



WA-484-P 3D MARINE SEISMIC SURVEY

ENVIRONMENT PLAN: PUBLIC SUMMARY

CGG Services SA

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WA-484-P 3D MARINE SEISMIC SURVEY ENVIRONMENT PLAN: PUBLIC SUMMARY

This summary of the Environment Plan (EP) for the CGG Services SA (CGG) WA-484-P 3D MSS, which will be acquired in the Carnarvon 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 proposes to acquire a three-dimensional (3D) marine seismic survey (MSS), known as the WA-484-P 3D MSS, in the northern Carnarvon Basin offshore from WA (**Figure 1**). The WA-484-P 3D MSS will be comprised of approximately ~2,000 km² of 3D seismic data acquisition in Petroleum Exploration Permits WA-484-P and WA-480-P in water depths ranging between 1,630 and 3,000 metres.

The proposed survey is to be acquired during 2014, and with intention to avoid acquisition throughout the blue whale migration period. The duration of the survey will be approximately 75 days.

ASSESSMENT UNDER THE EPBC ACT

As the proponent for the WA-484-P 3D MSS, CGG took the decision not to refer the proposed survey under the Commonwealth *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The survey area for the proposed WA-484-P 3D MSS is not considered a habitat that is critical to the survival of any listed species. Similarly, there are no EPBC Act-listed threatened ecological communities (TEC) in the vicinity of the survey area. There is no real chance or possibility that the proposed survey will result in significant impacts to any matters of National Environmental Significance (NES)—as defined in the Commonwealth Department of Environment significant impact guidelines for NES matters.

The survey will be carried out in accordance with the Australian Commonwealth Government Guidelines: *EPBC Act Policy Statement 2.1 – Interaction between offshore seismic exploration and whales*.

COORDINATES OF THE PROPOSED ACTIVITY

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

Figure 1 – Location map - WA-484-P 3D MSS operational area

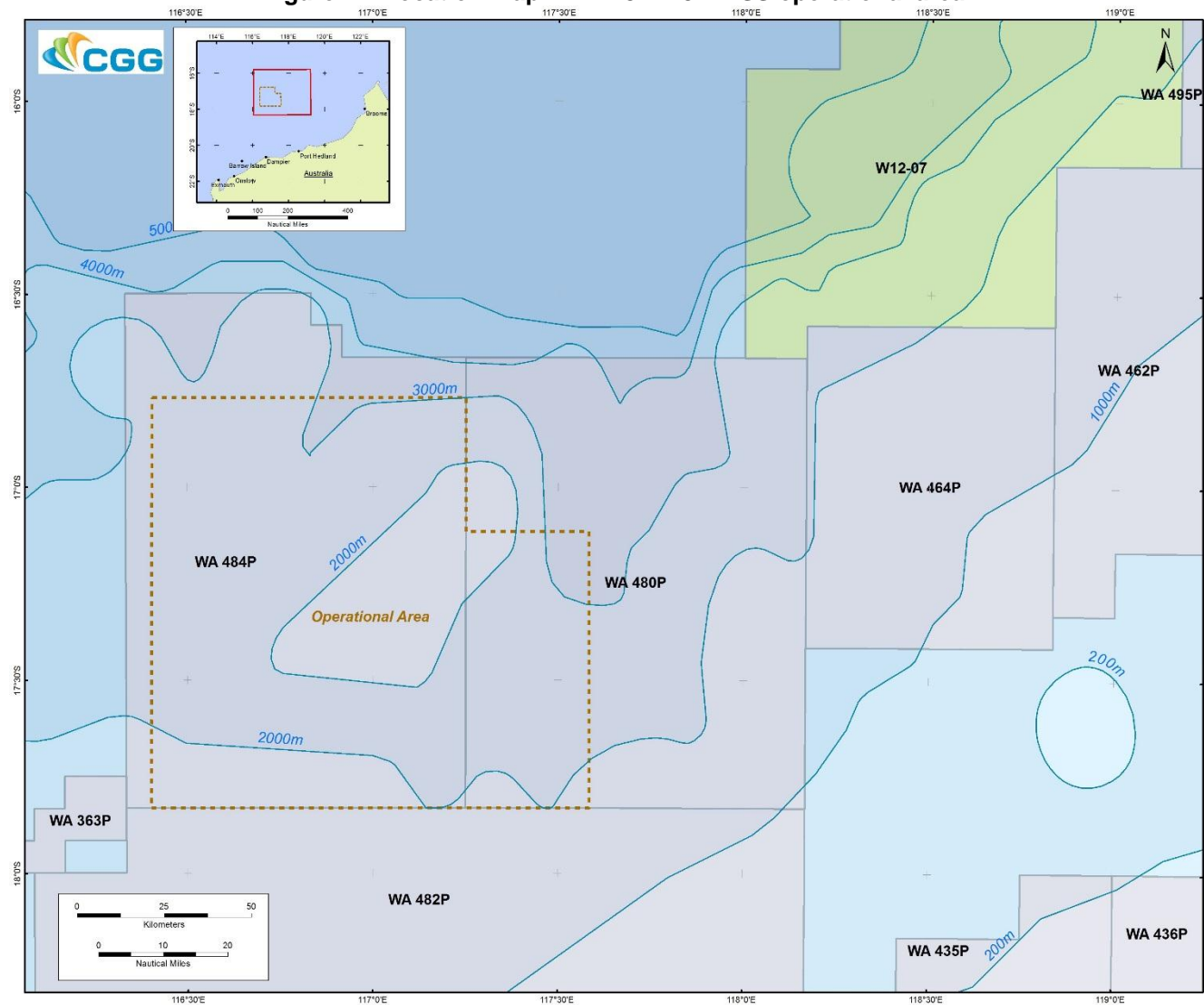


Table 1 – WA-484-P 3D MSS– boundary coordinates

Latitude (S)			Longitude (E)		
Degrees	Minutes	Seconds	Degrees	Minutes	Seconds
Operational Area					
16	46	09	116	24	25
16	46	09	117	15	05
17	06	58	117	15	05
17	06	56	117	34	56
17	49	55	117	35	05
17	49	55	117	15	05
17	49	55	116	24	07

