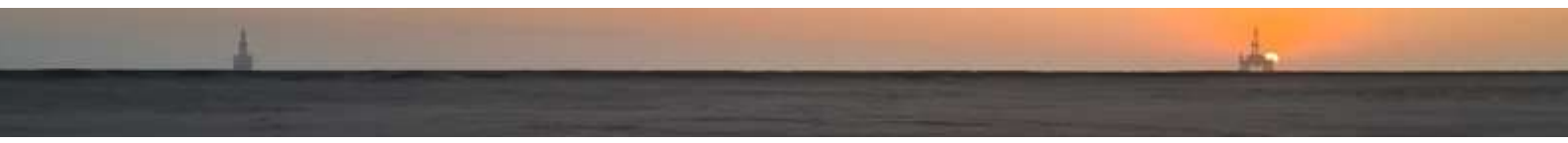
Eastern Echo Free Zone Entity (FZE)

Final Environmental Management Plan (EMP) Report to Support the Application for Environmental Clearance Certificate (ECC) for Proposed Multiclient/Proprietary 2D / 3D Seismic Survey Over the Area of Interest (AOI) covering Blocks 2010A, 2010B, 2011B, 2109, 2110A, 2110B, 2111A, 2111Ba, 2111Bb, 222210A, 2210B, 2211Aa, 2211Ab, 2211Ba, 2211Bb, 2310, 2311B, 2311B, 2312, 2410, 2411, 2412A, 2412B, 2511, 2512A, 2512B, 2611, 2612A, 2612B, 2711, 2712A, 2712B, 2713, 2811, 2812A, 2812B, 2813A, 2813B, 2912, 2913A, 2913B and Parts of Blocks 1910A, 1910B, 2009, 1911, 2011A, 2012A, 2012B, 2112A, 2112B, 2212A, 2212B, 2313, 2413A, 2413B, 2513, 2613, 2714A, 2714B, 2814B, 2914A, and 2914B (Excluding Tripp Seamount),
Walvis, Lüderitz and Orange Basins, Offshore Deepwater Namibia



Eastern Echo Free Zone Entity (FZE)
Plot No. WWA115, Jebel Ali Free Zone
P.O. BOX 9261
DUBAI, UNITED ARAB EMIRATES

October 2023

SUMMARY INFORMATION

Proponent

Eastern Echo Free Zone Entity (FZE)

MEFT REFERENCE APPLICATION No.

App No. 230807**001838**

Project Title / Subject on the ECC

Proposed Multiclient/Proprietary 2D / 3D Seismic Survey Over the Area of Interest (AOI) covering Blocks 2010A, 2010B, 2011B, 2109, 2110A, 2110B, 2111A, 2111Ba, 2111Bb, 222210A, 2210B, 2211Aa, 2211Ab, 2211Ba, 2211Bb, 2310, 2311B, 2311B, 2312, 2410, 2411, 2412A, 2412B, 2511, 2512A, 2512B, 2611, 2612A, 2612B, 2711, 2712A, 2712B, 2713, 2811, 2812A, 2812B, 2813A, 2813B, 2912, 2913A, 2913B and Parts of Blocks 1910A, 1910B, 2009, 1911, 2011A, 2012A, 2012B, 2112A, 2112B, 2212A, 2212B, 2313, 2413A, 2413B, 2513, 2613, 2714A, 2714B, 2814B, 2914A, and 2914B (Excluding Tripp Seamount), Walvis, Lüderitz and Orange Basins,

Petroleum Exploration Activities

Proposed Multiclient / Proprietary 2D / 3D Seismic Survey Operations

National Regulatory Framework

Environmental Management Act (EMA), 2007, (Act No. 7 of 2007) and
Environmental Impact Assessment (EIA) Regulations No. 30 of 2012

