SUPERTUBES AND CONTOS MULTI CLIENT 3D MARINE SEISMIC SURVEY

ENVIRONMENT PLAN SUMMARY

TGS

October 2013

SUPERTUBES AND CONTOS MULTI CLIENT 3D MARINE SEISMIC SURVEY, ENVIRONMENT PLAN SUMMARY

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1 INTRODUCTION

The geophysical company TGS proposes to undertake two multi-client three-dimensional (MC3D) marine seismic surveys (MSS): Contos MC3D (CT-13) and Supertubes MC3D (ST-13), in the North West Marine Region (NWMR) offshore from Western Australia (WA) (**Figure 1**). The ST-13 MC3D MSS will commence early to mid-September and is expected to last approximately 14 days. The CT-13 MC3D MSS is scheduled to commence in December taking approximately 68 days to complete.

This document provides a summary of the Environment Plan (EP) that was accepted by the National Offshore Petroleum Safety and Environmental Management Authority (NOPSEMA) as part of the requirements under the Offshore Petroleum and Greenhouse Gas Storage (Environment) Regulations 2009 (Environment Regulations). This EP summary has been prepared as per the requirements of Regulation 11 (7) and (8) of the Environment Regulations.

2 LOCATION OF THE ACTIVITY

The ST-13 MC3D MSS operational area covers 5730 km^2, within which 570km^2 is intended to be surveyed. The exact coordinates of the surveyed area may change in the lead up to the survey (in light of client / commercial factors) so the purpose of providing an operational area is to show the outer extent of the area within which the survey may be conducted, including all vessel manoeuvring and line run outs. An additional 2 dimensional (2D) tie line of 36 km will be surveyed within the ST-13 operational area. The CT-13 MC3D MSS operational area comprises 3070 km^2, within which, 2827km^2 will be surveyed. The larger operational area allows for vessel manoeuvring and line run outs at the eastern and western extent of the surveyed areas.

The ST-13 MC3D MSS operational area includes sections of petroleum permits WA-434-P, WA-439-P, WA-364-P and WA-366-P. The CT-13 MC3D MSS operational area includes sections of permits WA-205-P, WA-335-P, WA-351-P, WA-376-P, WA-478-P, WA-483-P and WA-392-P (**Figure 1**).

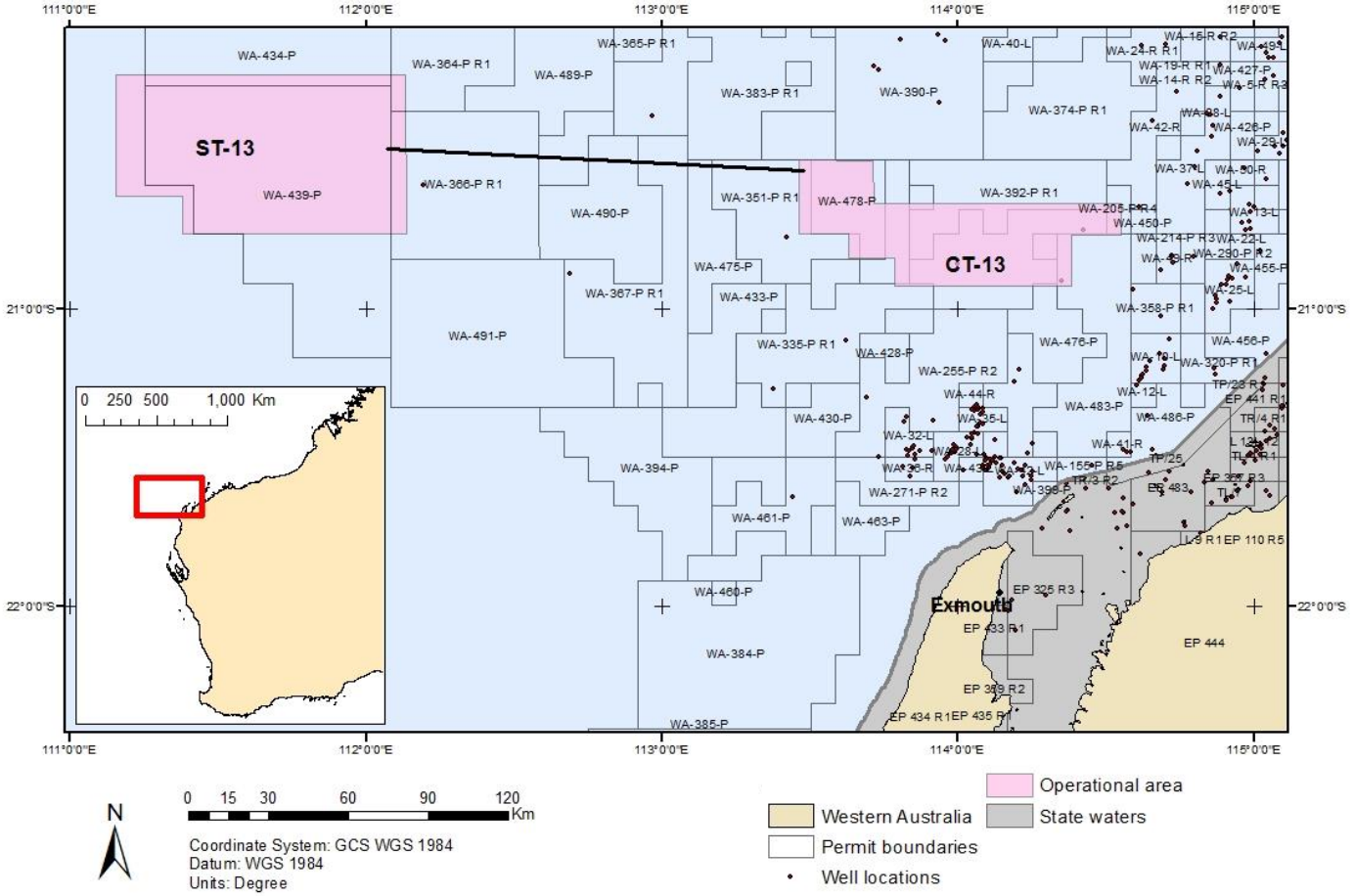
Boundary coordinates for the two operational areas are provided in **Table 1**.

