



SCHILD PHASE II
MULTI CLIENT 3D MARINE SEISMIC SURVEY

ENVIRONMENT PLAN: PUBLIC SUMMARY

CGG Multiclient and New Ventures

Revision 0

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SCHILD PHASE II MARINE SEISMIC SURVEY ENVIRONMENT PLAN: PUBLIC SUMMARY

This summary of the Environment Plan for the CGG Schild Phase II MC3D marine seismic survey, which will be acquired in the Browse Basin offshore from Western Australia (WA), has been submitted to the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA), to comply with Regulations 11(7) and 11(8) of the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009.

INTRODUCTION

The geophysical company CGG Multiclient and New Ventures (CGG) proposes to acquire a multi-client three-dimensional (MC3D) marine seismic survey (Schild Phase II MC3D MSS), in the Browse Basin offshore from Western Australia (WA) (**Figure 1**). The Schild Phase II MC3D MSS will be comprised of approximately 16,650 square kilometres (km²) of 3D seismic acquisition in Petroleum Exploration Permits AC/P36, AC/P37, AC/P48, WA-274-P, WA-281-P, WA-285-P, WA-315-P, WA-341-P, WA-343-P, WA-344-P, WA-371-P, WA-377-P, WA-398-P, WA-408-P, WA-410-P, WA-411-P, WA-471-P, Retention Lease Areas AC/RL8, WA-44-L, WA-50-L, WA-51-L and adjacent open acreage areas.

The Schild Phase II MC3D survey is scheduled to commence in October 2013, with an expected duration of over 12 months. The period indicated is for acquisition of the entire survey program, in reality the survey will probably be acquired in phases due to vessel availability and environmental considerations.

The Schild Phase II MC3D was referred to the Commonwealth Department of the Environment (DoE) (formerly the Department of Sustainability, Environment, Water, Population and Communities) on 7 June 2013 (EPBC Reference Number 2013/6894) and was assessed as “not a controlled action if undertaken in a particular manner”. The manner in which the proposed action must be taken includes:

1. Part A. Standard Management Procedures of the *EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales* (September 2008), using the 2 km low power zone, and the 500m shutdown zone must be implemented during all seismic operations.
2. Between 1 April and 31 August and 1 October and 31 December the following Part B. Additional Management Procedures must be implemented during all seismic operations:
 - a. Two dedicated Marine Mammal Observers (MMO) must be employed onboard the seismic vessel for the duration of the survey. At least one MMO must be on the seismic vessel observing for blue whales or unidentified whales during daylight hours.
 - b. If the survey is required to shutdown or powerdown 3 or more times per day (i.e. 24 hours) for three consecutive days as a result of sighting blue whales or unidentified whales, then the seismic operations must not be undertaken thereafter at night time or during low visibility conditions, until there has been a 24 hour period, which included seismic operations during daylight hours and good visibility conditions, during which no shutdowns or powerdowns have occurred for blue whales or unidentified whale sightings.

Two temporal and spatial restrictions on acquisition have been applied to the proposed survey, as part of particular manner conditions:

- Between 1 July and 31 October, the seismic source must not be discharged in waters less than 200 m in depth.
- Refuelling of the seismic vessel and any support vessels must not be undertaken within a distance of 25 km of any emergent land or shallow water features (20 m or less depth).

The survey will be carried out in accordance with these specific temporal and spatial restrictions on acquisition, and with the other particular manner conditions specified in the Decision Instrument.

COORDINATES OF THE PROPOSED ACTIVITY

Boundary coordinates for the ~16,650 km² survey area (**Figure 1**) are provided in **Table 1**.

Table 1: Schild Phase II MC3D survey area – boundary coordinates

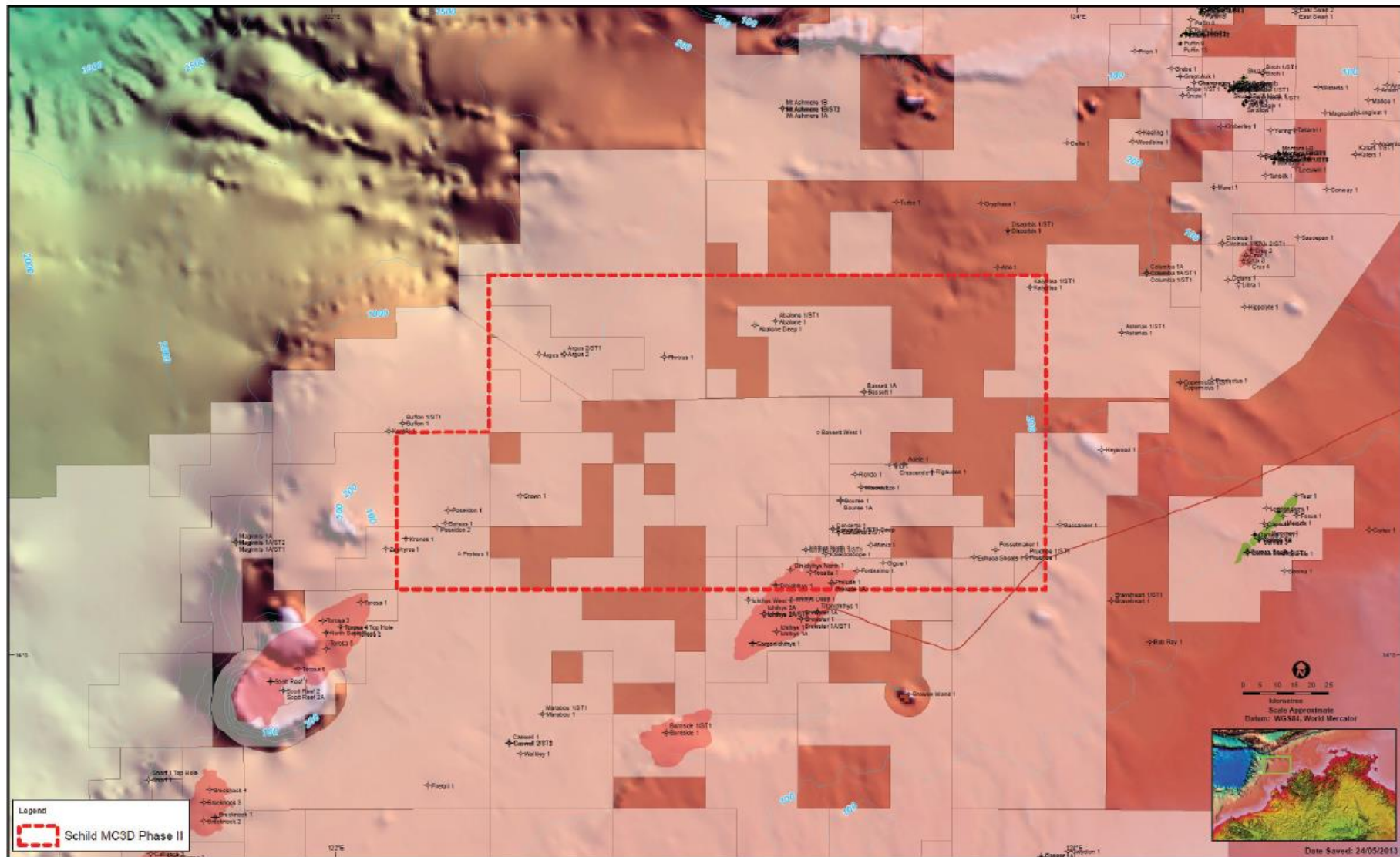
Latitude (S)			Longitude (E)		
Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
12	59	54.96	122	25	04.48
12	59	54.92	123	55	04.44
13	49	53.80	123	55	06.13
13	49	55.09	122	10	04.51
13	24	54.36	122	10	04.48
13	24	52.45	122	25	04.48