Proponent Address

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CITATION: **Risk-Based Solutions (RBS), 2023.** Eastern Echo FZE Environmental Management Plan (EMP) Report to Support the Application for Environmental Clearance Certificate (ECC) for Proposed Multiclient/Proprietary 2D / 3D Seismic Survey Over the Area of Interest (AOI) covering Blocks 2010A, 2010B, 2011B, 2109, 2110A, 2110B, 2111A, 2111Ba, 2111Bb, 222210A, 2210B, 2211Aa, 2211Ab, 2211Ba, 2211Bb, 2310, 2311B, 2311B, 2312, 2410, 2411, 2412A, 2412B, 2511, 2512A, 2512B, 2611, 2612A, 2612B, 2711, 2712A, 2712B, 2713, 2811, 2812A, 2812B, 2813A, 2813B, 2912, 2913A, 2913B and Parts of Blocks 1910A, 1910B, 2009, 1911, 2011A, 2012A, 2012B, 2112A, 2112B, 2212A, 2212B, 2313, 2413A, 2413B, 2513, 2613, 2714A, 2714B, 2814B, 2914A, and 2914B (Excluding Tripp Seamount), **Walvis, Lüderitz and Orange Basins, Offshore Deepwater Namibia**

DR SINDILA MWIYA, TEAM LEADER / ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP), PERMITTING / DE-RISKING ADVISORS / ENVIRONMENTAL CONSULTANTS DECLARATION

I, Dr Sindila Mwiya, working for Risk-Based Solutions (RBS) CC, the Permitting / De-Risking Advisors / Environmental Consultants and being the Environmental Assessment process Team Leader and EAP for the preparation of this Environmental Management Plan (EMP) Report to support the application for Environmental Clearance Certificate (ECC) for the proposed Multiclient/Proprietary 2D / 3D Seismic Survey over the Area of Interest (AOI) covering Blocks 2010A, 2010B, 2011B, 2109, 2110A, 2110B, 2111A, 2111Ba, 2111Bb, 222210A, 2210B, 2211Aa, 2211Ab, 2211Ba, 2211Bb, 2310, 2311B, 2311B, 2312, 2410, 2411, 2412A, 2412B, 2511, 2512A, 2512B, 2611, 2612A, 2612B, 2711, 2712A, 2712B, 2713, 2811, 2812A, 2812B, 2813A, 2813B, 2912, 2913A, 2913B and Parts of Blocks 1910A, 1910B, 2009, 1911, 2011A, 2012A, 2012B, 2112A, 2112B, 2212A, 2212B, 2313, 2413A, 2413B, 2513, 2613, 2714A, 2714B, 2814B, 2914A, and 2914B (Excluding Tripp Seamount), Walvis, Lüderitz and Orange Basins, Offshore Deepwater Namibia, by Eastern Echo FZE (the Proponent), hereby declares that:

1. All the environmental reports have been prepared in accordance with the provisions of the Petroleum (Exploration and Production), 1991, (Act No. 2 of 1991), Petroleum Laws Amendment Act, 1998, (Act 24 of 1998), the Environmental Management Act, 2007, (Act No. 7 of 2007), all other applicable national laws, and Regulations and Good International Industry Practice (GIIP).

2. I am highly qualified and experienced in environmental assessments and management, marine seismic survey operations, offshore oil and gas exploration and production operations and hold a PhD with research interests, academic training, and technical knowledge in Engineering Geology, Geotechnical, Geoenvironmental and Environmental Engineering, Artificial Intelligence and Knowledge-Based Systems with special focus on EIAs, EMPs, EMSs, SEAs, SEMPs and ESG with respect to subsurface resources (minerals, petroleum, water) and energy in arid and semiarid environments.

3. I am an Engineering and Environmental Geologist with extensive technical knowledge and experience in conducting environmental assessments, management, and monitoring for offshore and onshore subsurface resources (petroleum, solid state minerals, water, geothermal), exploration and utilisation and have undertaken more than 200 projects since 2004, including more than seventy (70) oil and gas exploration and production related environmental assessments, management, and monitoring projects in different parts of the World.

4. I have performed the work relating to this project in an objective manner, even if the outcomes will result in views or Records of Decision that may not be favourable to the Stakeholders or the Proponent, and.