Table 1: Co-ordinates for the Supertubes and Contos Operational areas

Survey	Latitude	Longitude
CT-13	-20.50	113.46
	-20.50	113.71
	-20.65	113.72
	-20.64	114.55
	-20.75	114.55
	-20.75	114.38
	-20.92	114.38
	-20.92	113.78
	-20.83	113.78
	-20.83	113.63
	-20.75	113.63
	-20.75	113.46
ST-13	-20.75	112.14
	-20.75	111.38
	-20.62	111.38
	-20.62	111.15
	-20.21	111.15
	-20.21	112.13
	-20.75	112.14

Datum: GDA94

Figure 1: Location of the ST-13 and CT-13 3D MSS operational areas, showing permit areas and location of existing oil and gas wells[1]



[1] The CT-13 and ST-13 MC3D MSS were originally designed to be carried out in succession with a 'transit line' linking the two operational areas. Please note that due to the revised timing of CT-13, this will no longer be the case; with the surveys being carried out independently.

3 DESCRIPTION OF THE ACTIVITY

3.1 Survey Parameters

The marine seismic survey proposed is 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 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 survey area at a speed of approximately 8-9 km/hr. As the vessel travels along the survey lines a series of noise pulses (every 8-10 seconds) will be directed down through the water column and seabed. The released sound is attenuated and reflected at geological boundaries and the reflected signals are detected using sensitive microphones arranged along a number of hydrophone cables (streamers) towed behind the survey vessel. The reflected sound is then processed to provide information about the structure and composition of geological formations below the seabed in an attempt to identify hydrocarbon reservoirs.

The seismic array will comprise a maximum of twelve seismic cables, with a maximum length of 6 km. The seismic cables are towed side by side and the spacing will be 100 m between each seismic cable. The seismic energy source tow depth will be 7 m (+/- 1 m) and the cable tow depth will be 8 m (+/- 1 m). The operating pressure for the seismic energy source will be approximately 2,000 psi and will consist of two sub-arrays, each with a maximum volume of approximately 4,000 cui.

The sub-arrays will be fired alternately, with a shotpoint interval of 18.75 m horizontal distance. The source produces sound pulses (within a few metres in the order of 265-275 dB re 1µPa sound pressure level – SPL) at frequencies extending up to approximately 100 Hz. These sound pulses decrease to levels in the order of 201 dB re 1µPa (SPL) within 1 km of the source and approximately 181 dB re 1µPa (SPL) within 10 km, dependent on the sound propagation characteristics of the area.

3.2 Survey Vessels

TGS proposes to conduct the ST-13 and CT-13 MC3D MSS using a purpose-built seismic survey vessel. At least one support vessel will escort the survey vessel at all times to maintain a safe distance between the survey array and other vessels, and also to manage interactions with shipping and fishing activities, if required. The support vessels will also re-supply the survey vessel with logistical supplies, including refuelling as necessary.

4 DESCRIPTION OF THE ENVIRONMENT

4.1 Regional setting

The proposed ST-13 and CT-13 MC3D survey area lies entirely in Commonwealth marine waters of the North-west Marine Region (NWMR). Water depths in the ST-13 and CT-13 operation areas range from >400 to 1600 m. The ST-13 operational area is located on the Exmouth Plateau in the Carnarvon Basin which has water depths of ~1000–3000 m. The CT-13 operational area is closer to mainland Western Australia, covering the North West Shelf (NWS). The NWS includes shallower water depths (to shorelines) and is scattered with islands, the largest of which is Barrow Island.