Datum: WGS84

At its closest point, the survey is located ~340 km north-northwest of Port Hedland, ~340 km north of Dampier, ~340 km north of Karratha, and 165 km west of the southernmost reef of the Rowley Shoals (Imperieuse Reef).

The water depth of the operational area varies between 1,630 m to 3,000 m, with the deepest water depths situated in the northwest corner of the operational area (**Figure 1**).

DESCRIPTION OF THE PROPOSED ACTIVITY

The proposed survey is to be carried out in 2014, though intention is to avoid acquisition throughout the blue whale migration period. The duration of the survey will be approximately 75 days, dependent on weather and environmental conditions.

The survey vessel will tow seismic equipment along a series of predetermined sail lines within the survey area. As the survey vessel travels along the sail lines, compressed air will be discharged from a source array towed behind the vessel at 7 m to 8 m (+/- 1 m) below the water surface. A series of noise pulses (discharged every 8 to 10 seconds) will be directed down through the water column and seabed. The released sound will be attenuated and reflected at geological boundaries and the reflected signals are detected using sensitive microphones (hydrophones) arranged along a number of cables (streamers) that are towed behind the vessel at a depth of 6 m to 8 m (+/- 1 m). 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 streamer spread will consist of 8 to 12 streamers with a maximum length of 6,000 m, each towed 100 m apart. The operating pressure for the airgun array will be ~2,000 psi. The airgun array will consist of two sub-arrays, each with a maximum volume of 4,000 cui. These sub-arrays will be fired alternately with a shot point interval of 25 m horizontal distance and will produce at source (i.e., within 1 m of the centre of the array) sound pulses of ~242 dB re 1µPa-m sound pressure level (SPL) at frequencies up to 200 Hz.

CGG proposes to conduct the WA-484-P 3D 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 ~4 – 4.8 knots.

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 WA-484-P 3D MSS area is located in the Northwest Transition provincial bioregion of the Northwest Marine Bioregion. The Northwest Transition is located off the continental shelf between the Dampier Archipelago and Lacepede Islands, with a total area of 184,424 km². It encompasses a range of water depths, from the shelf break (at 200 m depth) over the continental slope, to depths of more than 1,000 m. At their deepest, waters within the Northwest Transition reach depths of around 5,980 m over the Argo Abyssal Plain.

Physical Environment

The climate in the WA-484-P 3D MSS area is expected to be similar to that of the Rowley Shoals area, which experiences a tropical monsoon climate, subject to cyclonic activity between December and April. This is associated with mild summers and winters, with westerly to north-westerly rain-bearing winds from November to March, and strong easterly to south-westerly trade winds which occur continuously from May to October. On the coast at Port Hedland, the average rainfall is 319 mm, with evaporation rates between 3,000 mm to 3,200 mm throughout the year. Intense rainfall may occur during the passage of summer tropical cyclones generally between December and April, but peak in February and March.

The area is strongly influenced by the Indonesian Throughflow, the Leeuwin Current, the South Equatorial Current and the Eastern Gyral Current. The major surface currents in the region flow polewards, away from the equator. Below the surface currents, there are a number of subsurface currents, the most important of which is the Leeuwin under-Current and the West Australian Current. These currents flow towards the equator.

The Indonesian Throughflow Current brings warm and relatively fresh water to the region from the western Pacific via the Indonesian Archipelago. Both the Indonesian Throughflow and Leeuwin Currents are influenced by seasonal variability in pressure gradients. During the North-west Monsoon (December to March), the pressure gradient between the Pacific and Indian Oceans is reduced resulting in a weakening of the currents. During the south-east monsoon (April to September), the pressure gradient becomes more intense, strengthening the South Equatorial current and Eastern Gyral Current, which may give rise to anti-clockwise circulations resulting in a northward movement of water over the continental slope. Seawater (surface) temperatures are approximately 24°C in the Rowley Shoals region. There is little annual variation in sea temperature and minimal stratification. Surface salinities typically average 34-35 parts per thousand.

The North West Shelf and Exmouth Plateau are areas of known high internal wave activity in the shelf break region. The area is influenced by strong tidal activity with internal waves causing deep-water upwelling, which increase the biological productivity at the shelf break. Areas of continental slope in this bioregion are believed to have different physical attributes to areas of continental slope in adjacent bioregions, particularly due to the locality of the Northwest Transition, which occurs predominantly in water depths of 4,000 m. Other topographic features within the bioregion include areas of rise, ridges, canyons and apron/fans. The bioregion also has reefs such as Mermaid, Clerke and Imperieuse reefs located about 145 km east of the survey area. The Rowley Shoals are a series of isolated, reef-rimmed platforms along a north-south orientation that rise vertically to the surface from water depths of about 400 m on the continental slope.

