Nerites Season 2 Multi Client 3D Marine Seismic Survey

Environment Plan: Public Summary

TGS-NOPEC Geophysical Company Pty Ltd

Revision 2

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1. INTRODUCTION

The geophysical company TGS-NOPEC Geophysical Company Pty Ltd (TGS) proposes to acquire a multi client three-dimensional (MC3D) marine seismic survey (MSS) within the Great Australian Bight (GAB), in the South-west Marine Region (SWMR) (see **Figure 1.1**). The full fold survey area for the Nerites Season 2 MC3D MSS is approximately (~) 17,199 square kilometres (km^2) within Exploration and Production Permits EPP 37, EPP 39 and EPP 40 (operated by BP Developments Australia Pty. Ltd), and EPP 44 and EPP 45 (operated by Chevron Australia New Ventures Pty Ltd). The Nerites Season 2 MC3D MSS is proposed to have a duration of two months, in the period January to end of June 2015.

Phase II of the Nerites MC3D MSS will be acquiring data in the period November 2014 to approximately June 2015. The Nerites Season 2 MC3D MSS will overlap Phase II of the Nerites MC3D MSS (see **Figure 1.1**). This means that during the period January to June 2015 there will be two seismic survey vessels acquiring data concurrently within the overall Nerites operational area. Due to data quality issues, these surveys would be spaced at least 30 km apart, so the cumulative effects of noise on the surrounding environment will be negligible. This is consistent with the number of multi client surveys acquired by the industry in Australian waters in recent years, so there is no increased risk associated with permitting a larger area, as at any one time the vessel and towed streamer footprint within the permitted area will not be increased.

1.1. LOCATION OF THE ACTIVITY

The proposed Nerites Season 2 MC3D MSS area is located entirely within Commonwealth waters in the Ceduna sub-basin south of South Australia (SA). At the closest point, the survey area is located ~190 km west of the Eyre Peninsula, 270 km south-west from Ceduna and 180 km from the nearest mainland coastline (see **Figure 1.1**). The water depths in the operational area are in the range of ~750 to 3,500 metres, with the shallowest water depths situated along the north-eastern boundary.

1.2. COORDINATES OF THE PROPOSED ACTIVITY

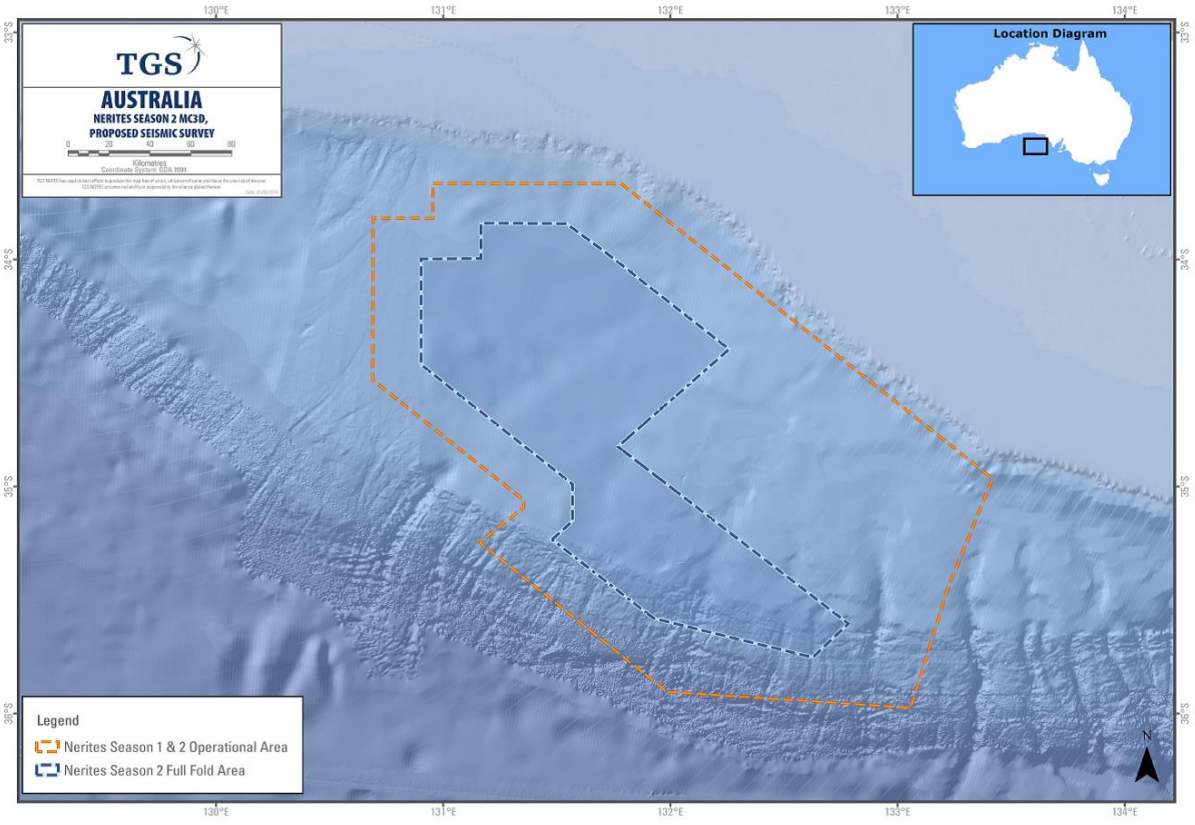
Boundary coordinates for the operational area (see **Table 1.1**) are shown in **Figure 1.1**.

Table 1.1- Coordinates of the Nerites Season 2 MC3D MSS Operational Area

Latitude (S)	Longitude (E)
Decimal degrees	
-35.7862	132.8898
-35.7329	132.0875
-35.2485	131.4613
-35.1522	131.5690
-35.1521	131.5690
-35.1520	131.5692
-34.9898	131.5693
-34.4632	130.9029
-33.9979	130.9027
-33.9957	131.1661
-33.8414	131.1671
-33.8434	131.6503
-35.0181	133.1662
-35.7862	132.8898

Datum: GDA 94

Figure 1.1- Location of the Operational and Full Fold Areas for the Nerites Season 2 MC3D MSS



1.3. DESCRIPTION OF ACTIVITY

The proposed marine seismic survey will be a typical 3D survey similar to most others conducted in Australian marine waters (in terms of technical methods and procedures). No unique or unusual equipment or operations are proposed. The proposed survey will be conducted using a purpose-built seismic survey vessel.

During the proposed activities, the survey vessel will traverse a series of pre-determined sail lines within the Nerites Season 2 MC3D MSS full fold survey area at a speed of ~8 - 9 km/hr. As the vessel travels along the survey lines a series of noise pulses (approximately every 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 12 solid streamers (cables), with a maximum length of ~8 km. The seismic cables are towed side-by-side and the spacing will be 120 m between each cable. The seismic energy source tow depth will be 7.5 m (+/-0.5 m) and the cable tow depth will be 12 – 30 m (+/-1 m). The operating pressure for the seismic energy source will be approximately 2,000 psi and the source will be deployed in two arrays, each with a maximum volume of 4,100 cubic inches (cui). These arrays will be activated alternately, every 25 m along each acquisition line (i.e. 50 m per array).

Source Volume Justification

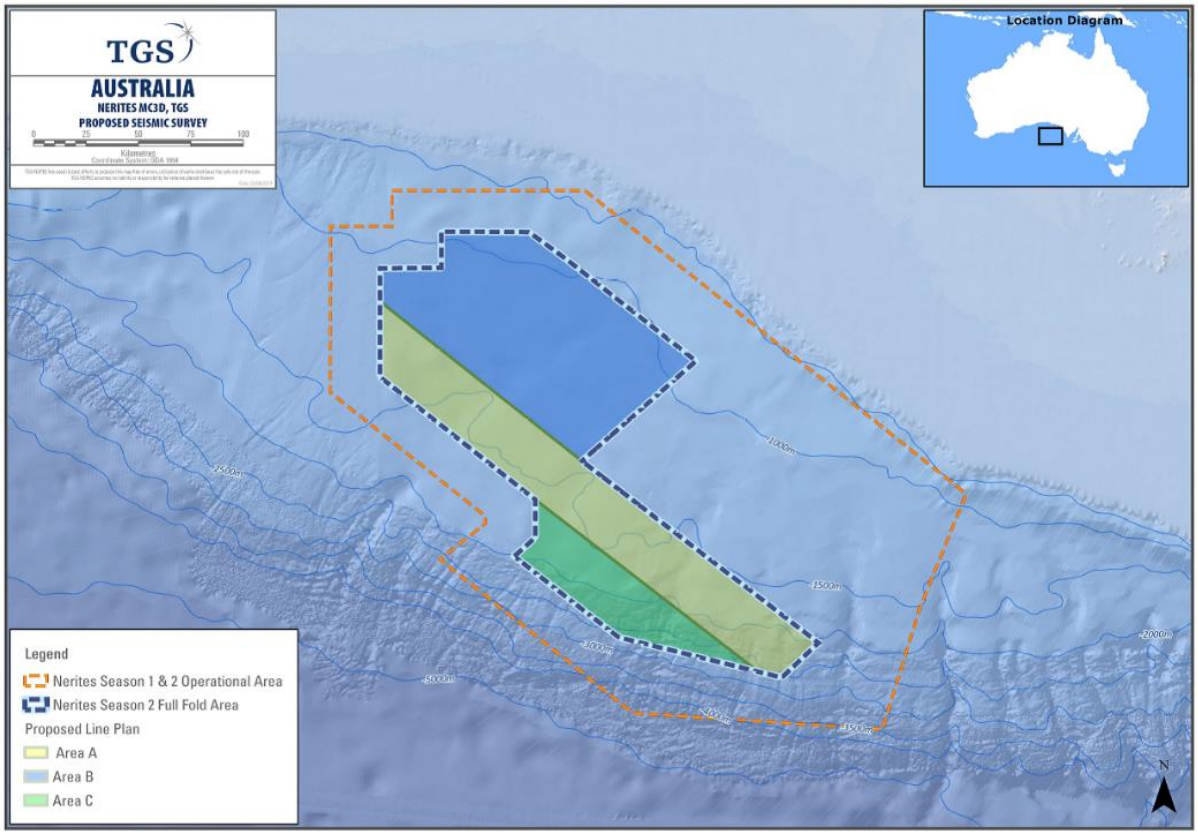
The volume of the source that has been chosen is as low as reasonably practicable (ALARP) when considering the geological target being aimed for. Usually a larger volume equates to a stronger signal (peak amplitude), better signal to noise, deeper penetration and hence improved data quality. Total energy source volumes will vary from survey to survey and are designed to provide sufficient seismic energy to illuminate the geological objective of the survey, whilst minimising environmental disturbance. The amount of seismic energy that is required is a factor of the depth of the geological target, the geology itself as well as the water depth (in this case ~750 – 3,500 m). Factors considered in determining the optimal array volume include modelling of the primary to bubble ratio, which should be as large as possible. If the bubble is too large, not as much energy is going into the peak, and the bubble can interfere with the signal. If the array is too large it can cause excessive ringing which may swamp the signal. For this survey a source volume of 4,100 cui was found to be the lowest possible source in order to achieve the survey requirements.

Acoustic modelling has been undertaken by Curtin University, Centre for Marine Science and Technology (CMST) to predict received sound exposure levels (SEL) from two seismic vessels simultaneously operating within the 3D Nerites survey area in the GAB. Two scenarios were considered that encompass the worst case scenario for sound exposure levels produced within the survey area and in the broader region that would be received on sensitive receptors.

The first scenario modelled the source vessels when located at the closest distance to the continental shelf edge, where biological important areas (BIA) for pygmy blue and sperm whales exist. The results from the modelling showed that maximum SELs received at the shelf edge (defined by the 200 m bathymetry contour) 104 km from the source did not exceed 160 dB re 1 μPa^2s and was well below the noise levels reported as causing a behavioural response in baleen and toothed whales. Richardson *et al*. (1995) reported that baleen whales seemed tolerant of low and moderate level noise pulses from distant seismic surveys and usually continued their normal activities when exposed to pulses with received levels as high as 150 dB re 1µPa, and sometimes even higher. Gordon *et al*. (2004) concluded the potential for temporary threshold shift (TTS) was approximately 195 dB re 1 μPa^2s for toothed whales. EPBC Policy Statement 2.1 Part A Standard Management Measures and Part B Additional Management Measures will be implemented as detailed in **Section 6**.

The second scenario considered the maximum SELs likely to be produced using two seismic source vessels operating at the same time. TGS developed a seismic line plan which split the survey area into three areas. This approach was created to maximise the distance between the two vessels when acquiring data. Both vessels will be operating in separate areas at the furthest distance apart as practicable to reduce the cumulative impact of sound propagated by two seismic vessels operating at any one time (see **Figure 1.2**). The worst case scenario was modelled on the two vessels operating 30 km apart. The maximum SELs at the midway point between the two vessels did not exceed 160 dB re 1 μPa^2s and was below levels reported to cause behavioural responses for baleen and toothed whales (McCauley *et al*. 2003, Richardson *et al*. 1995, Nedwell *et al*. 2004). Further information on the potential impacts resulting from the seismic survey on sensitive receptors is summarised in **Section 3**. EPBC Policy Statement 2.1 Part A Standard Management Measures and Part B Additional Management Measures will be implemented as detailed in **Section 6**.

Figure 1.2 – Nerites Season 2 MC3D MSS Acquisition Line Plan



Survey Vessels

TGS proposes to conduct the Nerites Season 2 MC3D MSS using the purpose-built seismic survey vessel M/V *Polar Duchess*, or a similar vessel. The *Polar Duchess* is owned and managed by GC Rieber Shipping and operated by Dolphin Geophysical AS. The seismic 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. The seismic survey vessel will have an implemented and tested Shipboard Oil Pollution Emergency Plan (SOPEP), in accordance with Regulation 37 of Annex I of MARPOL 73/78.

At least one support / chase vessel will accompany the seismic survey vessel at all times to maintain a safe distance between the survey array and other vessels and manage interactions with shipping and fishing activities. A proposed support vessel for this survey is the M/V *Rig Andromeda*, or a similar vessel. The support vessel 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 will have an implemented and tested SOPEP. If the survey vessel needs to be refuelled 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). There are no shallow or emergent features within, or adjacent to, the operational area.

2. DESCRIPTION OF THE RECEIVING ENVIRONMENT

In accordance with Regulation 13(2) of the Environment Regulations, a description of the existing environment that may potentially be affected by planned and unplanned activities relating to the Nerites Season 2 MC3D MSS is presented in this section. It includes a description of relevant natural, cultural and socio-economic aspects of the environment, as well as details of relevant values and sensitivities.

The description includes Regional Setting (**Section 2.1**); Physical Environment (**Section 2.2**); Biological Environment (**Section 2.3**) and Socio-Economic Environment (**Section 2.4**) and covers the aspects of the environment that are relevant for consideration of the environmental risks and impacts of the proposed operations.

2.1. REGIONAL SETTING

The Nerites Season 2 MC3D MSS polygon lies entirely in Commonwealth marine waters of the SWMR in the Bight Basin (Ceduna and Polda sub-basins) covering water depths between ~750 to 3,500 m, with the shallowest water depths situated along the north-eastern boundary. At the closest point, the operational area is located ~190 km west of the Eyre Peninsula, ~270 km south-west from Ceduna and ~180 km distance from the nearest mainland coastline (see **Figure 1.1**). The SWMR comprises Commonwealth waters from the eastern end of Kangaroo Island in SA to Shark Bay in Western Australia (WA), spanning ~1.3 million km^2 of temperate and subtropical waters offshore from SA and WA.

2.2. PHYSICAL ENVIRONMENT

2.2.1. Climate and Meteorology

The climate of the coastal area of the GAB is typically semi-arid and is characterised by hot, dry summers and cool, wet winters. It is largely influenced by mid-latitude anticyclones or high pressure systems, which pass from west to east across the continent. Rainfall varies with latitude, from ~500 mm in the south to <300 mm in the north. Mean monthly maximum temperatures on the coast range from 26°C in January to 18°C in July at Eucla and from 28°C in January to 17°C in July at Ceduna.

During the winter the wind direction is predominantly southerly to south-easterly winds and low pressure systems travel across the Southern Ocean between 40^o and 50^{o}S, bringing frontal activity and rain. During the summer, northerly to north-westerly winds dominate. However, along the GAB and the western coast of Eyre Peninsula, strong westerly, onshore winds have reworked the coast, creating extensive dune systems. The nearest wind station to the operational area (to the west of the northern part of EPP 37) has an average wind speed of 14.72 knots/7.57 ms^{-1}, and maximum wind speed of 44 knots/22.6 ms^{-1} per annum.

2.2.2. Oceanography

The oceanography of the GAB is typified by a high energy wave regime and a coastline exposed to a persistent south-west swell generated by the westerly moving low pressure cyclones south of

the mainland. This south-west to westerly swell ranges from <2 m for 50% of the year, to 2 - 4 m for 30 - 45% of the year and >4 m approximately 10% of the year. Wind generated sea conditions also provide an additional source of wave energy, with seas averaging 0.5 to 2 m.

Tides along the western Eyre coast are microtidal in range and are predominantly semi-diurnal with a marked diurnal inequality between the two daily tides. There are four major water masses influencing the oceanography of the GAB: Leeuwin Current; Central Bight water mass; West Wind Drift cold water mass; and surface-flowing Flinders Current.

The circulation on the Southern Shelf is mainly wind driven, where current speed is almost non-existent within the GAB. Generally, in winter the flow is towards the east, and in summer towards the west. The Leeuwin Current flows predominantly from west to east during winter from May to September-October. In summer, the flow along the Bonney Coast is reversed by the south-easterly winds, and a shelf anticyclonic circulation occurs in the central GAB that appears to be easterly.

The Leeuwin Current transports warm, nutrient-poor water eastward along the shelf break and upper slope. Meso-scale eddies form from the Leeuwin Current south of the Eyre Peninsula, where coastal topography changes direction. Eddies also drift westward from south of Victoria and first encounter the slope south of the Recherche Archipelago. Here they take on warm water from the Leeuwin Current and strengthen, continuing their movement westward for up to 18 months. Beneath the Leeuwin Current the cooler waters of the Flinders Current provide a deep westward conveyor belt for the Region's fauna. The strength and behaviour of the Flinders Current is affected by wind and the density of the water bodies on the shelf, and at times may disappear or even reverse direction. The bioregion has areas of seasonal upwelling and downwelling along the continental slope.

During the summer months (February - March), the warm waters of the south-west coast of Eyre Peninsula (from Baird Bay to western Kangaroo Island), are subject to localised, seasonal, cold, nutrient-rich coastal upwellings. Open coast sea temperatures in the GAB vary from a summer sea surface temperature of 19^{o}C to a winter sea surface temperature of 16^{o}C.

2.2.3. Geomorphology

The seafloor of the Southern Province is characterised by a long continental slope incised by submarine canyons. Although most of the slope is marked by canyons, the Albany Group in the east and the canyons south of the Eyre Peninsula are the most dramatic, cutting deeply into areas of steep slope. There are also two distinctive mid-slope terraces, the Ceduna and Eyre Terraces, covering an area of 147,150 km^2. The terraces are intersected by numerous canyons and gullies, which are broader and more widely spaced than the Albany Canyons. The Ceduna Terrace (200 - 3,000 m water depth) is the most extensive, being about 700 km long and reaching 200 km in width. The Eyre Terrace (200 – 1,600 m water depth) is smaller and narrower, reaching a maximum width of 70 km. The shallow South Australian Abyssal Plain gives way, in the west, to the Diamantina Fracture Zone, a highly rugged seabed composed of deep ridges with a characteristic east-west orientation. Some of the troughs can reach depths of up to 5,900 m.

2.3. BIOLOGICAL ENVIRONMENT

The SWMR has a notably high level biodiversity and endemism due to a number of factors, such as long periods of geological isolation, persistent high energy environment, warm-water intrusion via the Leeuwin Current and areas where cold, nutrient-rich, deep ocean waters rise to the surface in the east of the region. Areas of particular importance include the Houtman Abrolhos Islands, the meeting of tropical and temperate fauna along the west coast, the Recherche Archipelago, and the soft sediment ecosystems in the GAB.

The biological productivity of the SWMR is low due to the low-nutrient tropical waters carried south by the Leeuwin Current and its effect in suppressing upwelling of nutrients from deeper cold waters and the absence of significant rivers contributing nutrients into the marine environment through run-off. Small seasonal upwellings occur at known locations and, because of the overall nutrient-poor nature of the region's waters, these hotspots of productivity have a disproportionate influence on the region's ecosystems. For this reason they have been identified as key ecological features (KEF; see **Section 2.3.3**). The main areas of relatively higher seasonal productivity in the region are the Perth Canyon, Albany canyon group, Kangaroo Island canyons and pool, Cape Mentelle and eddy fields that spin off the Leeuwin Current along the west and south coasts of Western Australia.