The Exmouth Plateau is a significant geomorphic feature in the NWMR. It has a relatively uneven seabed and may include pinnacles. On the northern section of the plateau is a gully margin and escarpments incised by canyon systems. These are recognised as a distinct feature, but little is known of their ecology and geomorphology (DSEWPaC, 2012).

Inshore areas of the NWMR have predominantly sandy sediments, with mostly muddy sediments occurring offshore from the 200 m isobath. Sediments of the Exmouth Plateau have a strong biological component, due to the deposition of organic matter from the water column over a long period of time (DSEWPaC, 2012).

4.2 Physical Environment

The NWMR is subject to an arid (mainly summer rain) subtropical climate with tropical cyclone activity from November to April. The summer and winter seasons fall into the periods September-March and May-July respectively. In summer, mean daily temperatures range between 20°C and 34°C. During winter, mean daily temperatures range between 17°C and 26°C (Chevron Australia, 2008). Relative humidity at Barrow Island ranges from 61% in the winter months (September) to 70% in the summer (February) (BoM, 2012).

Rainfall on Barrow Island varies significantly each year and is dependent on rain-bearing low-pressure systems, thunderstorm activity, and the passage of tropical cyclones (which generally occur from November to April). Average annual rainfall at Barrow Island is 306 mm with most rain (85%) occurring between January and July (BoM, 2012). The cyclone season is November to April with the majority of cyclones moving down the north-west coast between 40-400 km offshore and at an average speed of 16 km per hour. An average of five tropical cyclones per year occur in the Pilbara Region (BoM, 2011), with an average of two per year passing through the Barrow Island area (Chevron Australia, 2005). Winds are predominantly WSW from October to April and ESE from May to September. Average 10 minute wind speed in non-cyclonic conditions is 6 ms^{-1} with a 5% exceedence value of 12 ms^{-1}.

Offshore surface water temperatures range between approximately 20°C in winter and 31°C in summer (Chevron Australia, 2005). Water circulation in the region is influenced by the southward-flowing Leeuwin Current and the Indonesian Throughflow (Chevron Australia, 2010). The Leeuwin Current flows south along the shelf break and is shallow (less than 300 m deep) and narrow (50–100 km wide). The Leeuwin Undercurrent is also a feature of this bioregion and flows northward beneath the Leeuwin Current, between 250–450 m water depth on the continental slope. The Leeuwin Current is strongest during autumn and winter. Circulation of Indonesian Throughflow (ITF) waters into the NWMR (via the South Equatorial Current and Eastern Gyral Current) comprises the dominant surface flow. This circulation is subject to seasonal variation as well as inter-annual variation. Astronomical tides on the NWMR are semidiurnal and generally quite large, ranging from 0.95 m near Exmouth to more than 3 m on the inner shelf near Broome.

Water clarity in the region varies according to water movement and sediment type (Chevron Australia, 2011). The shallow, nearshore coastal waters off the west coast of Barrow Island generally have low levels of turbidity and concentrations of suspended sediments (<5 mg/L), which is indicative of clear water environments. Little salinity stratification occurs between the surface and bottom waters in this area (Chevron Australia, 2010) with salinity ranging from 35.08 to 37.75 ppt.

4.3 Biological Environment

4.3.1 Biological Productivity

It is believed that overall biological productivity above the Exmouth Plateau and slope is generally low. However, the Exmouth Plateau acts as a physical obstacle, forcing deeper, cooler and more nutrient-rich waters onto the plateau. Detritus falling from the pelagic environment to the seabed plays a key role in nutrient cycling from pelagic to benthic environments (Brewer *et al.*, 2007).

4.3.2 Biological Communities

The NWMR represents the beginning of a transition between tropical and temperate biological communities. The predominantly southward flowing surface currents continue to bring tropical Indo–Pacific organisms into this bioregion, but the presence of the northward flowing Leeuwin Undercurrent also transports temperate species from more southern areas (Brewer *et al.*, 2007).

Despite the relatively poor knowledge of the benthic communities on the Exmouth Plateau, information on sediments in the bioregion indicates that benthic communities are likely to include filter feeders and epifauna. Soft-bottom environments are likely to support patchy distributions of mobile epibenthos, such as sea cucumbers, ophiuroids, echinoderms, polychaetes and sea-pens. The biological communities within canyons in the bioregion are also poorly understood. The canyons in this bioregion may channel currents onto the plateau, driving upwelling in the canyon heads. These are associated with aggregations of baitfish, which in turn attract larger pelagic species such as billfish and tuna (DSEWPaC, 2012).

Pelagic species occurring above the plateau, slope and canyons are likely to include nekton and small pelagic fish, attracted to seasonal upwellings, as well as larger predators such as billfish, sharks and dolphins. A number of migratory species have been recorded in this bioregion including whale sharks, cetaceans and marine turtles are known to traverse the bioregion. All are known to feed on and around the adjacent Ningaloo Reef, which is situated on the shelf and slope of the Cape Range Peninsula (DSEWPaC, 2012)..