5. I am an independent consultant not related to the Proponent, I co-own and operate an independent company (Risk-Based Solutions CC) which is not related to the Proponent. Except for the fees payable for professional consulting services rendered to the Proponent, I have no shares, interests, or involvement in the license, financial or other affairs or business or operational decisions of either the Proponent or the decision-making structures of Government

……

Dr Sindila MWIYA
Environmental Assessment Practitioners (EAPs)\Team Leader
Permitting / De-Risking Advisors / Environmental Consultants
RISK-BASED SOLUTIONS (RBS) CC

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NONTECHNICAL SUMMARY

Eastern Echo Free Zone Entity (FZE), the **("Proponent"**), herein referred as **("Eastern Echo"**) intend to acquire Multiclient/Proprietary 2D/3D seismic survey activities over an Area of Interest (AOI) covering Blocks 2010A, 2010B, 2011B, 2109, 2110A, 2110B, 2111A, 2111Ba, 2111Bb, 222210A, 2210B, 2211Aa, 2211Ab, 2211Ba, 2211Bb, 2310, 2311B, 2311B, 2312, 2410, 2411, 2412A, 2412B, 2511, 2512A, 2512B, 2611, 2612A, 2612B, 2711, 2712A, 2712B, 2713, 2811, 2812A, 2812B, 2813A, 2813B, 2912, 2913A, 2913B and parts of Blocks 1910A, 1910B, 2009, 1911, 2011A, 2012A, 2012B, 2112A, 2112B, 2212A, 2212B, 2313, 2413A, 2413B, 2513, 2613, 2714A, 2714B, 2814B, 2914A, and 2914B (Excluding Tripp Seamount). The AOI falls in the Walvis, Lüderitz and Orange Basins, offshore northcentral, southcentral and southern Namibia, respectively.

The Multiclient/Proprietary 2D/3D seismic survey activities are listed activities in Environmental Management Act, (EMA), 2007, (Act No. 7 of 2007) and Environmental Impact Assessment (EIA) Regulations No. 30 of 2012 and cannot be undertaken without an Environmental Clearance Certificate ("ECC"). The Proponent is required to have undertaken environmental assessment comprising Scoping, Environmental Impact Assessment ("EIA") and Environmental Management Plan ("EMP") to support the application for ECC. In fulfilment of this environmental requirements, the Proponent appointed Risk-Based Solutions (RBS) CC as the Environmental Consultant to prepare all the required reports and apply for the ECC with respect to the proposed Multiclient/Proprietary 2D/3D seismic survey operations in the Walvis, Lüderitz and Orange Basins, offshore Namibia.

The proposed amended AOI falls in water depths ranging from ca-500m to ca-4000m from east to west, respectively. The first survey event of proposed Multiclient / Proprietary 2D/3D seismic survey activities may commerce from January 2024, if the ECC is granted by the Environmental Commissioner in the Ministry of Environment, Forestry and Tourism. The proposed survey will be undertaken over multiple survey events and annual seasons using survey vessels that are compliant to the International Convention for the Prevention of Pollution from Ships (MARPOL) and Namibian Maritimes legal requirements.

This Environmental Management Plan ("**EMP**") Report is prepared based on the findings and recommendations of the impact assessment results presented in the updated Environmental Impact Assessment ("**EIA**") Report. This EMP Report provides key mitigations measures with respect to the significant impacts that the proposed Multiclient / Proprietary 2D/3D seismic survey activities are likely to have on the receiving marine environments (physical, biological, socioeconomic and ecosystem). The mitigation measures cover the entire outlined project area in the Walvis, Lüderitz and Orange Basins, offshore Namibia and the immediate surrounding areas with respect to routine and non-routine or accidental events / activities during the mobilisation and pre-survey preparation, actual survey, and post survey / demobilisation operations project stages.

The environmental assessment process inclusive of the preparation of EIA and this EMP Report has been undertaken in accordance with the provisions of Petroleum (Exploration and Production) Act 1991 (Act 2 of 1991) and associated amendments, the Environmental Impact Assessment (EIA) Regulations No. 30 of 2012 and the Environmental Management Act, 2007 as well as international best practices. Key project alternatives as described in the EIA Report includes the following:

- Project location and the no-action alternative.
- Other marine users, and potential user conflicts, influence on the ecosystem function, services, use values and non-use or passive.