2.3.1. Productivity and Plankton Communities

The warm, low salinity waters of the Leeuwin Current are responsible for the significant tropical element in the phyto- and zooplankton of the GAB. Highest phytoplankton abundances in the region have been reported as occurring during the summer upwelling season. An upwelling phytoplankton bloom may facilitate the dominance of certain species in the zooplankton community with reproductive strategies that allow rapid colonisation of areas of abundant food supply, namely the crustaceans, copepod and cladocera. Winter productivity throughout the GAB was low due to deep mixing following long periods of downwelling favourable winds.

2.3.2. Benthic Flora and Fauna

Within the Flindersian Province, approximately 1,200 species of macroalgae, 17 species of seagrasses, 110 species of echinoderms and 189 species of ascidians have been recorded. The South Australian waters have been divided into spatially explicit marine bioregions; Eucla, Murat and Eyre. In the west, the subtidal coastal habitats of the Eucla bioregion reflect the areas exposure to strong south-westerly swells. Bare sand with patches of reef support low-diversity algal communities such as kelp (*Ecklonia radiata*) and the fucoid *Scytothalia dorycarpa*. The Murat bioregion to the east is more variable in nature and therefore has more variable habitats. Sheltered bays protected from south-westerly swells support beds of seagrass (*Posidonia sinuosa, Amphibolis antarctica, Heterozostera tasmanica*) and stands of mangroves (*Avicennia marina*). Further to the east, the Eyre bioregion is a site of localised upwelling and cold temperate algal species can be found on the reefs.

2.3.3. Pelagic Fish

The Leeuwin Current is intimately linked to the population dynamics of many of WA's and, to a lesser extent, SA's, commercially important species. The life history characteristics, such as spawning, migration, recruitment and feeding patterns, and ultimately the overall production, of many species along the western and southern seaboard of Australia have evolved under the influence of such a current system.

Some pelagic species use the Leeuwin Current to disperse from the north-western waters of Australia to the southern seaboard of Australia. For instance, the southern bluefin tuna (*Thunnus maccoyii*) spawns in the Java Sea and migrates southward along the western Australian coastline and eastward along the southern coast of Australia. Its' distribution and abundance being influenced by the seasonality, strength and timing of the Leeuwin Current. Other pelagic fish whose distribution and abundance are affected by the Leeuwin Current include mackerel (*Scomber australasicus*), horse mackerel (*Trachurus declivis*), Australian salmon (*Arripis truttaceus*), and Australian herring (*Arripis georgianus*).

The assemblages of small pelagic fish that occur in the GAB have been described as relatively diverse. The Australian sardine, round herring, sandy sprat and blue sprat are abundant in some areas. Other species that are also relatively common include the Australian anchovy, jack mackerel and yellowtail scad, blue mackerel, redbait and the saury.

2.3.4. Protected Marine Fauna

A review of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act) database (Protected Matters search tool; PMST) held by the DoE was conducted for the operational area described by the boundary coordinates provided in **Table 1.1**, with the application of a 1 km buffer zone. The Protected Matters search indicates a total of 56 marine species listed under the provision of protection status (23 listed as Threatened; 29 as Cetaceans; 29 as Migratory; and 24 Listed marine species) that are likely to occur within, or adjacent to, the Nerites Season 2 MC3D MSS operational area. The 23 listed Threatened species that may occur in, or relate to, the operational area are as follows:

1. the blue whale;
2. the southern right whale;
3. the humpback whale;
4. the southern royal albatross;
5. the northern royal albatross;
6. the Antipodean albatross;
7. the Tristan albatross;
8. the wandering albatross;
9. the blue petrel;
10. the southern giant-petrel;
11. the northern giant-petrel;
12. the sooty albatross;
13. the soft-plumaged petrel;
14. the shy albatross;
15. the white-capped albatross;
16. the black-browed albatross;
17. the Campbell albatross;
18. the southern Royal albatross;
19. the northern Royal albatross;
20. the loggerhead turtle;
21. the green turtle;
22. the leatherback turtle; and
23. the great white shark.

The operational area for the proposed Nerites Season 2 MC3D 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) or critical habitats within the vicinity of the operational area. The operational area is not within, or adjacent to, a World Heritage Property, a National Heritage Place or Wetland of International Importance. The operational area does overlap with the GAB Commonwealth Marine Reserve.

The PMST report did not identify any key ecological features (KEF) within, or adjacent to, the Nerites Season 2 MC3D MSS operational area. The ancient coastline KEF runs north-east of the operational area ~70 km away at the closest point. The Kangaroo Island Pool, Canyons and adjacent shelf break and Eyre Peninsula upwellings are south-east and north-east of the operational area, respectively. The Kangaroo Island canyons are ~50 km south-east of the operational area.

Biologically Important Areas (BIA)

The BIA that overlap the Nerites Season 2 MC3D MSS fullfold area are:

- foraging area for sperm whales; and
- foraging areas for short-tailed shearwater.

2.3.4.1. Cetaceans

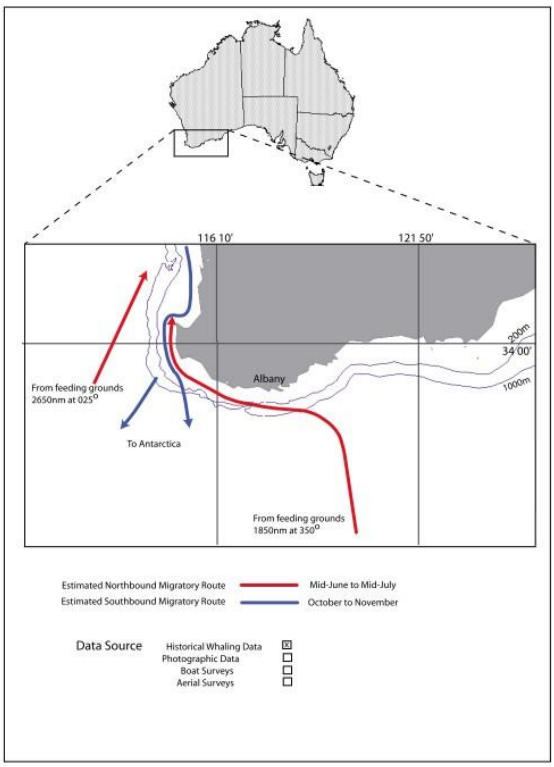
The EPBC Act database lists 29 cetacean species that may occur in, and adjacent to, the operational area of the Nerites Season 2 MC3D MSS, all of which are protected under the EPBC Act. Two of these are classified as Endangered; the blue/pygmy blue whale and southern right whale. Three are listed as Vulnerable; the humpback whale; the fin whale; and the sei whale.

Humpback whales

Humpback whales are listed in the EPBC Act database as a Vulnerable species that may occur within the SWMR during their northbound migration to Camden Sound or southbound migration back to Antarctic waters. However, there are no BIA identified for breeding, foraging or migration routes for humpback whales in the GAB. The population that winters off WA is known as the Group IV population. Its migration in the region is characterised by three distinct directional phases:

- Northbound phase - starts April, peaks July and tapers off by August. Northerly migrating humpback whale numbers peak during late July/early August, and may extend north to the continental shelf edge at 130 km offshore, generally out to the 200 m isobath.
- Transitional phase (peak numbers expected at this time) - between late August and early September.
- Southbound phase – usually occurring between late August and early September, although smaller numbers may occur until November (this phase of migration is segmented by 2–3 week delay in appearance of peak numbers of cow/calf pods after the main migratory body has passed). Southerly migration in this area is contracted in a narrower band than the northerly migration route, generally occurring closer to the coast in waters less than 100 m deep (see **Figure 2.1**).

Figure 2.1- Estimated Migratory Routes for the Southwest Australian Coast



The closest migratory route to the Nerites Season 2 MC3D MSS operational area passes Cape Leeuwin, ~1,000 km to the west. The northward migration peaks early to late June and the southward migration peaks mid-October to late November. The proposed survey will not overlap in timing with the humpback whale migration in this area, and given the distance to the humpback migratory pathway, encounters with migrating individuals are unlikely. The nearest known humpback whale resting / aggregation area is Flinders Bay, located ~1,500 km from the operational area. Since the operational area is not located in biologically significant areas (breeding, feeding and migrating areas), it is unlikely that humpback whales will be encountered during the survey. Indeed, during the BP Exploration Ceduna 3D MSS, no humpback whales were observed throughout the duration of the survey (conducted between November 2011 and May 2012), and only three humpback whales were sighted during the entire Phase I of the Nerites MC3D MSS (towards the end of May and beginning of June 2014).

Blue/pygmy blue whale

Blue/pygmy blue whales are widely distributed throughout the world's oceans. This species has 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. 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.

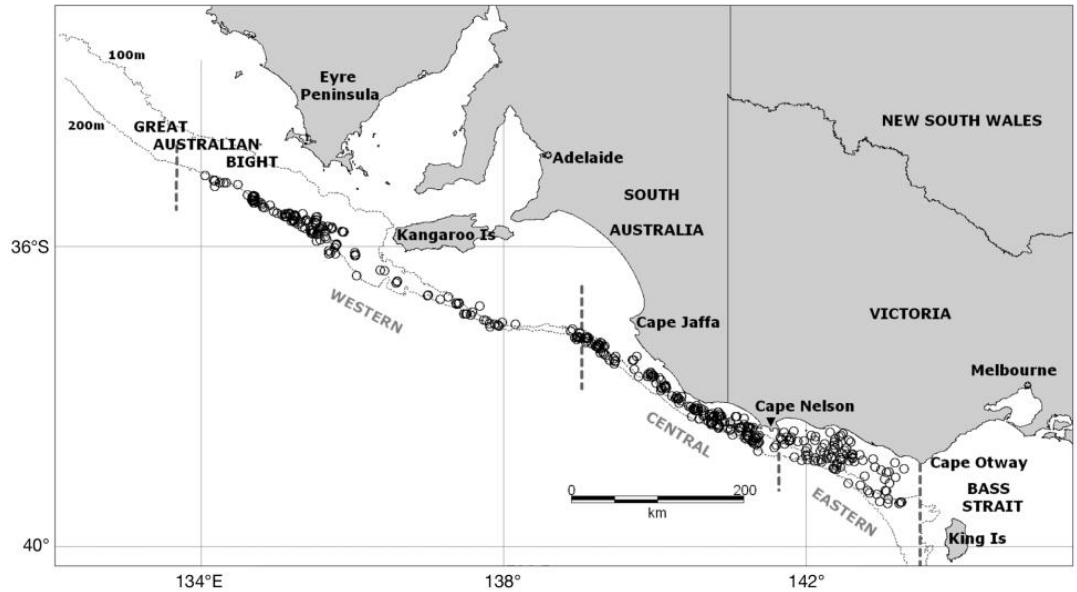
There are two distinct subspecies of the blue whale in the Southern Hemisphere, the true blue whale of the southern hemisphere (*Balaenoptera musculus intermedia*) and the pygmy blue

whale (*Balaenoptera musculus brevicauda*). The true blue whale is usually found south of 60°S and the pygmy blue whale is found north of 55°S, and so pygmy blue whales are the blue whales subspecies most commonly sighted in Australian waters.

Known areas of significance to pygmy blue whales are feeding areas around Perth Canyon in WA (December to April); and Duntroon Basin, SA; and the Bonney upwelling, south-east SA to western Victorian waters (between November to April). The Bonney upwelling extends west from Cape Nelson. It is part of a regional upwelling system with an alongshore extent of ~800 km from the Bass Strait to the eastern GAB upwelling and Kangaroo Island canyons. Gill *et al.* (2011) undertook aerial surveys and plotted the distribution of blue whale sightings between 2002 and 2007 (see **Figure 2.2**) to establish links between feeding pygmy blue whales and the cold water nutrient rich regional upwellings.

Figure 2.2 is split into the western (GAB area), central and eastern zones. The study suggests that low densities of blue whales moved eastward during November and December as the season progressed with pygmy blue whales restricted to the GAB and central zones in November and moving into the eastern zone in December. The pygmy blue whales were then widely spread throughout the central and eastern zones from January to April, with most animals departed from the feeding ground by late April. Although the movement of pygmy blue migration to feeding areas is variable and associated with cold water upwellings and food source, the study suggests that the peak time for pygmy blue whales migration and feeding in the GAB is in November/December.

Figure 2.2 - Distribution of Blue Whale Sightings 2002-2007



Twelve sightings of pygmy blue whale were recorded in November only during BP Exploration's Ceduna 3D MSS, carried out between November 2011 and May 2012. An aerial survey monitoring programme undertaken by Blue Whale Study Inc. on behalf of Bight Petroleum in the eastern GAB for the 2011-2012 upwelling season (November-March) sighted

pygmy blue whales in the month of December only, thus supporting the previous study findings.

During Phase I of the Nerites MC3D MSS four Marine Fauna Observers (MFO) were employed during the survey from January until June 2014. Throughout this survey only one pygmy blue whale was sighted - in May. In addition, the International Fund for Animal Welfare (IFAW) conducted visual and acoustic surveys over EPP 41 and EPP 42 (west of Kangaroo Island and to the south-east of the Nerites Season 2 MC3D MSS operational area) during April and May 2013. No pygmy blue whales were sighted during these surveys.

The Nerites Season 2 MC3D MSS is not proposed to start until January 2015, which is outside the peak feeding periods, and therefore it is likely that the majority of pygmy blue whales would have migrated southwards. It is possible that individuals may pass through the operational area en route to the Bonney upwelling feeding areas, however these are likely to be present in low numbers.

Figure 2.3 shows the pygmy blue whale sighting depth distribution in the three zones. This suggests that the preferred foraging habitat preferences of pygmy blue whales is in water depths of 100-200 m. **Figure 2.4** shows the BIA for migrating pygmy blue whales in the GAB area, which is adjacent to the northern part of the Nerites Season 2 MC3D MSS full fold survey area. The full fold area of the Nerites Season 2 MC3D MSS does not overlap the BIA for pygmy blue whales, in addition there will be no line turns, run-ins or run-outs taking place within the pygmy blue whale BIA, therefore no seismic activity will be undertaken within the BIA. It should be noted that the BIA covers an area 20 nautical miles (nm) either side of the 200 m isobath, which appears to be an over estimation of the area where pygmy blue whales have been previously sighted, in particular for depths greater than 500 m (see **Figure 2.3**).

Figure 2.3– Pygmy Blue Whale Sightings Depth Distribution

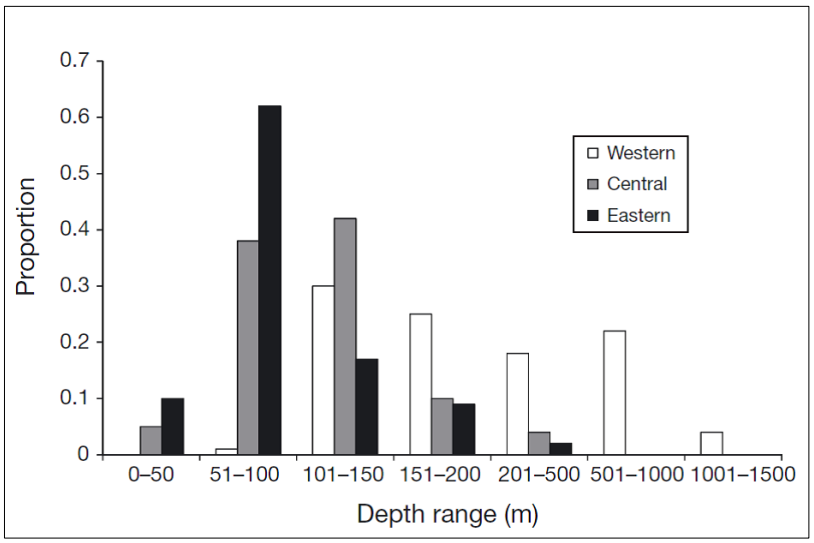
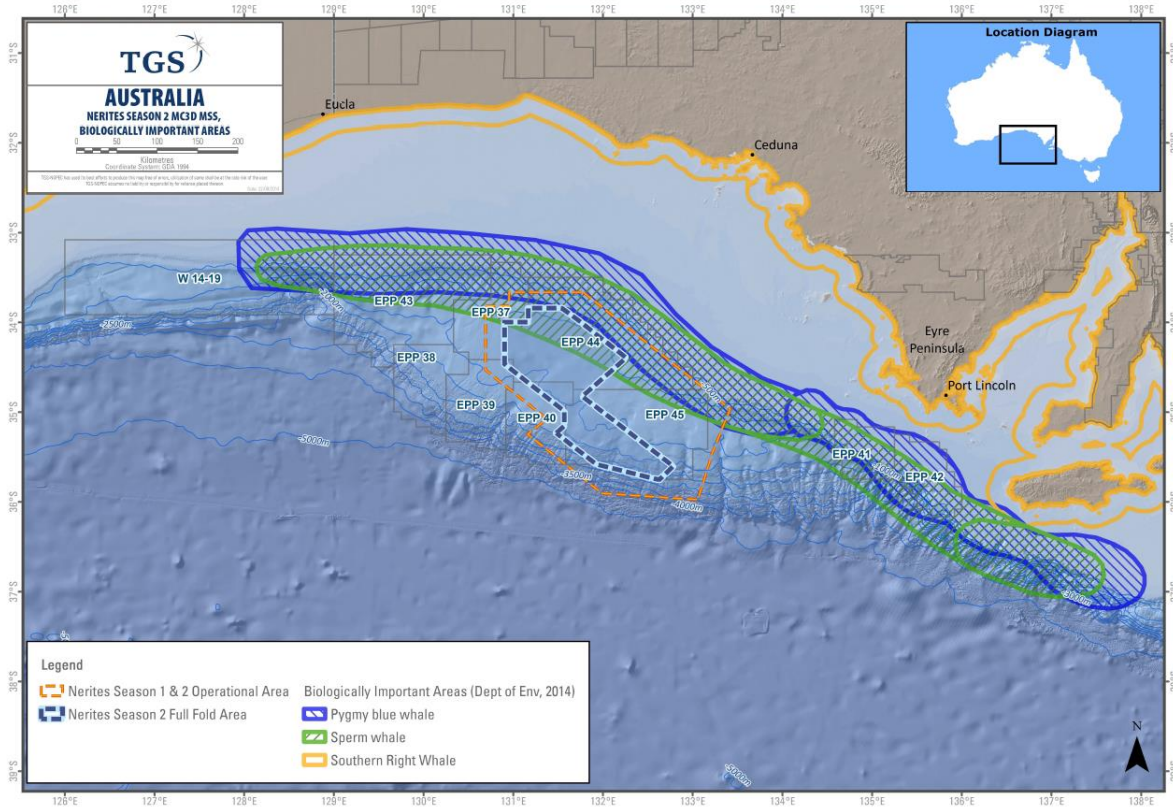


Figure 2.4 – Pygmy Blue Whale Migration Route BIA, Sperm Whale Foraging BIA, and Southern Right Whale Calving BIA



Southern Right Whale

The southern right whale is listed as Endangered under the EPBC Act and there are known BIA along the GAB coastline for breeding and calving habitat (see **Figure 2.4**). Australian southern right whales migrate seasonally between higher latitudes and mid latitudes. They are regularly present on the Australian coast from about mid-May to mid-November. Isolated sightings of individuals may also be made outside the periods of regular presence, although summer occurrence would be highly unusual. The general timing of migratory arrivals and departures varies slightly on an inter-annual basis.

In Australia, calving/nursery grounds are occupied from May to October (occasionally as early as April and as late as November), but not at other times. Female-calf pairs generally stay within the calving ground for 2–3 months. Other population classes stay for shorter and variable periods. Peak periods for mating are from mid-July through August. Known calving / nursery locations are Head of Bight (31°28'S, 131°08'E), Fowlers Bay (31°59'S, 132°28'E) and Encounter Bay (35°35'S, 138°40'E). Southern right whales exhibit a strong tendency to return to the same breeding location. This is particularly evident for reproductively mature females, where 92% showed a tendency to return to the Head of Bight calving area.

A number of additional areas for non-calving southern right whales are emerging which might be of importance in Storm Bay and Sleaford Bay.

Figure 2.5 shows the coastal aggregation areas for southern right whales. On the Australian coast individual southern right whales use widely separated coastal areas (200 – 1,500 km apart) within a season, with substantial coast-wide movement indicating that connectivity of coastal habitat is important. Exactly where whales approach and leave the Australian coast from, and to, offshore areas is not well understood. A defined near-shore coastal migration corridor is unlikely given the absence of any predictable directional movement of southern right whales.