Datum: WGS84

At the closest point, the southeast corner of the survey area is located ~166 km from the mainland coastline of the west Kimberley (inshore of Bigge Island). The southern boundary of the survey area is located ~30 km north of Browse Island (**Figure 1**). Seringapatam Reef is located ~12 km to the west of the survey area, and north Scott Reef is located ~27 km southwest from the southwest corner of the survey area. The survey area is located ~129 km northwest of the Maret Islands. The northern boundary of the survey area is located ~50 km and ~80 km south of Cartier Island and Ashmore Reef, respectively.

Water depths in most of the survey area range from ~100 to 1,000 m, with the deepest water depths situated in the northwest part of the survey area. The eastern boundary of the survey area is located ~14 km west of Heywood Shoal, and the southeast corner of the survey area is located ~7 km north of Echuca Shoal (**Figure 1**).

Figure 1: Location map – Schild Phase II MC3D marine seismic survey



DESCRIPTION OF THE PROPOSED ACTIVITY

The Schild Phase II MC3D MSS is scheduled to commence in October 2013, with an expected duration of over 12 months. The period indicated is for acquisition of the entire survey program, in reality the survey will probably be acquired in phases due to vessel availability and environmental considerations.

Timing of commencement is dependent on fair sea state conditions suitable for marine seismic acquisition, the availability of the survey vessel for conducting the survey, and granting of approvals from the appropriate government bodies.

During the proposed activities, the survey vessel will traverse a series of pre-determined sail lines within the survey area at a speed of approximately 8-9 km/hr. As the vessel travels along the survey lines a series of noise pulses (every 8-10 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 number of hydrophone cables (streamers) 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.

The seismic array will comprise of eight to 12 solid streamers, with a maximum length of 8,100 m. Streamer spacing will be between 50, and 100 m, and line spacing will be between 500 and 1,000 m. The source (airgun array) tow depth will be 5-9 m (+/- 1 m) and the streamer tow depth will be 6 m at the head of the streamers and 50 m at the tail. The operating pressure for the airgun array will be approximately 2,000 psi. The airgun array will consist of two sub-arrays, each with a maximum volume of 4,500 cui. These sub-arrays will be fired alternately, with a shotpoint interval of either 18.75 or 25.0 m vertical distance, and will produce at source (i.e. within a few metres of the airguns) sound pulses in the order of 263 dB re 1 μ Pa-m (sound pressure level - SPL), at frequencies extending up to approximately 200 Hz. The sound pulses from this airgun array are expected to decrease to sound exposure levels (SEL) in the order of 165 to 175 dB re 1 μ Pa².s within 1 km of the source and approximately 160 dB re 1 μ Pa².s within 2 km, dependent on the sound propagation characteristics of the area.

CGG proposes to conduct the Schild Phase II MC3D MSS using the purpose-built seismic survey vessel *Geo Caspian*, which is owned by Volstad Maritime AS and operated by CGG. The survey vessel 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, including a Shipboard Oil Pollution Emergency Plan (SOPEP) in accordance with Regulation 37 of Annex 1 of MARPOL 73/78.

The vessel will travel within the survey area at an average speed of 8-9 km per hour (approximately 4.5 knots).

One or more support vessels will accompany the seismic survey vessel to maintain a safe distance between the survey array and other vessels, and also to manage interactions with shipping and fishing activities if required. The support vessel(s), which have a crew of approximately 15 personnel, will also re-supply the survey vessel with fuel and other logistical supplies. If required (i.e. for vessels over 400 GRT) the support vessel(s) will have an implemented and tested SOPEP.

During the survey, the survey vessel will be refuelled at sea using the support vessel either within or immediately adjacent to the survey area. At sea refuelling will only take place during daylight hours, and will not take place within a distance of 25 km from any emergent land or shallow water features (<20 m water depth).

DESCRIPTION OF THE ENVIRONMENT

The proposed Schild Phase II MC3D MSS lies entirely in Commonwealth marine waters in the Kimberley sub-system of the North-west Marine Region (NWMR or the Region), which extends from the southern boundary west of Broome to the northern edge of the Exmouth Plateau. Mid-shelf waters (100-500 m water depths) of the Kimberley sub-system consist of submerged reef platforms and mounds that support a diverse array of biological habitats, including coral reefs.

Physical Environment

South-east trade winds are prevalent from April to September. From May to August the winds average 11 to 30 km/h; however winds stronger than 31 km/h are not uncommon. The trade winds are usually associated with fine dry weather. They produce a large swell that impacts on the southern side of most reefs in the area, producing consolidated crustose coralline algae and limestone substrates on the reef slope to depths characteristic of outer reefs or oceanic atolls.

The North-west or West Monsoons prevail from December to March and are associated with prominent cloud, rain and thunderstorm activity. Cyclones may occur between December and April. Typically, cyclones move south-west across the Arafura and Timor Seas. Gale to hurricane force winds are liable to be encountered over an area between about 32 and 240 km wide. During the south-east tradewinds (April to September), the predominant direction of the ocean current is west-southwest. In the monsoon season (December to March), when winds come from the north-west or west, the direction of the ocean current reverses, becoming east-northeast. The mean rate of ocean currents throughout the year is usually less than 0.5 knots.

Overall, a key characteristic of the regional oceanography of the NWMR is the poleward flow of the main surface currents. The significant difference in steric height between the Pacific and Indian Oceans drives Pacific waters through the Indonesian archipelago via the Indonesian Through Flow into the Indian Ocean. A portion of these waters eventually travel polewards via a strong alongshore pressure gradient. This pressure gradient is not present along the eastern edge of other major oceans and makes the Western Australian system unique globally. The pressure gradient may be reinforced through surface cooling of waters as they move southwards.

The NWMR's large scale surface currents are subject to strong seasonal variations, largely due to annual variation in the alongshore pressure gradient that is the main driver of the Region's surface currents. The South Equatorial Current and Eastern Gyral Current intensify during July-September. Similarly, the Leeuwin Current is strongest in autumn, and diminishes during the North-west Monsoon (December-March).

The seafloor across the NWMR is distinguished by a range of topographic features such as canyons, plateaux, terraces, ridges, reefs, and banks and shoals. The slope is relatively flat, but includes a number of large canyon heads that were probably excavated during and after continental break-up by sediment and water movements. There are a number of reefs and islands in the Kimberley system of the NWMR adjacent to the Schild Phase II MC3D survey area including:

- Heywood Shoal and Echuca Shoal, located ~14 km and ~7 km east of the eastern boundary of the survey area, respectively.
- Seringapatam Reef (located ~12 km west of the survey area) is a shelf atoll on the upper continental slope in water depths of 500–1,500 m.
- Scott Reef is a large shelf atoll comprised of two reefs, North Scott Reef and South Scott Reef. North and South Scott Reef are located ~27 km and ~48 km west of the survey area, respectively.
- Ashmore Reef which is located ~80 km north of the survey area.
- Cartier Island, located ~50 km north of the survey area.