The upper and middle parts of the continental slope in this bioregion have important demersal fish communities, which display a high degree of endemism compared with other areas of slope. The high numbers of species found here is believed to be associated with areas of enhanced biological productivity as a result of the interaction between seasonal currents and seabed topography described above (DSEWPaC, 2012).

4.3.3 Protected Marine Fauna

A review of the EPBC Act database (Protected Matters search tool) identified 10 threatened species, nine of which are also migratory, and a further six species listed as migratory only (see **Table 2**). These include:

- Seven migratory cetaceans, of which three are threatened.
    - Migration periods of two threatened species, the humpback and blue whale, may overlap in timing with the survey. However, given the distances between known migratory pathways and the survey areas, encounter rates are expected to be low.
    - Encounters of southern right whales (the third of the threatened species) are not expected.
    - Encounter rates of migratory-only species are also expected to be low.
- Five migratory marine reptiles, all of which are threatened.
    - Marine turtle species may be present in the operational area however, given the water depths of the operational areas individuals are expected to be transitory only and encounter rates are considered low.
- Two species of migratory shark.
    - Both species may transit through the survey area, although encounter probability is expected to be low.
- Two species of threatened seabirds, one of which is also migratory.
    - Both species may occur within the survey area, however, given distance from any emergent features, individuals are most likely to be transitory only.

The operational area for the proposed ST-13 and CT-13 MC3D MSS is not considered habitat that is critical to the survival of any listed species due to their widespread distribution outside of the operational areas. Similarly, there are no EPBC Act-listed threatened ecological communities (TECs) in the vicinity of the survey area.

Table 2: Protected marine fauna and likely occurrence in the survey area

Species type	Scientific name	Common name	EPBC Status*	Likely presence in the survey area
Cetaceans	*Balaenoptera bonaerensis*	Antarctic minke whale	M	Unlikely
	Balaenoptera edeni	Bryde's whale	M	Possible – recorded further south
	Balaenoptera musculus	Blue whale	E, M	Possible –survey period overlaps known migration season
	Eubalaena australis	Southern right whale	E, M	Unlikely – occur at latitudes greater than proposed survey
	Megaptera novaeangliae	Humpback whale	V, M	Possible – survey period overlaps known migration season
	Orcinus orca	Killer whale, Orca	M	Possible – although often seen in shelf waters, prefers deeper waters.
	Physeter macrocephalus	Sperm whale	M	Possible – more widely dispersed offshore than near shelf edge
Marine reptiles	*Caretta caretta*	Loggerhead turtle	E, M	Possible – may migrate through deeper offshore waters
	Chelonia mydas	Green turtle	V, M	Possible – feed on macroalgae in shallower waters
	Dermochelys coriacea	Leatherback turtle	E, M	Possible – may migrate through deeper offshore waters
	Eretmochelys imbricata	Hawksbill turtle	V, M	Unlikely - mainly shallow waters closer to islands, reefs and coast for feeding and breeding
	Natator depressus	Flatback turtle	V, M	Unlikely – mainly shallow waters closer to islands, reefs and coast for feeding and breeding
Sharks	*Isurus oxyrinchus*	Shortfin mako	M	Possible
	Isurus paucus	Longfin mako	M	Possible
Seabirds	*Macronectes giganteus*	Southern giant-petrel	E, M	Unlikely - does not breed in region
	Pterodroma mollis	Soft-plumaged petrel	V	Unlikely - does not breed in region

**M=migratory, V=vulnerable, E=endangered*

4.4 Socio-economic Environment

4.4.1 Commercial Fisheries

The ST-13 and CT-13 MC3D survey area is located in waters that constitute part of five Commonwealth managed commercial fisheries:

- the North West Slope Trawl Fishery (NWSTF);
- the Western Deepwater Trawl Fishery (WDTF);
- the Southern Bluefin Tuna Fishery (SBTF)
- the Western Skipjack Tuna Fishery (WSTF); and
- the Western Tuna and Billfish Fishery (WTBF).

And five State fisheries:

- the North Coast Prawn Managed Fishery (NCPMF)
- the Mackerel Managed Fishery (MMF);
- the Northern Shark Fishery (NSF);
- the Pearl Oyster Managed Fishery (POMF); and
- the Beche-de-mer Fishery (BDMF)

Of these fisheries, only the NWSTF and WDTF (Commonwealth), and NCPMF and MMF (State), are active in the operational areas of the ST-13 and CT-13 MC3D MSS.