Biological Environment

On average, 60% of the sediments in the North-west Marine Region are carbonate derived. The highest carbonate contents occur on the shelf, including areas associated with reefs and algal banks. The Carnarvon Basin, including the Exmouth Plateau, is generally made up of sediments primarily comprising muddy sand and sandy mud. This type of substrate indicates the main benthic community would comprise filter feeders and epifauna.

Further down the slope of the North Carnarvon basin in the deeper regions, studies indicate the seabed consists of fine muddy carbonate sediments. The sediments of the slope are dominated by sands, whereas the sediments of the abyssal plain/deep ocean floor are dominated by muds. The seabed would likely support small fauna living between the grains of sediment such as nematodes, larger infauna that burrow into sediments, (e.g. polychaete worms and isopods) and sparsely distributed epibenthic communities such as seapens, sea cucumbers and crabs. The proposed survey area lies in water depths greater than 1,630 m and therefore habitats such as coral reefs, seagrass meadows and algae beds are unlikely to occur. Water depth also has a significant overriding influence over productivity in the marine environment, due to its influence on light availability. This is reflected by distinct onshore and offshore assemblages of major pelagic groups of phytoplankton, microzooplankton, mesoplankton and ichthyoplankton.

The slope habitat of the Northwest Transition marine bioregion is associated with important populations of demersal fish species. Over 508 fish species have been identified on the slope in this area, and 64 of these species are endemic. Demersal slope fish species in this bioregion are distributed across a number of distinct depth ranges on the slope, specifically areas of the upper slope (between 225 m to 500 m) and mid-slope (750 m to 1,000 m).

A search of the EPBC Act database (Protected Matters search tool) was conducted for the area described by the boundary coordinates provided in **Table 1**, with the application of a 1 km buffer zone. A total of 39 species of protected marine fauna may occur in the proposed WA-484-P 3D MSS area. Of this total, the following species were listed as potentially having habitat in the survey area:

- twenty-two species of cetacean. Two of these species have a threatened status and six species have a migratory status under the EPBC Act;
- two species of shark listed as having migratory status; and
- ten reptile species listed, of which five are listed as threatened and migratory.

Cetaceans

Twenty-two marine mammal species are listed under the EPBC Act may occur within the survey area. The threatened and migratory species listed are:

- blue/pygmy blue whale;
- humpback whale;
- Antarctic minke whale;
- Bryde's whale; and
- killer whale.

These species are further discussed below.

Blue/pygmy blue whale

There are two sub-species of blue whale in the Southern Hemisphere; the southern blue whale and the pygmy blue whale. The southern blue whale is found south of 60°S and the pygmy blue whale is found north of 55°S. Therefore, it is likely that the majority of blue whales occurring in Australian waters are pygmy blue whales.

Blue whales are widely distributed throughout the world's oceans and it is thought that they follow deep oceanic routes. Little is known about their precise migration paths but it is believed blue whales migrate south to Antarctic waters in early summer (October to December) and leaves in autumn migrating to tropical breeding areas (deep oceanic waters of Indonesia and possibly SW Pacific) during winter. The northward component of this migration takes place from May to August, however no specific migration routes have been identified in Australian waters.

Sightings in Australian waters have been widespread, and it is likely that the whales occur right around the continent at various times of the year. However, much of the Australian continental shelf and coastal waters have no particular significance to the whales and are used only for migration and opportunistic feeding. The only known areas of significance to blue whales are feeding areas around the southern continental shelf, notably the Perth Canyon (off Rottnest Island) in WA (during December to April), and the Bonney Upwelling and adjacent upwelling areas of South Australia and Victoria. The Perth Canyon is ~1,600 km south of the proposed survey area. Aerial surveys between 1999 and 2004 recorded an average of 30 individuals at the peak of the season (March-May). Acoustic detections suggest that true blue whales also over-winter around the Perth Canyon and head south in mid-October.

A recent study into the migratory distribution and behaviour of pygmy blue whales that feed in the Perth Canyon region was conducted in 2011 by the Australian Marine Mammal Centre. The study used satellite tracking to determine if the same blue whales feeding in the Perth Canyon were migrating north to the Banda Sea (Indonesia) as was previously recorded. Three whales were tracked through to North West Cape and each then took a similar bearing to cross the Timor Sea. Given the approximate bearings these whales take from North West Cape, they tend to leave Australian waters when north of Broome to Cape Londonderry in the Kimberley. Overall, the study suggested that the northern migration route and final destination appears to be common to the pygmy blue whale population. In winter, blue whales are believed to calve in tropical waters and births peak in May to June, however the exact breeding grounds of this species are unknown.

Blue whales have been reported to move between Scott Reef and Browse Island (~700 km northeast of the proposed survey area) during July (northern migration) and again during October-November as part of their southern migration. Based on acoustic data, individual blue whales are likely to travel alone or in small groups. The migration route for pygmy blue whales is designated a biologically important Area. Due to the uncertainty in the timing of the survey, it is possible that blue/pygmy blue whales may be present as migrating individuals or small pods during the proposed survey; however, no known aggregation or breeding areas are located within the proposed MSS area.

Humpback whale

The most commonly sighted whale in continental shelf waters of the North-west region is the humpback whale. The WA population of humpback whales migrates north each year between its feeding grounds in Antarctic waters and breeding and calving grounds in the Kimberley region of WA. Immature individuals and lactating females arrive first, followed by non-pregnant females arriving last. The peak of the northbound migration between Exmouth Gulf and the Dampier Archipelago occurs around late July, concentrated along the 200 m depth contour.