- Browse Island, located ~30 km south of the survey area, is a sand and limestone cay situated on a limestone coral reef.

Biological Environment

Overall, this sub-system is thought to have low productivity, largely due to the influence of the ITF and hence the chlorophyll maximum is too deep to facilitate high primary production on a regular basis. Productivity would be associated with ephemeral events, such as topographically induced water movement around geomorphic features (i.e. coral reefs, canyon heads), therefore causing some mixing of the water column. It was suggested that eddies may form on the inshore side of the emergent reefs and islands in this sub-system and therefore could be an important mechanism for mixing the water column and thereby stimulating primary production.

Repeating patterns of swirling vortices caused by the unsteady separation of flow around islands (referred to as Van Karman vortex streets) are thought to occur around the islands (on their leeward sides) of this sub-system, and may result in enhanced horizontal and vertical mixing of waters around the islands. These ephemeral but repeating events may support large populations of pelagic fish and seabirds. The islands and reefs are a key biodiversity focal point in this subregion. Associated pelagic communities provide a constant food source for cetaceans, dogtooth tuna, Spanish mackerel and pelagic sharks.

Browse Island, located ~30 km south of the survey area, is an important site for bird and turtle communities as well as a site of upwelling. Upwelling around the island is believed to be associated with increased concentrations of tropical krill. These tropical krill aggregations may be important as there have been possible, but unconfirmed, sightings of humpback whales feeding around Browse Island.

Benthic Habitats

Generally, the granitic substrate throughout the Kimberley sub-system is hard and rough due to its erosion resistance and provides a diversity of habitats for benthic flora and fauna.

Much of the outer mid-shelf is covered by a relatively featureless, sandy-mud seabed with a sparse covering of sessile organisms dominated by filter-feeding heterotrophs such as gorgonians, sponges, soft corals, echinoderms and detritus-feeding crabs and echinoderms. This is especially true of the non-trawled areas in the deeper water, and the soft-bottomed rises. However, the many limestone banks are likely to be a key ecological feature of this region. They have a harder substrate and are likely to support a more diverse range of sessile benthos such as hard and soft corals, gorgonians, encrusting sponges and macroalgae; and consequently, a more reef-associated fish and elasmobranch fauna. Although these waters may be relatively oligotrophic for part of the year, these communities probably rely on primary productivity from phytoplankton and commensal zooxanthellae (within hard corals). The mid-shelf banks, although poorly understood, are likely to support a unique and diverse invertebrate and fish fauna, with communities that change significantly with depth along their slopes.

Protected Marine Fauna

A review of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) database (Protected Matters search tool) held by the DoE was conducted for the survey area polygon described by the boundary coordinates provided in **Table 1**, with the application of a 1 km buffer zone.

The 10 listed Threatened species that may occur, or relate to, the survey area are:

1. the Australian lesser noddy;
2. the blue whale;
3. the humpback whale;

4. the loggerhead turtle;
5. the green turtle;
6. the leatherback turtle;
7. the hawksbill turtle;
8. the olive ridley turtle;
9. the flatback turtle; and
10. the whale shark.

As indicated by the Protected Matters search the Schild Phase II MC3D survey area overlaps part of one Key Ecological Feature (KEF).

1. The continental slope demersal fish communities

The survey area is located adjacent to three other KEFs in the NWMR – the ancient coastline at 125 m depth contour; Seringapatam Reef and Commonwealth waters in the Scott Reef Complex and Ashmore Reef and Cartier Island and surrounding Commonwealth waters. There are a number of Biologically Important Areas (BIA) (e.g. breeding, nesting, foraging areas) for EPBC Act-listed species of marine fauna that are in the vicinity of the Schild Phase II MC3D survey area. The BIA with ranges overlapping the survey area include:

- breeding areas for the red-footed booby, lesser and greater frigate bird, white-tailed tropic bird and wedge-tailed shearwater; and
- foraging areas for the whale shark.

However, the breeding sites for the red-footed booby, lesser and greater frigate bird, white-tailed tropic bird and wedge-tailed shearwater are confined to the islands within Ashmore Reef, Cartier Island and Adele Island and, as such, would not actually overlap the Schild Phase II MC3D survey area as there are no emergent features within the area.

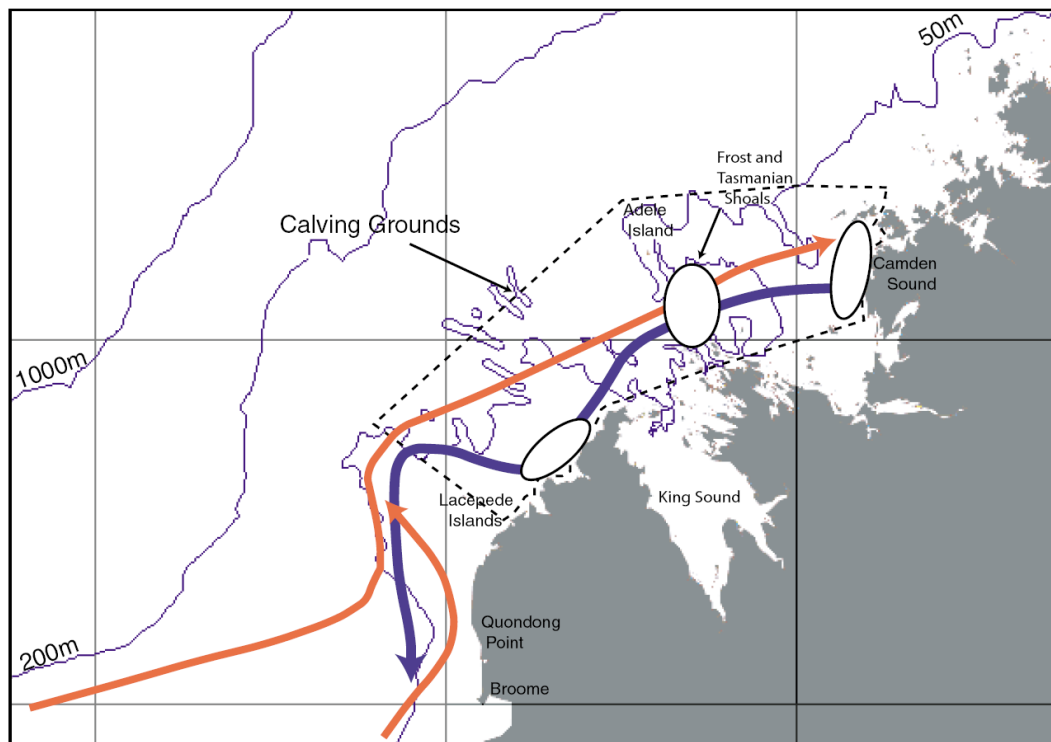
Whales and Dolphins

The EPBC Act database lists 22 cetacean species that may occur in, and adjacent to, the survey area of the Schild Phase II MC3D MSS, all of which are protected under the Act; one of which is also classified as Endangered, one as Vulnerable and six as Migratory species.