Figure 2.5 - Coastal Aggregation Areas for Southern Right Whales

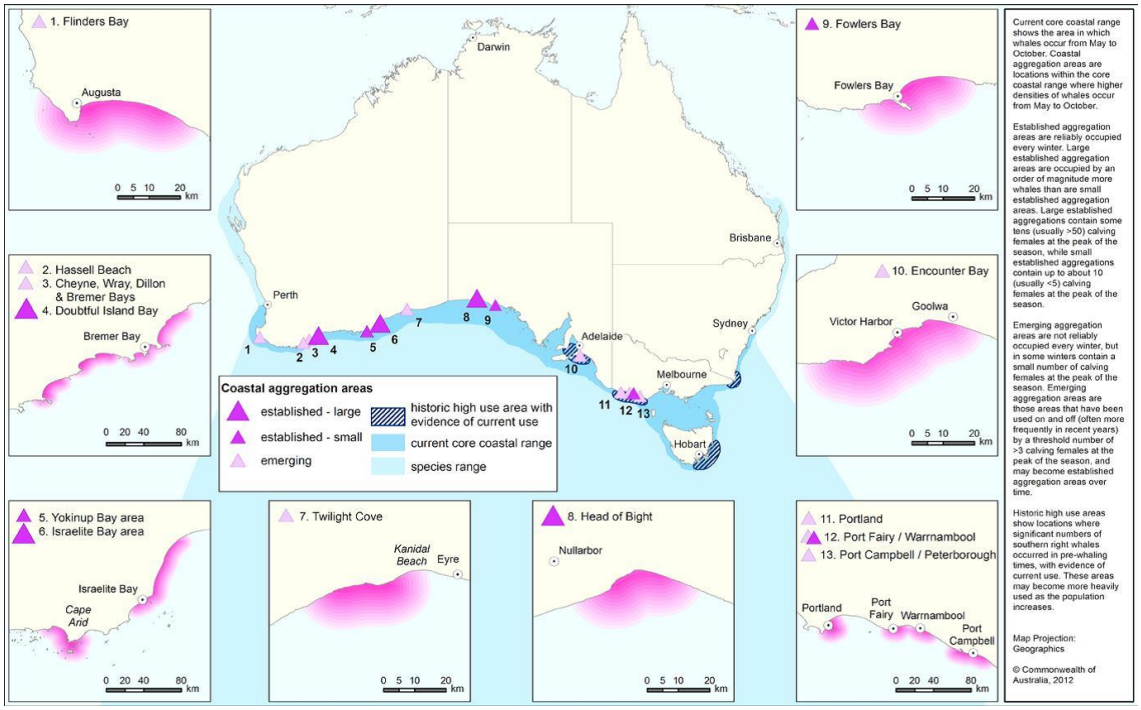


Figure 2.4 shows the BIA for breeding and calving areas for southern right whales. During calving, the whales are generally within 2 km of the shoreline with calving occurring in waters less than 10 m deep. The closest aggregation areas to the Nerites Season 2 MC3D MSS operational area are Fowlers Bay and the Head of Bight, located ~ 215 km and 270 km away, respectively. During Phase I of the Nerites MC3D MSS there were no sightings of southern right whales in the operational area from January to June 2014. The timing of the proposed Nerites Season 2 MC3D MSS will only overlap the start of the migration and calving period at the end of May 2015. Therefore, it is unlikely that southern right whales will be encountered during the survey.

Sperm whale

Sperm whales sightings have been recorded from all Australian states. Sperm whales tend to inhabit offshore areas with a water depth of 600 m or more, and are uncommon in waters less than 300 m deep. Concentrations of sperm whales are found where the seabed rises steeply from great depth, particularly in submarine canyons and are associated with concentrations of major food in areas of upwelling. Deep canyons off the SA coast and associated upwellings

are known to provide a food source for sperm whales. **Figure 2.4** shows the BIA for sperm whale feeding areas that overlaps the Nerites Season 2 MC3D MSS operational area.

There is a generalised migration southwards in summer, with a corresponding movement northwards in winter. Key recognised localities for sperm whales include the area between Cape Leeuwin and Esperance close to the edge of the continental shelf; and south-west of Kangaroo Island, SA (~850 km and 250 km away from the operational area, respectively).

IFAW conducted visual and acoustic surveys over EPP 41 and EPP 42 (west of Kangaroo Island and to the south-east of the proposed Nerites Season 2 MC3D MSS operational area) during April and May 2013. Sperm whales were detected acoustically, usually in waters deeper than 1,000 m, and although there were no sightings during vessel surveys, the aerial surveys conducted of the same area reported two sightings of three individual sperm whales. Aerial surveys undertaken by Blue Whale Study Inc. on behalf of Bight Petroleum in the eastern GAB for the 2011-2012 upwelling season (November-March) sighted four sperm whales during the month of November (only) to the west of Port Lincoln. During Phase I of the Nerites MC3D MSS four sperm whales were sighted in March 2014. Low numbers of sperm whales may occur within or in proximity to the Nerites Season 2 MC3D MSS operational area during the survey, however significant numbers are not expected to be encountered.

2.3.4.2. Pinnipeds

Two of the three species of pinnipeds that occur in Australia are found in the GAB—the Australian sea lion (*Neophoca cinerea*) and the New Zealand fur seal (*Arctocephalus forsteri*), which both belong to the Family Otariidae (eared seals). The Nerites Season 2 MC3D MSS operational area does not overlap but is adjacent to a BIA (foraging) for Australian sea lions. The Australian sea lion is endemic to Australia. The world population is estimated at 10,000-12,000 individuals, with approximately 7,500 occurring in SA and 3,100 in WA. Almost 10% of the SA population occurs in the GAB. Of particular significance, are the small breeding colonies along the cliffs of the GAB.

Five of the known breeding sites for Australian sea lions produce more than 100 pups each year, representing more than 50% of all pups born. These five sites are all off SA: Dangerous Reef (Southern Eyre Peninsula); the Pages Islands (outside the SWMR); West Waldegrave Island (Western Eyre Peninsula); Seal Bay (Kangaroo Island); and Olive Island (Western Eyre Peninsula). In the GAB, Australian sea lions have been recorded to depths of 90 m, and at most 100 km away from the coastline in relation to low foraging activity. However, the Australian sea lion has a higher foraging effort closer to shore, mainly within 50 km from coastlines as a result of the greater availability of prey species. Due to the extensive depths in the operational area (~750 m – 3,500 m), the distance from the preferred coastal habitats (200 km), and from the nearest recorded breeding site (<180 km), including their high site fidelity, it is highly unlikely that any Australian sea lions will be encountered during the survey.

2.3.4.3. Sharks

The great white shark is listed both as a Vulnerable and a Migratory species under the EPBC Act. The inshore waters of the GAB, including the Head of Bight are a BIA (foraging) for the great white sharks. Evidence indicates that pinniped colonies are areas where great white sharks can aggregate or frequently revisit to feed and the BIA for the white shark correlates

with these areas. Large breeding populations in the SWMR are at North and South Neptune Islands, Kangaroo Island and Liguanea Island, which account for more than 80% of the national pup production for the species. The Spencer Gulf and Gulf St Vincent are considered important feeding grounds for sub-adult white sharks, although juvenile and large adult sharks have also been observed in these areas.

2.3.4.4. Marine Turtles

The EPBC PMST identified a total of three marine turtle species that may occur within, and in waters surrounding, the Nerites Season 2 MC3D MSS operational area; all of which are listed Threatened and Migratory species: loggerhead turtle (Endangered and Migratory); green turtle: (Vulnerable and Migratory); and leatherback turtle: (Endangered and Migratory). There are no known BIA for foraging or nesting/internesting for all three species in the GAB.

The green turtle is the most widespread and abundant turtle species in Australian waters, and is distributed in subtropical and tropical waters of the northern and southern hemispheres. However, individuals have been known to stray into temperate waters such as the northern Spencer Gulf and north-eastern Kangaroo Island. As a result, of near coastal habitat feeding preferences and northern distribution, green turtles are unlikely to be encountered within the Nerites Season 2 MC3D MSS operational area.

Loggerhead turtles have been infrequently recorded in SA, including northern Spencer Gulf waters and north-west of Kangaroo Island over 300 km east of the operational area, however there are no known BIA for foraging in the GAB and since their nesting areas are far to the north the probability of encountering this species in the operational area is low.

The leatherback turtle is a highly pelagic species, venturing close to shore mainly during the nesting season. Leatherback turtles are known to occur in waters all around Australia and can be found foraging year-round in Australian waters over continental shelf waters. Adults feed mainly on pelagic soft-bodied creatures such as jellyfish and tunicates, which occur in greatest concentrations at the surface in areas of upwelling or convergence. The regular appearance of leatherback turtles in cool temperate waters is thought to be due to the seasonal occurrence of large numbers of jellyfish. Individuals may transit through the survey area, however, they are unlikely to be encountered in significant numbers.

2.3.4.5. Seabirds

The EPBC Act PMST lists 14 species of seabirds that may potentially occur within the area, however, only the short-tailed shearwater has a BIA (foraging) that overlaps the Nerites Season 2 MC3D MSS operational area. The Recherche Archipelago (~650 km west of the operational area), Flinders Island and Greenly Island (~150 km east of the operational area), Nuyts Archipelago (~260 km north-west of the operational area), and Althorpe, Neptune Islands, Lewis, Hopkins and Williams Islands (<300 km east of the operational area) are known rookeries. Birds returning to their breeding colonies may at most transit over the operational area. Given the distance from the known Australian breeding sites hundreds of kilometers away, only a limited number of individuals are likely to be present.

The white-faced storm petrel is not listed in the EPBC PMST and has a BIA (foraging) adjacent to the Nerites Season 2 MC3D MSS operational area. White-faced storm petrels breed

throughout the SWMR as far north as the Houtman Abrolhos Islands, with an estimated 160,000 pairs breeding adjacent to the region. It is unlikely that significant number of this species will be present within the operational area.

Albatrosses and petrels are among the most oceanic of all seabirds, and seldom come to land unless breeding. Although several species of albatrosses are known to feed in the GAB there are no breeding populations in or adjacent to the region. Albatrosses feed in offshore areas during the winter months, typically along the edge of the continental shelf and over open waters. Known albatross breeding colonies in south-east Australia are located on Albatross Island, Bass Strait, and Mewstone and Pedra Branca off Tasmania, over 650 km away from the operational area.

The southern giant-petrel, northern giant-petrel, soft-plumaged petrel and blue petrel are highly migratory and have a large natural range, and breeding pairs can be found across all of Australia.

The soft-plumaged petrel is generally found over temperate and sub-Antarctic waters in the South Atlantic, southern Indian and western South Pacific oceans. In the southern Indian Ocean, the species is most numerous between 30°S and 50°S from the South African to the WA coasts. Although the species is possibly common in seas south-west of Australia, an important Australian breeding population occurs on Maatsuyker Island, Tasmania (>1,000 km away from the operational area). Given the distance from the known Australian breeding sites, only a limited number of individuals are likely to be present within the operational area. Furthermore, the timing of the survey overlaps with the soft-plumaged petrel breeding season when breeding individuals will be confined to breeding sites at least several hundred kilometres from the operational area, reducing the likelihood of encounters further.

The blue petrel has a circumpolar distribution, ranging south to the pack-ice and north to about 30°S. The blue petrel has been recorded off the Australian coast between East Gippsland in Victoria and the Perth area of WA, but there are few records in the GAB. The blue petrel is rarely recorded north of 37°S on the east coast of Australia, and has not been recorded north of 32°S in south-western Australia. It occurs predominantly between July and September in Australia.

2.4. SOCIO-ECONOMIC ENVIRONMENT

2.4.1. Commercial Fisheries

The proposed Nerites Season 2 MC3D MSS has the potential to interact with several Commonwealth and State-managed fisheries. The following section details the commercial fisheries that may be operating within, or adjacent to, the operational area.

2.4.1.1. Commonwealth Fisheries

Commonwealth fisheries are managed by the Australian Fisheries Management Authority (AFMA) and operate from 3 nm of baseline out to 200 nm (the extent of the Australian Fishing Zone - AFZ). The Nerites Season 2 MC3D MSS has the potential to overlap the following Commonwealth-managed fisheries:

- Western Tuna and Billfish Fishery (WTBF);
- Western Skipjack Tuna Fishery (WSTF);
- Small Pelagic Fisheries (SPF);
- Southern and Eastern Scalefish and Shark Fishery (SESSF);
- Southern Squid Jig Fishery (SSJF); and
- Southern Bluefin Tuna Fishery (SBTF).

Western Tuna and Billfish Fishery (WTBF)
The management plan for the WTBF began in 2005, however AFMA granted statutory fishing rights in 2010. Under the plan, output controls are implemented through individual transferable quotas (ITQs) for the four key commercial species (bigeye tuna, yellowfin tuna, striped marlin and swordfish). Determinations of total allowable commercial catch (TACC) are made in accordance with Australia's domestic policies and apply to the AFZ and the high-seas area of the Indian Ocean Tuna Commission (IOTC) area of competence.

In 2011, the recorded catch was 263 tonnes and 415 tonnes in 2012. Due to the small number of active vessels in the WTBF, gross value of production remains confidential. In 2012 WTFB fishing intensity was mainly focused within the Perth Canyon region, Cocos and Christmas Islands and some areas in northern WA. No fishing activity was recorded in the GAB and for this reason impacts on the fishery are not expected.

Western Skipjack Tuna Fishery (WSTF)
Two stocks of skipjack tuna are thought to exist in Australian waters: one on the east coast and one on the west coast. The two stocks are targeted by separate fisheries: the Eastern Skipjack Tuna Fishery (ESTF) and the WSTF. The ESTF and WSTF extend through the same area as the Eastern Tuna and Billfish Fishery (ETBF) and the WTBF, respectively, with the exception of an area of the ETBF off north Queensland. Skipjack tuna is not always present in the AFZ, its distribution is heavily influenced by inter-annual variability in environmental conditions. Variability in the availability of skipjack tuna in the AFZ, and the prices received for product, influence participation levels in the STF. There was no fishing catch, effort or active vessels for WSTF in the AFZ in the 2010–11 and 2011-12 fishing season, therefore impacts on the fishery are not expected.

Southern and Eastern Scalefish and Shark Fishery (SESSF)
The SESSF is a multi-sector, multi-gear and multispecies fishery, targeting mainly fish and shark stocks. The SESSF is the largest Commonwealth fishery in volume terms and accounted for 27% of the gross value of production (GVP) of Commonwealth fisheries in 2011–12. It covers almost half the area of the AFZ and spans both Commonwealth and State waters (under Offshore Constitutional Settlement arrangements). The SESSF was established in 2003 through the amalgamation of four fisheries— the South East Trawl, GAB Trawl, Southern Shark Non-trawl and South East Non-trawl fisheries—under a common set of management objectives.

In 2009, AFMA created the South East Management Advisory Committee (SEMAC) to provide advice to the AFMA Commission on management measures for the SESSF. The SPF management advisory committee (MAC) and Squid MAC became part of SEMAC in 2010,

however the Great Australian Bight Trawl Sector MAC (GABMAC) remains separate. Annual SESSF landings declined from a peak of almost 37,000 t in 2002 to about 19,000 tonnes in 2012, as a result of reductions in species quotas and fishing effort. The GVP was $83.8 million in the 2011–12 financial year. The Nerites Season 2 MC3D MSS operational area overlaps the Gillnet, Hook and Trap Sectors, Great Australian Bight Trawl Sector (GABTS) and Scalefish Hook Sector. As a result of the vast fishing area, in which the survey only encompasses a small proportion, the proposed seismic survey is not thought likely to significantly impact the fishery. Furthermore, the survey vessel will be continually moving, and so specific fishing areas will available within a matter of hours.

Small Pelagic Fishery (SPF)
The SPF extends from southern Queensland to southern WA. Small pelagic species are generally caught during targeted fishing for a single species and have been taken in significant volumes within both Commonwealth and adjacent State management jurisdictions. These species are also taken to a lesser extent in several other Commonwealth and State-managed fisheries, mainly the trawl sectors of the SESSF, the ETBF, the WTBF, and the New South Wales Ocean Hauling Fishery. While the east and west stocks are both multijurisdictional (state and Commonwealth), SA manages the western stock of Australian sardine.

The fishery is primarily a purse-seine fishery. Catch has decreased since 2003–04. This appears to be driven by economics and logistical limitations, rather than any decline in resource abundance. In addition to the targeted species, a number of byproduct species are taken, including skipjack tuna, silver trevally and barracouta. Yellowtail scad is also caught in the fishery but is not currently a key target species for Commonwealth fishers. In 2010-11, the recorded catch was 535 tonnes and 153 tonnes in 2011-12. The Nerites Season 2 MC3D MSS operational area overlaps with the western sub-area of the fishery, although the majority of fishing effort is located in the waters surrounding Port Lincoln. Further, since the fishery in the GAB is focused within the 200 m isobath, and the depths of the proposed survey are ~750 to 3,500 m, the seismic survey is not considered to impact the SPF.

Southern Squid Jig Fishery (SSJF)
The SSJF is a single-method (jigging), single-species fishery, targeting Gould's squid. The fishery is located off New South Wales, Victoria, Tasmania and SA, and in a small area of oceanic water off southern Queensland, with most fishing taking place in the areas of Queenscliff and Portland. The SSJF is managed by the Commonwealth Government, although jigging operations within coastal waters (inside the 3 nm limit) are managed by the adjacent State government.

Jig vessels operate at night in continental-shelf waters between 60 m and 120 m in depth. The main trawl catches are taken in depths of 100–200 m. Gould's squid is also caught in other Commonwealth fisheries, mostly by demersal otter trawling, and particularly in the SESSF. In the Commonwealth Trawl Sector (CTS) of the SESSF, the annual catch of squid has ranged between 440 tonnes and 956 tonnes over the past 10 years. In the GABTS, the annual catch peaked in 2006 at 262 tonnes, but has been much less in recent years, dropping to 30 tonnes in 2012. For the SSGF the recorded catch was 650 tonnes in 2011 and 832 tonnes in 2012. Previous fishing effort has focused around Port Lincoln and does not overlap the Nerites

Season 2 MC3D MSS operational area. Furthermore, since the fishery in the GAB is focused within the 200 m isobath, and the depths of the proposed survey are ~750 to 3,500 m, the seismic survey is not considered likely to impact the SSJF.

Southern Bluefin Tuna Fishery (SBTF)
Southern bluefin tuna (SBT) constitutes a single, highly migratory stock that spawns in the north-east Indian Ocean and migrates throughout the temperate, southern oceans. It is one of the most highly valued fish species for sashimi, and is targeted by fishing fleets from a number of nations, both on the high seas and within the Exclusive Economic Zones (EEZ) of Australia.

Young fish (1–4 years) move from the spawning ground (off north-western Australia, south of Indonesia) into the AFZ and southwards along the WA coast. Surface-schooling juveniles are found seasonally in the continental shelf region of southern Australia, but the proportion of the juvenile stock that migrates into this area is not known. Juvenile SBT (2–3 years) are targeted in the GAB by Australian fishers using purse-seine gear. This catch is transferred to aquaculture farming operations off Port Lincoln in SA, where the fish are grown to a larger size to achieve higher market prices.

The GVP in 2011–12 from the SBTF was estimated to be $40.6 million. For most fish caught in the SBTF (those not caught by longline), this value reflects the value of fish at the point of transfer to pens for farming. The wild-caught value for 2011–12 is relatively low in historical terms, although it is higher than the value in 2009–10 and 2010–11 ($26 million and $31.3 million, respectively). The farmed value of SBT production in 2011–12 after ranching and grow-out was $150 million. Reduced supply of bluefin tuna to the global market is understood to have increased the price of SBT through 2012 which has contributed to an increase in the real value of SBT exports in 2011–12. The Nerites Season 2 MC3D MSS operational area overlaps with the SBTF. However, the majority of fishing effort in the last two seasons has been confined to areas south-west of Port Lincoln, particularly along the shelf edge within the 200 m isobath, whereas the depths of the proposed survey are ~750 to 3,500 m.

2.4.1.2. State Administered Fisheries

There are a number of State-managed fisheries that are in the vicinity of the Nerites Season 2 MC3D MSS operational area in SA. The State fisheries administered by the Primary Industries and Regions South Australia (PIRSA) are:

- Abalone Fishery: Western Zone;
- Blue Crab Fishery;
- Charter Boat Fishery;
- Marine Scalefish Fishery;
- Miscellaneous Fishery: The Giant Crab Fishery;
- Prawn Fisheries: Gulf St Vincent, Spencer Gulf and West Coast;
- Rock Lobster Fishery: Northern Zone; and
- Sardine Fishery

Abalone Fishery

The SA commercial Abalone Fishery is divided into three separate fisheries; Western Zone, Central Zone and Southern Zone. The Nerites Season 2 MC3D MSS polygon does overlap the Abalone Fishery in the Western Zone, however divers will not be harvesting at the water depths of the operational area (~750 to 3,500 m), and therefore the survey is not expected to negatively impact the fishery.