Detailed mitigation measures and monitoring plan have been developed and are presented in this EMP Report for implementation and monitoring by the Proponent. The mitigation measures presented in this EMP merged the Proponent's international best practices mitigations measures with local species events such as the whale migration corridors and timings, key fish spawning areas and timing, key fishing seasons, breeding and feeding areas as well as several unique marine ecosystems of the Walvis, Lüderitz and Orange Basins, offshore Namibia.

The overall EMP framework and mitigation measures presented in this report are tailored-made to Namibia's southern offshore environment and considered the peak primary and secondary Whales migration periods in Namibia of between May-July and October–November, respectively, as well as the probability of encountering whales outside these peak migration periods. Offshore seismic survey, especially 3D survey, can only be undertaken in the Namibian waters during calm summer weather window months between November-March. Temporary, operational and other key avoidance mitigatory measures have been considered in this EMP to mitigate for the likely overlaps of marine mammal migratory periods and other marine users with the suitable weather window for undertaking seismic survey in the Namibian marine environment.

In addition to the company's strict compliance with all the relevant national regulations and standards, the Proponent has taken into considerations the international standards of protection developed through the Joint Nature Conservation Committee (JNCC) "guidelines for minimising the risk of injury and disturbance to marine mammals from seismic surveys", and the Energeo Alliance's, formerly known as the International Association of Geophysical Contractors (IAGC), "recommended mitigation measures for cetaceans during geophysical operations".

These international best industry practices have proved to be effective in several different countries like Canada, Australia, Norway, and the United States. These guidelines have been developed based on noise attenuation modelling, international experiences during seismic acquisition and a cautious approach to the disturbance of marine mammals from seismic surveys. The following is the summary of the basis for the temporary, operational and other key avoidance mitigatory measure as presented in this EMP report with respect to the proposed Multiclient / Proprietary 2D/3D seismic survey activities in the Walvis, Lüderitz and Orange Basins, offshore Namibia:

1. Seasonality and timing.
2. Establishment of buffer zones.
3. Use of Marine Mammal Observer (MMO).
4. Use of Fisheries Liaison Officers (FLOs).
5. Use of Passive Acoustic Monitoring (PAM) Technology.
6. Soft starts' and 'pre-activation' observations.
7. Termination of activation in the 500m exclusion zone with respect to marine mammals.
8. Marine Animal Monitoring and Mitigation Plan aboard the Survey Vessel.
9. The use of Turtle friendly tail buoys.
10. The use of support vessel and fisheries liaison officer.
11. Pollution and spill prevention and management.
12. Compliance to all MARPOL (marine pollution) regulations and waste disposal procedures, and.
13. Adoption of the precautionary principles in the absence of any specific mitigation measures being provide in this updated, the Proponent shall always adopt the precautionary approach.

Good communication and pre-notification practices will limit unnecessary disruption and delays to other marine users. Due consideration should be given to the presence of all fishing vessels while running survey lines and communication channels should be kept open to avoid close encounters. Additionally, support vessels moving to/from Lüderitz Bay may encounter commercial fishing vessels of other fishing sectors and potentially cause disruption, but on a very short-term.

Adherence to prescribed maritime communication procedures will limit any likely encounters. In the interests of amicable co-use of the marine resources, and for marine safety, the following procedures should mitigate any negative interactions with the fishing vessels:

1) The surveyor must formally notify the Petroleum Commissioner (MME) of the survey, stating the proposed location of the survey lines, the commencement date and the anticipated duration.

2) This information should also be relayed to all affected parties (Directorate of Maritime Affairs, Namibian Ports Authority, South African HydroSAN and the MFMR Monitoring, Control and Surveillance Unit - Walvis Bay).

3) In the interest of good relations, direct communication and facilitation with any vessels in the area at the time of the survey is important. Openness to the possibilities of adjusting survey lines and trawling location to cause minimum disruption of operations to both parties.

