beaufort Sea indicated that seals (mainly ringed seals) usually tolerate strong sound pulses from nearby seismic vessels. Only a minority of the seals within a few hundred metres show evidence of localised avoidance, and any effects on seal behaviour are not very consistent or conspicuous. During discharge of a full seismic array it was measured that there was a partial avoidance zone of Arctic seals from the vessel at distances under 150 m, with the seals not moving farther than 250 m from the vessel.

Based on the limited data on pinnipeds in water exposed to multiple pulses, exposures in the ~150 to 180 dB re 1 µPa range (rms values over the pulse duration) generally have limited potential to induce avoidance behaviour in pinnipeds. Received levels exceeding 190 dB re 1 µPa were determined to be likely to elicit responses, at least in some ringed seals, which are phociids. Based on the modelled sound pressure levels (SPL) for the 4,280 cui proposed for use during the Rocket MC2D MSS, SPL >190 dB re 1 µPa would only occur within ~500 m of the operating array.

In the case of pinnipeds exposed to sequences of airgun pulses from an approaching seismic vessel, most animals may show little avoidance unless the received levels are high enough for mild temporary threshold shift (TTS) to occur. A paper published in 2007 proposed injury (i.e. TTS onset) criteria for pinnipeds in water of 218 dB re 1 µPa (SPL), or an SEL of 186 dB re 1 μPa^2-s. SPL / SEL of these magnitudes would only be experienced at extremely close range (e.g. <50 m or so) from an operating array of the size proposed for the Rocket MC2D MSS, particularly for otariid species such as Australian sea lions. The noise created during seismic surveys is generally considered to be outside of the hearing range of Australian sea lions, and is therefore not considered to be a great source of disturbance, and the species is mobile and can exhibit avoidance behaviour if disturbed.

4.4.8 Disturbance to Sharks

Limited research has been conducted on shark responses to marine seismic surveys. Sharks differ from bony fish in that they have no accessory organs of hearing such as a swim bladder and therefore are unlikely to respond to acoustical pressure. One study also suggested that the lateral line system does not respond to normal acoustical stimuli, and is unable to detect sound-induced water displacements beyond a few body lengths, even with large sound intensities. Other reports indicate that sharks are highly sensitive to sound between approximately 40 and 800 Hz, which overlaps with seismic sound frequencies. Another study established that an individual shark will suddenly turn and withdraw from a sound source of high intensity (more than 20 dB re 1µPa above broadband ambient SPL) when approaching within 10 m of the sound source.

The available evidence indicates sharks will generally avoid seismic sources and the likely impacts on whale sharks and white sharks are expected to be limited to short-term behavioural responses, possibly including avoidance of the operating airgun array. These behavioural responses are unlikely to be significant at a population level (see **Section 4.4.9**).

It is highly unlikely that the underwater noise emissions from the airgun array would cause any pathological effects (lethal and sub-lethal injuries), resulting in immediate and delayed mortality and physiological effects on whale sharks and white sharks.

4.4.9 Spatial and Temporal Overlap with Critical Habitat and Peak Periods of Activity for Protected Marine Fauna

Humpback whales

The Phase 1 and Phase 2 operational areas for the Rocket MC2D MSS do not represent critical habitat (e.g. calving, nursing, resting, breeding, feeding areas; narrow restricted migratory pathways) for any cetacean species that may occur in the region. The central part of the Phase 1 operational area is located adjacent to the humpback whale resting area in Shark Bay, but at the closest point the minimum separation distance is ~30 km.

Whilst the Phase 1 and Phase operational areas overlap the BIA (migration north and south) for humpback whales, the timing of the survey will mean that acquisition will be completed prior to the peak period for the northbound migration in area between Jurien Bay and Carnarvon (early to mid-July). Additionally, the survey will not overlap any component of the southbound migration of humpback whales in the region, as it will commence after the end of the 2014 migration season. Therefore, some humpback whales may be encountered in both the Phase 1 and Phase 2 operational areas towards the end of the survey (i.e. May to June 2015). These animals will be transient and able to move around and away from the survey vessel and acoustic source, as the operational areas do not overlap any critical habitat for humpback whales in the region.

Pygmy blue whales

The Phase 1 and Phase 2 operational areas overlap the BIA (migration north and south) for pygmy blue whales off the coast of WA. Consequently, there is the possibility that migrating (and possibly feeding) pygmy blue whales may be encountered in both the Phase 1 and Phase 2 operational areas during the survey. The survey will overlap the peak period for the northbound migration of pygmy blues between the Perth Canyon and North West Cape (early April to late May). Migrating blue whales will be transient and able to move around and away from the survey vessel and acoustic source.