Blue Crab Fishery
There are two blue crab fishing zones; the Gulf St Vincent Blue Crab Fishing Zone, and the Spencer Gulf Blue Crab Fishing Zone**.** The Nerites Season 2 MC3D MSS is not anticipated to impact the fishery given the distance from the fishing zones in the Gulf of St Vincent and Spencer Gulf of operational area (over 200 km away). Furthermore, the habitats most often fished include saltmarshes, mangroves, tidal flats and dense seagrass meadows, which do not occur within the operational area.

Charter Boat Fishery
Charter boat fishing is considered a commercial platform to undertake recreational fishing activities. Charter boat fishing occurs in coastal waters of SA and has bag, boat and size limits for individual passengers. A large number of species are caught by charter boat fishers, with key target species including snapper, King George whiting and SBT. The Nerites Season 2 MC3D MSS operational area overlaps with the southernmost sections of the Charter Boat Fishing area, however this overlap is ~200 km from shore. It is not expected that a significant number of charter boat vessels will travel this distance, and therefore the survey is not expected to impact the fishery. Furthermore, the benthic habitats within the operational area are in stark comparison to the habitats in which the Charter Boat Industry regularly frequents, reducing the likelihood of recreational fishing occurring within the operational area.

Marine Scalefish Fishery
The commercial Marine Scalefish Fishery (MSF) is a multi-species and multi-gear fishery. There are over 60 species of marine 'scalefish' taken commercially, however the majority of fishing effort is concentrated on four primary species; King George whiting, southern garfish, snapper and southern calamari. Together, these four species account for approximately 60% of the total fishery production (by weight) and 70% of the total fishery value. Most of the catches of these primary species come from the two gulfs (Gulf of St Vincent and Spencer Gulf; over 240 km east from the operational area).

The MSF operates in all coastal waters (State waters, high tide mark to 3 nm) of SA including gulfs, bays and estuaries (excluding the Coorong estuary), from the WA border to the Victorian border. For some species, the Offshore Constitutional Settlement extends the fishery area out to the Australian EEZ - 200 nm. For this reason the Nerites Season 2 MC3D MSS operational area overlaps the MSF area. However as a result of the majority of the fishing occurring within near coastal waters, for example 60% of the fishery production within Gulf of St Vincent and Spencer Gulf, it is not expected that the seismic survey will significantly impact the fishery. The seismic vessel will also be continuously moving, therefore any specific fishing grounds will be available within a matter of hours. Ongoing consultation with all relevant fishing stakeholders in the GAB will also reduce any impact to fisheries and their associated organisations.

Rock Lobster Fishery: Northern Zone
The SA Rock Lobster Fishery is separated into two fishing zones; the northern zone and the southern zone. The waters which the northern zone cover includes a stretch of coastline in

excess of 3,700 km from the River Murray mouth to the WA border in the GAB, from the low water mark to the edge of the AFZ. The Rock Lobster Fishery in the northern zone is generally in deeper waters ranging from 20 to 600 m, typically over the edge of the continental shelf at around 200 m, and may overlap with the Nerites Season 2 MC3D MSS operational area. However, since the seismic vessel will also be continuously moving, displacement of fishing vessels will be short term only. Continuous consultation with all relevant fishing stakeholders in the GAB will also reduce any impact to fisheries and their associated organisations.

SA Miscellaneous Fishery: The Giant Crab Fishery
The Miscellaneous Fishery is a multi-species, multi-gear fishery comprising a range of different species that do not fall within existing management arrangements of other fisheries or are specialised fisheries. The Miscellaneous Fishery typically encompasses new and developing and/or small-scale fisheries. Many of these fisheries are low production and/or low value. Biological information on the majority of the miscellaneous species taken is limited. The Giant Crab fishery within the Miscellaneous Fishery is closely linked to the Rock Lobster Fishery. The Giant Crab Fishery is divided into two zones, southern and northen. The total commercial catch of giant crabs from SA waters is typically in the range of 17 to 21 tonnes per year.

The fishing grounds are generally in deeper waters, ranging from 20 to 600 m, typically over the edge of the continental shelf at around 200 m, and may overlap with the Nerites Season 2 MC3D MSS operational area. However, since the seismic vessel will also be continuously moving, displacement of fishing vessels will be short term only. Ongoing consultation with all relevant fishing stakeholders in the GAB will also reduce any impact to fisheries and their associated organisations.

Prawn Fisheries: Gulf St Vincent, Spencer Gulf and West Coast
The largest known population of western king prawns is in the Spencer Gulf of SA with smaller populations located in Gulf St Vincent and the West Coast waters of SA. Three commercial prawn fisheries occur within SA; the Gulf St Vincent Prawn Fishery, the Spencer Gulf Prawn Fishery and the West Coast Prawn Fishery. All three fisheries are based exclusively on the western king prawn which lives at depths ranging from 15-50 m. Since the Nerites Season 2 MC3D MSS operational area does not overlap the prawn fishing grounds, the proposed seismic survey is not expected to impact the prawn fisheries.

Sardine Fishery
The SA Sardine Fishery targets the Australian pilchard (sardine). Fishing may be undertaken over the whole year using large purse seine nets (up to 1,000 m in length). The Sardine Fishery is a component (purse seine gear endorsement) of the South Australian MSF. The fishery principally catches sardine, making up 98% of the catch. The vast majority of the total allowable commercial catch (TACC or quota) of sardines is used as fodder for the SBT aquaculture sector. The area of the fishery includes all SA waters out to the edge of the 200 nm AFZ overlapping with the Nerites Season 2 MC3D MSS operational area. However, since the seismic vessel will be continuously moving, any displacement of fishing vessels will be short term in duration. Furthermore, the fishery covers all SA waters, of which the operational area overlaps with a relatively small proportion. It is therefore considered that impacts on this fishery will be minimal. Ongoing consultation with all relevant fishing stakeholders in the GAB will also reduce any impact to fisheries and their associated organisations.

2.4.2. Petroleum Exploration and Production

The SWMR 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. The Nerites Season 2 MC3D MSS operational area overlaps Exploration and Production Permits EPP 37, EPP 39 and EPP 40 (operated by BP Developments Australia Pty. Ltd); and EPP 44 and EPP 45 (operated by Chevron Australia New Ventures Pty Ltd). There is also an abandoned oil well (Gnarlynots-1; drilled by Woodside in 2003) within the operational area.

2.4.3. Commercial Shipping

Within the southern section of the Nerites Season 2 MC3D MSS operational area there is significant national and international commercial shipping traffic that follows the traffic route from Port Lincoln and other SA ports to all westward destinations via the south-west WA coast. Due to the slow survey vessel speed and restricted manoeuvrability it may be necessary for commercial shipping vessels to take avoidance measures. Consultation with associated stakeholders, such as the Australian Maritime Safety Authority (AMSA) will be ongoing prior to and throughout the duration of the survey.

2.4.4. Tourism and Recreation

Recreational fishing may be undertaken in the area. However, due to the deepwater location of the operational area and the distance to the coast, there is not expected to be a high level of recreational activity undertaken in the area.

2.4.5. Cultural Heritage

There are no known indigenous cultural heritage values or issues for the waters and seabed within and immediately adjacent to the Nerites Season 2 MC3D MSS operational area. Similarly, there are no current or pending Native Title Determinations for the waters and seabed within and immediately adjacent to the operational area. Under the *Historic Shipwrecks Act 1976* (Commonwealth), all wrecks older than 75 years are protected. There are no known historic shipwreck sites within or adjacent to the Nerites Season 2 MC3D MSS operational area.

2.4.6. National Heritage

The Great Australian Bight Marine Park and Commonwealth Waters is listed on the Register of the National Estate (non-statutory archive). There are no places listed on the Commonwealth Heritage List within or adjacent to the Nerites Season 2 MC3D MSS operational area.

2.4.7. Marine Parks and Reserves

The Nerites Season 2 MC3D MSS operational area overlaps the GAB Commonwealth Marine Reserve (CMR) and is adjacent to the Murat CMR (150 km north of the operational area); and the Western Eyre CMR (35 km east of the operational area). The GAB CMR encompasses the former designated Marine Mammal Protection Zone (IUCN VI) and Benthic Protection Zone (IUCN VI) of the GAB Marine Park, first declared in 1998. These reserves were extended and combined in November 2012 to form the GAB CMR covering 45,926 km^2 with a water depth range of <15 to 6,000 m. The Nerites Season 2 MC3D MSS operational area overlaps

with the GAB CMR Multiple Use Zone (MUZ), which allows oil and gas activities to be undertaken. The management plan for the former GAB Marine Park (Commonwealth Waters) has now expired and transitional management arrangements apply until the new management plan comes into effect.

2.4.8. Defence Activities

The Commonwealth Department of Defence (DoD) training areas do not extend into any offshore waters of the GAB. The closest training areas are in the Investigator Strait (a body of water lying between the Yorke Peninsula and Kangaroo Island) used for military flying and firing, and waters off Port Lincoln used for firing and naval operations (over 200 km east from the survey area).

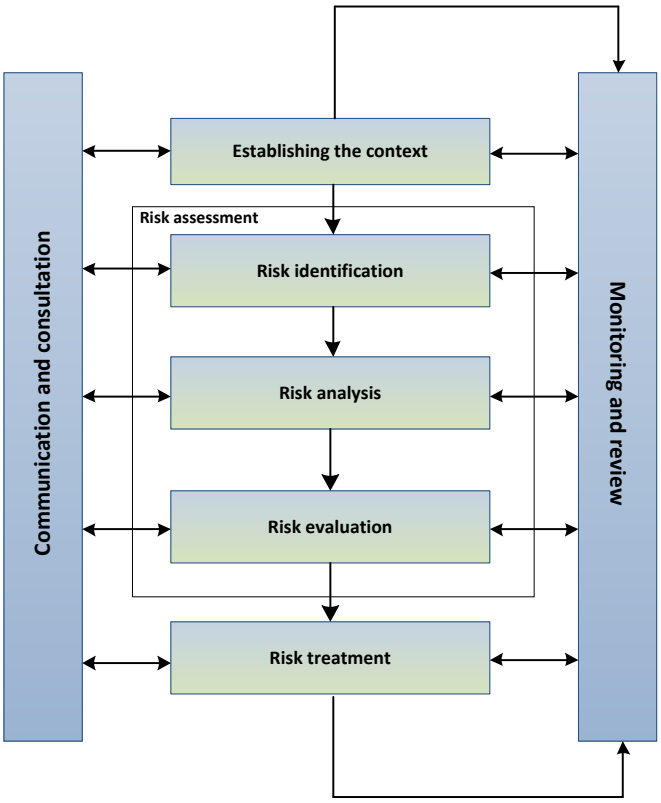
3. ENVIRONMENTAL RISK ASSESSMENT METHODOLOGY

An Environmental Risk Assessment (ERA) of the proposed Nerites Season 2 MC3D MSS has been undertaken to understand and manage the environmental risks associated with the activity to a level that minimises impacts on the environment and meets the objectives of the proposed 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 assessment has been undertaken to identify the sources of risk (aspects) and potential environmental impacts associated with the activity and to assign a level of significance or risk to each impact. This subsequently assists in prioritising mitigation measures to ensure that the environmental impacts are managed to ALARP.

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. The key steps used for the risk assessment are shown in **Figure 3.1**.

Figure 3.1 - Key Steps used for Risk Assessment



The environmental risks associated with the proposed seismic survey operations have been assessed by a methodology (see **Figure 3.1**) that:

- identifies the activities and the environmental aspects associated with them;
- identifies the values/attributes at risk within and adjacent to the Nerites Season 2 MC3D MSS operational area;
- defines the potential environmental effects of the activities;
- identifies the likelihood of occurrence and potential consequences; and
- determines overall environmental risk levels using a likelihood and consequence matrix.

The likelihood of occurrence for the key potential environmental impacts from the Nerites Season 2 MC3D MSS has been estimated based on industry incident reporting (see **Table 3.1**). **Table 3.1** also includes a qualitative description of environmental effects assigned to each category of consequence.

Table 3.1- Definitions for Qualitative Assessment of Likelihood and Environmental Effects

Likelihood	**Qualitative description of likelihood**
Unlikely	Impact has not occurred in the past and there is a low probability that it will occur in exceptional circumstances.
Possible	Impact may have occurred in the past and there is a moderate probability that it will occur at some time.
Likely	Impact has occurred in the past and there is a high probability that it will occur at some time.
Highly Likely	Impact has been a common problem in the past and there is a high probability that it will occur in most circumstances.
Routine	Impact will occur, is currently a problem in the area or is expected to occur in almost all circumstances.
Consequence	**Qualitative description of environmental effects**
Slight	Possible incidental impacts to flora and fauna in a locally affected environmental setting. No ecological consequences.
Minor	Reduction of the abundance/biomass of flora and fauna in the affected environmental setting. No changes to biodiversity or ecological system.
Moderate	Reduction of abundance/biomass in the affected environmental setting. Limited impact to local biodiversity without loss of pre-incident conditions.
Severe	Substantial reduction of abundance/biomass in the affected environmental setting. Significant impact to biodiversity and ecological functioning. Eventual recovery of ecological systems possible, but not necessarily to the same pre-incident conditions.
Catastrophic	Irreversible and irrecoverable changes to abundance/biomass in the affected environmental setting. Loss of biodiversity on a regional scale. Loss of ecological functioning with little prospect of recovery to pre-incident conditions.

Table 3.2 shows the overall environmental risk assessment matrix (also referred to as an event potential matrix) that compares the likelihood and consequences of potential environmental impacts arising from the Nerites Season 2 MC3D MSS and assigns a level of risk.

Table 3.2- Generic Environmental Risk Assessment Matrix

	LIKELIHOOD				
CONSEQUENCE	**Unlikely**	**Possible**	**Likely**	**Highly Likely**	**Routine**
Catastrophic	**High**	**High**	**High**	**High**	**High**
Severe	**Medium**	**Medium**	**Medium**	**High**	**High**
Moderate	**Medium**	**Medium**	**Medium**	**Medium**	**Medium**
Minor	**Low**	**Low**	**Medium**	**Medium**	**Medium**
Slight	**Low**	**Low**	**Low**	**Low**	**Low**

High Risk Level: Apply strict precautionary principle, and industry best practice to reduce to ALARP.

Medium Risk level: Apply standard cost-benefit approach to reduce risk to ALARP.

Low Risk level: Apply normal business management practice to avoid impact.

3.1. IDENTIFICATION OF RISKS AND IMPACTS

The environmental risks and potential environmental impacts of the proposed Nerites Season 2 MC3D MSS have been determined on the basis of TGS's previous seismic survey experience in the region and the outcomes of the ERA.

3.1.1. Environmental Aspects

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.

3.1.2. Environmental Impacts

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

- disturbance to marine fauna including cetaceans, pinnipeds, 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.

4. ASSESSMENT OF ENVIRONMENTAL IMPACTS AND RISKS

This section briefly describes the potential risks and impacts that could occur as a result of the proposed activity. **Section 4** details the risk assessment and **Section 6** summarises the control measures that will be implemented to minimise impacts to receptors described herein.

4.1. DISTURBANCE TO MARINE FAUNA

4.1.1. Discharge of Underwater Seismic Pulses

As detailed in **Section 1.3** TGS commissioned CMST to undertake acoustic propagation modelling to predict received SELs from two seismic vessels simultaneously operating within the survey area. Two scenarios were considered that encompass the worst case scenarios for sound exposure levels produced within the survey area and in the broader region that would be received on sensitive receptors.

The modelling showed that maximum SELs received at the shelf edge (a BIA for sperm and pygmy blue whales; see **Figure 2.4**) 104 km from the source did not exceed 160 dB re 1 μPa^2s and was well below the noise levels reported as causing a behavioural response in baleen and toothed whales. The maximum increase in received SELs likely to occur midway between two vessels operating at the same time in the worst case scenario at both sources did not exceed 160 dB re 1 μPa^2s. The SELs at the midway point between the two vessels was below levels reported to cause behavioural responses for baleen and toothed whales (McCauley *et al*. 2003, Richardson *et al*. 1995, Nedwell *et al*. 2004). Further information on the potential impacts on marine fauna are discussed below.

4.1.1.1. Disturbance to Marine Invertebrates

Few marine invertebrates have sensory organs that can perceive sound pressure, but many have organs or elaborate arrays of mechanoreceptors that are sensitive to hydro-acoustic disturbances (McCauley 1994). Close to a seismic source, the mechano-sensory system of many benthic crustaceans will perceive the ‘sound’ of airgun pulses, but for most species such stimulation would only occur within the near-field or closer, perhaps within distances of several metres from the source (McCauley 1994).

In an extensive review, Moriyasu *et al*. (2004) provided a summary of impacts of seismic airguns on marine invertebrates based on literature reviews. They conclude that “very limited numbers of experiments were scientifically and reasonably conducted” but the results of nine quantitative studies showed five cases of immediate (lethal or physical) impacts of seismic airguns on invertebrate species and four cases of no impacts. One study showed physiological impacts and another showed no physiological impact. Three cases showed behavioural impacts and one study showed no impact on behaviour.

4.1.1.2. Disturbance to Planktonic Organisms

Except for fish eggs, larvae and other minute planktonic organisms within a few metres of an airgun, no planktonic organisms are likely to be affected significantly by airgun array discharges (McCauley 1994). The range of pathological effects on fish eggs and larvae is likely to be restricted to less than approximately 2 m. Calculations show that less than 0.02% of plankton in the area would be affected. Any effect on the planktonic organisms from the seismic discharge is insignificant compared with the size of the planktonic population in a survey area or natural mortality rates for planktonic organisms.

4.1.1.3. Disturbance to Fish

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

- short ranges and high sound intensities (i.e. <1 km range from source);
- populations that cannot move away from operating arrays (e.g. site-attached reef species);
- survey that take place over protracted periods close to areas important for the purposes of feeding, spawning or breeding; and
- survey that take place over protracted periods close to areas that constitute narrow, restricted migratory paths.

Available evidence suggests that behavioural changes for some fish species may be no more than a nuisance factor. For example, the temporary, short range, displacement of pelagic or migratory fish populations may have insignificant repercussions at a population level (McCauley 1994).

There is a high likelihood that seismic airgun noise could cause the following effects in some finfish: avoidance; startle/alarm response; changes in swimming patterns; and changes in vertical distribution. These effects are expected to be short-lived, with duration of effect less than or equal to the duration of exposure, are expected to vary between species and individuals, and be dependent on the properties of received sound (DFO 2004). The ecological significance of such effects is expected to be low, except where they influence reproductive activity.

The threshold received SEL that could result in various behavioural effects in fish outlined above are:

<u>Low level behavioural effects</u>:

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

<u>High level behavioural effects</u>:

- fright/flight at >180 dB re 1µPa^2.s (species with limited home ranges or site-attached and/or territorial strategies) (Woodside 2007).

There are no documented cases of fish mortality upon exposure to seismic airgun noise under field operating conditions (DFO 2004). The threshold received SELs that could result in various sub-lethal and/or physiological effects are:

- onset of short term reversible loss in hearing sensitivity (temporary threshold shift - TTS) at >180 dB re 1µPa^2.s (site-attached species);
- onset of longer term loss in hearing sensitivity (TTS/permanent threshold shift – PTS) at >187 dB re 1µPa^2.s (site-attached species); and
- TTS onset but no injury to non-auditory tissues to ~1 kg sized fish at >200 dB re 1µPa^2.s (site-attached species) (Woodside 2007).

Disturbance to Sharks

Hastings and Popper (2005) documented further studies that sharks and rays probably do not detect sounds at frequencies above 800 to 1000 Hz, although there is little information on the specific effects of noise on sharks and rays. Sharks are known to be highly sensitive to low frequency sounds between 40-800 Hz sensed solely through the particle-motion component of an acoustic field. Sharks are attracted to sounds possessing specific characteristics, for example irregular pulse, broadband frequency and transmitted with a sudden increase in intensity (i.e. resembling struggling prey) (Myrberg 2001).

The key physiological factor which influences whether underwater noise will have a great effect on fish is the presence of a swim-bladder. The swim-bladder is a gas-filled chamber which assists with buoyancy or hearing, and vibrations in the water can result in trauma due to the disparity of acoustic impedance between water and gas filled chambers. Cartilaginous fish (sharks) do not have swim bladders and are therefore less sensitive to underwater noise and trauma. If a swim bladder is present, fish with a mechanical coupling of the swim bladder to the ear and/or a swim bladder of resonate frequency in the order of several hundred Hz are most susceptible to the effects of underwater noise (McCauley 1994). As a result the impact of the seismic activities on sharks, in particular great whites, is lower.