4) Good communications through MFMR to the fisheries (i.e., Association of Namibian Fishing Industries and the Namibian Large Pelagic and Hake Longlining Association) with pre-notification of survey activities and vessel paths (navigational co-ordinates of the survey area, timing and duration of proposed activities).

5) Notices to Mariners should be distributed timeously to fishing companies and directly to fishing vessels, stating the following: The co-ordinates of the proposed survey lines, timeframes and day-to-day location of the survey seismic vessel, safe operational limits of the survey vessel, and, movements of support vessels.

6) Radio Navigation Warnings and Notices to Mariners should be distributed via Navigational Telex (Navtext) and Lüderitz radio for the duration of the survey.

7) It is recommended that updates of the scheduled weekly survey plan be circulated to the operators of affected fishing vessels on a daily basis and notify trawlers when the survey may move into trawling areas.

8) Establish communications with the known long-line fishers if drifting buoys (with radar responders) are sighted.

9) Award compensation for damage to fishing gear and other proven direct impacts should it be shown the damage is as a direct result of negligence on the part of the contractor, and.

10) An experienced Fisheries Liaison Officer (FLO) should be deployed on board the survey vessel to initiate and facilitate radio communications with maritime vessels in the vicinity of the survey area. The FLO should report daily on vessel activity, ramp up procedures, environmental matters, fauna sightings, and respond and advise on action to be taken in the event of encountering fishing gear.

It is hereby recommended that the proposed Multiclient / Proprietary 2D/3D seismic survey activities covering the Walvis, Lüderitz and Orange Basins, offshore deep-water Namibia, shall go-ahead and be granted with an ECC.

The proposed Multiclient / Proprietary 2D/3D seismic survey in the Walvis, Lüderitz and Orange Basins, offshore deep-water Namibia can coexist with other proposed and ongoing marine related activities in the AOI (Table 1).

Based on the findings of the EIA Report (Table 1) and the mitigation measures provided in this EMP, the first annual survey event for the proposed Multiclient / Proprietary 2D/3D seismic survey activities is recommended to start from December where possible, if the ECC is granted by the Environmental Commissioner. However, if the survey has to start before December due to the limited favourable weather window for conducting seismic survey in the Namibian waters which is from November-March, the Proponent shall implement the precautional principles, mitigation measures linked to international

best practices as recommended by the Joint Nature Conservation Committee (JNCC) of the Energeo Alliance, formerly known as thew International Association of Geophysical Contractors (IAGC), for protecting cetaceans during geophysical operations in addition to the other key mitigation measures as detailed in the EMP Report.

All environmental liabilities rest with the Proponent as ultimately responsible for the EMP implementation, environmental performance monitoring and reporting thereof to the Environmental Commissioner in the Ministry of Environment, Forestry, and Tourism as may be stipulated in the ECC to be issued.

A “Close Out” report shall be prepared and submitted to the Government (Ministry of Mines and Energy, (MME), Ministry of Environment, Forestry, and Tourism (MEFT), Ministry of Fisheries and Marine Recourse (MFMR) and the Ministry of Work and Transport (MWT), Department of Maritimes Affairs) after completing each event of the proposed Multiclient / Proprietary 2D/3D seismic survey activities operations.

Additionally, notifications to marinas shall be issued supported by continuous communications and monitoring during the actual survey operations. Seismic survey operations within the proposed AOI should not coincide with the MFMR stock assessment survey as shown in Table 1. Additional detailed mitigation measures are provided in the specialist reports Annex 2 and 3 to the EIA Report.

The following is the summary of the EMP recommendations to be implemented and monitored by the Proponent with respect to the proposed Multiclient / Proprietary 2D/3D seismic survey activities over the Walvis, Lüderitz and Orange Basins, offshore Namibia:

1. Procedure for commencement of operations.
2. Procedure for ongoing operations.
3. Procedure for testing source elements.
4. General practices.
5. Pollution prevention and management.
6. Spills prevention and management.
7. Overall compliances, and.
8. Adoption of the precautionary principles.