Marine turtles

The Phase 1 and Phase 2 operational areas for the Rocket MC2D MSS do not represent critical habitat (e.g. nesting, internesting, breeding, feeding areas; narrow restricted migratory pathways) for any marine turtle species that may occur in the region. Additionally, the two operational areas do not overlap any BIA for marine turtles in the NWMR (there are no designated BIA for turtles in the SWMR).

Australian sea lion

The Phase 2 operational area overlaps ~400 km^2 of the BIA (foraging [male]) for Australian sea lions in the waters surrounding the Abrolhos Islands. However, only ~5 km of the end of one the 2D lines in the Phase 2 operational area actually overlaps this BIA.

This species will be present in the region year round and therefore may be present in or transiting through the waters in the south-east corner of the Phase 2 operational area. Maximum utilisation of the islands they live on occurs during their breeding season, which for most islands in the area occurs between January and June. However, the overlap between areas where the full airgun array will be being discharged (i.e. not during line run-ins and run-outs) and this BIA is minimal (~5 km). Impacts are likely to be restricted to short-term and temporary behavioural responses of any animals in the immediate vicinity (less than a few hundred metres) of the survey vessel when the full airgun array is being discharged.

White shark

The Phase 2 operational area overlaps ~125 km^2 of a BIA (foraging) for white sharks in the waters surrounding the Abrolhos Islands. However, none of the 2D lines in the Phase 2 operational area actually overlap this BIA. Impacts are likely to be restricted to short-term and temporary behavioural responses of any animals in the immediate vicinity (less than a few hundred metres) of the survey vessel when the full airgun array is being discharged. These behavioural responses are unlikely to be significant at a population level, particularly as there is only a very small area of overlap between the Phase 2 operational area and the BIA, and given that none of the 2D lines overlap the BIA.

Whale shark

The Phase 1 and Phase 2 operational areas do not represent critically important areas (migration, breeding or foraging areas) for the whale shark. The Phase 1 operational area does not overlap the BIA (foraging – high density prey) that is located along Ningaloo Reef, and acquisition in the Phase 1 operational area will be completed well before the commencement of the seasonal aggregation of whale sharks at Ningaloo Reef (April to June). Given that satellite tagging/tracking studies have shown that when leaving Ningaloo Reef some whale sharks head south before migrating off on three broad trajectories into the Indian Ocean it is possible that whale sharks may be encountered during the operations within the northern part of the Phase 2 operational area. However, it is not expected that whale sharks will be encountered in significant numbers and those individuals that are encountered are likely to be transient.

4.4.10 Cumulative Impact Assessment

There is a possibility that there may be a number of marine seismic surveys taking place over the same area, and during the same timeframe (December 2014 to June 2015), which could result in cumulative impacts on matters of National Environmental Significance (NES), such as whales, the Australian sea lion and the white shark. This sub-section assesses the potential cumulative impact the Rocket MC2D MSS may have if it coincides with other seismic surveys in the same area.

Imperial Multiclient 2D MSS, CGG Services (Australia) Pty Ltd

Based on the summary information posted on NOPSEMA's website, this survey is proposed to take place in a polygon located in Commonwealth waters adjacent to WA, ~100 km from Exmouth, ~90 km from Carnarvon and 25 km from Geraldton, in water depths of ~40 m to >1,000 m. No information is available on the proposed timing for this survey, or for the exact location of the survey area.

Houtman Sub-basin 2D Seismic Survey, Geoscience Australia

Based on the summary information posted on NOPSEMA's website, this survey is proposed to take place in an area defined by a Special Prospecting Authority (WA-23-SPA) and an Access Authority (WA-67-AA) covering part of the Houtman Sub-basin. Again, no information is publicly available on the proposed timing for this survey. However, Spectrum has been in communication with Geoscience Australia (GA) with regards to this survey, as GA propose to use the same survey vessel (MV *Duke*) as proposed for the Rocket MC2D MSS. Spectrum is aware that the Houtman Sub-basin 2D survey is planned to commence in late October – early November 2014 and has a planned duration of ~35 days, i.e. the survey be completed prior to the commencement of the Rocket MC2D MSS.

In the event that the timing of the proposed Imperial Multiclient 2D MSS and the Rocket MC2D MSS overlapped, the two surveys would not be undertaking seismic acquisition in proximity to each other, due to the potential for noise interference to affect seismic data quality. Concurrent surveys usually require a minimum separation distance of ~60 km between any two operating seismic survey vessels (Duncan 2009). If separation distances between the survey vessels are closer than 60 km then the two proponents routinely work out procedures for simultaneous operations to eliminate or minimise the

potential for noise interference and data corruption. Measures such as, a time-sharing arrangement where, over a 24 hour period each vessel will acquire for a period of 12 hours whilst the airgun arrays of the other vessel are shut down.