Disturbance to Southern Bluefin Tuna

To date there are no known specific literature relating to seismic airgun noise impacts on scombroid fishes. As with other fishes, there is no external opening to the ear and the canals and arrangements of bones in the ear are typical of teleosts (Popper 2003). Ultrastructural examinations of the sensory epithelia in these tunas suggest that they are hearing generalists, as they lack specializations in either hair cell orientation or concentration to enhance hearing (Popper 1981, Song *et al.* 2006). Behavioural and physiological studies provide evidence that tunas are hearing generalists (narrower frequency range with higher auditory thresholds), which may be able to detect sounds of frequencies <1,000 Hz. Most species in this family possess a swim bladder, but lack the mechanical connection to the inner ear and the otoliths. As a group, they seem able to detect mid-range frequencies (~300 - 1,000 Hz).

A study on the effects of boat noise on caged northern bluefin tuna (with similar sized swim bladder to SBT) observed the behavioural responses in large in-ocean cages to noise from passing vessels (Sara *et al.* 2007). The results showed:

- changes in schooling behaviour and swimming direction, increased vertical movement towards surface or bottom of the cage in response to approaching car ferries and hydrofoils emitting noise in the range of 120 to 137 dB re 1 µPa-m at frequencies up to 200 Hz; and
- various other types of behaviour in response to sounds from small boats.

This study examined the effects of continuous noise sources from different types of vessels, and therefore has limited value in determining what tuna behavioural responses could be to impulsive sound sources such as seismic airguns.

4.1.1.4. Disturbance to Marine Turtles

Electro-physical studies have indicated that the best hearing range for marine turtles is in the range 100 to 700 Hz, which overlaps with the frequency range of maximum energy in the horizontally propagating component of a seismic array 'shot' (McCauley 1994). Studies indicate that marine turtles may begin to show behavioural responses to an approaching seismic array at received sound levels of approximately 166 dB re 1 µPa (rms), and avoidance at around 175 dB re 1 µPa (rms) (McCauley *et al.* 2003). This corresponds to behavioural changes at ~2 km, and avoidance from ~1 km.

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

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

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

Feeding areas and migratory paths of turtles traverse both shallow and deep-water areas, and therefore individuals of all sizes may be encountered during the Nerites Season 2 MC3D MSS. The auditory sensitivity of marine turtles is reported to be centred in the 400 to 1,000 Hz range, with a rapid drop-off in noise perception on either side of this range (Richardson *et al.* 1995). This auditory range matches their weak vocalisation abilities, which are also in the low frequency range (100 to 700 Hz).

From airgun exposure tests on a caged green turtle and a loggerhead turtle, that were extrapolated to response levels for a typical airgun array operating at full power in 100 m water

depth, McCauley *et al.* (2003) concluded that turtles would, in general, probably show behavioural responses at 2 km and avoidance behaviour at 1 km from such operations.

There are no known turtle nesting, feeding or aggregating sites in the GAB. Loggerhead, green and leatherback could potentially transit through the survey area, however it is expected that individuals transiting the survey area will take evasive action before sound levels are great enough to cause physical damage. As such, impacts from acoustic disturbance to loggerhead, green and leatherback turtle are not anticipated as a result of the Nerites Season 2 MC3D MSS.

4.1.1.5. Disturbance to Pinnipeds

Australian sea lions show strong site fidelity to breeding colonies, with restricted, benthic foraging movements to undertaken at a maximum of 90 m depth and less than 100 km from the coast (Costa *et al.* 1998). As a result of the water depths in the survey area (~750 to 3,500 m), the distance from the preferred coastal habitats and from the nearest recorded breeding site (<150 km), high site fidelity and apparent tolerance of seismic discharges (Harris *et al.* 2001), Australian sea lions are unlikely to be significantly impacted by the Nerites Season 2 MC3D MSS.

4.1.1.6. Disturbance to Cetaceans

Baleen whales

Baleen whales produce a rich and complex range of underwater sounds ranging from about 8 Hz to 12 kHz but with the most common frequencies below 1 kHz (McCauley 1994). This combined with studies of their hearing apparatus suggests that their hearing is also best adapted for low frequency sound. Baleen whales make individual sounds that may last for up to 16 seconds (Richardson *et al.* 1995) and humpback whales are known to “sing” for long periods. These sounds are thought to be used in social interactions and communication between individuals and groups.

McCauley *et al.* (2003) report humpback whale song components reaching 192 dB re 1µPa^2 (p-p) as well as levels of 180 to 190 dB re 1µPa^2 (p-p) for humpback pectoral fin slapping and breaching sounds. Physical damage to the auditory system of cetaceans may occur at noise levels of about 230 to 240 dB re 1µPa (Gausland 2000), which is equivalent to a distance of about 1-2 m from the energy source. Because of the good swimming abilities of marine mammals and their avoidance of either the vessel or the airgun array, it is highly unlikely that any marine mammals will be exposed to levels likely to cause pathological damage (McCauley 1994).

Noise associated with airguns used during seismic surveys can cause significant behavioural changes in whales (McCauley 1994). Behavioural responses to airgun noise include swimming away from the source, rapid swimming on the surface and breaching (McCauley *et al.* 2003). The level of noise at which response is elicited varies between species and even between individuals within a species (Richardson *et al.* 1995). Stone (2003) suggests that different groups of cetaceans adopt different strategies for responding to acoustic disturbance from seismic surveys with baleen and killer whales displaying localised avoidance, pilot whales showing few effects and sperm whales showing no observed effects.

A comprehensive study carried out by McCauley *et al.* (2003) monitored the effects of seismic survey noise on humpback whales in the Exmouth Gulf region of Western Australia. The following conclusions were drawn from this research:

- only localised avoidance was seen by migrating whales during the seismic operation, indicating that the 'risk factor' associated with the seismic survey was confined to a comparatively short period and small range displacement;
- coupled with the fact that humpback whales were seen to be actively utilising the 'sound shadow' near the surface, then it is unlikely that animals will be at any physiological risk unless at very short range from a large airgun array, perhaps of the order of a few hundred metres; and
- upper levels of noise at 1.5 km from the seismic survey array are in the order of 182 dB re 1µPa², which is still well below the source levels of the highest components of humpback whale song (192 dB re 1µPa²). Thus, at 1.5 km the received airgun signal is still well within the range which humpback whales would be expected to cope with physiologically, since it would be difficult to argue that humpback whale song can cause physiological problems to the animals (McCauley *et al.* 2003).

With regards to avoidance behaviour by baleen whales, it is known that baleen whales will avoid operating seismic vessels and the distance over which the avoidance occurs seems to be highly variable between species and even within species. It is considered that this avoidance behaviour represents only a minor effect on either the individual or the species unless avoidance results in displacement of whales from nursery, resting or feeding areas, at an important period for the species. The Nerites Season 2 MC3D MSS polygon does not overlap known critical habitats for any cetacean species.

Toothed Whales

Toothed whales produce a wide range of whistles, clicks, pulsed sounds and echolocation clicks. The frequency range of toothed whale sounds excluding echo location clicks are mostly <20 kHz with most of the energy typically around 10 kHz, although some calls may be as low as 100 to 900 Hz. Source levels range from 100 to 180 dB re 1 µPa (Richardson *et al.* 1995). The sounds produced other than echo location clicks are very complex in many species and appear to be used for communication between members of a pod in socialising and coordinating feeding activities.

For toothed whales exposed to single short pulses, the TTS threshold appears to be, to a first approximation, a function of the energy content of the pulse (Finneran *et al*. 2002). In their review, Nedwell *et al.* (2004) considered the potential for TTS and concluded that the threshold for TTS was approximately 195 dB re 1 µPa. This is consistent with the review and calculations contained with Richardson and Moulton (2006) who considered the TTS threshold to be 192 to 202 dB re 1 µPa and reasonably consistent with the value presented by DEWHA (2008) of 186 dB re 1 µPa. Seismic pulses with received levels of 186 dB re 1 µPa or more are usually restricted to a radius of no more than about 300 m around a seismic airgun array, therefore the potential for TTS is extremely low as it would be necessary for the whale to be <1 km from the airgun array and remain within this range as the vessel traversed a distance of 4-5 km.

There is little systematic data on the behavioural response of toothed whales to seismic surveys. Richardson *et al*. (1995) reports that sperm whales appeared to react by moving away from surveys and ceasing to call even at great distances from a survey. However, in a 2003 study supported by the US Minerals Management Service (Jochens and Biggs 2003) two controlled exposure experiments were carried out (including one with three simultaneously tagged whales) to monitor the response of sperm whales to seismic source. The whales were exposed to a maximum received level of 148 dB re 1µPa. There was no indication that the whales showed horizontal avoidance of the seismic vessel nor was there any detected change in feeding rates of the tagged sperm whales.

Smaller toothed cetaceans have poor hearing in the low frequency range of airgun array noise (10 to 300 Hz) and seismic operators sometimes report dolphins and other small toothed whales near operating airgun arrays. However, there is a component of seismic pulses in the higher spectrum and in general most toothed whales do show some limited avoidance of operating seismic vessels. Goold (1996) studied the effects of 3D seismic surveys on common dolphins in the Irish Sea. The results indicated that there was a local displacement of dolphins around the seismic operation. This observation is consistent with data compiled by Stone (2003) from marine mammal observers onboard seismic vessels in the North Sea that shows small toothed whale species tend to move away from operating airguns.

The hearing capability of larger toothed whales (such as the killer whale) is unknown, but it is possible that they can hear better in the lower frequencies than the smaller toothed cetaceans. If this is the case, in lieu of any other information, their reactions to seismic survey vessels may be akin to those of the baleen whales. It is considered that the potential adverse effect on toothed whales would only occur if the whale is within close range (i.e. less than a few hundred metres).

Overlap with Critical Cetacean Habitat and Peak Periods of Activity

The Nerites Season 2 MC3D MSS polygon overlaps a BIA (foraging) for sperm whales (see **Figure 2.4**). There is a possibility of encountering feeding sperm whales during the north-eastern corner of the survey area and for this reason a number of mitigation measures will be implemented to remove any potential impact on this species (see **Section 6**).

The fullfold area for the Nerites Season 2 MC3D MSS does not overlap the BIA for migrating pygmy blue whales, in addition there will be no line turns, run-ins or run-outs taking place within the pygmy blue whale BIA, therefore no seismic activity will take place within the BIA for pygmy blue whales. The preferred foraging habitat preferences of pygmy blue whales is in water depths of 100-200 m (Gill *et al.* 2011). It should be noted that the BIA covers an area 20 nm either side of the 200 m isobath, which appears to be an over-estimation of the area where pygmy blue whales have been previously sighted in particular for deeper depths offshore.

The Nerites Season 2 MC3D MSS is not proposed to start until January 2015, which is outside of the peak feeding period (November/December) and the majority of pygmy blue whales would have migrated southwards (Gill *et al.* 2011). It is possible that individuals may pass through the survey area en route to the Bonney upwelling feeding areas, however they are only likely to be present in low numbers.

Noise modelling commissioned by TGS showed that the highest SELs at the 200 m isobath (the most common depth that feeding blue whales were observed; Gill *et al.* 2011) did not exceed 160 dB re 1 μPa^2s, was only slightly above ambient and well below the noise levels reported as causing a behavioural response in baleen whales. Therefore, it is unlikely that the Nerites Season 2 MC3D MSS will negatively impact feeding pygmy blue whales. Furthermore, mitigation measures will be implemented to minimise the likelihood of any potential impacts (see **Table 6.1**, **Section 6**).

The timing of the proposed Nerites Season 2 MC3D MSS will only overlap the start of the southern right whale migration and calving period at the end of May 2015. The closest aggregation areas to the Nerites Season 2 MC3D MSS polygon are Fowlers Bay and the Head of Bight, ~215 km and 270 km distance away respectively. Acoustic modelling showed the maximum SELs at distance from the source of up to 200 km SELs were below 80 dB re 1 μPa^2s which is well below the noise levels reported as causing a behavioural response in baleen whales. Therefore, it is unlikely that the Nerites Season 2 MC3D MSS will negatively impact breeding and calving southern right whales. Furthermore mitigation measures will be implemented to minimise the likelihood of any potential impacts (see **Table 6.1**, **Section 6**).

The proposed survey will not overlap in timing with the humpback whale migration in this area, and given the distance to the humpback migratory pathway, encounters with migrating individuals are unlikely. The nearest known humpback whale resting / aggregation area is Flinders Bay located ~1,500 km from the survey area. Since the survey area is not located in biologically significant areas (breeding, feeding and migrating), it is unlikely that humpback whales will be encountered during the survey. Furthermore mitigation measures will be implemented to minimise the likelihood of any potential impacts (see **Table 6.1**, **Section 6**).

4.1.1.7. Cumulative Impact Assessment

The closest distance two seismic vessels could be operating at any one time i.e. the worst case scenario was modelled. The SELs at long ranges on the continental shelf were predicted to be similar to those to that of the highest levels of what a single source would produce at that location. Therefore in the unlikely event that two vessels would be operating at 30 km apart (due to the seismic vessel line plan; see **Figure 1.2**, **Section 1.3**) the sound received at the continental shelf would be the same as that of a single vessel operating. Furthermore the maximum received level at the continental shelf edge (defined by the 200 m bathymetry contour) was below levels reported to cause behavioural responses for baleen and toothed whales (McCauley *et al*. 2003, Richardson *et al*. 1995, Nedwell *et al*. 2004). At distances up to 200 km where there may be areas for calving southern right whales the SELs would be below 80 dB re 1 μPa^2s which is well below the noise levels reported as causing a behavioural responses (McCauley *et al*. 2003).

The Ceduna MC3D MSS has been approved and is due to commence from October 2014 to May 2015. The survey area is located ~40 km at the closest point from the fullfold survey area for Nerites Season 2 MC3D MSS. In addition the line run-ins, runouts, soft-starts and line turns will occur within a further 15 km of the PGS Ceduna MC3D MSS polygon (NOPSEMA 2014). Therefore the closest distance a PGS survey vessel would be acquiring data from a TGS survey vessel would be ~55 km. The source volume proposed for the Ceduna MC3D MSS is 4,130 cui (NOPSEMA 2014) which is the a similar volume as to what was modelled for two

TGS survey vessels acquiring data at 30 km (4,100 cui). Therefore the combined SELs from the TGS and PGS vessel acquiring data at distance of 55 km is likely to be lower than a 3 dB increase from two TGS vessels operating at distance of 30 km (worst case scenario).

4.1.2. Light Generation

Lighting on both the survey and support vessels is required for safe navigation and work practices at night, and has the potential to create light pollution that may affect some marine species, primarily seabirds and turtles.

Loggerhead, green and leatherback turtles have the potential to be present in the Nerites Season 2 MC3D MSS polygon, however the vessels will be moving continually and consequently the effects of artificial lighting are likely to be less than for a stationary source. There are no known nesting sites in the vicinity, therefore lighting from the survey vessel will not have the potential to disorientate or attract turtle hatchlings.

It is not anticipated that the Nerites Season 2 MC3D MSS will have any impact on any species of seabird due to their mobility and distance of the potential survey area to any nesting sites.

The potential impacts to other marine fauna from light emissions is expected to be restricted to localised attraction, temporary disorientation and increased predation and as such, are considered to be minor and localised to a small proportion of the population.

4.1.3. Vessel and Towed Equipment Interactions with Marine Fauna

Survey and support vessels working within, and travelling to and from the Nerites Season 2 MC3D MSS polygon may present a potential physical hazard (e.g. animal displacement or vessel strike) to marine fauna including whales, dolphins, and turtles.

Loggerhead, green and leatherback turtles have the potential to be present in the Nerites Season 2 MC3D MSS polygon, however, the survey area does not include any shallow water features that may represent feeding areas for turtles. Additionally turtle guards will be fitted on the tail bouys throughout the duration of survey, thus reducing the risk of turtle entanglement.

The impact from vessel interactions with marine fauna can be as minimal as behavioural changes by the marine fauna to severe impacts such as mortality resulting from vessel strikes. Vessel collisions contribute to the mortality of marine fauna, notably turtles (Lutcavage *et al*. 1997; Hazel *et al.* 2007) and large cetaceans. Vessel traffic has severely affected North Atlantic right whales, for which collisions have been identified as a major source of mortality. Stranding records for Queensland, indicate that 14% of dead marine turtles had been struck by vessels (Hazel and Gyuris 2006). These records are largely from populated areas of the state and comprise an unknown proportion of the total mortality. Marine seismic surveys involve the use of two or more vessels travelling at slow speed (around 4 knots) along defined paths and therefore pose less of a risk. Support vessel-marine fauna interaction procedures have been prepared to ensure any interactions between the support vessel and cetaceans, pinnipeds and turtles are managed in accordance with Part 8 of the EPBC Regulations 2000.

4.2. DISTURBANCE TO BENTHIC HABITATS

4.2.1. Anchoring

Anchoring will not occur within the Nerites Season 2 MC3D MSS polygon due to the water depths within the area (~750 – 3,500 m). Anchoring outside the Nerites Season 2 MC3D MSS polygon would only occur in emergency circumstances and the survey and support vessels are fitted with highly sophisticated position fixing equipment.

4.2.2. Vessel Grounding

The potential for the survey and support vessel to become grounded while working within the Nerites Season 2 MC3D MSS polygon is non-existent due to the absence of shallow waters (<20 m water depth) and any emergent features within or immediately adjacent to the Nerites Season 2 MC3D MSS polygon. Water depths in the Nerites Season 2 MC3D MSS polygon are ~750 – 3,500 m.

4.2.3. Equipment Dragging or Loss

In the unlikely event of damage to or loss of a solid seismic streamer, potential environmental effects will be limited to physical impacts on benthic communities arising from the seismic streamer and associated equipment sinking to the seabed. Seismic streamers are fitted with pressure-activated, self-inflating buoys that are designed to bring the streamers to the surface if lost accidentally during a survey. As the equipment sinks it passes a certain water depth at which point the buoys inflate and bring the equipment back to the surface where it can be retrieved by the seismic or support vessels. Dragging of streamers along the seabed is unlikely given the water depth range (~750 to 3,500 m) and the absence of any shallow waters or emergent features across the Nerites Season 2 MC3D MSS polygon. Therefore the risk of significant impacts resulting from equipment dragging or loss is considered to be very low.

4.3. REDUCED AIR QUALITY FROM ATMOSPHERIC EMISSIONS

Atmospheric emissions from the proposed survey include greenhouse gas (GHG), NOx (nitrogen oxide), SOx (sulphur oxide), CO (carbon monoxide) and particulate matter (dark smoke) emissions from:

- use of survey and support vessel main engines for propulsion;
- use of survey and support vessel main and emergency power generation equipment;
- use of marine diesel by the survey vessel workboat; and
- incineration of oily sludges onboard the survey vessel.

Atmospheric emissions generated during the survey will result in a localised, temporary reduction in air quality. Incineration of oily sludges is not expected to generate any significant atmospheric emissions, due to the infrequent nature of the activity and the small volumes of material being burnt during each disposal episode.

4.4. INTRODUCTION OF INVASIVE MARINE SPECIES

Invasive Marine Species (IMS) are marine plants or animals that have been introduced into a region beyond their natural range and have the ability to survive, reproduce and establish founder populations. Species of concern vary from one region to another depending on various environmental factors such as water temperature, salinity, nutrient levels and habitat type. These factors dictate their survival and invasive capabilities. IMS have the potential to be introduced via:

- biofouling on vessel hulls and other external niches (e.g. propulsion units, steering gear and thruster tunnels);
- biofouling of vessel internal niches (e.g. sea chests, strainers, seawater pipe work, anchor cable lockers and bilge spaces etc.);
- biofouling on equipment that routinely becomes immersed in water; and
- discharge of high risk ballast water taken up at international or domestic sources.

Once introduced, IMS can cause serious environmental, social and economic impacts through predation or displacement of native species. These direct or indirect impacts also have the potential to threaten a range of sectors including: commercial fisheries and aquaculture tourism industry; human health; shipping; and infrastructure.

4.4.1. Ballast Water

Ballast water which may potentially harbour invasive marine species can be released by seismic and support vessels during marine seismic surveys. The Australian Quarantine Inspection Service (AQIS) has introduced the mandatory Australian Ballast Water Management Requirements that are enforced under the *Quarantine Act 1908*. Under these arrangements all vessels that have travelled from international waters are obligated to assess and manage their ballast water in accordance with the AQIS requirements. These arrangements prohibit the discharge of high-risk ballast water within Australian territorial seas (within 12 nautical miles of Australian territories) including Australian ports. It is also recommended by AQIS that ballast exchanges be conducted as far as possible away from shore and in water at least 200 m deep.