Table 1: RBS developed coexistence Knowledge-Based System Model Methodology (KBSMM) log framework fully validated and populated during the EIA process in identifying suitable window/s of opportunities for undertaking the proposed Multiclient/Proprietary 2D/3D seismic survey activities with respect to the receiving environment in the Walvis, Lüderitz and Orange Basins, offshore Namibia.

MONTH	KEY FISHING SEASON (KEY SPECIES)	MAIN SPAWNING ACTIVITIES (KEY SPECIES)			MINISTRY OF FISHERIES AND MARINE RESOURCES STOCK SURVEYS		KEY CETACEOUS PRESENCES / MIGRATORY TIMES		OTHER KEY USERS	WEATHER WINDOW	COMMENTS ON OFFSHORE SEISMIC SURVEY OPPORTUNITY WINDOW
January	Pole and line Tuna, Hake Longline, Hake Trawl, Surface Longline, Monk, Rock Lobster		Hake spawning occurs throughout the year with main spawning period between July -October	Cape Monk spawn throughout the years, with peaks in Jul & Sep for females & Aug for males	Hake Stock Survey	Rock Lobster Monthly Stock Survey		Cetacean including Whales may be found in the Namibian waters	❖ Marine Diamond Exploration and Mining in shallow water less than -200m. ❖ The Survey area covers an area which is a busy international shipping lane	Good	Impact – Hake Stock Survey (less than-1000m), Tuna migrating (Trip Seamount) **SURVEY PLANNED TO START 2024**
February	Pole and line Tuna, Hake Longline, Hake Trawl, Surface Longline, Monk, Rock Lobster										Impact – Hake Stock Survey (less than-1000m), Tuna migrating (Trip Seamount)
March	Pole and line Tuna, Hake Longline, Hake Trawl, Surface Longline, Monk, Rock Lobster										Impact – Tuna migrating (Trip Seamount)
April	Pole and line Tuna, Hake Longline, Hake Trawl, Surface Longline, Monk, Rock Lobster									Moderate Mixed	Impact – Tuna migrating (Trip Seamount)
May	Hake Trawl, Monk						Whales Migration Primary Peak Period				No Impacts but unfavorable weather
June	Snoek, Hake Trawl, Monk	Snoek, and Orange Roughy								Very Poor	No Impacts but unfavorable weather
July	Hake Trawl, Monk										Impact – Orange Roughy spawning (shallow waters), Snoek migrating in deepwater
August	Hake Trawl, Monk										Impact – Orange Roughy aggregated spawning, Snoek migrating in deepwater
September	Surface Longline, Hake Trawl, Monk	Rock Lobster					Whales Migration Secondary Peak Period			Poor	Impact – Snoek migrating in deepwater
October	Pole and line Tuna, Surface Longline, Monk				Rock Lobster Stock Survey					Moderate Mixed	Impact – Shallow water rock Lobster Stock Survey, Tuna migrating (Trip Seamount)
November	Pole and line Tuna, Hake Longline, Hake Trawl, Surface Longline, Monk, Rock Lobster				Monk Stock Survey					Good	Impact – Monk Stock Survey (less than-1000m), Tuna migrating (Trip Seamount)
December	Pole and line Tuna, Hake Longline, Hake Trawl, Surface Longline, Monk, Rock Lobster										Impact – Tuna migrating (Trip Seamount)

1. INTRODUCTION

1.1 General Project Overview

Eastern Echo Free Zone Entity (FZE) here in referred as ("**Eastern Echo**") (the "**Proponent**") is proposing to conduct a regional Multiclient (MC) or Proprietary / Exclusive 2D/3D seismic survey over and Area of Interest (AOI) situated in the Walvis, Lüderitz and Orange Basins, offshore, Namibia (Figs. 1.1-1.3).