The humpback whale is the most commonly sighted whale in northern Western Australian waters. The species has been observed seasonally to complete their northern migration in the Camden Sound area of the west Kimberley, approximately 90 km south-east of the survey area, after feeding in Antarctic waters during the summer months. It is likely that the whales follow a predictable migratory path and migrate both north and south within the continental shelf boundary (200 m bathymetry). However, on the southbound migration it is likely that most individuals, and particularly cow/calf pairs, will stay closer to the coast than the northern migratory path. This is confirmed by recent satellite tracking of southbound female humpback whales in the Kimberley region.

In the Kimberley, humpback whales are seen regularly in coastal waters and out to 50 km offshore from Camden Sound to Joseph Bonaparte Gulf during winter months. As the Group IV humpback whale population continues to recover from whaling, the core calving grounds in the Kimberley (Beagle Bay to Adele Island to Kuri Bay to Montgomery Reef to Cape Leveque - high density areas for calving humpback whales during July-November (**Figure 2**) will continue to expand as animals seek other areas for calving and breeding. The area from Kuri Bay to Cape Londonderry is a recent extension of this core area.

Figure 2: Positions of the Group IV humpback whale calving grounds and migratory routes leading to and from the area



Notes: Circled areas have the highest concentrations of whales.

The majority of the Schild Phase II MC3D survey area is located on the upper continental slope in water depths of ~200-1,000 m. There is a very small portion of the survey area in water depths <200 m, located in the southeast corner of the survey polygon. At the closest point, the southeast corner of the survey area is located ~115 km from the nominal boundary of the humpback whale calving ground area identified in **Figure 2**. The southeast corner of the survey area is located at least 180 km from the core areas within the calving grounds (e.g. Camden Sound) that have the highest concentrations of whales.

The Schild Phase II MC3D MSS is scheduled to commence in October 2013, with an expected duration of over 12 months. The survey may, therefore, overlap the humpback whale calving period on the west Kimberley coastline in 2014.

Other rare species of whale which may be present in, or adjacent to, the survey area include the blue whale. Blue whales are widely distributed throughout the world's oceans and have been recorded offshore in all states excluding the Northern Territory. 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. Blue whales are believed to calve in tropical waters in winter and births peak in May to June, however the exact breeding grounds of this species are unknown.

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 northward component of this migration takes place from May to mid-August, with a peak in July-August, and the southward 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.

Consequently, there is the possibility that migrating (and possibly feeding) blue whales may be encountered in the survey area during the proposed period of acquisition for the survey (commencing October 2013 with a duration of >12 months).

Offshore waters of the NWMR once supported substantial populations of sperm whales. The presence of sperm whales as evidenced by 19th Century whaling industry data suggests occasional bursts in production, which may be associated with variations in slope (such as canyon heads) and may support species at a number of trophic levels. The old sperm whaling grounds lie to the north and west of Scott Reef.

There are no known breeding, calving or feeding grounds for any listed threatened or migratory whale species within, or in the immediate vicinity of the Schild Phase II MC3D survey area.

By applying comprehensive cetacean interaction management procedures, including the use of 'Standard Management Measures': soft starts, a 2 km low-power zone and 500 m shut down zone, plus the additional mitigation measure of two dedicated Marine Fauna Observers (MFOs), direct adverse physiological effects on any whales that may be encountered during the survey are extremely unlikely and any potential disturbance would be minimised.

Marine Reptiles

Six marine turtle species may occur in the survey area and surrounding waters – the green turtle, leatherback turtle, hawksbill turtle, loggerhead turtle, flatback turtle, and olive ridley turtle; Scott Reef is an important breeding site for two species of marine turtle listed under the EPBC Act. These include a small, genetically distinct, population of the Vulnerable and Migratory green turtle and a population of the Vulnerable and Migratory hawksbill turtle. Adult and juvenile green turtles and hawksbill turtles are also likely to feed in this region.

Browse island, located ~30 km from the southern boundary of the survey area (**Figure 1**), is a major rookery for green turtles, and flatback turtles also nest on the island. The main nesting season for green turtles in the region is likely to be December to February.

Green turtles feed on macroalgae and are by far the most common turtle seen in nearshore waters. Loggerhead turtles are carnivorous, feeding mainly on molluscs and crustaceans. Hawksbill turtles feed mainly on sponges and are more often found in deeper waters of the NWMR. Green, flatback and loggerhead turtles all breed from September to March, while the hawksbill turtle breeds from July to March. The reefal habitats in the photic zone are key feeding habitats for green and hawksbill turtles. The pinnacle habitats on the mid-shelf may be very important habitats along the migration paths for these species in the sub-region.

The leatherback turtle is a pelagic feeder, found in tropical, subtropical and temperate waters throughout the world. Nesting is mainly confined to tropical beaches although some nesting occurs on subtropical beaches. No major nesting has been recorded in Australia, although scattered isolated nesting (1-3 nests per annum) occurs in southern Queensland and the Northern Territory.

It is unlikely that marine turtles will be encountered during the seismic acquisition throughout most of the survey area, given the water depths (~100-1,000 m) and lack of shallow submerged features. It is possible that turtles, particularly green turtles, may be encountered in the southern extent of the survey area during the peak of the nesting season (January to February).

Other EPBC Act protected marine species that may be present in the survey area and surrounding waters include sea snakes. Sea snakes are frequently observed in and around offshore islands and

the waters of the shelf generally. There is no information on their frequency of occurrence in deeper offshore waters (except for Scott Reef), though individuals are often observed at the surface.

Sharks and Ray-finned Fishes

The whale shark is listed as Vulnerable and Migratory under the EPBC Act. Although there are no records of the whale shark's presence in the survey area there have been sightings in the region, and they are known to occur in both tropical and temperate waters and are normally oceanic and cosmopolitan in their distribution. The tracks of a whale shark tagged at Ningaloo Reef in 2005 passed through the Browse Basin, just to the east of south Scott Reef. A BIA (foraging area) for the whale shark overlaps a small portion of the survey area in the southeast corner and it is possible that whale sharks may be encountered during the proposed Schild Phase II marine seismic survey.

Other EPBC Act protected marine species that may occur within the survey area and surrounding waters include various species of pipefishes and seahorses (Family Syngnathidae).

Seabirds and Shorebirds

Six EPBC Act-listed species of seabird may occur in the survey area and surrounding waters: the Australian lesser noddy, the streaked shearwater, the lesser frigatebird, the great frigatebird, the red-footed booby and the white-tailed tropic bird. Apart from the Australian lesser noddy, all of these species are listed Migratory species under the EPBC Act. It is possible that these listed migratory species may fly over the survey area.

The survey area is located approximately ~166 km from the nearest mainland coastline and there is no information concerning the populations of seabirds utilising these waters. However, the distributions of many common seabirds overlap the Browse Basin and are expected to occur in the survey area. These include ten species of tern, three species of booby, and the lesser frigatebird.

Browse Island and the islands within the Ashmore Reef National Nature Reserve are important seabird nesting sites. Ashmore Reef (~80 km north of the survey area) is recognised as regionally important for seabirds, with 16 species known to breed on the islands within the reef—for example, large nesting colonies of sooty terns, common noddies, bridled terns, crested terns and lesser frigatebirds. It is also internationally significant as a stop-over site for a number of migratory shorebirds.