Additionally the towed streamer array for the both the Rocket MC2D MSS and the Imperial Multiclient 2D MSS will be up to ~8 km long, therefore it is imperative that each survey vessel maintain appropriate separation distances from all vessel traffic for safety and operational reasons. In summary, the acquisition of these surveys is likely to be temporally and spatially separated as a result of the following factors:

- the necessity to reduce data interference;
- the necessity to reduce safety risks associated with towed equipment; and
- Spectrum engagement with CGG to avoid overlap between the two surveys where possible.

Given the factors outlined above, it is expected that sound exposure levels associated with both the Rocket MC2D MSS and the Imperial Multiclient 2D MSS will have attenuated well below known behavioural avoidance response levels for marine fauna at the closest distance to concurrent surveys. Consequently, in this instance concurrent seismic exploration activities are unlikely to result in significant impact to matters of NES.

5 MONITORING OF ENVIRONMENTAL PERFORMANCE

5.1 ONGOING MONITORING

The Rocket MC2D MSS will be managed in compliance with the accepted EP for the activity, all applicable laws and regulations, the Spectrum HSE Policy, and Gardline CGG's ISM Safety Management System for the MV *Duke*, which includes:

- Shipboard Safety Procedures Manual (SSPM);
- Shipboard Safety Management Manual (SSMM);
- Safety Operations Manual (SOM);
- Ballast Water Management Plan; and
- Emergency Contingency Manual (ECM);

The EP is intended to serve as a practical environmental management tool that can be used throughout the proposed survey by Gardline CGG to implement targeted environmental control measures. The objective of the EP is to ensure that potential adverse environmental impacts and risks associated with the proposed activities, during both routine and non-routine operations, are continuously reduced to as low as reasonably practicable (ALARP) and that the environmental performance outcomes (EPO) and environmental performance standards (EPS) included in the EP are met. To facilitate this objective, a comprehensive Environmental Risk Assessment (ERA) has been undertaken to determine those activities and environmental aspects that pose an elevated risk of environmental impact. The outcomes from the ERA form the foundation upon which relevant preventative and mitigation measures can be identified and implemented to ensure that adverse environmental impacts and risks are avoided or minimised.

The implementation strategy for the EP, including procedures that will apply during emergencies or potential emergencies, describes in detail the arrangements in place to allow Spectrum to continually manage the environmental impacts and risks of its activities to acceptable levels and ALARP. It includes:

- details of when the titleholder will report to the Regulator in relation to the titleholder's environmental performance;
- a description of the environmental management system for the activity, including specific measures to ensure that:
    - the environmental impacts and risks of the activity continue to be identified and reduced to a level that is ALARP;
    - control measures detailed in the EP are effective in reducing the environmental impacts and risks of the activity to ALARP and an acceptable level;
    - environmental performance outcomes and standards set out in the EP are being met;
    - chain of command, and roles and responsibilities in relation to the implementation, management and review of the EP;
    - training and competencies, including induction into the EP; and
    - monitoring, recording, audit, management of non-conformance and review of the environmental performance and the implementation strategy.

Environmental performance of the Rocket MC2D MSS is reviewed in a number of ways. These reviews are undertaken to:

- ensure all significant environmental aspects of the activity are covered in the EP;
- ensure that environmental management measures to achieve EPO and EPS are being implemented, reviewed and where necessary amended;
- identify potential non-conformances and opportunities for continuous improvement;
- ensure that all EPO and EPS have been met before completing the activity: and
- ensure that all environmental commitments contained in the Environmental Commitments Register (ECR) have been fulfilled.

The following arrangements will be established to review environmental performance of the activity:

- An inspection(s) of the survey vessel will be carried out before or during the activity to ensure that procedures and equipment for managing routine discharges and emissions are in place to enable compliance with the EP.
- A summary of the key information, commitments, EPO, EPS and MC for the activity (ECR) will be distributed aboard the survey vessel, and implementation of the environmental EPO and commitments will be monitored on a regular basis by the Client Site Representative and MFOs.

Regulation 26C of the Environment Regulations requires that "*a titleholder undertaking an activity must submit a report to the Regulator in relation to the titleholder's environmental performance for the activity, at the intervals provided for in the environment plan*". Spectrum will prepare a Post-survey Environmental Review Report (PERR) for the Rocket MC2D MSS that will comprise a review of achievement of the EPO for the survey to determine if they have been met, The PERR will include:

- A review of the following routine activities and incident records
  - start-up delays, power downs or stop work procedures instigated as a result of whale sightings;
  - cetacean sighting records;
  - turtle and whale shark sighting records;
  - records of any vessel or towed equipment interaction with marine fauna ;
  - accidental discharge of hazardous materials;
  - fuel and oil spills;
  - vessel collisions; and
  - negative interactions with commercial fishing vessels and shipping.
- An assessment of adherence to requirements of the EP, including the EPO and EPS.
- A review of compliance with the Spectrum HSE Policy.
- A review of all environmental incidents (recordable and reportable) and any other issues.
- Performance in fulfilling all commitments listed on the Environmental Commitments Register.