4.4.2. Biofouling

Biofouling on vessel hulls and other external niche areas, biofouling on internal niches and biofouling on equipment routinely immersed in water all pose a potential risk of introducing IMS into Australia. Under the National Biofouling Management Guidance for the Petroleum Production and Exploration Industry (Commonwealth of Australia 2009) a risk assessment approach is recommended to manage biofouling. The potential biofouling risk presented by the survey and support vessels selected to acquire the Nerites Season 2 MC3D MSS will relate to the length of time that these vessels have already been operating in Australian waters or, if they have been operating outside Australian waters, the location/s of the surveys they has been undertaking, the length of time spent at these location/s, and whether the vessels have undergone hull inspections, cleaning and application of new anti-foulant coating prior to returning to operate in Australia.

Antifoulant coating was applied in November 2011 to the survey vessel. This coating is considered suitable for both coastal and deep sea vessels and is in compliance with the

International Convention on the Control of Harmful Anti-Fouling Systems on Ships (IMO document AFS/CONF/26). An independent Risk Assessment of the likelihood of IMS will be undertaken following by a diving inspection to confirm the vessel and all seismic equipment are clean prior to retuning to Australian waters. The support vessel will be contracted from companies operating out of Port Lincoln and therefore will pose a low risk of introducing IMS.

4.5. MARINE POLLUTION FROM ROUTINE DISCHARGES

Risks to marine environmental resources within the Nerites Season 2 MC3D MSS polygon (and adjacent areas) from routine discharges are considered to be negligible given that all wastes, other than sewage, grey water and putrescibles wastes, will be incinerated aboard the survey vessel or compacted and disposed of onshore.

4.5.1. Sewage, Grey Water and Putrescible Wastes

Routine discharge of wastewater to the ocean will cause a negligible and localised increase in nutrient concentrations. The total nutrient loading from vessel operations during the Nerites Season 2 MC3D MSS will be insignificant in comparison to the natural daily nutrient flux that occurs within the region.

4.5.2. Bilge Water

The survey and support vessels may need to discharge bilge water during the Nerites Season 2 MC3D MSS. This can cause a localised reduction in water quality if not treated prior to discharge, however bilge water will be treated and disposed of in accordance with MARPOL 73/78 Annex I.

4.5.3. Other Wastes

The survey and support vessels will also produce a variety of other solid and liquid wastes, including packaging and domestic wastes that could potentially impact the marine environment if accidentally released in significant quantities resulting in a reduction in water quality and physical impacts on marine fauna. Management measures will be implemented during the Nerites Season 2 MC3D MSS to prevent the release of wastes.

4.6. MARINE POLLUTION FROM ACCIDENTAL DISCHARGES

The survey and support vessels will store and use fuel and a variety of hazardous materials such as lubricating oils and cleaning chemicals. During the survey, the survey vessel will be refuelled at sea using the support vessel, either within or immediately adjacent to the Nerites Season 2 MC3D MSS polygon. At sea refuelling will only take place during daylight hours and will not take place within a distance of 25 km of any emergent land or shallow water features (<20 m water depth).

4.6.1. Hazardous Materials

The vessel will store and use a variety of hazardous materials such as lubricating oils, cleaning chemicals and batteries. These materials have the potential to adversely impact the marine environment if accidentally released in significant quantities. The potential effects include a reduction in water quality and toxic effects on marine flora and fauna. Chemicals e.g. solvents and detergents, will typically be stored in small containers of 5-25 litre capacity and stored / used in internal areas where any leak or spill would be retained on board and cleaned up in

accordance with the Shipboard Oil Pollution Emergency Plan (SOPEP) and associated spill clean-up procedures. Some spills may occur when small containers of chemicals are being used in open areas, where there is a risk of some entering the sea if spilled. The realistic worst case volume would be 25 litres.

4.6.2. Fuel and Oil Spills

The hazards associated with fuel and oil spills during the Nerites Season 2 MC3D MSS are:

- on-deck leak or spill of small quantities (up to 50 litres) of hydraulic oil or lubricating oil;
- loss of up to 3,091 litres of diesel during refuelling operations, as a result of hose failure; and
- larger volume (up to 220 m^3) loss of diesel from a ruptured fuel storage tank, resulting from vessel collision or grounding.

The accidental discharge of fuel and oil has the potential to cause toxic effects on marine fauna and flora and a localised reduction in water quality. Potentially affected biota includes seabirds, cetaceans, turtles and pinnipeds that may come into contact with a surface hydrocarbon slicks as well as socio-economic impacts such as impact on commercial fishing.

The size of potential hydrocarbon spills on the decks of the survey and support vessels is likely to be less than 50 litres (based on shipping industry leak frequency analyses). This quantity relates primarily to the capacity of storage containers commonly used, plus volumes of hydraulic oil in hoses in equipment. In the case of deck spills, most of the spilt material is likely to be contained with bunds or containment lips installed to prevent discharge to sea.

The realistic worst case volume of diesel spilled during refuelling operations is 3,091 litres, arising from the total loss of the contents of the transfer hose (e.g. 5” hose of 244 m length) during refuelling. Dry break couplings would prevent any more than the hose volume being spilled in the event of hose failure. In reality, a more likely scenario is a pin hole leak or a large hole in the hose, resulting in a highly visible sheen on the sea surface enabling action to be taken to stop the leak by the operation supervisor(s) before more than a few litres is spilt.

The largest fuel oil tank is inside of the hull of the *Polar Duchess*, with void tanks on either side, thus reducing the likelihood of rupture in the event of a vessel-to-vessel collision. The central tank has a maximum capacity of 244 m^3. The tanks are never filled to 100% capacity. It is the vessel owners policy that the tanks will only be filled to 90% capacity. Therefore, in the extremely unlikely (improbable) event of a ruptured fuel tank as a result of collision, the maximum spill size possible would be in the order of ~220 m^3 of MGO. However, this could only occur in the event of a rupture of one of the vessels’ largest MGO tanks and complete loss of all of its contents and the volume of the fuel lost to the marine environment would be expected to be less than the total capacity of the tank due to:

- if the tank was holed below the water line, then it would only leak down to a level equivalent to the water line, and
- emergency procedures would be carried out to transfer the contents of the tank to other MGO tanks onboard the vessel.

The ADIOS2 (Automated Data Inquiry for Oil Spills) oil weathering model was run for both a summer and winter release scenarios using the worst case scenario for an oil spill of MGO from the largest tank at maximum capacity of 220 m^3 (90% full). The results showed that a surface diesel slick would disperse and evaporate rapidly given the energetic environmental conditions that would be encountered in the waters of the GAB and would only persist at most for 38 hours during the winter scenario within a zone of potential impact (ZPI) of 24.6 km; and 18 hours during the summer scenario within a ZPI of 15.5 km. There are no shallow or sensitive emergent features within the Nerites Season 2 MC3D MSS polygon. Six sites (closest to the survey area) were selected based on potential environmental sensitivities and mapped against the ZPIs for summer and winter scenarios.

The ZPIs for summer and winter scenarios overlapped the GAB CMR MUZ and pygmy blue and sperm whale BIAs. The Nerites Season 2 MC3D MSS is proposed to acquire data from January to June 2015, during which time the majority of the pygmy blue whales will be foraging in the Bonney upwelling area (see **Section 2.3.4.1**). Sperm whales may be present, however in low numbers.

The GAB CMR has important foraging areas for the Australian sea lion, great white shark, sperm whale, shearwaters; and is a globally important seasonal calving habitat for the threatened southern right whale. The Australian sea lion has a higher foraging effort closer to shore, mainly within 50 km from coast line as a result of the greater availability of prey species (Hamer et al. 2009). Due to the extensive depths in the survey area (~750 m – 3,500 m), the distance from the preferred coastal habitats (200 km), and from the nearest recorded breeding site (<180 km), including their high site fidelity, it is highly unlikely that the Australian sea lion will be impacted by a potential oil spill. Fish and sharks do not generally break the sea surface and therefore unlikely to be impacted by a surface slick. Loggerhead, green and leatherback turtles may occur in the survey area in low numbers. Seabirds returning to their breeding colonies may at most transit over the survey area, however given the distance from the known Australian breeding sites hundreds of kilometres away, only a limited number of individuals are likely to be present in the survey area.

Overall, the impact of surface and/or entrained hydrocarbons on protected areas and species is considered moderate, however the nature of diesel in the marine environment is highly evaporative and dispersive and is not expected to persist for more than 38 hours for the winter scenario. In addition even in a worst case scenario the largest spill size would be less than 220 m^3 and given the low risk of an oil spill occurring during a collision it is unlikely that significant numbers of any of these faunal groups will be exposed to surface diesel slicks within the time frame prior to natural weathering (~2% remaining after 38 hours – winter scenario and ~1% remaining after 18 hours – summer scenario).

4.6.3. Commercial Fisheries

There are a number of commercial fisheries operating within the area of the Nerites Season 2 MC3D MSS polygon. The following fisheries; WTBF, WSTF, SPF, SESSF, SSJF, SBTF, Abalone Fishery, Blue Crab Fishery, Charter Boat Fishery, Marine Scalefish Fishery, Miscellaneous Fishery, Prawn Fisheries, Rock Lobster Fishery, and Sardine Fishery have been contacted by TGS directly and via the appropriate fishing industry organisations and

informed of the location of the proposed Nerites Season 2 MC3D MSS. Disruption to commercial fisheries in the area could result from:

- direct effects of underwater noise disturbance on target fish populations;
- indirect effects on the CSIRO aerial surveys which influence the catch quota for SBT
- direct effects of underwater noise disturbance to SBT whilst being towed to the ranching pontoons.
- indirect effects of underwater noise disturbance on fish prey species;
- restriction of access to fishing grounds due to vessel movements and operations;
- seismic equipment loss and subsequent interference with fishing gear (entanglement);
- loss of fishing gear e.g. buoyed fish traps;
- recreational take of finfish species from the survey and support vessels; and
- direct and indirect effects arising from surface diesel slicks and entrained hydrocarbons.

The most sensitive time for the tuna fishing industry is from October to January. In previous years the majority of the SBT TAC has been caught before January, and it is likely that the start date of Nerites Season 2 MC3D MSS will not impact on the SBT fishery as the majority of TAC will have been caught.

The threshold received SELs that could result in the onset of short term reversible loss in hearing sensitivity (TTS) were recorded at >180 dB re 1µPa^{2}s (Woodside 2007) which is well above the maximum SELs (128 dB re 1µPa^2.s) that would be received at the continental shelf. SBT are hearing generalists species that are adapted to swimming at high speeds. Studies on caged tuna showed a change in schooling behaviour in response to approaching car ferries emitting noise in the range of 120 to 137 dB re 1 µPa-m (Sara *et al.* 2007). The Nerites Season 2 MC3D MSS is not directly in the tow path of the SBT operations and therefore the worst case maximum SELs of 128 dB re 1 µPa^{2}s potentially detected at the continental shelf is not likely to have an impact on SBT or other commercial fish species.

The sardine industry is the main food source for the SBT and is dependent on a stable SBT Industry. The SA Sardine Industry Association's (SASIA) main concern would be driven by any negative impacts on the normal migratory pattern of SBT during the catching window. The mitigation and management measures proposed to remove any potential impacts for the tuna fishery industry will also minimise the likelihood of any impacts to the SASF.

The main area of sardine fishing is in the Spencer Gulf and therefore nowhere near the proposed seismic survey area. Consequently, it is not likely that there will be any direct impacts to the SASF from the proposed survey.

The Great Australian Bight Industry Association (GABIA) expressed concern that seismic survey operations maybe having an impact on catch rates, profitability, catch levels and quota values resulting from the Fishery Independent Surveys (FIS). The GABIA provided data on catches for Bight redfish and flathead over the period 2005-2011. For the Bight redfish catch rates, there appears to be a significant increase in catch in 2007 and 2009. The IonGeo BightSPAN 2D MSS was undertaken in 2009 and there does not appear to be any correlation between this survey and the catch of Bight redfish. For flathead catch rates there appears to

be a decline in 2007 and 2008, however, there were no seismic surveys acquiring during this time and therefore cannot be attributed to lower catch rates.

In 2011, there is a noticeable decline in catches for Bight redfish. The Ceduna 3D MSS, GAB was acquiring data during 2011, however there are other factors that could have contributed to the decline in catch. There was a marine heatwave off the SW coast of WA in February to March 2011, which coincided with an extremely strong La Niña event and a record strength Leeuwin Current (Pearce *et al*. 2011). Temperatures of 23.2 °C and 22.3 °C were recorded at Albany and Esperance respectively. The mean temperature at Esperance is 20.6 °C, which is a 1.7 °C increase in water temperature. Biological effects reported fish and invertebrate deaths, extensions and contractions in species distributions, variations in recruitment and growth-rates, impacts on trophic relationships and community structure, and variations in catch rates of exploited species. As such, the elevated water temperatures were viewed as resulting either in mortality or in a variety of "sub-lethal" effects, both of which can have either short or long-term implications (Pearce *et al*. 2011).

There is currently insufficient evidence to indicate that seismic operations are impacting on catch rates in the GAB Trawl Fishery when considering other factors that could have an influence on catch rates. The fullfold survey area is ~40 km at the closest point from the Central 2 FIS survey area. Therefore, seismic acquisition is not likely to have an impact on the FIS.

4.6.4. Shipping and Petroleum Activities

There are no potential impacts on petroleum activities, however, commercial shipping activity in the southern part of the Nerites Season 2 MC3D MSS polygon area is high. The survey vessel and towed array represent a potential navigational hazard and vessels will need to avoid the seismic vessel to prevent collisions, entanglement of seismic cables, and other incidents. Any vessels contracted by TGS will comply with MARPOL requirements and other applicable maritime laws and operate strictly in accordance with standard operating procedures for marine operations.

4.6.5. Heritage and Conservation Values

It is highly unlikely that the proposed Nerites Season 2 MC3D MSS will impact on the environmental values of any heritage listed places or protected areas, given the location of the survey area in deep offshore waters of the continental slope.

4.6.6. Defence Activities

The Department of Defence training areas do not extend into any offshore waters of the GAB. The closest training areas are in Investigator Strait used for military flying and firing, and waters off Port Lincoln used for firing and naval operations (~200 km east from the survey area). There is no intention to undertake helicopter crew changes, so there is limited potential for helicopters flying out to the survey vessel to interfere with military aircraft operating within GAB waters if the survey period coincides with planned exercises or routine military aircraft operations.

4.7. SUMMARY OF ENVIRONMENTAL RISK ASSESSMENT RESULTS

The risk assessment indicates that the potential impacts arising from the proposed Nerites Season 2 MC3D MSS operational area can be categorised as having Low to Medium risk levels. No risks were assessed as High. **Table 4.1** presents a summary of the assessed level of residual (post-mitigation) environmental risk associated with the proposed seismic survey. The environmental aspects of the survey that have the potential to cause significant environmental effects (Medium or High risk levels) 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 discharge of hazardous materials.
- Accidental fuel and oil spills from the survey or support vessels.
- Vessel collisions resulting in fuel and oil spills.

In this case a number of additional control measures were also assessed, and were found to be not practicable—i.e. the cost, time and effort required to implement the measure is grossly disproportionate to the benefit gained. A summary of the control measures that will be implemented are shown in **Table 6.1**, **Section 6.**

Table 4.1 - Summary of Environment Risk Assessment for the Nerites Season 2 MC3D MSS

Hazard	Environmental aspect	Potential environmental impacts	Risk		
			Consequence of impact	Likelihood of the identified consequence	Residual risk level
Disturbance to marine fauna	Discharge of underwater seismic pulses	Behavioural and physiological effects on cetaceans, pinnipeds, turtles and fish	Slight	Possible	**Low**
		Physiological effects on benthic invertebrates and plankton	Slight	Possible	**Low**
	Light generation from vessels	Behavioural effects on dolphins, turtles, fish and seabirds	Slight	Possible	**Low**
	Vessel and towed equipment interactions	Behavioural and physical effects on cetaceans, pinnipeds and turtles	Minor	Possible	**Low**
Disturbance to benthic habitats	Deployment and retrieval of anchors	Localised physical damage to benthic habitats	Slight	Possible	**Low**
	Vessel grounding		Minor	Unlikely	**Low**
	Equipment damage, dragging or loss		Slight	Possible	**Low**
Atmospheric emissions	Operation of machinery and vessels powered by internal combustion engines	Localised reduction air quality Greenhouse gas emissions	Slight	Likely	**Low**
Invasive marine species	Discharge of ballast water from vessels	Introduction and establishment of IMS and displacement of native marine species	Minor	Possible	**Low**
	Biofouling of vessel hulls, other niches and immersible equipment		Minor	Possible	**Low**
Marine pollution from routine discharges	Discharge of sewage, grey water and putrescible wastes	Localised reduction in water quality due to nutrient enrichment	Slight	Routine	**Low**

Hazard	Environmental aspect	Potential environmental impacts	Risk		
			Consequence of impact	Likelihood of the identified consequence	Residual risk level
	Discharge of bilge water	Acute toxicity effects on marine fauna and flora Localised reduction in water quality	Slight	Possible	**Low**
	Discharge of other wastes i.e. garbage	Localised reduction in water quality Physical impacts on marine fauna i.e. from plastics	Minor	Possible	**Low**
Marine pollution from accidental discharges	Hazardous materials	Toxic effects on marine fauna and flora Localised reduction in water quality Indirect effects on commercial fisheries	Moderate	Possible	**Medium**
	Fuel and oil spills		Moderate	Possible	**Medium**
Disturbance to social and community values	Interaction with commercial fisheries	Disruption to commercial fishing vessels Potential direct and indirect noise impacts on target species Restriction of access to fishing grounds, loss/damage to gear Recreational take of finfish species	Minor	Possible	**Low**
	Interaction with shipping and petroleum infrastructure	Disruption to shipping and petroleum exploration activities	Slight	Possible	**Low**
	Operation of vessels within protected areas and heritage places	Disturbance to heritage and conservation values	Slight	Possible	**Low**

5. IMPLEMENTATION STRATEGY

5.1. ENVIRONMENTAL MANAGEMENT FRAMEWORK

The design and execution of the proposed Nerites Season 2 MC3D MSS will be conducted under the framework of the TGS Environmental Policy and HSE Management System. The seismic programme will be supported by a bridging document between the TGS and Dolphin Geophysical for the operation of the survey vessel.

To ensure TGS's environmental management standards and performance objectives are achieved, Dolphin Geophysical will be required to comply with all relevant requirements of TGS's HSE systems/policies and standards.

TGS and its contractor will apply a tiered approach to optimising the environmental performance of the project and ensuring that TGS'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 Nerites Season 2 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 Dolphin Geophysical as well as documents written specifically for the Nerites Season 2 MC3D MSS. Many of the procedures apply to all vessels in the Dolphin Geophysical fleet, however the associated work instructions are generally vessel specific. Relevant Dolphin Geophysical procedural documents that will be implemented during the survey include:

- Anchor checklist;
- Chief engineers standing orders operational procedures;
- Damage stability operational procedures;
- Support and chase vessel manual;
- Garbage management operational procedures;
- Garbage management plan for the *Polar Duchess;*
- Garbage record book and environmental record keeping operational procedures;
- Grounding operational procedures;
- Hull damage operational procedures;
- Incinerator operational procedures;
- ISO 14001 International Standard for Environmental Management Systems;
- Master standing orders operational procedures;
- Navigational instructions and duties of the officer on watch operational procedures;
- Workboat/Streamer Section Change operational procedures;
- Ship Energy Efficiency Management Plan (SEEMP);
- *Polar Duchess* Ballast Water Management Plan;
- Procedure to prevent impacts on benthos;

- Storage use of hazardous materials operational procedures;
- *Polar Duchess* Crew HSE Plan;
- Project Plan;
- *Polar Duchess* SOPEP; and
- the EP, and an associated environmental commitments register (ECR).

The contractor-specific documentation will be updated in accordance with the EP and other client requirements. The Project HSE Plan, which complements the EP, includes procedures for the following:

- emergency response;
- waste management;
- hazardous materials and handling; and
- fuel/oil spills.

The Implementation Strategy for the EP includes an outline of:

- Environmental management strategies.
- Roles and responsibilities.
- Training and competency.
- Monitoring.
- Auditing.
- Management of non-conformance.
- Record keeping.
- Emergency response and contingency planning.
- EP review.
- Stakeholder consultation.

TGS is responsible for ensuring that the proposed Nerites Season 2 MC3D MSS is managed in accordance with the Implementation Strategy and the TGS Environmental Policy and HSE Management System.

5.1.1. Management Strategies

This section of the EP summary outlines the management strategies in place to ensure that the environmental impacts and risks associated with the activity are reduced to ALARP, and to ensure compliance with all relevant legislation.

Environmental management strategies have been formulated to address the identified environmental hazards for the proposed survey, categorised in the following groups:

- Disturbance to Marine Fauna.
- Disturbance to Benthic Habitats.
- Atmospheric Emissions.
- Invasive Marine Species.
- Marine Pollution from Routine Discharges.
- Marine Pollution from Accidental Discharges.
- Disturbance to Social and Community Values.