BIA (foraging and breeding areas) for the brown booby, lesser frigatebird, greater frigatebird, red-footed booby, roseate tern, little tern, wedge-tailed shearwater and white-tailed tropicbird are located within the vicinity of the survey area.

Migratory shorebirds are likely to be present in the region between July and October and again between March and April as the survey area is located within the East Asian-Australasian Flyway. Migratory shorebirds are listed as Migratory and Marine species under the EPBC Act and all are also listed under the convention on Migratory species (CMS). Additionally, some species are listed on the China-Australia Migratory Bird Agreement (CAMBA), the Japan-Australia Migratory Bird Agreement (JAMBA), and/or the Republic Of Korea Australia Migratory Bird Agreement (ROKAMBA).

Socio-Economic Environment

Commercial Fisheries

The principal commercial fisheries in the NWMR focus on tropical fin fish, particularly the high-value emperors, snappers and cods which are taken by the Northern Demersal trap fisheries. The typical catch is in the order of 3,000 tonnes annually, making these fisheries, at an estimated annual value of around \$12 million, the most valuable fin fish sector in the state. The NWMR has a number of small, limited-entry trawl fisheries for prawns, producing about 700 tonnes annually, valued at around \$10

million. There are also significant fisheries for Spanish mackerel, barramundi/threadfin salmon and shark, and a developing fishery for blue swimmer crabs. However, the bioregion is increasingly coming under threat from international poaching, particularly for sharks. A number of fin fish activities, including offshore demersal line fishing and near-shore beach seining and gillnetting, also occur in the region.

Commercial fisheries that can operate in the region include:

- the Northern Demersal Scalefish Managed Fishery (NDSF);
- the WA North Coast Shark Fishery (WANCSF);
- the Mackerel Managed Fishery (MMF);
- the North West Slope Trawl Fishery (NWSTF); and
- the Pearl Oyster Managed Fishery (POMF);

These are generally small, non-intensive fisheries that have very limited activity in the southern Browse Basin and are unlikely to be impacted by the proposed survey.

The NDSF is divided into two fishing areas, an inshore sector (Area 1) and an offshore sector (Area 2). Under a voluntary industry agreement, the offshore sector (Area 2) has been further divided into three zones – A, B and C. Zone B comprises the area of historical fishing activity and exploitation, while Zone A is an inshore developmental area and Zone C is an offshore deep-slope developmental area representing waters deeper than 200 m. Access to the offshore sector (Area 2) of the NDSF is currently limited to 11 licences under an individually transferable effort (ITE) system. During 2011, seven vessels (trap fishing only) collectively held and operated the effort individually assigned to the 11 licences. The NDSF principally targets red emperor and goldband snapper, with a number of species of snappers, cods and emperors comprising the remainder of the catch. Fishers in this fishery don't usually operate in water depths greater than 100 m, and very rarely in water depths greater than 200 m. Therefore, it is unlikely that any vessels fishing in Area 2 Zone C of the NDSF will be operating in most of the waters covered by the Schild Phase II MC3D survey area, which covers water depths of ~100-1,000 m.

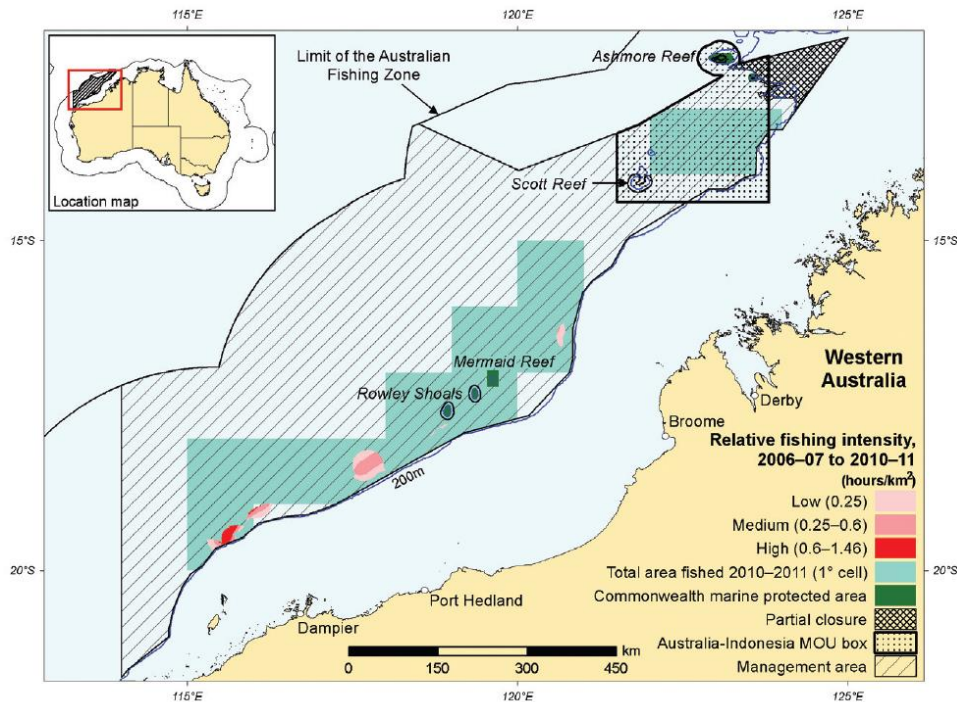
The WANCSF is licensed to operate in the area encompassing the Schild Phase II MC3D survey area, but activity is expected to be limited. There were two active licenses in the northern WANCSF during 2008/09, but there was no reported fishing activity in the northern shark fisheries during 2009/10 or 2010/11.

The MMF uses near-surface trolling gear from small vessels in coastal areas around reefs, shoals and headlands to target Spanish mackerel and jig fishing is also used to capture grey mackerel. Permit holders may only fish for mackerel by trolling or handline. The Schild Phase II MC3D survey area is located within Area 1 (Kimberley) of the MMF. There are currently 23 permits in Area 1 of the fishery with the combined quota allocations being consolidated onto four vessels. The majority of the catch is taken in the Kimberley Area, reflecting the tropical distribution of mackerel species.

The NWSTF operates off north-western Australia from 114°E to 125°E, roughly between the 200 m isobath and the outer boundary of the Australian Fishing Zone. The NWSTF has traditionally targeted scampi and deepwater prawns. However, in recent years, Australian scampi has been the main target of the fishery. Demersal trawl gear is used in the NWSTF. Fishing for scampi occurs over soft, muddy sediments or sandy habitats, typically at depths of 350–600 m on the continental slope. Whilst there are seven fishing permits in the NWSTF only one vessel was active in the fishery in 2010-2011, with Australian scampi being the main target. Recent effort in the fishery has been dominated by a small number of vessels based in WA. Whilst the Schild Phase II MC3D survey area is located within the overall management area for the NWSTF (see **Figure 3**), it is apparent that in recent years (2006-

2011) most of the effort and catch within the fishery has occurred in shallower, upper slope waters (350-600 m) to the southwest and northeast of the Rowley Shoals. Some fishing activity in 2010-2011 has also occurred to the northeast of Scott Reef (**Figure 3**), overlapping a large part of the Schild Phase II MC3D survey area.