Breeding and calving takes place between mid-August and early September between Broome and the northern end of Camden Sound (~800 km northeast of the proposed survey area). The southbound return migration peaks around early September, with pods preferring to travel in shallower waters, typically less than 200 m deep, confirmed by recent aerial and boat-based surveys, and within 9 nm (17 km) of the coast. Females with calves are the last to leave the breeding grounds, stopping to rest in Exmouth Gulf and Shark Bay (more than 550 km southwest and 950 km south-southwest of the survey area respectively).

The transition period (between the northbound and southbound migrations) occurs between early August and early September. Pod sizes off the North West Cape during this time are higher than at any other time of the year. During the transition period, whale pods are more dispersed, occurring in shallow waters (about 50 m) and in waters as deep as 1,200 m. Many cow/calf pairs use the Exmouth Gulf (~550 km south of the proposed survey area) as a resting ground during the transition period on their southbound migration, with many males entering the gulf intent on mating.

The proposed WA-484-P 3D MSS area is outside of the northern and southern migration route.

Antarctic minke whales

Antarctic minke whales have been recorded offshore from all Australian states with the exception of the Northern Territory (NT). Their distribution along the west coast of Australia is currently unknown. This species is known to undertake annual migrations to feeding grounds in southern Australian and Antarctic waters during summer; and winter breeding grounds in open ocean areas throughout tropical and sub-tropic waters.

Although it may be possible that this species is encountered during the survey, the proposed survey area is not known to be critical habitat for Antarctic minke whales.

Bryde's whale

Bryde's whales are found year-round in waters between 40°S and 40°N, both oceanic and inshore, primarily in water temperatures exceeding 16.3°C and have been recorded from all Australian states except the NT. The coastal form of the Bryde's whale appears to be limited to the 200 m depth contour, moving along the coast in response to availability of suitable prey. Bryde's whales residing inshore appear to breed and calve all year round, while those that reside in offshore waters have an extended breeding and calving season over several months during winter. The offshore form is found in deeper waters (500 m to 1,000 m).

Bryde's whales residing inshore appear to breed and calve all year round, while those that reside in offshore waters have an extended breeding and calving season over several months during winter. The larger offshore form exhibits some seasonal movement, whilst the smaller inshore form is usually sedentary, although details of movement patterns are not well described or understood.

The proposed survey area is not known to be critical habitat for Bryde's whales, and given the limit of their presence in waters greater than 1,000 m, it is unlikely that this species will be present within the survey area.

Sperm whale

Sperm whales have been recorded from all Australian states. Females and young male sperm whales are restricted to warmer waters, generally north of ~45°S, while older males travel to and from colder waters and to the edge of the Antarctic pack-ice. No population estimates are available for sperm whales in Australian waters. Lack of taxonomic resolution, plus a lack of abundance and distribution data do not allow definitive assessment of the likelihood for sub-populations within Australian populations of sperm whale.

Off the WA coast, sperm whales appear to be less concentrated close to shelf edge and more widely dispersed offshore. In the open ocean there is a generalised migration southwards in summer, with a corresponding movement northwards in winter. These whales may migrate through waters along the entire Australian coastline, although their distribution in the northernmost coastal regions is limited. Sperm whales have been recorded both acoustically and visually during aerial surveys, occasionally occurring in the deep, oceanic waters of the North West Shelf. Therefore, low numbers of sperm whales may occur within or in the vicinity of the proposed survey area.

Killer whale

The killer whale is widely distributed in polar and equatorial waters, but appears to prefer deep, cold waters. The killer whale has been recorded from all states in Australia. The total number of killer whales in Australian waters is unknown. Lack of taxonomic resolution, plus a lack of abundance and distribution data, does not allow definitive assessment of the number of subpopulations of killer whales in Australian waters. This species has a large natural range and the migrations and likely occurrence of this species are difficult to predict. While this species has been recorded on the North West Shelf, this species is not known to use the tropical waters of the proposed survey area for feeding, breeding or resting.

Sharks

The shortfin mako shark and longfin mako are both listed as migratory under the EPBC Act. Shortfin and longfin makos are highly mobile species with oceanic and pelagic habit, and are only occasionally found inshore. The shortfin mako is known to occur in both tropical and temperate waters and is normally oceanic and cosmopolitan in its distribution. It is widespread in Australian waters commonly found in waters with temperatures greater than 16°C. The longfin mako is a more tropical species than the shortfin mako and although rare it has been found in Australian waters north of Geraldton, WA, including the northern coast of the continent and to at least Port Stephens in New South Wales.

Both species are considered to have undergone substantial declines globally due primarily to their continued interaction with fisheries, low reproductive capacity and longevity. In WA, there is little information available that describes population estimates or distributions. Given their widespread and highly dispersed distribution, the shortfin and longfin mako may transit the survey area; however it is unlikely that the survey area represents critical habitat (key feeding, breeding, pupping areas) for the mako sharks.

Reptiles

Marine Turtles

Five species of marine turtles occur in waters of the North-west region of WA. A summary of marine turtle ecology on the North West Shelf is provided in **Table 3**. Of the five, only four species are known to be reproductively active in the North West Shelf region of WA: the green; flatback; hawksbill; and loggerhead turtles. Although all the aforementioned turtles may occasionally pass through the proposed survey area, there are no known turtle nesting or critical feeding areas within or in the vicinity of the survey area.