A copy of the PERR will be submitted to NOPSEMA within two months following completion of the survey.

5.2 REVIEW OF THE EP

Management of changes to the scope (e.g. timing, location or survey details described in the EP) are the responsibility of the Spectrum Project Manager. As required under Regulation 17 of the Environment Regulations, Spectrum will submit a revision of the EP to NOPSEMA if any of the following criteria are met:

- The commencement of any new activity, or any significant modification, change, or new stage of an existing activity, not provided for this EP.
- The occurrence of any:
  - significant new environmental impact or risk;
  - series of new environmental impacts or risks;
  - significant increase in an existing environmental impact or risk; and
  - series of increases in existing environmental impacts or risks,
  - not provided for in this EP.
- Any significant change to the receiving physical, biological or socio-economic environment within, or immediately adjacent to, the Rocket MC2D MSS Phase 1 and Phase 2 operational areas.
- The identification of any:
  - KEF not already described in this EP;
  - threatened species of cetacean, marine reptile, pinniped, sharks and ray-finned fish not already described in this EP; and

- critical habitat/BIA for threatened species not already described in this EP, which has spatial overlap with the Rocket MC2D MSS Phase 1 and Phase 2 operational areas.

A risk assessment will be undertaken for all changes in scope to assess potential impacts of the change. If the change meets any of the criteria detailed above, a revision/resubmission of the EP will occur, and the proposed change to the activity will not commence until the revised EP has been accepted by NOPSEMA.

Notification to other government authorities, where required, will be undertaken by the Project Manager. Notifications will include details of the change and procedures that will be put in place for managing or mitigating the additional or modified risks.

6 OIL POLLUTION EMERGENCY PLAN RESPONSE ARRANGEMENTS

The Oil Pollution Emergency Plan (OPEP) for the proposed Rocket MC2D MSS, taking into account the nature and scale of the activity and the potential spill risks involved (see above) comprises components of the survey vessel Shipboard Oil Pollution Emergency Plan (SOPEP) that manage the environmental impacts of a spill, supported as required by applicable established, statutory OPEPs (e.g. NATPLAN, WestPlan MOP, WA DoT OSCP). In summary, the following plans are in place as a contingency in the unlikely event of an oil spill, which as a whole, represent the OPEP for this activity:

- Survey vessel SOPEP - deals with spills which are either contained on the vessel or which can be dealt with from / by the vessel.
- National Plan for Maritime Emergencies (NATPLAN): Australian Maritime Safety Authority (AMSA) - is the Jurisdictional Authority (JA) and Control Agency (CA) for spills from vessel which affect Commonwealth waters, i.e. outside of 3 nm from the coast.
- WA State Emergency Management Plan for Marine Oil Pollution (WestPlan-MOP) and Department of Transport (DoT) Oil Spill Contingency Plan (OSCP) - deals with spills from the vessels which affect WA State waters.

6.1 VESSEL SOPEP

The survey vessel SOPEP, which has been prepared in accordance with the IMO guidelines for the development of shipboard oil pollution emergency plans (resolution MEPC.54(32) as amended by resolution MEPC.86(44)), includes emergency response arrangements and provisions for testing the SOPEP (oil pollution emergency drills), as required under Regulations 14(8AA), 14(8A) and 14(8B) to 14(8E) of the Environment Regulations. The last SOPEP drill undertaken was on 13-9-2014.

A further two drills of the oil spill emergency response arrangements will be conducted during course of the Rocket MC2D MSS. All drills will be reported as per MARPOL Annex I (Regulation 15) requirements and reviewed three times a year as part of the ongoing monitoring and improvement of emergency control measures. The SOPEP is subject to four scheduled drills per annum, therefore a minimum of two drills will be conducted during the course of the Rocket MC2D MSS.

A planned maintenance system (PMS) will be implemented on the survey vessel, to ensure that all equipment used during operations is in full working order, and does not represent a hydrocarbon spill risk. Stocks of absorbent materials aboard the survey vessel will be checked for their adequacy and replenished as necessary prior to the commencement of activities.

6.2 EMERGENCY RESPONSE ARRANGEMENTS

Priority actions in the event of a fuel or oil spill are to make the area safe and to stop the leak and ensure that further spillage is not possible. Deployment of small absorbent booms and other materials will be undertaken so as to maximise recovery of spilled material. All deck spills aboard the survey vessel will be cleaned-up immediately, using appropriate equipment from the onboard spill response kits (e.g. absorbent materials etc.) to minimise any likelihood of discharge of spilt hydrocarbons or chemicals to the sea. This is a standard operating procedure (SOP) for the survey vessel.