Figure 3: Relative fishing intensity in the NWSTF, 2006–07 to 2010-2011



The POMF is a quota-based, dive fishery, operating in shallow coastal waters along the North-West Shelf. The harvest method is drift diving, in which six to eight divers are attached to large outrigger booms on a vessel and towed slowly over the pearl oyster beds, harvesting legal sized oysters by hand as they are seen. The species targeted is the Indo-Pacific, silver-lipped pearl oyster. The Schild Phase II MC3D survey area is located within Pearl Oyster Zone 3, and there are two licensees in this zone. Given that the POMF is a dive fishery operating in shallow coastal waters it is extremely unlikely that there will be any activity in this fishery in the deep (~100-1,000 m water depths), offshore waters of the survey area, located ~166 km from the west Kimberley coastline.

Traditional Fisheries

Indonesian fishermen have visited the north-western Australian coast and around the islands and reefs of this coastline for almost three centuries, focusing their fishing effort on a range of species, including:

- beche-de-mer (trepang or sea cucumber);
- various molluscs, particularly trochus shell and clams;
- seabirds (particularly frigate birds) and eggs;
- sharks; and
- marine turtles.

In November 1974, traditional Indonesian fishing practices - referring exclusively to non-motorised sailing craft, were permitted in the region and formalised under a Memorandum of Understanding (MOU) between the Governments of Australia and Indonesia. This MOU covers Scott Reef, Seringapatam Reef, Browse Island, Ashmore Reef and Cartier Island (the MOU 74 Box). The MOU

74 Box is an area of approximately 50,000 km² within the Australian Fishing Zone where Indonesian traditional fishermen are allowed to fish under the provision of the MOU that recognised the long history of traditional Indonesian fishers, enabling them to continue their customary practices and target species such as trepang, trochus, abalone and sponges. As a result, Indonesian fishing vessels may move through waters within and adjacent to the survey area, although traditional fishing is predominantly around the shoals. Fishing effort is difficult to estimate.

The Schild Phase II MC3D survey area overlaps a significant portion of the MOU 74 Box.

Petroleum Exploration

The southern Browse Basin has been the target of significant petroleum exploration activity stretching back over the past 40 years. There have been a large number of both 2D and 3D seismic surveys conducted in the region, plus the drilling of both exploration and appraisal wells. At present, there are no petroleum production facilities located within or adjacent to the survey area, but the area is adjacent to a number of previously-discovered gas and oil fields (Burnside and Ichthys gas fields to the south; and Torosa gas field to the southwest).

Commercial Shipping

No defined commercial shipping lanes exist in the Schild Phase II MC3D survey area, or in adjacent waters. The major commercial shipping route through the region passes well to the west of Scott Reef.

Tourism and Recreation

Due to the location of the survey area and distance to coastal areas of northern Western Australia there are no recreational activities undertaken in the area.

Cultural Heritage

There are no known indigenous cultural heritage values or issues for the waters and seabed within and immediately adjacent to the Schild Phase II MC3D survey area. Similarly, there are no current or pending Native Title Determinations for the waters and seabed within and immediately adjacent to the survey area. There are a large number of listed historic shipwrecks in the region, located mainly around Browse Island, including one which is listed on the Register of the National Estate (Browse Island [East] Wreck).

National Heritage

There are no places listed on the Commonwealth Heritage List or the Register of National Estate within or immediately adjacent to the Schild Phase II MC3D survey area. There are six places listed on the Commonwealth Heritage List or the Register of National Estate within the southern Browse Basin region:

- “Scott Reef and Surrounds”.
- “Seringapatam Reef and Surrounds”.
- “Adele Island and Reefs”.
- Ashmore Reef National Nature Reserve.
- “The West Kimberley”.
- “Browse Island (East) Wreck”.

North Scott Reef is located ~27 km southwest from the southwest corner of the survey area; Seringapatam Reef is located ~12 km to the west of the survey area; and Browse Island is located ~30 km south of the survey area. Ashmore Reef is located ~80 km north of the northern boundary of the survey area. At the closest point, the boundary of the West Kimberley listed Heritage area is located ~118 km from the southeast corner of the survey area.

Marine Parks and Reserves

The southeast corner of the Schild Phase II MC3D survey area is situated ~64 km northwest of the boundary of the Kimberley Commonwealth Marine Reserve. At the closest point, the survey area is located ~134 km northwest of the boundary of the proposed North Kimberley Marine Park (in WA State waters). Camden Sound Marine Park, which is also in WA State waters is situated ~165 km from the eastern boundary of the survey area.

Defence Activities

There are no designated defence or military exercise areas (MEA) in the vicinity of the Schild Phase II MC3D survey area. The southern boundary of the Schild Phase II MC3D survey area is located ~26 km north of an MEA, the RAAF Curtin Air-to-Air Weapons Range R811. When activated by a Notice to Airmen (NOTAM), the restricted airspace can operate down to sea level.

MAJOR ENVIRONMENTAL HAZARDS AND CONTROLS

An Environmental Risk Assessment (ERA) has been undertaken to understand and manage the environmental risks associated with the Schild Phase II MC3D MSS to a level that minimises impacts on the environment and meets the objectives of the survey. The ERA methodology applied is consistent with the *Australian/New Zealand Standard AS/NZS ISO 31000:2009 Risk management—Principles and guidelines*, *Handbook HB 203:2012 Managing environment-related risk*, and *Handbook HB 89-2012 Risk management - Guidelines on risk assessment techniques*.

The risk has been measured in terms of likelihood and consequence, where consequence is defined as the outcome or impact of an event, and likelihood as a description of the probability or frequency of the identified consequence occurring. A summary of the key sources of environmental risk (aspects) for the proposed activity include:

- discharge of underwater seismic pulses;
- light generation from vessels;
- interactions of vessels with marine fauna;
- anchoring or grounding of vessels used for the activity;
- dragging or loss of streamers and associated equipment;
- emissions to atmosphere from vessels;
- discharge of ballast water and vessel biological fouling (biofouling);
- routine discharge of wastewater and waste to the ocean from survey and support vessels;
- accidental discharge of hydrocarbons and chemicals to the ocean from survey and support vessels;
- interactions with commercial fishing and shipping; and
- operation of the survey and support vessels within, or in the vicinity of protected areas and heritage places.

A summary of the potential environmental impacts associated with the sources of environmental risk listed above include:

- disturbance to marine fauna including cetaceans, whale sharks, turtles and fish;
- disturbance to the seabed and benthic habitats and communities;
- reduced air quality from atmospheric emissions as a result of operation of machinery and use of internal combustion engines;
- introduction of invasive marine species as a result of ballast water discharge and vessel biological fouling;
- marine pollution from routine discharges including sewage water, bilge water and other solid wastes;
- marine pollution from accidental discharges including hydrocarbon spills and hazardous

- materials;
- disturbance to social and community values due to interactions with commercial fishing vessels, and shipping;
 - disturbance to heritage and conservation values.

The environmental aspects of the Schild Phase II MC3D MSS that have the potential to cause significant environmental effects have been determined through an evaluation of the proposed activity, the surrounding environment including specific sensitivities and values, and legislative requirements. These environmental aspects are:

- accidental discharged of hazardous materials;
- accidental fuel and oil spills from the survey and support vessels; and
- vessel collisions, resulting in fuel and oil spills and/or damage to benthic habitats.