Table 3 – Summary of marine turtle ecology on the North West Shelf

Species	Food	Habitat	Population	Breeding and Nesting
Hawksbill turtle	Mainly feed on sponges, but also soft corals, sea grasses and molluscs in waters less than 20 m deep.	Tidal and sub-tidal coral and rocky reef, as far south as Shark Bay in WA.	One genetic stock, centred on the Dampier Archipelago. Although a small population, it is one of the largest remaining populations in Indian Ocean.	<p><u>Breeding</u> North West Shelf population breed between July and March.</p> <p><u>Nesting</u> Nests in a small range, from Cape Range to the Dampier Archipelago. Rosemary Island in the Dampier Archipelago has a major rookery. The Montebello and Lowendal island groups, and the Muiron Islands, Bessieres and Airlie islands are also nesting sites. Peak nesting is between September and November.</p>
Green turtle	Herbivorous – seagrass and algae in shallow waters. Carnivorous in first year.	Found in water depths of less than 20 m. Rookery concentrated on Barrow Island.	Most widespread and abundant turtle species in WA, supporting only one genetic stock. Population is in the order of tens of thousands. Barrow Island population thought to be about 100,000.	<p><u>Breeding</u> Summer breeding close to Barrow Island.</p> <p><u>Nesting</u> Barrow Island – nesting starts in November, peaks in January-February, ends in April. Serrurier Island – nesting between August and March. Ningaloo coast, Exmouth Gulf & Muiron Islands – nesting between November and March.</p>
Flatback turtle	Mid-water plankton and benthic animals.	Mid-shelf water depths (up to 50 m). Shallow, soft bottom habitats of coastal and continental shelf waters of northern Australia.	Endemic to the Australian continental shelf, locally abundant species. Barrow Island east coast population estimated at 10,000 animals.	<p><u>Breeding</u> Locations and timing unknown.</p> <p><u>Nesting</u> Characterised by summer nesting, with peak nesting in December and January. About 700 nest on Barrow Island annually (one-third of Pilbara total), preferring lower energy beaches on east coast. Other nesting sites include the Montebello and Lowendal island groups, and the Dampier Archipelago.</p>
Leatherback turtle	Mid-water soft bodied organisms such as jellyfish, and benthic animals.	Mid-shelf water depths (up to 50 m).	Records only of occasional foraging in the region.	<p><u>Breeding</u> Large portion of Australian population migrate to Java, Indonesia to breed.</p> <p><u>Nesting</u> Nesting cycle of 2-3 years, with females laying eggs 4-5 times per season. No confirmed nesting sites in WA.</p>
Loggerhead turtle	Mid-water plankton and benthic animals (molluscs and crustaceans). Mainly carnivorous.	Mid-shelf water depths (up to 50 m).	WA supports one genetic stock. Least abundant of the marine turtles in WA.	<p><u>Breeding</u> Breeding occurs from November to March.</p> <p><u>Nesting</u> Muiron Islands, Ningaloo coast and Shark Bay – between September and March. Hatchlings emerge mostly from February to early March.</p>

Seasnakes

A search of the EPBC Act Protected Matters database identifies five species of seasnake as possibly occurring within the proposed survey area, none of which are listed as threatened or migratory. Given the water depths present in the proposed survey area and the distance from the nearest emergent reef system and coastlines (>180 km), probability of encountering seasnakes during the survey activities is considered low.

Socio-economic Environment

Coastal Settlements

The proposed WA-484-P 3D MSS area is a significant distance from any coastal settlement. The nearest townships to the proposed WA-484-P 3D MSS area are Port Hedland (Town of Port Hedland), located approximately 340 km south-southeast of the survey and Dampier/Karratha (Shire of Roebourne), 340 km to the south.

Commercial Fisheries

Commercial fisheries that can operate in the region include:

Commonwealth:

- North West Slope Trawl Fishery (NWSTF)
- Western Tuna and Billfish Fishery (WTBF)
- Western Skipjack Fishery (WSF)
- Southern Bluefin Tuna Fishery (SBTF)

State:

- Mackerel Managed Fishery (MMF) (Area 2 – Pilbara)
- Pilbara Line Fishery (PLF), part of the Pilbara Demersal Scalefish Fishery
- West Coast Deep Sea Crustacean Fishery (WCDSCF)

The NWSTF extends from 114°E to about 125°E off the WA coast between the 200 m isobath and the outer limit of the Australian Fishing Zone (AFZ). There is a possibility that the proposed WA-484-P 3D MSS area may overlap in the southern most corner of the trawl area. The WTBF covers an extensive area - westward from Cape York Peninsula (142°30'E) off Queensland to 34°S off the WA west coast. It also extends eastward from 34°S off the west coast of WA, across the Great Australian Bight to 141°E at the South Australian/Victorian border. Although the licence area overlaps with the WA-484-P 3D MSS area there are no licensed vessels operating around the proposed survey area. The WSF overlaps the survey area, however, there have been no Australian fishing vessels active in the region since 2011. The SBFT extends to the high seas for Australian flagged vessels and therefore overlaps the survey area, however, currently there is no fishing effort around the survey area.

The MMF extends from Augusta in the south to the WA/NT border out to 200 nm and therefore overlaps the survey area, however, fishing is concentrated around reefs, shoals and headlands outside of the WA-484-P 3D MSS area. The PLF does not overlap it occurs in waters <200 m depth. The WCDSCF includes all waters north of 34°24'S (Cape Leeuwin) and west of the NT border on the seaward side of the 150 m isobaths. The WA-484-P 3D MSS area overlaps the licence area, however, fishing effort is concentrated in water depths of 500-800 m.