Given the offshore location of the most of the Rocket MC2D MSS Phase 1 and Phase 2 operational areas the preferred strategy for diesel spills will be to allow small spills to disperse and evaporate naturally, and monitor the position and trajectory of any surface slicks (see below).

6.2.1 Commonwealth Waters

For Commonwealth waters initial actions will be undertaken by the survey vessel with subsequent actions determined in consultation with the regulatory authorities (AMSA) under NATPLAN, having regard to the potential impacts posed by the spill. AMSA has indicated that it does not require titleholders to directly consult on OPEPs for seismic surveys or those addressing the operations of offshore supply vessels. Such operations are already covered by existing NATPLAN arrangements. AMSA is the responsible Combat Agency (CA) for oil spills from vessels within the Commonwealth

jurisdiction and will respond in accordance with its Marine Pollution Response Plan as approved by the AMSA Executive. Upon notification of an incident, AMSA will assume control of the incident.

6.2.2 State Waters

If surface slicks appear likely to enter WA State waters then subsequent actions will be determined in consultation with the WA DoT under WestPlan–MOP and the WA DoT OSCP. The WA DoT is the designated combat agency for oil spills from vessels within the WA State jurisdiction.

Treatment measures addressing the generation of impacts associated with shoreline protection and clean-up are addressed in the WestPlan-MOP and WA DoT OSCP that requires the provision of temporary storage, transportation and final disposal in compliance with Government disposal approvals.

In the event of a large diesel spill occurring during the Rocket MC2D MSS, Spectrum will inform a number of key stakeholders (apart from the response and combat agencies outlined above), primarily within the commercial fishing industry, but also including a number of WA State Government departments (e.g. Department of Mines and Petroleum [DMP]; Department of Fisheries [DoF); DPAW).

6.2.3 Type I Operational Monitoring

In the event of an accidental event that resulted in a large diesel spill to the waters surrounding the survey vessel, Gardline CGG and Spectrum would be responsible for undertaking Type I “Operational Monitoring” that would have the primary objective of spill surveillance and tracking. This monitoring will be implemented to:

- determine the extent and character of a spill;
- track the movement and trajectory of surface diesel slicks;
- identify areas/ resources potentially affected by surface slicks; and
- determine sea conditions/ other constraints.

This monitoring will enable the survey vessel Master to provide the necessary information to the relevant Combat Agency (AMSA or WA DoT), via a POLREP form, to determine and plan appropriate response actions under NATPLAN or the WestPlan-MOP / WA DoT OSCP (if either of these plans are actually activated). Operational monitoring and observation in the event of a spill will inform an adaptive spill response and scientific monitoring of relevant key sensitive receptors (see below).

Specific monitoring / data requirements are:

- estimation of sea state; wind direction and speed
- locating and characterising any surface diesel slicks;
- GPS tracking, manual or computer predictions; and
- GIS mapping.

This operational monitoring will be restricted to daylight hours only, when surface slicks will be visible from either vessels or via aerial surveillance. The information gathered from this monitoring will be passed on to the relevant Combat Agency, via the POLREP form, but also via ongoing SITREP reports following the initial spill notification to RCC Australia.

Gardline CGG and Spectrum will implement, assist with, or contribute to (including funding if required) any other operational monitoring as directed by the Combat Agency.

6.2.4 Type II Scientific Monitoring

Stochastic spill modelling conducted as part of the oil spill risk assessment for the Rocket MC2D MSS indicates low level probabilities of surface slicks and entrained oil from a large MGO spill contacting sensitive receptors adjacent to the eastern boundaries of the Phase 1 and Phase 2 operational areas.

Given this level of risk, if a large diesel spill occurs from the survey vessel during the Rocket MC2D MSS and this incident results in surface slicks or entrained oil entering the waters of the Ningaloo Coast or Shark Bay World Heritage Properties or the Abrolhos Islands FHPA, Spectrum will work with the relevant stakeholders to develop and implement appropriate Type II “Scientific Monitoring” to understand the

effects of the spill and any response activities on the marine environment. This scientific monitoring will have a focus on relevant environmental and social values and sensitive receptors

For development of a Type II scientific monitoring plan that would be applied in the event of a large diesel spill from the Rocket MC2D MSS impacting upon the Ningaloo Coast or Shark Bay World Heritage Properties or the Abrolhos Islands FHPA, the relevant stakeholders would be (but not necessarily be limited to):

- the Combat Agency (WA DoT);
- the WA Environmental Protection Authority (EPA);
- the WA Conservation and Parks Commission (CPC);
- the WA DPaW;
- NOPSEMA;
- the Commonwealth Department of Environment (DoE);
- appropriate marine research and monitoring organizations, such as:
    - the WA Marine Science Institution (WAMSI);
    - the Australian Institute of Marine Science (AIMS);
    - the UWA Oceans Institute; and
    - environmental consultancy companies with appropriate expertise and experience in hydrocarbon spill monitoring
- marine contractors able to provide appropriate vessels for inshore/shallow water work in the Ningaloo Coast or Shark Bay World Heritage Properties or the Abrolhos Islands FHPA; and
- key marine users in these protected areas.