Implemented control measures documented in **Table 2** ensures that the environmental risks associated with these impacts are maintained at ALARP levels, while maintaining economic viability for the proposed activity. These control measures are taken into consideration in calculating the residual risk associated with the activity of impact.

MANAGEMENT APPROACH

The design and execution of the proposed Schild Phase II MC3D MSS will be conducted under the framework of the CGG Environment Policy and Fugro Geoteam HSE Management System. The seismic programme will be supported by Fugro Geoteam's Offshore Emergency Response Procedure a project-specific HSE Plan, and an Interface Document between the Fugro-Geoteam AS and the owner of the survey vessel (Volstad Maritime AS). To ensure CGG's environmental management standards and performance objectives are achieved, Volstad Maritime AS will be required to comply with all relevant requirements of CGG's HSE systems/policies and standards.

CGG and its contractor will apply a tiered approach to optimising the environmental performance of the project and ensuring that CGG's environmental management standards and performance objectives are achieved. The approach involves identification of local and regional environmental sensitivities, prioritisation of risks, determination of appropriate practices and procedures to reduce those risks, and clear designation of roles and responsibilities for implementation. A series of work instructions, procedures and plans will be used for the Schild Phase II MC3D MSS to ensure that appropriate management measures are applied as required to minimise the risk of environmental disturbance from operations. The work instructions, procedures and plans are documented within corporate systems/manuals developed by Fugro Geoteam as well as documents written specifically for the Schild Phase II MC3D MSS. Many of the procedures apply to all vessels in the Fugro Geoteam fleet (now CGG). However the associated work instructions are generally vessel specific.

CGG is responsible for ensuring that the proposed Schild Phase II MC3D MSS is managed in accordance with the Implementation Strategy describing in the Environment Plan and the CGG HSE Management System. Given the control measures that will be implemented for environmental aspects of the survey, the risk of significant adverse environmental effects from the proposed Schild MC3D MSS has been assessed as low for all aspects, apart from discharge of hazardous materials, fuel and oil spills and vessel collisions, which have been assessed as medium.

The implementation of specific whale monitoring and encounter procedures will be used to minimise the potential for any adverse effects to whales. These procedures comply fully with the Australian Commonwealth Government Guidelines: *EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales* (September 2008). Two dedicated, expert Marine Fauna Observers (MFOs) will be aboard the survey vessel for the duration of the Schild Phase II MC3D

MSS. The key role of the MFOs will be to monitor the waters around the survey vessel for the presence of cetaceans, whale sharks and turtles during daylight hours. The MFOs will be responsible for ensuring that the interaction procedures are implemented and followed correctly during survey activities. The MFOs will also be responsible for recording any cetacean sightings during the survey on the appropriate sightings forms, using the DoE CSA database.

The survey will be conducted in water depths of approximately 100 m – 1,000 m and in an area that is located at least 27 km from any beaches and adjacent shallow waters that are important for turtle nesting, hatching and breeding (e.g. Sandy Islet on south Scott Reef; Browse Island). The survey area is not located close to any locations important for seabird or shorebird breeding or feeding. The survey is unlikely to have any significant effects on benthic communities due to the water depths across the survey area. Anchoring of the survey or support vessel(s) will only occur in emergency circumstances and vessels are fitted with highly sophisticated position fixing equipment. At sea refuelling of the survey vessel will only take place during daylight hours, and will not take place within a distance of 25 km from any emergent land or shallow (<20 m water depth) water features.

Between 1 July and 31 October, there will be no seismic acquisition in waters less than 200 m in depth.

The spill risk assessment, which was conducted as part of the evaluation of environmental impacts and risks for the proposed survey, indicated that the probability of surface diesel slicks contacting Seringapatam Reef, and North and South Scott Reef is significantly lower during the summer period (December to February) than during March to November. Accordingly, acquisition of survey components within a distance of ~35 km of Seringapatam Reef and North Scott Reef (i.e. within the WA-315-P and WA-398-P exploration permits; see Area A in **Figure 4**) will be scheduled to take place in the period December 2013 to February 2014.

CONSULTATION PLAN

Consultation with stakeholder groups, primarily within the commercial fishing industry, concerning the proposed Schild Phase II MC3D survey has taken place prior to, and during the preparation of the Environment Plan. The following fisheries bodies and organisations have been contacted and informed of the proposed operations:

- A Raptis and Sons;
- Austral Fisheries;
- Australian Southern Bluefin Tuna Industry Association (ASBTIA)
- Commonwealth Fisheries Association (CFA);
- Kimberley Professional Fishermen's Association (KPFA);
- MG Kailis;
- Northern Fishing Companies Association (NFCA);
- Northern Wildcatch Seafood Australia (NWSA);
- Pearl Producers Association (PPA);
- Recfishwest;
- WA Fishing Industry Council (WAFIC);
- WA Seafood Exporters; and
- WestMore Seafoods.

In addition, 36 individuals or entities who currently hold licences (one or more) that enable them to operate in the NDSF, MMF and WANCSF were contacted and provided with details of the Schild Phase II MC3D survey.

Consultation with all of the stakeholders listed above, plus others identified during the consultation process, will continue during and after the survey if required.

Figure 4: Schild Phase II MC3D Area A - acquisition between December 2013 and February 2014

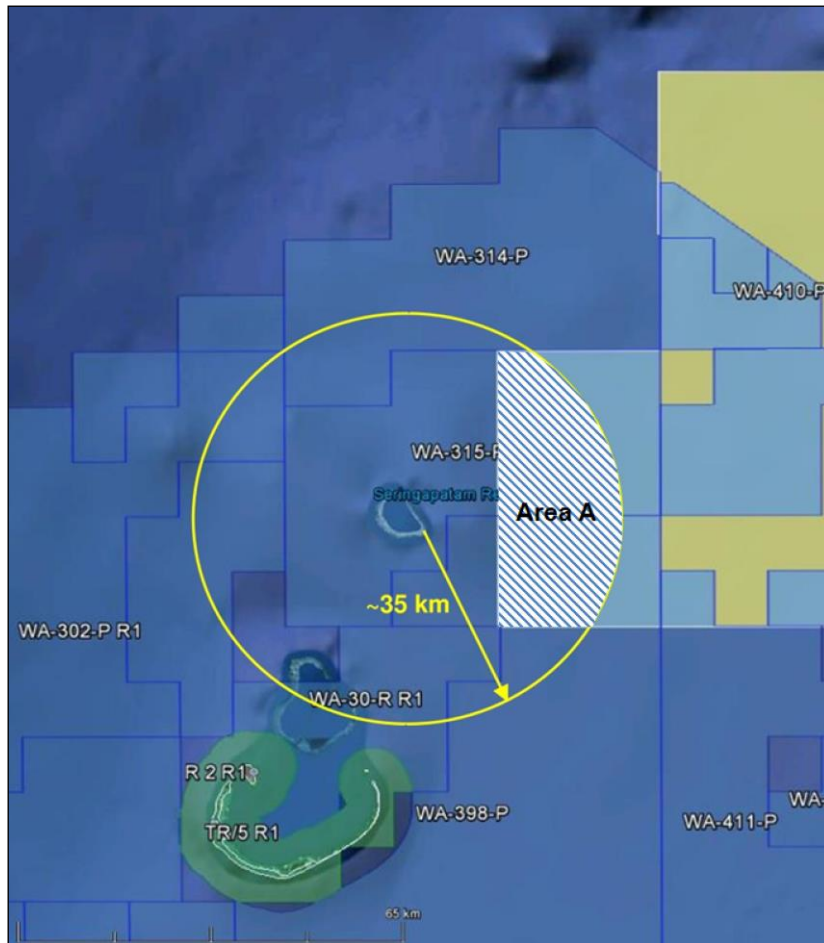


Table 2: Summary of environmental risk assessment for key aspects of the Schild Phase II MC3D MSS