4.4.2 Petroleum Exploration and Production

Petroleum permits within the ST-13 and CT-13 operational areas have been subject to a relatively low level of petroleum exploration activities (seismic surveys and exploration drilling) over the past 30 years or so. Four exploration wells were drilled in 1996 in open acreage adjacent to permit WA-392-P. The CT-13 MC3D MSS operational area is located ~30 km to the west of the Gorgon gas field. There are no production facilities within the operational areas.

4.4.3 Shipping

Although there are no defined shipping lanes in the region, AMSA has established a network of Shipping Fairways off the norther-west coast of Australia. While the ST-13 MC3D MSS operational area is well clear any shipping fairways, the CT-13 MC3D MSS operational area overlaps with the western-most fairway identified (AMSA 2012). As such, some commercial shipping may be encountered during the CT-13 MC3D MSS.

4.4.4 Marine Parks and Reserves

The nearest Commonwealth marine reserve to the ST-13 and CT-13 MC3D survey area is the Gascoyne Commonwealth Marine Reserve. The ST-13 operational area overlaps with ~477 km^2 of the Multiple Use Zone (in which mining operations, including oil and gas activities, are allowable) at the northern edge of the Gascoyne CMR. The CT-13 operation area overlps with ~200 km^2 of the Multiple Use Zone at the northeastern corner of the Gascoyne CMR. The Ningaloo Commonwealth Marine Reserve is located approximately 82 km south of the southern boundary of the CT-13 survey area and the State-managed Ningaloo Marine Park approximately 83 km in the same direction. At the closest point, the ST-13 and CT-13 MC3D MSS operational area is ~92 km to Montebello Marine Park, ~72 km to Montebello Commonwealth Marine Reserve and ~74 km to Barrow Island Marine Park, all in a westerly direction (DSEWPaC, 2013).

4.4.5 Defence Activities

RAAF Learmonth is located >100 km south of the CT-13 operational area. The RAAF also operates the Learmonth Air Weapons Range which covers about 189.54 km^2 and is located 30 km south-west of the airbase, well away from the ST-13 and CT-13 MC3D MSS operational areas. This area is approved for live weapons firing, including high explosive weapons. When activated by a Notice to Airmen (NOTAM), the restricted airspace can operate down to sea level.

5 IDENTIFICATION AND ASSESSMENT OF ENVIRONMENTAL RISKS AND IMPACTS

An Environmental Risk Assessment (ERA) has been undertaken to compile the potential environmental risks associated with the ST-13 and CT-13 MC3D MSS to ensure they are reduced to As Low As Reasonably Practicable (ALARP) and will be of an acceptable level consistent with TGS's standards. The key environmental hazards and control measures to be applied to the ST-13 and CT-13 MC3D MSS are highlighted in **Table 3** below.

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 cables, cable fluid and associated equipment;
- emissions to atmosphere from vessels;
- discharge of ballast water and vessel biological fouling;
- routine discharge of wastewater and waste to ocean from survey and support vessels;
- accidental discharge of hydrocarbons and chemicals to ocean from survey and support vessels;
- vessel collisions resulting in fuel and oil spills, and/or damage to benthic habitats;
- interactions with commercial fishing, shipping and defence activities; and
- operation of the survey and support vessels within, or in the vicinity of, protected and heritage areas.

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

- disturbance to marine fauna including cetaceans, 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, grey water, bilge water and other putrescible wastes (i.e. foodscraps);
- marine pollution from accidental discharges including spills of hydrocarbons and hazardous materials;
- disturbance to social and community values due to interactions with commercial fishing vessels, shipping and military aircraft; and
- disturbance to heritage and conservation values due to operation of vessels within, or in the vicinity of, protected areas.

The environmental aspects of the ST-13 and CT-13 MC3D MSS that have the potential to cause significant environmental effects have been determined through an evaluation of the proposed activity, the surrounding environment including specific sensitivities and values, and legislative requirements. These environmental aspects are:

- accidental discharge of hazardous materials;
- accidental fuel and oil spills from the survey and support vessels; and
- vessel collisions, resulting in fuel and oil spills.

Implemented control measures documented in **Table 3** ensure that the environmental risks associated with these impacts are reduced and maintained at ALARP levels, while maintaining economic viability for the proposed activity. These control measures are taken into consideration in calculating the residual risk associated with the potential environmental impacts.

Table 3: Summary of the environmental risk assessment for the ST-13 and CT-13 MC3D MSS