The environmental management strategies incorporate the environmental performance outcomes (EPO), environmental performance standards (EPS) and measurement criteria (MC) referred to in Division 2.3, Clause 13(4) of the Environment Regulations. The EPO defined in the environmental management strategies are based on the identified environmental aspects, associated environmental impacts and the assessed risks, corporate policies and performance commitments, and applicable regulatory requirements.

5.1.2. ALARP Demonstration

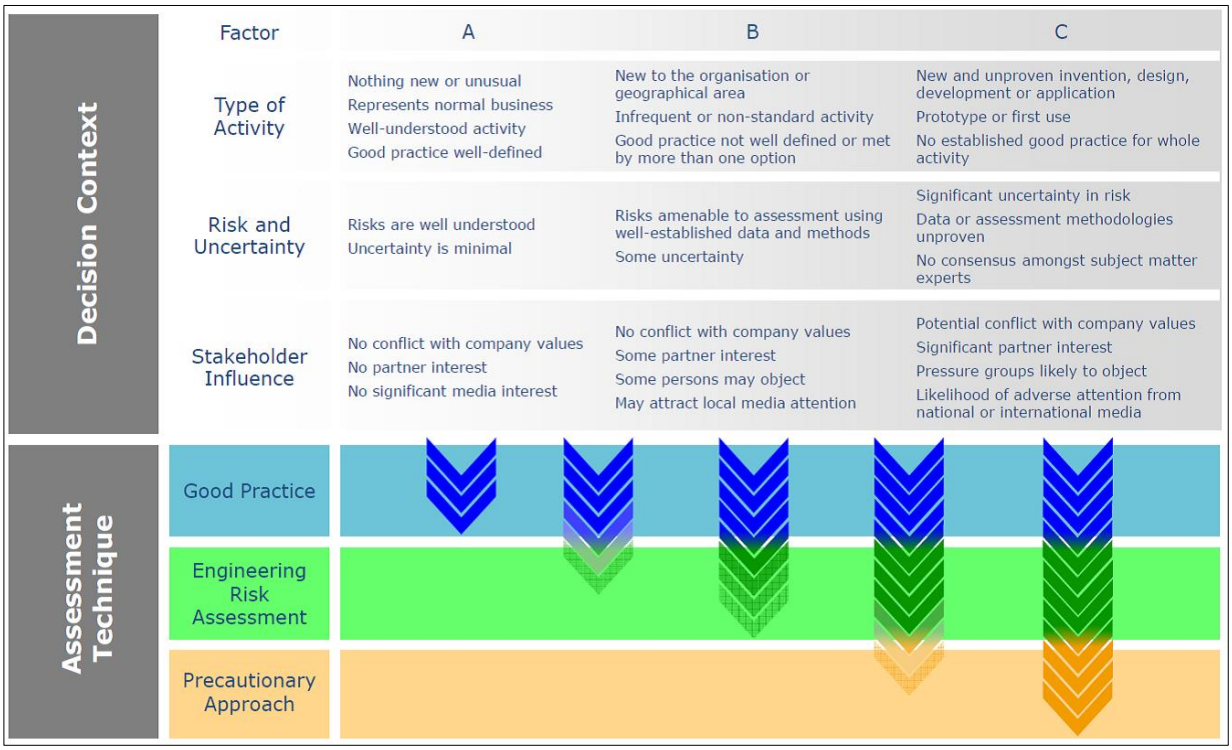
Regulation 11(1)(b) of the Environment Regulations require a demonstration that environmental impacts are reduced to ALARP.

Determining whether risks have been reduced to ALARP (as low as reasonably practicable) requires an understanding of the nature and cause of the risk to be avoided and the sacrifice (in terms of safety, time, effort and cost) involved in avoiding that risk. The hierarchy of decision tools used in this case (from lowest risk to highest risk) has been adapted from the UKOOA Industry Guidance on Risk Related Decision Making. **Figure 5.1** illustrates the UKOOA framework.

Within the context of a specific decision situation, the framework provides a means to:

- Determine the relative importance of the various methods of assessing risk (e.g. by reference to standards, cost benefit analysis (CBA), or societal values).
- Judge which of these methods is best placed to determine whether the risks are tolerable and ALARP.

Figure 5.1 - Risk Related Decision Making Framework



The UKOOA guidance describes a range of appropriate bases (i.e. tools or protocols) for risk decision making. These bases provide a means to assess the relative importance of adherence to, and reliance on, the following when making decisions to either accept or further treat risks:

- Codes and Standards.
- Good Practice.
- Engineering Judgement.
- Risk Analysis.
- Company Value.
- Societal Values.

A summary of the application of these decision making tools and protocols in relation to the different levels of risk identified is provided in **Table 5.1**.

Table 5.1 – Decision Making Tools and Protocols

Risk rating	Decision making tools	Decision making protocols
Low Risk (Acceptable Zone)	Comparison to codes and standards, good oilfield practice and professional judgement are used to assess risk acceptability	If the environmental risk of the hazard has been found to be "Acceptable" and the control measures are consistent with applicable standards and 'good oilfield practice' then no further action is required to reduce the risk further. However, if a control measure that would further reduce the impact or risk is readily available, and the cost of implementation is not disproportionate to the benefit gained, then it is considered 'reasonably practicable" and should be implemented.
Medium Risk (ALARP Zone)	Risk based analysis are used in addition to comparison to codes and standards, good oilfield practice and professional judgement to assess risk acceptability.	An iterative process to identify alternative / additional control mechanisms has been conducted to reduce the risk to the "Acceptable" zone. However, if the risk associated with a hazard cannot be reasonably reduced to the "Acceptable" zone without grossly disproportionate sacrifice; then the mitigated environmental risk is considered to be ALARP.
High Risk (Intolerable and Unacceptable Zone)	All of above decision-making tools apply plus consideration of company values and societal values	If the environmental risk of the hazard has been found to fall within this zone then the activity should not be carried out. Work to reduce the level of risk should be assessed against the precautionary principle with the burden of proof requiring demonstration that the risk has been reduced to the ALARP Zone before the activity can be commenced.

The risk assessment approach described above implies a level of proportionality wherein the principles of decision making applied to each particular impact category (or hazard) are proportionate to acceptability of environmental risk of that potential impact. The decision making principles for each level risk are based on the precautionary principle (as defined in the EPBC Act) and provide assurance that the environmental impacts and risks are of an acceptable level and reduced to ALARP.

For the purposes of determining whether the identified risks associated with the Nerites Season 2 MC3D MSS have been reduced to ALARP, the "decision context" for each of the risks identified in the Nerites Season 2 MC3D MSS ERA was reviewed. All of the risks associated with the survey correspond to the description of Decision Context Type "A" (see **Figure 5.1**)—i.e. they do not represent anything new or unusual; are well understood risks; control measures represent established "good practice"; and there are no major stakeholder implications.

A number of control measures were assessed for practicability. All represent existing, recognised 'good practice', have been found to be practicable, and accordingly, will be implemented during the Nerites Season 2 MC3D MSS. Additional control measures were also assessed, and were found to be not practicable—i.e. the health and safety risks associated, cost, time and effort required to implement the measure is grossly disproportionate to the benefit gained. The control measures that will be implemented for the Nerites Season 2 MC3D MSS are described in **Table 6.1**, **Section 6**.

When formulating control measures for each environmental hazard, the 'Hierarchy of Controls' philosophy is applied, shown in **Table 5.2**. The Hierarchy of Controls is a system used in industry to minimise or eliminate exposure to hazards, and is part of TGS's HSE Management System. The Hierarchy of Controls are, in order of effectiveness:

- Eliminate;
- Substitute;
- Engineer;
- Isolate;
- Administration; and
- Protection.

Although commonly used in the evaluation of occupational health and safety (OHS) hazard control, the Hierarchy of Controls philosophy is also a useful framework to evaluate potential environmental controls to ensure reasonable and practicable solutions have not been overlooked. Treatments considered by TGS to be reasonably practicable have been implemented, while those considered to be not reasonably practicable have not been implemented.

Table 5.2 - Hierarchy of Controls

Control	Effectiveness	Seismic survey examples
Eliminate		*Get rid of the impact or risk.* Excess chemicals are returned to shore rather than discharged overboard.
Substitute		*Change the impact or risk for a lower one.* Substitute a large airgun array for a smaller one.
Engineering		*Engineer out the impact or risk.* Use solid streamers rather than fluid-filled streamers.
Isolation		*Isolate people or the environment from the impact or risk.* Avoid acquiring data near sensitive turtle nesting beaches during nesting season.
Administrative		*Provide instructions or training to people to lower impact or the risk.* The use of procedures (e.g. at sea refuelling procedures) and pre-work job hazard analysis (JHAs) to assess and minimise the environmental impacts or risks of an activity.
Protective*		*Use of protective equipment.* The provision and use of personnel protective equipment (PPE).

5.1.3. Demonstration of Acceptability

Regulation 11(1)(c) of the Environment Regulations requires a demonstration that environmental impacts are of an acceptable level.

TGS considers a range of factors when evaluating the acceptability of environmental impacts and risks associated with its activities. This evaluation works at several levels, as outlined in **Table 5.3.**

Table 5.3 - Acceptability Test

Test	Question	Acceptability demonstrated
Policy compliance	Is the proposed management of the impact or risk aligned with the TGS Environmental Policy?	The impact or risk must be compliant with the objectives of the company policies.
Management System Compliance	Is the proposed management of the impact or risk aligned with the TGS Environmental Policy and HSE Management System?	Where specific TGS or Dolphin Geophysical procedures and work instructions are in place for management of the impact or risk in question, acceptability is demonstrated.
Social acceptability	Have stakeholders raised any concerns about activity impacts or risks, and if so, are measures in place to manage those concerns?	Stakeholder concerns must have been adequately addressed and closed out.
Laws and standards	Is the impact or risk being managed in accordance with existing Australian or international laws or standards, such as EPBC Policy Statements, MARPOL, AMSA Marine Orders, Marine Notices etc.	Compliance with specific laws or standards is demonstrated.
Industry best practice	Is the impact or risk being managed in line with industry best practice, such as APPEA Code of Environmental Practice, IAGC guidelines etc.?	Management of the impact or risk complies with relevant industry best practice.
Environmental context	Is the impact or risk being managed pursuant to the nature of the receiving environment (e.g. sensitive or unique environmental features generally require more management measures to protect them than environments widely represented in a region)?	The proposed impact or risk controls, EPO and EPS must be consistent with the nature of the receiving environment.
Environmentally Sustainable Development (ESD) Principles	Does the proposed impact or risk comply with the APPEA Principles of Conduct (APPEA 2003), which includes that ESD principles be integrated into company decision-making.	The Nerites Season 2 MC3D MSS is consistent with the APPEA Principles of Conduct.
ALARP	Are there any further reasonable and practicable controls that can be implemented to further reduce the impact or risk?	There is a consensus that residual risk has been demonstrated to be ALARP.

A description of demonstration of acceptability has been undertaken in the Nerites Season 2 MC3D MSS EP in a manner consistent with the Acceptability test, shown in **Table 5.3**.

6. SUMMARY OF THE CONTROL MEASURES

Table 6.1 – Summary of Control and Mitigation Measures

Impact Category	Potential Impacts	Control and Mitigation Measures	Residual Risk Level
Disturbance to Marine Fauna	• Potential noise impacts on cetaceans, pinnipeds and turtles from underwater seismic pulses	• Implementation of EPBC Policy Statement 2.1 - Part A - Standard Management Procedures throughout the duration of the survey: - Pre-start visual observation undertaken by MFO for 30 minutes out to 3 km observation zone with a 2 km low power zone and 500 m shut-down zone - If no whales sighted soft start can commence for 30 minutes - During night or low visibility soft start up may be commenced provided that there have not been 3 or more whale instigated shut-downs during the preceding 24 hour period or if operations were not previously underway during the preceding 24 hours, the vessel has been in the vicinity (10km) of the start up position for 2 hours (under good visibility conditions) within the preceding 24 hour period, and no whales have been sighted. • Use of four MFOs for duration of survey • Implementation of EPBC Policy Act Statement 2.1 – Part B Additional Management Measures when in the BIA for sperm whales: - Use of PAM when in the BIA for sperm whales to monitor a 3 km observation zone. If a sperm whale, beaked whale or other species of baleen whale that vocalises at high frequencies is detected within 2 km of the source 'power down' will be implemented and within 500 m from the source a shut-down will be implemented as per Part A - Standard Management Procedures. • Pre-survey induction includes coverage of EPBC Act Policy Statement 2.1 requirements	**Low**
	• Potential disturbance from light emissions from survey and support vessel to surrounding sea surface	• External lighting of survey vessel is minimised to that required for navigation, vessel safety, safety of deck operations	
	• Potential behavioural physical impacts on cetaceans, pinnipeds and turtles from vessel interactions	• Application of support vessel-marine fauna interaction procedures modified from the Australian National Guidelines for Whale and Dolphin Watching • Knowledge of applicable guidelines described in AMSA Marine Notice 12/2011 • Adherence to the TGS vessel Workboat/Streamer Section Change operational procedures • Turtle guards will be fitted to tail buoys throughout the survey	
Disturbance to Benthic Habitats	• Potential damage to benthic habitats from vessel anchoring	• Anchoring will not be undertaken due to water depths across the operational area (~750 – 3,500 m) • Anchoring in shallow waters near shoals (e.g. reefs, islands or the mainland coastline will only occur in an emergency. All measures will be taken to avoid sensitive benthic habitats (corals, seagrasses, macroalgal beds) • Adherence to the requirements of Vessel Bridge Routines – Anchoring and Anchor Watch Checklist	**Low**

Impact Category	Potential Impacts	Control and Mitigation Measures	Residual Risk Level

	• Potential damage to benthic habitats from vessel grounding	• Use of approved navigation systems and depth sounders.
		• Standard maritime safety/navigation procedures.
		• Application of relevant TGS Operational Procedures:
		  • Adherence to the requirements of the Master Standing Orders/Night Order Book Operational Procedures.
		  • Adherence to the requirements of the vessel Grounding Operational Procedures.
		  • Adherence to the requirements of the Navigational Instructions Including Duties of the Officer On Watch Operational Procedures.	

	• Potential damage to benthic habitats from equipment damage, dragging or loss	• In-water equipment lost will be recovered, if technically and financially feasible • Adherence to the requirements of vessel operational procedures to ensure that a Workboat/Streamer Section Change is done in a safe and standardised method using the Workboat • Detailed records of known equipment losses overboard will be maintained	
Atmospheric Emissions	• Localised reduction air quality • Greenhouse gas emissions	• Adherence to Marine Orders – Part 97 • Implementation of Planned Maintenance System (PMS) aboard survey vessel • Use of low sulphur diesel fuel • Adherence to the requirements of Vessel Bridge Routines • Incinerator compliant with MARPOL Annex VI requirements • Implementation of Ship Energy Efficiency Management Plan (SEEMP)	**Low**
Introduction of invasive marine species	• Introduction and establishment of IMS and displacement of native marine species	• Adherence to Marine Orders – Part 98 • Vessels required for the proposed activity will not discharge ballast water without prior authorisation from Department of Agriculture (DoA) Biosecurity • Adherence to the requirements of Vessel Ballast Water Management Plan • Recent IMS Risk Assessment and anti-fouling coating application for survey and support vessels • AF coating meets IMO 2001 Convention requirements • Survey and support vessels will have all the necessary DoA Biosecurity clearances to operate unrestricted anywhere in Australian waters • Familiarity of guidelines detailed in the National Biofouling Management Guidance for the Petroleum Production and Exploration Industry • Any known or suspected introduced aquatic species will be reported to PIRSA FishWatch	**Low**

Impact Category	Potential Impacts	Control and Mitigation Measures	Residual Risk Level

Marine pollution from routine discharges	• Localised reduction in water quality
	• Acute toxicity effects on marine fauna and flora
	• Physical impacts on marine fauna i.e. from plastics
		• Adherence to Marine Orders – Part 96
		  - discharge of sewage and putrescibles waste will be of short duration with high dispersion and biodegradability;
		  - all sewage and putrescible waste treatment systems and holding tanks are to be fully inspected within the last 12 months; and
		  - onboard sewage treatment plant to be approved by the International Maritime Organisation (IMO).
		• Adherence to the requirements of Vessel Bridge Routines - Chief Engineer's Standing Order
		• Adherence to the requirements of the vessel Incinerator Operation Procedure. Sewage and putrescible wastes macerated prior to disposal
		• Sewage and putrescible wastes passed through a comminuter and a disinfection system – the final product to pass through a screen of <25 mm diameter prior to disposal to the sea
		• Discharge of sewage which is not comminuted or disinfected will only occur at a distance of >12 nm from the nearest land
		• Untreated sewage will not be discharged instantaneously but at the discharge rate defined in Marine Orders - Part 96 when the vessel is en-route and proceeding at a speed not less than 4 knots
		• Discharge of sewage which is comminuted using a certified approved sewage treatment plant will only occur at a distance of > 3 nm from the nearest land
		• Treated sewage will not be discharged instantaneously but at the discharge rate defined in Marine Orders - Part 96 when the vessel is en-route and proceeding at a speed not less than 4 knots
		• If vessels are unable to treat/store grey water biodegradable soaps and detergents will be used
		• Bilge water treated and disposed of in accordance with MARPOL Annex I requirements
		• Adherence to the requirements of the vessel Chief Engineers Standing Orders Operational Procedures
		• Bilge water contaminated with hydrocarbons must be contained and disposed of onshore, except if the oil content of the effluent without dilution does not exceed 15 ppm or an IMO approved oil/water separator is used to treat the bilge water. The vessel must not be stationary when undertaking discharge
		• Containment and onshore disposal of bilge water contaminated with chemicals, except if chemical has a low toxicity, as determined by relevant MSDS
		• Bilge water contaminated with chemicals to be contained and disposed of onshore, except if the chemical is demonstrated to have a low toxicity (determined by MSDS)
		• Adherence to Marine Orders – Part 95
		• Application of relevant Dolphin Geophysical procedures and work instructions
		  - Adherence to the requirements of Vessel Environmental Management Procedures.
		  - Adherence to the requirements of the vessel Garbage Record Book and Environmental Record Keeping Operational Procedures.
		  - Adherence to the requirements of the vessel Garbage Management Plan (IMO No. 9190298).
		  - Adherence to the requirements of the vessel Garbage Management Operational Procedures.
		  - Garbage handled and disposed of in accordance with MARPOL Annex V requirements
		• Application of garbage, solid and liquid wastes handling and disposal requirements
		  - No discharge of plastics or plastic products of any kind from vessel or support vessel
		  - No discharge of domestic wastes or maintenance wastes from survey and support vessel
		  - All waste receptacles aboard survey and support vessel covered with tightly fitting, secure lids to prevent any solid wastes from blowing overboard
		  - 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
		  - Hydrocarbons located above deck stored with some form of secondary containment to contain leaks or spills (e.g. bund, containment pallet, transport packs)
		  - Correct segregation of solid and hazardous wastes
		  - Incinerator will be operated in accordance with established operating procedures that align with manufacturers specifications
		• Provision of appropriate segregation facilities on survey and support vessel including integral waste oil tank for oils and sludge
			Low

Impact Category	Potential Impacts	Control and Mitigation Measures	Residual Risk Level