This scientific monitoring will focus on a number of key environmental and social values and sensitive receptors, including (but not limited to):

- sediment and water quality;
- benthic primary producer habitat (BPPH);
- rocky shore/intertidal reef platform communities; intertidal sand/mudflat communities;
- subtidal soft-bottom communities;
- sea birds; dugong; Australian sea lions; turtles; whale sharks; finfish; benthic invertebrates; and
- commercial and recreational fishing; and tourism.

The scientific monitoring program will be developed to ensure that it is sufficient to inform any remediation activities, particularly with respect to shoreline environments, and that is meets the monitoring guidelines and methodologies described in the following best practice guidance documents:

- the AMSA Oil Spill Monitoring Handbook; and
- the Oil Spill Monitoring Background Paper.

Gardline CGG has public liability insurance that covers any pollution that could result in environmental damage, specifically pollution emanating from their vessels. As such, this insurance would cover the cost of environmental monitoring or clean-up post spill. These policies cover activities in Australian Commonwealth and State waters, including the Rocket MC2D MSS.

6.2.5 Reporting

Any fuel or oil spills aboard either the survey or support vessels must be reported to Spectrum as required by Section 6 of the Shipboard Safety Management Manual (Reporting and Analysis of Accidents and Hazardous Occurrences and Health Safety, Security and Environmental Observations). In the event of spillage of any oil or diesel spills to the sea, AMSA will be notified immediately (via RCC Australia using a POLREP form) to ensure prompt and appropriate mobilisation of relevant response plans. Any significant spills (greater than 80 L) will be reported to NOPSEMA as reportable incidents.

7 DETAILS OF CONSULTATION

7.1 CONSULTATION ALREADY UNDERTAKEN

Consultation with the majority of stakeholders was undertaken between August and November 2014. A letter was sent to stakeholders, detailing the survey parameters, location of Phase 1 and Phase 2 operational areas, duration and proposed activities. Relevant stakeholders, including those potentially involved in oil spill response, were invited to provide comments on the survey. A number of stakeholders did not reply or replied only to acknowledge receipt of the invitation with no further comment.

Courtesy calls, to remind stakeholders/organisations that had not yet responded to the stakeholder letter, were made to the following organisations on the 25-26 September 2014: GFCL; GPFA; KPFA; UMWPFA; Panorama Management Pty Ltd; Recfishwest; WRLC and Westmore Seafoods. No objections or claims to the proposed activity were raised during these phone calls. Prior to commencement of Phase 2 of the survey, Spectrum will contact these stakeholders again, and make the offer of face-to-face meetings so that any new claims/objections can be raised, and to facilitate the process of explaining operations, timing, and the seven to ten day forecasts of operations within the Phase 2 operational area.

The stakeholders consulted prior to, and during, the preparation of the EP are listed in Table 7-1 along with their objections/claims, an assessment of their merits and Spectrum's response.

7.2 PLANS FOR ONGOING CONSULTATION

At least three weeks prior to commencing the Rocket MC2D MSS, Spectrum will contact relevant stakeholders to provide detailed information for the proposed activity, location and geographical coordinates for the Phase 1 and Phase 2 operational areas, timing and duration, parameters for the towed seismic array (airgun array towed streamer, tail buoy etc.), and details of the survey vessel and chase vessel. At this point, stakeholders will have a further opportunity to raise any specific concerns or issues with Spectrum, regarding the proposed survey.

Prior to the commencement of the survey, Spectrum will consult a number of additional stakeholders, primarily within the offshore E&P industry. These consultations will include, as far as possible, other geophysical companies operating in Australian waters, plus titleholders of petroleum titles adjacent to the proposed Rocket MC2D MSS Phase 1 and Phase 2 operational areas. The primary objective of this consultation will be to ascertain if there are any other seismic surveys proposed for areas adjacent to the Rocket MC2D MSS operational areas over the same time period.

Consultation with stakeholders will be ongoing throughout the period the Rocket MC2D MSS EP is valid. Spectrum will comply with requests by stakeholders for additional information and requests for updates during any activities undertaken within the Phase 1 and Phase 2 operational areas. Spectrum will assess the merits of any new claims or objections made by a stakeholder whereby they believe the activity may have adverse impacts upon their interest or activities. If the claim has merit, where appropriate, Spectrum shall modify management of the activity.