Commercial Shipping

The Australian Maritime Safety Authority (AMSA) has identified that the proposed survey area is an area of major shipping, in particular the Dampier Shipping Fairway and the Port Walcott to Lombok route. Consultation with AMSA indicates that this traffic consists mainly of tanker and bulk cargo vessels of national and international significance. Therefore, significant traffic will be encountered in

the survey area. An escort vessel to identify potential shipping threats, together with navigational warnings via the Australian Hydrographic Service (Notice to Mariners) and the AMSA Rescue Coordination Centre (Auscoast warnings) will be implemented prior to survey commencement such that commercial vessels are aware of survey vessel movements during the survey.

Under the *Navigation Act 2012*, all vessels operating in Australian waters are required to report their location on a daily basis to the Rescue Coordination Centre (RCC) in Canberra. This Australian Ship Reporting System (AUSREP) is an integral part of the Australian Maritime Search and Rescue system and is operated by AMSA through the RCC.

Petroleum Exploration and Production

Current operating facilities and developments nearest to the proposed survey include the Modoc Venture 11 (~165 km to the south), Angel Gas Platform (~190 km to the south), North Rankin A Platform (~200 km to the southeast), Greater Gorgon gas fields (~340 km to the southeast), and Pluto gas field (~275 km to the southeast), though there are no petroleum developments in any of the permits directly adjacent to WA-484-P.

Tourism and Recreation

The proposed WA-484-P 3D MSS area lies in a remote offshore location (~340 km northwest of Port Hedland), and is therefore unlikely to be of interest to recreational fishing or any tourist activities. The closest nature-based tourism and recreational area is the Rowley Shoals Marine Park, ~160 km east (at Imperieuse Reef) of the survey area.

Defence Activities

There are no known defence activities or military exercise areas within or near the proposed survey area.

Cultural Values

There are no known historic shipwrecks within, or in the immediate vicinity of the proposed survey areas according to the Australian National Shipwreck database. The closest shipwrecks to the survey area, located in the Rowley Shoals area (~160 km east of the survey area) are the sailing vessels *Alfred*, *Lively*, *Pelsart* and *See Taube*.

A search of the Aboriginal heritage database, managed by the Department of Aboriginal Affairs reveals there are no known indigenous heritage values within or adjacent to the operational area.

Conservation Values and Sensitivities

The WA-484-P 3D MSS area is located within the south western portion of the Argo-Rowley Terrace Commonwealth Marine Reserve (CMR), however, it is within the Multiple Use Zone and a significant distance away from the Marine National Park Zone. The Mermaid Reef CMR and the Kimberley CMR are in the vicinity of the WA-484-P 3D MSS area, however, it is a significant distance to the north east of the survey area. Mermaid Reef (Rowley Shoals) was listed on the Commonwealth Heritage List in 2004 and is also encapsulated by the Mermaid Reef CMR. The proposed area is approximately ~235 km west of Mermaid Reef.

There are no World Heritage Properties in or adjacent to the proposed WA-484-P 3D MSS area. The nearest World Heritage Property is the Ningaloo Coast (~535 km south). There are no National Heritage places in the Vicinity the nearest National Heritage place is the Dampier Archipelago (including the Burrup Peninsula), located ~320 km south of the proposed area.

There are no listed Wetlands of International Importance in or adjacent to the proposed survey area. The nearest Wetland of International Importance is Eighty Mile Beach, which is located more ~390 km southeast of the proposed survey area.

The Rowley Shoals Marine Park was gazetted as an “A” Class reserve on 25th May 1990. The marine park is managed under the Rowley Shoals Marine Park Management Plan 2007-2017. Two reefs form the Rowley Shoals Marine Park; the Clerke and Imperieuse reefs. The marine park is vested in the WA Marine Parks and Reserves Authority (MPRA) and managed by the Department of Parks and Wildlife. Imperieuse Reef and Clerke Reef are located approximately 160 km and 210 km east of the proposed area, respectively.

MAJOR ENVIRONMENTAL HAZARDS AND CONTROLS

An Environmental Risk Assessment (ERA) has been undertaken to understand and manage the environmental risks associated with the WA-484-P 3D 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*.

A summary of key environmental hazards and control measures to be applied to the WA-484-P 3D MSS activities are shown in **Table 4**. Implemented control measures documented in **Table 4** ensures that the environmental risks associated with these impacts are maintained at levels that are As Low As Reasonably Practicable (ALARP), 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 WA-484-P 3D MSS will be managed in compliance with the WA-484-P 3D MSS EP accepted by NOPSEMA under the Environment Regulations, other relevant environmental legislation. The design and execution of the proposed WA-484-P 3D MSS will be conducted under the framework of the CGG Environment Policy and Health, Safety and Environment (HSE) Management System. The programme will also operate under CGG Event Management Standard Operating procedure (MAR QPM PRC 005E) and a project-specific HSE Plan. 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.

The objective of the EP is to ensure that potential adverse impacts on the environment associated with the WA-484-P 3D MSS, during both routine and non-routine operations, are identified, and will be reduced to ALARP and will be of an acceptable level. The WA-484-P 3D MSS EP details for each environmental aspect (identified and assessed in the Environmental Risk Assessment – Section 7 of the Environment Plan) specific performance objectives and standards, and identifies the range of controls measures (**Table 4**) to be implemented (consistent with the standards) to achieve the performance objectives and identifies the specific measurement criteria used to demonstrate that these performance objectives are achieved.

The implementation strategy detailed in Section 8 of the WA-484-P 3D MSS EP identifies the roles/responsibilities and training/competency requirements for all personnel (CGG and its contractors) in relation to implementing controls, managing non-conformance, emergency response and meeting monitoring, auditing, and reporting requirements during the activity. The WA-484-P 3D MSS EP details the types of monitoring and auditing that will be undertaken, the reporting

requirements for environmental incidents and reporting on overall compliance of the survey with the EP.