Impact Category	Potential Impacts	Control and Mitigation Measures	Residual Risk Level
Disturbance to marine fauna	<p>Cetaceans – behavioural reactions (avoidance, diving, increased dive times)</p> <p>Disturbance to marine turtles, whale sharks, fish communities, and seabirds</p>	<ul style="list-style-type: none"> • Adherence to EPBC Act Policy Statement 2.1 and the following additional mitigation measures: <ul style="list-style-type: none"> ➢ precaution zones (observation zone: 3 km+; low power zone: 2 km; and shutdown zone: 500 m) ➢ two dedicated MFOs on survey vessel ➢ application of vessel-whale interaction procedures for non-acoustic energy source operations • Adherence to Part B Additional Management Measures of the <i>EPBC Act Policy Statement 2.1</i>, as specified in the Decision Instrument: • Between 1 July and 31 October there will be no seismic acquisition in waters <200 m in depth • Detailed reports of all cetacean sightings will be recorded using the DoE CSA database • External lighting of vessels will be minimized to that required for safe navigation, vessel safety and safety of deck operations, except in the case of an emergency • Survey area is located at least 27 km from any beaches and adjacent shallow waters important for turtle nesting, hatching and breeding • Survey area is not located close to any locations important for seabird or shorebird breeding or feeding • Survey area will not be operating over critical habitat for feeding, spawning, breeding or migrating fish populations • Use of streamer tail buoys fitted with appropriate turtle guards 	Low
Disturbance to benthic habitats	Small localised disturbance to epibiota in event of loss of equipment	<ul style="list-style-type: none"> • Survey will be conducted in water depths of ~100 – 1,000 m and away from any shallow water areas • No anchoring of either the survey or support vessel will take place during the survey except in an emergency • All reasonable efforts taken to retrieve lost equipment • Recording and reporting of all items lost overboard 	Low
Introduction of invasive marine species	Introduction and establishment of invasive marine species with consequent impacts on benthic communities, fisheries etc	<ul style="list-style-type: none"> • Vessels required for the proposed activity will not discharge ballast water • Adherence to the Australian Ballast Water Management Requirements • Both the survey and support vessel(s) will have all the necessary AQIS clearances to operate unrestricted in Australian waters 	Low

Impact Category	Potential Impacts	Control and Mitigation Measures	Residual Risk Level
Marine pollution from routine discharges	Localised temporary decrease in ambient water quality from discharge of sewage, grey water, putrescible wastes and bilge water	<ul style="list-style-type: none"> • All sewage and putrescible wastes will be handled and disposed of in accordance with MARPOL Annex IV • Discharge of sewage and putrescible waste will be of short duration with high dispersion and biodegradability • Sewage and putrescible wastes macerated where possible prior to disposal • All sewage and putrescible waste treatment systems and holding tanks are to be fully operational prior to survey commencement • Relevant discharge requirements for treated and untreated sewage are adhered to (>3 nm from land for treated sewage; >12 nm from land for untreated sewage) • Bilge water will be treated and disposed of in accordance with MARPOL Annex I requirements 	Low
Marine pollution from accidental discharges	Acute toxicity effects on marine fauna, such as marine turtles, fishes and seabirds, from accidental discharges of hazardous materials	<ul style="list-style-type: none"> • Harmful Packaged Substances handled and disposed of in accordance with MARPOL Annex V • Garbage Management Plan in place detailing wastes generated and disposal requirements • No discharge of plastics or plastic products of any kind from vessels • All solid, liquid and hazardous wastes (other than sewage, grey water and putrescible wastes) will be incinerated or compacted (if possible) and stored in designated areas and sent ashore for recycling, disposal or treatment • Correct segregation of solid and hazardous wastes • Incinerators used are compliant with MARPOL and IMO requirements • All storage facilities and handling equipment will be in good working order and designed in such a way as to prevent and contain any spillage as far as practicable 	Medium

Impact Category	Potential Impacts	Control and Mitigation Measures	Residual Risk Level
	Acute toxicity effects on marine fauna from fuel and oil spills	<ul style="list-style-type: none"> • Survey and support vessels will comply with MARPOL Annex I requirements to prevent oil pollution (e.g. SOPEP implemented and tested for survey and support vessels) • Spill response bins/kits located in close proximity to hydrocarbon storage areas and replenished if required • Identified personnel trained in the use of the equipment • Hydrocarbons located above deck will be stored with some form of secondary containment to contain leaks or spills • If refuelling at sea does take place its will be subject to CGG Offshore Bunkering Instruction and additional requirements including: <ul style="list-style-type: none"> ➢ No refuelling within 25 km of emergent land or shallow water features (20 m or less depth) ➢ Refuelling will only be undertaken during daylight hours • Acquisition of survey components within a distance of ~35 km of Seringapatam Reef and North Scott Reef (Area A) will occur in the period December 2013 to February 2014 	Medium
Interaction with commercial fisheries and shipping activities	<p>Interference to commercial fishing vessels and shipping operating within or near the survey area and surrounding waters</p> <p>Potential direction and indirect noise impacts on target species</p> <p>Restriction of access to fishing grounds, loss or damage to fishing gear</p>	<ul style="list-style-type: none"> • Notification of the activity and details of the activity as required to relevant commercial fisheries management agencies, fishing industry bodies and individual companies • Consultation with AMSA prior to the survey commencing • Use of a support vessel or vessels to manage vessel interactions • Use of standard maritime safety procedures Notice to Mariners (NTM) via the Australian Hydrographic Service; radio contact; display of appropriate navigation beacons and lights • Compliance with AMSA administered marine safety regulations and marine notification requirements • Strict adherence to equipment handling and acquisition procedures • Fishermen and other mariners alerted of vessels presence and extent of towed array • Establishment of a vessel exclusion zone around the survey vessel • Where possible in-water equipment lost will be recovered • Detailed records of equipment lost overboard will be maintained 	Low
Operation of survey vessel within protected and heritage areas	Disturbance to heritage and conservation values	<ul style="list-style-type: none"> • Survey and support vessels will not enter waters adjacent (<3 nm) to Seringapatam Reef, Scott Reef or Browse Island, or of any other protected areas or heritage places, except in an emergency • All CGG and contractor personnel made aware of, and comply with, requirements of accepted EP 	Low



FURTHER DETAILS

For further information about the proposed CGG Schild Phase II MC3D MSS in the Browse Basin offshore from WA, please contact:

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