Prior to commencement of Phase 2 of the survey, Spectrum will contact the relevant fisheries stakeholders again, and make the offer of face-to-face meetings so that any new claims/objections can be raised, and to facilitate the process of explaining operations, timing, and the seven to ten day forecasts of operations within the Phase 2 operational area. On completion of each phase and upon completion of the entire survey, a notification will be sent to the relevant stakeholders or those that request post-survey notification.

Table 7-1 - Pre-survey consultation

Stakeholder	Summary of Response	Assessment of Merits of Claims/Objections Raised, with Response
Commonwealth Government		
Australian Fisheries Management Authority (AFMA)	Informed Spectrum that there are a quite a few fisheries that overlap the Phase 1 and Phase 2 polygon, and recommended that Spectrum consult with stakeholders associated with the fisheries in the area.	No further action required. Spectrum had already complied with this recommendation.
Australian Hydrographic Service (AHS)	Informed Spectrum that AHS requires survey details confirmed two weeks prior to survey commencing, a Notice To Mariners (NTM) will then be issued.	Spectrum will comply with this request. Information incorporated into the EP.
Australian Maritime Safety Authority (AMSA)	Informed Spectrum that the main commercial traffic route for WA passes through the proposed Phase 1 and 2 survey areas. Therefore, heavy commercial bulk shipping traffic will be encountered within these proposed areas. The Phase 2 survey area will also encounter commercial and domestic vessels inbound and outbound of Geraldton and Port Denison. The Phase 1 survey area will encounter vessels heading in and out of Shark Bay. Advised Spectrum to be active and maintain clear and effective communication with all shipping approaching and within the operational area, and that it must also be considered than any avoiding or diversionary action that may be taken by a non-survey related commercial vessel does not compound the issue of navigational safety. Informed Spectrum that the survey vessel must display appropriate day shapes, lights and streamers, reflective tail buoys, to indicate the vessel is towing and is therefore restricted in her ability to maneuver. Visual and radar watches must be maintained on the bridge at all times. Requested that AMSA's RCC is contacted for AUSCOAST warning broadcasts before any operations commence. Additionally, AHS must be contacted no less than 2 working weeks before operations commence for the promulgation of related NTM. Recommended that Spectrum, and closely liaise with, Geraldton Port Harbour Master well in advance of proposed activity. This will enable Pilots, Agents and owners of any shipping using the shipping fairway during survey operations to be further advised of survey details. Requested that at conclusion of the survey, Spectrum to contact AMSA to comment on operations and interaction with commercial shipping at the time of the survey (i.e. any lessons learnt).	Spectrum will comply with this request. Information incorporated into the EP.
Department of Defence (DoD): (Defence Property Services Group; Directorate of Property Acquisition, Mining and Native Title; Headquarters Air Command)	Advised Spectrum that DoD has no objection to proposed activity and informed Spectrum that AHS will require advanced notification of any seismic surveys and infrastructure developments within the designated area. Informed Spectrum that this information is critical to maritime safety and should be provided to reduce negative impacts on other maritime user. RAAF responded by informing Spectrum that the stakeholder letter had been received and forwarded for action/response as required.	Spectrum will comply with this request.
Department of Environment (DoE)	Informed Spectrum that offshore petroleum and greenhouse gas activities in Commonwealth waters must now be assessed and accepted by NOPSEMA under the OPGGS(E) Regulations to have EPBC Act coverage. DoE is not a relevant agency for consultation under the OPGGS(E) Regulations, as the NOPSEMA authorisation process encompasses the functions, interests and activities of the Department. The Department is currently collating advice for titleholders about its ongoing role in the Commonwealth marine area beyond the scope of the NOPSEMA environmental management authorisation process.	No further action required.
State Government		
WA Department of Fisheries (DoF)	DoF noted that seismic surveys have the potential to affect fish population and the operations of fishers who harvest these resources and referred Spectrum to the '*Guidance Statement on Undertaking Seismic surveys in Western Australian Waters*'. Recommended that Spectrum should consult with WAFIC, Recfishwest and individual licensed fishers regarding the overall proposal, including methods, and incorporate comments from this consultation in the EP submission. Should the multi-phase EP receive approval from NOPSEMA further consultation with DoF and other stakeholders on individual phases under the EP should occur a minimum of three months prior to commencement of an activity. As part of this consultation, Spectrum will need to provide: specific start and finish dates, spatial extent of proposed activities (including exclusion zones); and information on identified specific fishing interests, including previous consultation with individual licenced fishers.	Spectrum will comply with these requests. Additional information incorporated into the EP, where necessary. A detailed response was sent to DoF addressing each specific issue raised and Spectrum's response to the issue.