Marine pollution from accidental discharges	• Toxic effects on marine fauna and flora, from accidental discharges of hazardous materials
	• Localised reduction in water quality
	• Indirect effects on commercial fisheries
		• Adherence to Marine Orders – Part 94
		• Application of relevant Dolphin Geophysical procedures and work instructions
		  - Adherence to the requirements of the vessel Storage and Use of Hazardous Waste Material Operational Procedures
		  - Adherence to the requirements of Vessel Environmental Management Procedures
		• All chemical and hazardous wastes will be segregated into clearly marked containers prior to onshore disposal
		• All storage facilities and handling equipment will be in good working order and designed in such a way as to prevent and contain any spillage as far as practicable
		• All hazardous substances will have an MSDS in place that is readily available aboard the survey and support vessels
		• Adherence to Marine Orders – Part 21, Part 30, Part 59, Part 91, and COLREGS
		• SOPEP implemented and tested for vessels >400 GT. Drill conducted in Australian waters prior to survey
		• At least one SOPEP drill will be conducted aboard the survey vessel during survey
		• Spill response bins/kits located in close proximity to hydrocarbon storage areas
		• Issuing of appropriate NTM by AHS, and Auscoast warnings by RCC Australia
		• Refuelling at sea subject to Dolphin Geophysical Support and Chase Vessel Manual, and specific additional requirements
		  - application of 25 km exclusion zone from emergent land or shallow water features (20 m or less depth) for at sea refuelling operations
		  - refuelling of vessels will be undertaken under favourable wind and sea conditions as determined by the vessel Masters;
		  - refuelling will take place during daylight hours only;
		  - Job Hazard Analysis (JHA) undertaken before each fuel transfer;
		  - all valves and flexible transfer hoses inspected for integrity
		  - dry break couplings (or similar) in place for all flexible hydrocarbon transfer hoses
		  - Pre-approval of refuelling by Client Representative
		  - AMSA will be notified prior to commencing refuelling operations
		• In the event of any fuel or oil spills to sea SOPEP / OPEP procedures will be followed for notification and consultation with AMSA, to ensure prompt and appropriate mobilisation of NATPLAN or SAMSCAP, if required
		• When a fuel/oil spill to sea occurs the vessel Master will inform the RCC Australia using POLREP. RCC Australia, in turn, notify AMSA
		• Type I Operational Monitoring implemented for spill surveillance and tracking
		• Allow small diesel spills to disperse and evaporate naturally, and monitor position and trajectory of any surface slicks
		• Physical break up (using propwash from the support vessel) by repeated transits through slick may be considered for larger diesel slicks (after consultation with relevant Combat Agency [AMSA or SA DPTI])
		• Implementation of NATPLAN (by AMSA) or SAMSCAP (by SA DPTI), if required
		• AMSA consulted to ensure agreement in place for SOPEP interface with NATPLAN
		• Notification and engagement with appropriate stakeholders identified in the EP
		• Insurance policies to cover costs of environmental monitoring or clean up post spill
			Medium

Impact Category	Potential Impacts	Control and Mitigation Measures	Residual Risk Level
Disturbance to Social and Community Values	• Disruption to commercial fishing vessels • Potential direct and indirect noise impacts on target species	• Adherence to Marine Orders – Part 21, Part 30, Part 59, and COLREGS • Relevant fisheries stakeholders notified of proposed activities in advance of survey operations commencing • TGS will provide the fishery industry with a 'look ahead plan' every three days detailing the proposed seismic survey plan and coordinates • Adherence to relevant Dolphin Geophysical procedures and work instructions - Adherence to the requirements of the Master Standing Orders/Night Order Book Operational Procedures. - Adherence to the requirements of the Navigational Instructions Including Duties of the Officer On Watch Operational Procedures • Use of a Support & Chase vessel manual as guidance in managing vessel interactions • Issuing of appropriate NTM by AHS, and Auscoast warnings by RCC Australia • Survey and support vessels will use approved navigation systems and adhere to standard maritime safety / navigation procedures • Fishermen alerted of vessels presence and extent of towed array • Establishment of a vessel exclusion zone around the survey vessel • TGS will communicate directly with CSIRO and provide daily three day forecasts, or Lookahead, document • In-water equipment lost will be recovered, if technically and financially feasible • Recreational fishing from survey and support vessels is prohibited	**Low**
	• Disruption to commercial shipping activity	• Adherence to Marine Orders – Part 21, Part 30, Part 59, and COLREGS • Consultation with AMSA prior to survey commencing to determine level of commercial shipping in the vicinity of operational area • Adherence to relevant Dolphin Geophysical procedures and work instructions - Adherence to the requirements of the Master Standing Orders/Night Order Book Operational Procedures - Adherence to the requirements of the Navigational Instructions Including Duties of the Officer On Watch Operational Procedures • Use of a support vessel to manage vessel interactions • Issuing of appropriate NTM by AHS, and Auscoast warnings by RCC Australia • Survey and support vessels will use approved navigation systems and adhere to standard maritime safety / navigation procedures • Other mariners alerted of vessels presence and extent of towed array • Establishment of a CPA • In-water equipment lost will be recovered, if technically and financially feasible	
	• Disturbance to heritage and conservation values	• All TGS and contractor personnel made aware of, and comply with, requirements of accepted EP	
	• No incidents of interference and negative interactions with defence activities occur during the survey	• Consultation with Department of Defence • Adherence to the prohibition of vessel entry into designated petroleum safety zones	

7. SUMMARY OF THE ARRANGEMENTS FOR ONGOING MONITORING OF THE TITLEHOLDERS ENVIRONMENTAL PERFORMANCE

Environmental performance of the Nerites Season 2 MC3D MSS is reviewed in a number of ways. These reviews are undertaken to:

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

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

- An audit of the vessels will be carried out before or during the activity to ensure that procedures and equipment for managing routine discharges and emissions are in place to enable compliance with the accepted environment plan (EP).
- Prior to the survey commencing the Survey Environmental Advisor (SEA) will ensure that procedures and equipment are in place to enable the commitments, EPO, EPS and MC to be efficiently recorded in the ECR.
- A summary of the key information, commitments, EPO, EPS and MC for the activity (ECR) will be distributed aboard the survey vessel, and implementation of the environmental performance outcomes and commitments will be monitored on a regular basis by the SEA, in conjunction with the Client Site Representative.

Management of changes to scope (e.g. timing, location or operational details) are the responsibility of TGS. A risk assessment will be undertaken for all changes in scope to assess potential impacts of the change. If the change represents a significant modification that is not provided for in the accepted EP in force for the activity, a revision of the EP will be conducted in accordance with Regulation 17 of the Environment Regulations. The revised EP will be submitted to NOPSEMA in accordance with the requirements of Regulation 17(2), and the proposed change to the activity will not commence until the revised EP has been accepted by NOPSEMA.

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

8. SUMMARY OF THE RESPONSE ARRANGEMENTS IN THE OIL POLLUTION EMERGENCY PLAN

8.1. OIL POLLUTION EMERGENCY PLAN

The Oil Pollution Emergency Plan (OPEP) for the Nerites Season 2 MC3D MSS, taking into account the nature and scale of the activity and the potential spill risks involved (see above), comprises components of the survey vessel SOPEP that manage the environmental impacts of a spill, supported as required by applicable established, statutory OPEPs. In summary, the following plans are in place as a contingency in the unlikely event of an oil spill, which as a whole, represent the OPEP for this activity:

- Survey vessel SOPEP - deals with spills which are either contained on the vessel or which can be dealt with from / by the vessel.
- National Plan for Maritime Emergencies (NATPLAN): the Australian Maritime Safety Authority (AMSA) - is the Jurisdictional Authority (JA) and Control Agency (CA) for spills from vessel which affect Commonwealth waters, i.e. outside of 3 nm from the coast.
- The South Australian Marine Spill Contingency Action Plan (SAMSCAP) - deals with spills from the vessels which affect SA State waters.

8.2. VESSEL SOPEP

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

8.3. EMERGENCY RESPONSE ARRANGEMENTS

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

Given the location of the Nerites Season 2 MC3D MSS operational area the preferred strategy for diesel spills will be to allow small spills to disperse and evaporate naturally, and monitor the position and trajectory of any surface slicks (see below). Physical break up (using propwash from the support vessel) by repeated transits through the slick may be considered for larger slicks (following consultation with the Combat Agency – AMSA or SA DPTI).

8.3.1. Commonwealth Waters

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

8.3.2. State Waters

For State waters, initial actions will be undertaken by the survey vessel with subsequent actions determined in consultation with the regulatory authorities (SA DPTI) under the SAMSCAP, having regard to the potential impacts posed by the spill. SA DPTI is the designated Combat Agency for oil spills from vessels within the SA State jurisdiction. Upon notification of an incident, SA DPTI will assume control of the incident.

8.3.3. Type I Operational Monitoring

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

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

This monitoring will enable the Vessel Master to provide the necessary information to the relevant Combat Agency (AMSA or SA DPTI), via a POLREP form, to determine and plan appropriate response actions under NATPLAN or the SAMSCAP (if either of these plans are actually activated). Operational monitoring and observation in the event of a spill will inform an adaptive spill response and scientific monitoring of relevant key sensitive receptors.

This operational monitoring will be restricted to daylight hours only, when surface slicks will be visible from the support vessel and/or chase vessel surveillance. The information gathered from this monitoring will be passed on to the relevant Combat Agency, via the POLREP form, but also via ongoing SITREP reports following the initial spill notification to RCC Australia. TGS will implement, assist with, or contribute to (including funding if required) any other operational monitoring as directed by the Combat Agency.

No Type II “Scientific Monitoring” will be implemented by TGS as part of the OPEP for the Nerites Season 2 MC3D MSS. For the worst case scenario, the largest spill size would be <276 m^3; and surface slicks are likely to have dispersed and evaporated almost completely within ~22 hours (in summer months). It would not be possible to get additional vessels and appropriate personnel / equipment to undertake any Type II monitoring (e.g. of water quality

etc.) mobilised to the operational area or surrounding waters in a timeframe of anything less than 24 hours.

8.3.4. Training

In compliance with Regulation 14(4) and 14(5) a designated Oil Pollution Prevention Team (OPPT) will be trained to ensure they are familiar with their tasks and the equipment in the event of an oil spill.

8.3.5. Testing

A drill test of the oil spill emergency response arrangements will be conducted during the mobilisation phase prior to commencement of operations of the survey. All drill tests will be reported as per MARPOL Annex I (Regulation 15) requirements and will be reviewed as part of the ongoing monitoring and improvement of emergency control measures.

8.3.6. Reporting, Maintenance and Review

Any fuel or oil spills aboard either the survey or support vessels must be reported to TGS via the internal TGS Event Reporting Management. In the event of spillage of any oil or diesel spills to the sea, AMSA or SA DPTI will be notified by the appropriate Vessel Master immediately (via RCC Australia using a POLREP form) to ensure prompt and appropriate mobilisation of relevant response plans. Any significant spills (greater than 80 L) will be reported to NOPSEMA by TGS, as reportable incidents.

The OPEP will be regularly reviewed to ensure it is appropriate to the nature and scale of the activities within its scope and to ensure maintenance of the response capability and the operator's preparedness. In compliance with Regulation 14(8AA) the OPEP will be continuously reviewed and kept up-to-date to ensure new information or improved technology can be incorporated as specifies in the SOPEP.

9. DETAILS OF CONSULTATION ALREADY UNDERTAKEN, AND PLANS FOR ONGOING CONSULTATION

9.1. PHASE 1 – STAKEHOLDER CONSULTATION

An initial stakeholder listing was identified through:

- a review of relevant legislation applicable to Commonwealth waters petroleum and marine activities;
- identification of marine user groups in the area (possible recreational/commercial fisheries, fishing industry groups, merchant shipping, eco-tourism providers);
- identification of marine 'interest groups' (i.e. technical and scientific entities); and
- industry/company support groups.

Consultation with the following representative bodies and organisations was undertaken:

Commonwealth Government Department or Agency

- Australian Fisheries Management Authority (AFMA).
- Australian Maritime Safety Authority (AMSA).
- Australian Hydrographic Office (AHO).
- Department of Industry (DoI).
- Geoscience Australia.
- National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA).
- Department of Agriculture (DoA).
- Department of Environment (DoE).

South Australian Government Departments or Agencies

- Department of Environment Water and Natural Resources (DENR).
- Department of Primary Industry and Resources of South Australia (PIRSA) (Fisheries).
- Department for Manufacturing, Innovation, Trade, Resources and Energy (DMITRE), now Department of State Development (DSD).
- Department of Planning, Transport and Infrastructure (DPTI).
- Council District of Lower Eyre.
- Regional Development Australia Whyalla and Eyre Peninsula.
- Flinders Ports.
- City of Port Lincoln Council.
- District Council of Ceduna.
- Department of the Premier and Cabinet.
- SA Tourism Commission.

Fishery-interest Groups

- Australian Southern Bluefin Tuna Industry Association (ASBTIA).
- Great Australian Bight Fishing Industry Association (GABIA).
- Sardine Fishing Industry Association (SASIA).
- South Australian Rock Lobster Advisory Council (SARLAC).
- SA Aquaculture Council.
- Marine Fishers Association of SA.
- Commonwealth Fisheries Association (CFA).
- South-east Trawl Fishing Industry Association (SETFIA).
- Sustainable Shark Fishing Inc.
- Southern Squid Jig Fishery.
- Small Pelagic Fishery.
- Spencer Gulf and West Coast Prawn Fishermen's Association.

- The Sustainable Shark Fishing Association.
- Tuna Boat Operators Association SA.
- Wildcatch SA.
- Tropical Tuna Management Advisory Committee.
- RecFish SA.

Scientific Interest Group

- Blue Whale Study Group.
- Defence Science and Technology Organisation (DSTO).
- South Australian Research and Development Institute (SARDI).
- Commonwealth Scientific and Industrial Research Organisation (CSIRO).
- SA Museum.
- Flinders University Cetacean Ecology, Behaviour and Evolution Lab (CEBEL).

Non-Governmental Organisations

- Conservation Council of South Australia (CCSA).
- International Fund for Animal Welfare (IFAW).
- Migratory Wildlife Network (MWN).
- Pew Environmental Group.
- Australian Conservation Foundation (ACF).
- Australian Marine Conservation Society (AMCS).
- Greenpeace.
- World Wildlife Fund (WWF).
- The Nature Conservancy.
- Whale and Dolphin Conservation Society (WDCS).
- Wild Migration.
- Shipping Australia.
- Yalata Aboriginal Community, Ceduna.
- Port Lincoln Aboriginal Community Council.
- South Australian Chamber of Mines and Energy (SACOME).
- Australian Seafood Industry Council (ASIC).

Individuals

- Federal Member for Grey.
- Federal Member for Mayo.
- State Member for Finness.
- State Member for Flinders.
- State Member for Goyder.
- SA Greens Senator – Penny Wright.
- SA Minister for Mineral Resources & Energy – The Hon. Tom Koutsantonis.
- SA Minister for Agriculture, Food and Fisheries – Leon Bignell.
- SA Minister for Sustainability, Environment and Conservation – Ian Hunter.
- Dean Lukin.

Recreational Groups

- Boating Industry Association of SA.
- Charter Boat Fisheries.

Petroleum Operators

- BP Developments Australia Pty Ltd.
- Chevron Australia New Ventures Pty Ltd.

Stakeholder letters containing information describing the proposed survey were sent on 4th July 2014. A further letter was sent to all the stakeholders on 11th July 2014 with an update on project information regarding the distance between the two survey vessels within the operational area. TGS considers that comprehensive consultation with all persons or organisations whose functions, interests or activities that may be affected by the proposed survey has been carried out and that sufficient information has been provided to allow the relevant person to make an informed assessment of the possible consequences of the activity on the functions, interests or activities of the relevant person (Regulation 11A).

9.1.1. Assessment of the Merits of Stakeholder Concerns

An assessment of the merits of objections or claims about the adverse impact of the Nerites Season 2 MC3D MSS was made, and where practicable those with merit were incorporated into the survey design. The following objections and claims were identified (note where possible these have been grouped into common themes):

- **Marine Safety:** Stakeholders were concerned about shipping safety and interactions with fishing vessels. All suggested control measures relating to AMSA RCC notification to initiate AUSCOAST warnings, AHS notification to issue a Notice to Mariners (NTM) for the activity, use of a support vessel to manage vessel interactions, display of appropriate navigational beacons and lights, radar watch, radio contact to indicate the vessel is towing and has restricted ability to manoeuvre and a visual and radar watch will be maintained on the bridge at all times. Compliance with maritime orders, COLREGS, and the establishment of a vessel exclusion zone around the survey vessel will be implemented to minimise disruption to commercial shipping.
- **Tourism:** Stakeholders raised concerns that seismic testing may lead to resource extraction in the future, the risk of an accidental oil spill and the potential impact on tourism in the GAB. The need for drilling infrastructure (as well as shipping) to withstand extreme weather events that occur in the waters of the GAB as well as the depths to which drilling will need to go will further exacerbate this risk. TGS assessed the merits of this concern and concluded that risks resulting from oil extraction were not relevant to this application. The risk of a potential oil spill from the seismic vessel in the unlikely event of a vessel collision was modelled and assessed. The following measures will be implemented to minimise this risk: use of a support vessel to manage vessel interactions, display of appropriate navigational beacons and lights, radio contact, visual and radar watch will be maintained on the bridge at all times, compliance with maritime orders, COLREGS, and the establishment of a vessel exclusion zone around the survey vessel will be implemented. In addition insurance policies will be in place to cover the costs of environmental monitoring or clean-up in the event of an oil spill.
- **Commercial Fishing:**
    - ***Impacts to Fish*:** A number of stakeholders expressed concerns regarding the impact of seismic surveys on key fishing industries. These fisheries were consulted and the key concerns related to impacts from seismic activity on catch rates, quota and fishery independent surveys (see **Section 4.6.3**). TGS advised stakeholders that the Nerites Season 2 MC3D MSS EP includes an evaluation of all the potential environmental impacts and risks for the survey, including airgun noise emission impacts on fish, and acoustic modelling of predicted SELs. TGS agreed to provide stakeholders with a summary of the risk assessment undertaken on the effects of seismic surveys on fish, the

acoustic modelling results and measurements of water temperature and salinity taken during the survey.

- ***Impacts specifically relating to SBT:*** Concerns were raised that seismic operations may impact on the migration of SBT into the GAB. Further correspondence with the tuna fishing industry with regards to Nerites Season 2 MC3D MSS indicated that the majority of the SBT have migrated into the feeding grounds by mid-January. The most sensitive time for the tuna fishing industry is from October to January. In previous years the majority of the SBT TAC has been caught before January, and it is likely that the start date of Nerites Season 2 MC3D MSS (January) will not impact on the SBT fishery as the majority of TAC will have been caught.

- **EPBC Protected Matters Impacts:** Concerns were raised on the impacts to whales during the proposed survey. Stakeholders requested that a cumulative impact assessment (CIA) be undertaken to consider total loss of acoustic habitat over the whole area for whales, not just the total received in any one given location, including other seismic surveys planned in the GAB. TGS undertook a CIA (see **Section 4.1.1.7**) and provided the stakeholder with the results. In addition stakeholders requested the proposed mitigation measures to reduce impacts to whales, the acoustic modelling results and confirmation that PAM would be utilised for the detection and avoidance of deep diving cetaceans. TGS provided all the requested information and confirmation that PAM would be implemented for the survey.

9.2. PHASE 2 - PRE-SURVEY CONSULTATION

Prior to the commencement of the proposed survey TGS will consult a number of additional stakeholders, primarily within the offshore exploration and production industry. These consultations will include, other geophysical companies operating in Australian waters, plus titleholders of petroleum titles adjacent to the proposed Nerites Season 2 MC3D MSS operational area. The primary objective of this consultation will be to ascertain if there are any other seismic surveys proposed for areas adjacent to the Nerites Season 2 MC3D MSS operational area over the same time period.

RCC Australia will be contacted through rccaus@amsa.gov.au for AUSCOAST warning broadcasts before operations commence. TGS will provide the vessels details and area of operation and advise of the survey starts and end dates. The AHS will be contacted through hydro.ntm@defence.gov.au two or more weeks prior to survey commencement to enable NTM to be issued. Additionally, TGS will provide a three day forecast of the survey plan and coordinates to the relevant fisheries stakeholders and CSIRO. At the end of the survey TGS will provide verbal feedback to AMSA on the operations and the interaction with commercial shipping and any lessons learned.

9.3. PHASE 3 – ONGOING CONSULTATION AND PHASE 4 – POST SURVEY NOTIFICATION

TGS will make available the MFO data, which provides information on cetacean, pinnipeds, turtles and tuna sightings to relevant and interested stakeholders, as well as other data such as water temperature and salinity measurements. TGS will maintain ongoing consultation with parties deemed relevant throughout the operation of the survey (e.g. fishery bodies) and will provide a three day forecast of the survey location and coordinates.

As required under sub regulation 16(b), TGS shall assess the merits of any new claims or objections made by a stakeholder whereby they believe the activity may have adverse impacts upon their interest or activities. If the claim has merit, where appropriate, TGS shall modify management of the activity. Under subregulation 8(1) it is an offence for a titleholder to continue if a new impact or risk, or increase in the impact or risk, is not provided for in the EP in force.

Subsequently, TGS shall undertake an internal assessment to determine whether there is a significant new environmental impact or risk, or significant increase in an existing environmental impact or risk that is not provided for in the EP.

If a significant new or increased impact or risk is identified, as required under subregulation 17 (6), and it is not already appropriately covered under the EP, TGS shall submit a proposed revision to the EP. TGS shall determine at the time of the assessment, whether a risk or impact is considered 'significant' based on information available at that time.

10. DETAILS OF THE TITLEHOLDERS NOMINATED PERSON FOR THE ACTIVITY

For further information about the proposed Nerites Season 2 MC3D MSS in the GAB, SA, please contact:

Tanya Johnstone
Director – Project Development, Asia Pacific

TGS – NOPEC Geophysical Company Pty Ltd
Ground Floor, 1110 Hay Street
West Perth WA 6005

Tel: +61 8 9480 0022 / +61 418 949 153

Email: Tanya.Johnstone@tgs.com

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