Table 4 - Summary of environmental risk assessment for key aspects of the WA-484-P 3D MSS EP

Impact Category	Potential Impacts	Control and Mitigation Measures	Impact Ranking
Routine Impacts			
Underwater noise	Generation of underwater noise from the seismic source and vessels could cause disturbance to noise-sensitive species	<ul style="list-style-type: none"> • Adherence to EPBC Act Policy Statement 2.1 Part A Standard Management Procedures, and the following additional mitigation measures for whales: <ul style="list-style-type: none"> - precaution zones (observation zone: 3 km+; low power zone: 2 km; and shutdown zone: 500 m) - two dedicated MFO on survey vessel • Adherence to EPBC Act Policy Statement 2.1 Part B Additional Management Procedures, and the following mitigation measures for blue/pygmy blue whales during migration periods (July, 1st October – 31st November): <ul style="list-style-type: none"> - pre-start visual observation time increased from 30 min to 45min - shutdown zone increased to 3 km • Application of vessel-whale interaction procedures for non-acoustic energy source operations • Pre-survey induction includes coverage of EPBC Act Policy Statement 2.1 requirements • Detailed reports of all cetacean sightings will be recorded using the DoE CSA database 	Low
Light emissions	Localised light glow may act as an attractant to light-sensitive species (e.g., seabirds, squid, zooplankton), in turn affecting predator-prey dynamics.	<ul style="list-style-type: none"> • 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 not located near 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 • The Vessel Master ensures that vessel deck and navigational lighting is in line with the following so that light glow is minimised while ensuring the vessel is visible to other vessels: <ul style="list-style-type: none"> - Marine Orders Part 21 (Safety of navigation and emergency procedures). - Marine Orders Part 30 (Prevention of Collisions). - The Australian Offshore Support Vessel Code of Safe Working Practice 	Low
Atmospheric emissions	Decrease in air quality and contribution to GHG effect	<ul style="list-style-type: none"> • Diesel fuel will contain less than 3.5% m/m sulphur • All combustion equipment will be maintained in accordance with the vessel's PMS to ensure they are operating to design specifications • Fuel usage will be monitored and in the event of high fuel usage initiates corrective action in order to minimise excessive air pollution 	Low
Discharge of sewage and grey water	Increase in the content of nutrients and pathogens in the surrounding surface waters.	<ul style="list-style-type: none"> • All sewage and grey water discharges will be treated via an approved sewage treatment plant prior to overboard discharge in accordance with Regulation 9 of MARPOL Annex IV (enacted by AMSA Marine Orders Part 96, Sewage) • The sewage treatment plant will be maintained • Untreated sewage and grey water will only be discharged when the vessel is greater than 12 nm from shore (in the event of a plant malfunction) in accordance with Regulation 9 of MARPOL Annex IV (enacted by AMSA Marine Orders Part 96, Sewage) 	Low

Discharge of putrescible waste	Increase in nutrients in surrounding surface waters and increase in scavenging behaviour of marine fauna and seabirds	<ul style="list-style-type: none"> All food waste will be macerated to ≤ 25 mm in size prior to overboard discharge in accordance with Regulation 8 of MARPOL Annex V (enacted by AMSA Marine Orders Part 95, Garbage) to ensure rapid breakdown upon discharge The macerator is maintained (or repaired or replaced) to ensure it is fully functional. All non-putrescible galley waste (i.e., packaging, cooking oils and grease) will be securely stored prior to transfer back to shore for recycling or disposal 	Medium
Discharge of deck and bilge water	Pollution of surrounding surface waters and acute toxicity to marine fauna	<ul style="list-style-type: none"> The hydrocarbon and chemical storage areas (e.g., engine room) will be fully bunded and drain the bilge water tank Scupper plugs or equivalent drainage control measures are readily available to the deck crew so that deck drains can be blocked in the event of a hydrocarbon or chemical spill on deck to prevent or minimise discharge to the sea Bilge water will be treated through an oily water separator (OWS) set to prevent the discharge of water with a greater than 15 ppm OIW content in accordance with Regulations 12 & 14 of MARPOL Annex I OWS will be maintained in accordance to ensure it does not discharge water containing >15 ppm oil Residual oil from the OWS is pumped to tote tanks and transferred to shore (for recycling, reuse or disposal) A secure chemical storage facility will be available, bunded and used for the storage of all chemicals so as to prevent accidental discharge overboard Deck crew will be competent in spill response and have appropriate response resources in order to prevent hydrocarbon or chemical spills going overboard Spill response kits will be available in relevant locations and used in the event of a spill to deck to prevent or minimise discharge overboard 	Low
Disposal of hazardous and non-hazardous waste	Marine pollution causing fauna injury or death	<ul style="list-style-type: none"> Waste will be segregated, stored and handled in accordance with the vessel's Waste Management Plan, as required by Regulation 9 of Annex 5 of MARPOL (enacted by AMSA Marine Order Part 94, Packaged harmful substance and Marine Orders Part 95, Garbage) Crew members will be inducted into waste management procedures in order to minimise the potential for unpermitted wastes being discharged overboard and to ensure effective waste segregation. MSDS registers will be available in key locations (e.g., bridge, chemical locker) and kept up to date so that chemical spills to deck can be safely managed A waste manifest will be used to track all waste types and volumes transferred to the support vessels. All large, bulky items will be secured to the main deck in line with the Sea Fastening Procedure 	Low
Non-routine Impacts			
Seabed disturbance from anchoring	Turbidity and displacement of seabed habitat	<ul style="list-style-type: none"> Anchoring in shallow waters near shoals (e.g., reefs, islands or Pilbara coastline) will only occur in an emergency and all measures will be taken to avoid sensitive benthic habitats (e.g., corals,) The vessel materials and handling procedure will be implemented by the Crane Operator to prevent objects from dropping overboard 	Low
Introduction of invasive marine species	Loss of diversity and abundance of native species	<ul style="list-style-type: none"> The vessel will have anti-fouling system certification in place in accordance with AMSA Marine Order Part 98 (Anti-fouling systems) The vessel will have AQIS clearance to enter Australian waters in accordance with the Australian Ballast Water Management Requirements 	Medium