Impact category	Environmental aspect	Potential environmental impacts	Management controls	Residual risk
Disturbance to marine fauna	Discharge of underwater seismic pulses	Behavioural and physiological effects on fish	• EPBC Act Policy Statement 2.1 – Part A Standard Management Procedures • EPBC Act Policy Statement 2.1 – Part B measures (particular manner) • Application of 2 km low power zone • Use of two MFOs • Recording of cetacean sightings • Marine turtle and whale shark observations and shutdowns • Reporting of all marine fauna sightings • Acquisition of CT-13 survey outside humpback whale southbound migration period (i.e. from December 2013)	Low
		Behavioural and physiological effects on cetaceans		Low
		Behavioural effects and physiological on marine turtles		Low
		Physiological effects on benthic invertebrates		Low
		Physiological effects on plankton		Low
	Light generation from vessels	Behavioural effects on marine fauna	• Minimisation of survey and support vessel external lighting to levels required for navigation, vessel safety and safety of deck operations	Low
	Vessel interactions	Behavioural and physiological effects on marine fauna	• Australian National Guidelines for Whale and Dolphin Watching • Vessel Environmental Management Procedures • Guidelines for Extrication of Maritime Turtles • Recording and reporting of any vessel interactions with marine fauna • Specific vessel-whale interaction procedures for non-acoustic energy source operations	Low
Disturbance to benthic habitats	Deployment and retrieval of anchors	Localised physical damage to benthic habitats	• No anchoring within survey area, except in emergency situations • Anchoring in shallow waters shallower waters near the Pilbara coastline will only occur in emergency situations • All measures will be taken to avoid areas of sensitive habitat	Low
	Vessel grounding	Physical damage to benthic habitats	• Vessel Bridge Routines – Navigation in Critical Waters • Vessel Collision, Grounding, Hull Damage Procedures • Vessel Environmental Management Procedures • Survey and support vessels will use approved navigation systems and depth sounders • Standard maritime safety / navigation procedures	Low
	Equipment damage, dragging or loss	Localised physical damage to benthic habitats	• Vessel Environmental Management Procedures • Vessel Back Deck Operations – Deployment and Recovery of Cables • Vessel Back Deck Operations – Cable Maintenance Using the Workboat • Use of survey and support vessels with experienced operators and crew • Lost in-water equipment will be recovered, where possible • Recording / reporting of incidents involving loss of equipment (e.g. cable loss)	Low
Reduced air quality from atmospheric emissions	Operation of machinery and vessels powered by internal combustion	Localised reduction air quality Greenhouse gas emissions	• Compliance with PSPPS Act and Marine Orders - Part 97: Marine pollution prevention - air pollution • Optimisation of fuel use to increase efficiency and minimise emissions	Low

Impact category	Environmental aspect	Potential environmental impacts	Management controls	Residual risk
	engines		• Use of low sulphur diesel fuel (if/when available) • Implementation of a preventive maintenance system (PMS)	
Introduction of invasive marine species (IMS)	Discharge of ballast water from vessels	Introduction and establishment of IMS and displacement of native marine species	• No routine discharge of ballast water from survey or support vessels • Australian Ballast Water Management Requirements (if/when required)	Low
	Biofouling of vessel hulls and other niches	Introduction and establishment of IMS and displacement of native marine species	• All necessary AQIS clearances to operate unrestricted anywhere in Australian waters • Hull / marine equipment inspection (and cleaning if required) for vessels sourced from outside Australia • Reporting of known or suspected introduced species to FishWatch	Low
Marine pollution from routine discharges	Discharge of sewage, grey water and putrescible wastes	Localised reduction in water quality due to nutrient enrichment	• Compliance with PSPPS Act and Marine Orders - Part 96: Marine Pollution Prevention - Sewage • Vessel Environmental Management Procedures • Vessel Bridge Routines – Chief Engineer's Standing Order • Vessel Waste Disposal Procedures • Maceration / disinfection of sewage and putrescible wastes prior to disposal • Discharge of non-comminuted / disinfected sewage only at distance of >12 nm from nearest land • Discharge of comminuted / disinfected sewage only at distance of >3 nm from nearest land • If support vessel is unable to treat/store grey water (i.e. wastewater from sinks and showers) biodegradable soaps and detergents will be used (where possible) • Vessel Waste Log will be maintained to record waste management practices	Low
	Discharge of bilge water	Localised reduction in water quality	• Compliance with PSPPS Act and Marine Orders - Part 91: Marine Pollution Prevention - Oil • Vessel Environmental Management Procedures • Vessel Bridge Routines – Chief Engineer's Standing Order • Containment and onshore disposal of bilge water contaminated with hydrocarbons, except if the oil content is <15 ppm • Containment and onshore disposal of bilge water contaminated with chemicals, except if chemical has a low toxicity	Low
	Discharge of other wastes i.e. domestic or hazardous wastes	Toxic effects on marine fauna and flora Reduction in water quality Physical impacts on marine fauna i.e. from plastics	• Compliance with PSPPS Act and Marine Orders - Part 95: Marine Pollution Prevention - Garbage • Vessel Environmental Management Procedures • Vessel Waste Disposal Procedures • Survey vessel Garbage Management Plan • No discharge of plastics or plastic products of any kind from survey and support vessels • No discharge of domestic wastes or maintenance wastes from survey and support vessels • All waste receptacles aboard survey and support vessels will be covered with tightly fitting, secure lids • All solid, liquid and hazardous wastes (other than sewage, grey water and	Low