	Should there be any objections or claims raised during the consultation process, DoF requests that these matters are addressed to the satisfaction of NOPSEMA prior to the commencement of the activity. In the event of unresolved issues, DoF reserves the right to seek further engagement. DoF advised Spectrum of commercial fishing interests that exist in the bioregion associated with the proposed survey area. DoF requested that Spectrum specifically includes strategies in the EP to minimise the impacts of survey activities on fish spawning. The strategies may include (but are not limited to) soft starts, and sound and exposure time minimisation. Alternatively, it is preferable that seismic activities do not occur during the times of year that the key fish species may be spawning within the proposed area of activities. In accordance with the Fish Resources Management Regulations 1995, DoF requires that all vessel managers and operators of immersible equipment minimise the risk of translocating pests and diseases into or within WA waters. Vessel hulls, sea chests and niche areas must be 'clean' before each voyage Spectrum has noted that it is the DoF policy that the suspected or confirmed presence of any marine pest or disease be reported within 24 hours by email or telephone. This includes any organism listed in the WA Prevention List for Introduced Marine Pests. DoF requests that this information is forwarded directly to all vessel operators associated with this project and that any queries regarding the advice should be directed to the designated contact point at DoF.	
WA Department of Mines and Petroleum (DMP)	DMP thanked Spectrum for providing information on Rocket MC2D MSS. DMP noted that this activity will be assessed under the OPGGS(E) Regulations by NOPSEMA. DMP reviewed the notification and advised Spectrum that it does not require any further information at this stage. DMP advised Spectrum that any future activity notifications can be sent to the Petroleum Environment Branch email address.	No further action required.
WA Department of Parks and Wildlife (DPaW)	No response	
WA Department of Transport (DoT)	DoT confirmed that the stakeholder letter had been received and had no comment regarding the proposed survey.	No further action required.
Fisheries		
A Raptis & Sons	No response	
Austral Fisheries	No response	
Australian Longline Pty Ltd	No response	
Australian Southern Bluefin Tuna Industry Association (ASBTIA)	No response	
Commonwealth Fisheries Association (CFA)	No response	
Geraldton Fishermen's Co-operative Ltd (GFCL)	No response	
Geraldton Professional Fishermen's Association (GPFA)	No response	
Kalbarri Professional Fishermen's Association	KPFA confirmed that they have no concerns regarding the Rocket MC2D MSS, as they do not fish in the area.	No further action required.
MG Kailis Group	No response	
Northern Fishing Companies Association (NFCA)	No response	
Panorama Management Pty Ltd	Responded by saying that they would call their skipper to make sure that there were no issues. As the skipper hadn't responded they assumed that he did no foresee any issues with the survey.	

Recfishwest	No response	
Tuna West Indian Ocean Tuna Association	No response	
United Mid West Professional Fishermen's Association (UMWPFA)	No response	
WA Fishing Industry Council (WAFIC)	No response	
WA Seafood Exporters	No response	
Western Rock Lobster Council (WRLC)	No response	
WestMore Seafoods	No response	
Individual licence holders in the AIMWTMF; GDSF; MMF; SBPR; SBSF; WCDSCMF and WCDSF	No responses received from any of the 92 individuals or entities contacted	
NGOs		
Cape Conservation Group	1. CCG requested further information about the survey 19/10/14. 2. On 27/10/14, CCG sent a further email requesting information on survey start and finish dates, and on what mitigation factors have been put in place for pygmy blue whales. 3. On 4/11/14, CCG sent an email requesting information on how cumulative impacts. 4. On 13/11/14, another email was received from CCG asking whether all marine fauna sighting data would be sent to the DoE.	1. A letter was emailed to CCG on 20/10/14 providing additional details. 2. A response was emailed to CCG on 27/10/14. 3. A response was emailed to CCG on 5/11/14. 4. A response was emailed to CCG on 16/11/14
Centre for Whale Research (CWR)	No response	
International Fund for Animal Welfare (IFAW)	IFAW responded by requesting a copy of the GIS shapefile for the Phase 1 and 2 operational areas. Copies of the GIS shape files were sent to IFAW on 25/09/14.	No further action required.

7.3 DETAILS OF TITLEHOLDER'S NOMINATED LIASON PERSON

Details for Spectrum as the Titleholder, and for Spectrum's nominated liaison person with respect to the EP, are as follows:

Name:	Spectrum Geo Pty Ltd
Business address:	105 St Georges Terrace Perth WA 6000
Telephone:	+61 8 9322 3700
Fax:	+61 8 9322 1844
Email address:	jane.conder@spectrumasa.com
ABN:	90 003 632 166
Nominated liaison person:	Jane Conder, Commercial Director, Asia Pacific.