Interference with third-party vessels	Damage and/or loss of fishing equipment, loss of commercial catches and disruption to commercial activities	<ul style="list-style-type: none"> • Maintain anti-collision monitoring equipment (e.g., Global Maritime Distress and Safety System, GMDSS, and Automatic Identification System, AIS) in use in accordance with AMSA Marine Orders Part 30 (Prevention of collisions) • AMSA will be notified prior to mobilisation to location and prior to demobilisation from location • The Vessel Master will be qualified in accordance with AMSA Marine Orders Part 3 (Seagoing qualifications) (e.g., International Convention of Standards of Training, Certification and Watchkeeping for Seafarers, STCW95, GMDSS Proficiency) to operate radio equipment in order to minimise the chance of collisions • The Vessel Masters of the support vessels will scout the area around the streamers to prevent third-party vessels from interacting with the streamers. • Notification flyers, noting the survey area location and activity, will be issued to stakeholders prior to the survey commencing • The Vessel Master will sound the general alarm, manoeuvre the vessel to minimise the effects of the collision and implement all other measures as outlined in the vessel or structure collision procedure 	Low
Collision with megafauna	Vessel strike and/or entanglement with streamers resulting in fauna injury or death	<ul style="list-style-type: none"> • Tail buoys will be fitted with the turtle guards that prevent turtles entering the undercarriage of the buoy • The Australian Guidelines for Whale and Dolphin Watching will be adhered to, which means: <ul style="list-style-type: none"> - Caution zone (300 m either side of whales and 150 m either side of dolphins) – vessels must operate at no wake speed in this zone. - No approach zone (100 m either side of whales and 50 m either side of dolphins) – vessels should not enter this zone and should not wait in front of the direction of travel or an animal or pod. - Do not encourage bow riding. - If animals are bow riding, do not change course or speed suddenly. - If there is a need to stop, reduce speed gradually. • The MFO will report all cetacean sightings and interactions to the DoE within 3 months of survey completion • The MFO will report all known or suspected threatened fauna injuries or death to the DoE within 2 hours of the incident 	Low
Diesel spills	Marine pollution, potentially leading to injury or death of marine fauna or seabirds through ingestion or contact	<ul style="list-style-type: none"> • The CGG Bunkering Offshore Instruction (MAR_MSS_PRC_007E) will be implemented. This includes (but is not restricted to) a toolbox talk to discuss safety precautions for the bunkering activity • AMSA will be notified (via phone call) prior to the commencement of all bunkering operations • The fuel supply vessel will put in place the fenders • Both vessels will have a Deck Officer supervising the mooring lines. When mooring is complete, the fuel hose will be passed from the supply vessel to the survey vessel • Communications between the two vessels will be tested by the Vessel Masters prior to bunkering commencing • The Chief Engineer will supervise the entire bunkering operation • The Vessel Master will report an MGO spill to CGG Perth and lead the on-board spill response, in accordance with the vessel's SOPEP and Breached Hull procedures • AMSA and NOPSEMA will be contacted within 2 hours of a spill being identified • In the case of a spill operational monitoring studies will be undertaken in accordance with the Oil Spill Contingency Arrangements in order to detect the extent of the MGO spill • Operational monitoring reports will be provided to relevant regulatory agencies in order to characterise environmental impacts from an MGO spill • A drill test of the oil spill emergency response arrangements will be conducted during the mobilization phase prior to commencement of operations of the survey 	Low

CONSULTATION PLAN

Consultation with stakeholder groups, primarily within the commercial fishing industry, concerning the proposed WA-484-P 3D survey has taken place prior to, and during the preparation of the EP. The following fisheries bodies and organisations have been contacted and informed of the proposed operations:

- A Raptis & Sons
- Austral Fisheries Pty Ltd
- Australian Fisheries Management Authority (AFMA)
- Australian Hydrographic Service (AHS)
- Australian Maritime Safety Authority (AMSA)
- Australian Southern Bluefin Tuna Industry Association (ASBTIA)
- Commonwealth Department of the Environment (DoE)
- Commonwealth Fisheries Association (CFA)
- MG Kailis
- Northern Fishing Companies Association (NFCA)
- Tuna West Indian Ocean Tuna Association (TWIOTA)
- WA Department of Fisheries (DoF)
- WA Fishing Industry Council (WAFIC)
- WA Seafood Exporters
- WestMore Seafoods

In addition, 41 individuals or entities who currently hold licences (one or more) that enable them to operate in the MMF, PLF and WCDSCF were contacted and provided with details of the WA-484-P 3D MSS. Consultation with all of the stakeholders listed above, plus others identified during the consultation process will continue during, and after the survey if required.

FURTHER DETAILS

For further information about the proposed CGG WA-484-P 3D MSS in the Carnarvon Basin offshore from WA, please contact:

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