Impact category	Environmental aspect	Potential environmental impacts	Management controls	Residual risk
			putrescible wastes) will be incinerated or compacted (if possible) and stored in designated areas and sent ashore for recycling, disposal or treatment • Incinerators used are compliant with MARPOL and IMO requirements • All storage facilities and handling equipment will be in good working order and designed in such a way as to prevent and contain any spillage as far as practicable • Vessel Waste Log will be maintained to record quantities of wastes transported onshore, and detailed records of waste accidentally discharged	
Marine pollution from accidental discharges	Hazardous materials	Toxic effects on marine fauna and flora Localised reduction in water quality	• Compliance with PSPPS Act and Marine Orders - Part 94: Marine Pollution Prevention - Packaged Harmful Substances • Vessel Environmental Management Procedures • Vessel Waste Disposal 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 • Tested / implemented Shipboard Oil Pollution Emergency Plan (SOPEP) for both survey and support vessels • Material Safety Data Sheet (MSDS) readily available for all hazardous substances aboard survey and support vessels • Spill response bins/kits will be located in close proximity to hydrocarbon storage areas for prompt response in the event of a spill or leak. Kits checked for their adequacy and replenished as necessary. Personnel trained in use of this equipment	Medium
	Oil and chemical spills	Toxic effects on marine fauna and flora Reduction in water quality	• Adherence to the requirements of the Navigation Act 1912, and specifically Marine Orders – Part 30: Prevention of collisions • Adherence to the requirements of COLREGS • Vessel contractor's Environmental Management Procedures • Vessel contractor's Deck and Engine Maintenance General Procedures • Vessel contractor's Planned Maintenance System • Adherence to Vessel contractor's Deck and Engine Maintenance General Procedures and Planned Maintenance System • Adherence to the requirements of Vessel Back Deck Operations – Deployment and Recovery of Cables. • Adherence to the requirements of Vessel Back Deck Operations – Cable Maintenance Using the Workboat.	Medium
	Vessel collisions, grounding, sinking and spill during refuelling	Physical damage to benthic habitats Toxic effects on marine fauna and flora Reduction in water quality	• Adherence to the requirements of the Navigation Act 1912, and specifically Marine Orders – Part 30: Prevention of collisions • Adherence to the requirements of COLREGS • Vessel Collision, Grounding, Hull Damage Procedures • Support Vessels Procedures • Refuelling procedures (including supervision and shut off) • Survey and support vessels will use approved navigation systems and depth sounders • Standard maritime safety / navigation procedures	Medium

Impact category	Environmental aspect	Potential environmental impacts	Management controls	Residual risk
			• Hydrocarbons located above deck will be stored with some form of secondary containment to contain leaks or spills • Pre-approval of refuelling by TGS' Vessel Operations Manager • The survey vessel has an implemented and tested SOPEP • All cargo will be pre-slung • Refuelling will only be carried out within weather limit guidelines and in daylight hours • Recently certified transfer hoses and fittings	
Oil spill response	Implementation of oil spill response strategies	Disturbance to habitats and fauna Toxicity to marine fauna and flora Additional vessel presence (noise, emissions, discharges, collision risk)	• SOPEP in place • Consultation log detailing discussions with AMSA and DoT relating to interfaces between SOPEP/AMSA NATPLAN, WestPlan MOP and DoT MOSCP • Consultation log detailing discussions with AMSA and DoT to ensure all aspects of oil spill response are accounted for. • Oil spill reports demonstrating reporting of spills to AMSA and DoT • Vessel records of oil spill drills carried out • Assessment of implementation of SOPEP, AMSA NATPLAN, WestPlan MOP and DoT MOSCP • Insurance policies to cover costs of environmental monitoring or clean up post spill	Low
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 from survey vessels	• Adherence to the requirements of the Navigation Act 1912, and specifically Marine Orders - Part 30: Prevention of collisions • Adherence to the requirements of COLREGS • Notification of activity details to relevant fisheries stakeholders prior to survey commencement • Support Vessels Procedures • Vessel Back Deck Operations – Deployment and Recovery of Cables • Vessel Back Deck Operations – Cable Maintenance Using the Workboat • Vessel Collision, Grounding, Hull Damage Procedures • Use of a support vessel to manage vessel interactions • Use of standard maritime safety procedures • Compliance with AMSA administered marine safety regulations and marine notification requirements • Strict adherence to equipment handling and acquisition procedures • Fishermen and other mariners alerted of vessels presence and extent of towed array. Establishment of a vessel exclusion zone around the survey vessel. Display of appropriate navigational beacons and lights, radar watch, radio contact • In-water equipment lost will be recovered (where possible). Detailed records will be maintained of equipment lost overboard • Recreational fishing from the survey and support vessels will be prohibited	Low
	Interaction with shipping	Disruption to shipping activities	• Adherence to the requirements of the Navigation Act 1912, and specifically Marine Orders - Part 30: Prevention of collisions • Adherence to the requirements of COLREGS • Consultation with AMSA prior to the survey commencing to determine the level of commercial shipping in the vicinity of the survey area	Low

Impact category	Environmental aspect	Potential environmental impacts	Management controls	Residual risk
			• Support Vessels Procedures • Vessel Back Deck Operations – Deployment and Recovery of Cables • Vessel Back Deck Operations – Cable Maintenance Using the Workboat • Vessel Collision, Grounding, Hull Damage Procedures • Use of a support vessel to manage vessel interactions • Use of standard maritime safety procedures • Compliance with AMSA administered marine safety regulations and marine notification requirements • Strict adherence to equipment handling and acquisition procedures • Shipping alerted of vessels presence and extent of towed array. Establishment of a vessel exclusion zone around the survey vessel. Display of appropriate navigational beacons and lights, radar watch, radio contact • In-water equipment lost will be recovered (where possible). Detailed records will be maintained of equipment lost overboard	
	Interaction with defence activities	Disruption to aircraft participating in defence activities within the Learmonth Airspace	• Consultation with Department of Defence prior to the survey commencing to determine if there are any planned activities within the Learmonth Airspace that will coincide with the survey and proposed helicopter movements from Learmonth airport • Department of Defence will be notified of any aviation activities 2 – 3 weeks prior to their commencement	Low
Disturbance to heritage and conservation values	Operation of vessels within protected and heritage areas	Disturbance to heritage and conservation values	• Implementation of the performance objectives, standards and measurement criteria described in this EP • Ensuring that all contractor personnel are aware of and comply with the accepted EP	Low

6 MANAGEMENT APPROACH

The ST-13 and CT-13 MC3D MSS will be managed in compliance with the EP as accepted by NOPSEMA under the Environment Regulations, other relevant environmental legislation and TGS's corporate policies. The objective of the EP is to ensure that potential adverse impacts on the environment associated with the ST-13 and CT-13 MC3D MSS, during both routine and non-routine operations, are identified, and will be reduced to ALARP and will be of an acceptable level.

The design and execution of the ST-13 and CT-13 MC3D MSS will be conducted under the framework of the TGS Environmental Policy, TGS Health, Safety and Environmental (HSE) Management System, and the survey vessel operator HSE&Q Management System. The seismic programme will be supported by a project-specific HSE Plan (that includes Emergency Response (ER) procedures), the survey vessel operator's Emergency Response Procedures, and a TGS Emergency Preparedness Bridging Document (incorporated within the HSE Plan). To ensure TGS's environmental objectives and management standards are achieved, the survey vessel operator will be required to comply with all relevant requirements of TGS's HSE systems/policies and standards.

The EP includes specific performance objectives and standards, and identifies the key controls and mitigation measures (**Table 3**) to be implemented to achieve the performance objectives. These various commitments are communicated to all personnel involved in the ST-13 and CT-13 MC3D MSS. The implementation strategy detailed in the EP identifies the roles/responsibilities and competency/training requirements for all personnel (TGS and contractors) in relation to implementing controls, managing non-conformance, emergency response and meeting reporting requirements during the survey. The EP also details the types of auditing that will be undertaken and the reporting requirements for environmental incidents, and reporting for overall compliance of the MSS.

The vessel master(s) will be responsible for the day to day operation of the survey vessel, including any potential emergency situation. In the event of a fuel or oil spill to sea, the vessel Shipboard Oil Pollution Emergency Plan (SOPEP) will be activated, supported as required by applicable established, statutory (WA State and Commonwealth) Oil Spill Contingency Plans.

7 CONSULTATION

Consultation with stakeholder groups, primarily within the commercial fishing industry, concerning TGS's proposed ST-13 and CT-13 MC3D MSS began on the 23rd May 2013. In total, 25 organisations were contacted, in addition to all licence holders of two State fisheries.

TGS received feedback on the proposed activity from a range of stakeholders, including government agencies and commercial fisheries. While the feedback received did not highlight any stakeholder issues or concerns, it has allowed for the development of a communication and engagement strategy for each relevant stakeholder. TGS will maintain communication with stakeholders identified in this communication and engagement strategy to ensure they are informed of relevant aspects of the survey or changes that may affect them.

7.1 Pre-survey consultation

Prior to commencement of the survey, TGS will consult a number of additional stakeholders, primarily within the offshore E&P industry. These consultations will include, as far as possible, other geophysical companies operating in Australian waters, plus titleholders of petroleum titles adjacent to the ST-13 and CT-13 MC3D operational areas. The primary objective of this consultation will be to ascertain if there are any other seismic surveys proposed for areas adjacent to the survey area, over the same time period. In addition, Notices to Mariners covering survey activities will be issued via the Australian Hydrographic Service (notified 14 days prior to activity commencing).

8 CONTACT DETAILS

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