The following is the general summary of the proposed Multiclient/Proprietary 2D/3D seismic survey activities as presented in this EIA Report:

- **Proponent / Operating company** – Eastern Echo Free Zone Entity (FZE).
- **Proposed Activities / Type of Survey to be Conducted** – Multiclient/Proprietary 2D/3D seismic survey.
- **Location of the Proposed Survey Area of Interest (AOI)**-Blocks 2010A, 2010B, 2011B, 2109, 2110A, 2110B, 2111A, 2111Ba, 2111Bb, 222210A, 2210B, 2211Aa, 2211Ab, 2211Ba, 2211Bb, 2310, 2311B, 2311B, 2312, 2410, 2411, 2412A, 2412B, 2511, 2512A, 2512B, 2611, 2612A, 2612B, 2711, 2712A, 2712B, 2713, 2811, 2812A, 2812B, 2813A, 2813B, 2912, 2913A, 2913B and parts of Blocks 1910A, 1910B, 2009, 1911, 2011A, 2012A, 2012B, 2112A, 2112B, 2212A, 2212B, 2313, 2413A, 2413B, 2513, 2613, 2714A, 2714B, 2814B, 2914A, and 2914B (Excluding Tripp Seamount), Walvis, Lüderitz and Orange Basins, offshore Namibia.
- **Water depth of the AOI** – Ranges from ca-500 m to -4000 m from east to west, respectively.
- **Nearest Namibian Port** –Port of Walvis Bay (central) and Port of Lüderitz suitable when working in the southern portions of the proposed survey area.
- **Receiving Environment** – Marine environment, deep-water offshore central Namibia.
- **Survey Vessel (s)** – To be confirmed.
- **Desired acquisition time** – January 2024 subject to the outcomes of the EIA, and.
- **Estimated Duration of each survey event** –Seventy (70) days per survey event and multiple survey events will be undertaken over the likely three (3) years validity period of the ECC that may be granted by the Environmental Commissioner in the Ministry of Environment, Forestry and Tourism (MEFT).

1.2 Spatial Scope, and Survey Coverage

The spatial scope of the proposed 2D / 3D seismic survey and impact assessment and management thereof covers the following (Figs. 1.1-1.3):

- Current outlined initial survey area covering and any future survey extension falling within the Walvis, Lüderitz and Orange Basins, Offshore Namibia defined as the immediate impact zone: The receiving environment in this area likely to be directly influenced by the survey activities will includes a radius of 500 m safety exclusion zone around the survey vessel and surrounding areas where discharges to sea and sound may propagate and affect marine wildlife and immediate environment, and.
- Survey area broader impact zone include all the surrounding socioeconomic zones likely to be affected by the proposed survey operations and logistics including support vessels.

1.3 Proposed Project Implementation and Sources of Impacts

The following is the summary of the proposed project implementation stages as assessed in this Environmental Impact Assessment (EIA) Report with mitigation measures provided in the Environmental Management Plan (EMP) Report:

(i) Mobilisation and pre-survey preparations.

(ii) Actual survey operations.

(iii) Post survey operations, and.

(iv) Non-routine or accidental events.

The duration of each 3D or 2D seismic survey event will be variable but averaging seventy (70) days at sea. The activities associated with proposed project have been characterised and grouped as follows:

(i) Routine and physical presence of the survey and support vessels in the area including the Ports of Walvis Bay or Lüderitz, physical presence of survey and support vessels, Physical disturbance of the survey operations, sound generation from proposed 2D or 3D seismic survey source, including sound of the survey and support vessels engines, increased light levels from routine vessels operations, atmospheric emissions from routine operations of the survey and support vessels, and planned marine discharges, and.

(ii) Accidental events covering: Unplanned marine discharges (e.g., minor spillages of fuel, lubricants / maintenance oils, loss of vessel, equipment or material, collision with marine wildlife during vessel operations, and, loss of Marine Gasoline Oil (MGO) containment on the survey or support vessels due to ship collision or another major event.

Logistic support will be provided through the existing facilities in the Ports of Walvis Bay or Lüderitz for supplies, fuelling and crew changeover as may be required and if required. No helicopter crew transfer support is anticipated except in event of an emergency.

1.4 Eastern Echo Free Zone Entity (FZE) (The Proponent)

Eastern Echo Free Zone Entity (FZE), the Proponent, is an international seismic multiclient provider wholly owned by SLB Limited.

SLB (NYSE: SLB) is a global technology company driving energy innovation for a balanced planet. With a global presence in more than 100 countries and employees representing almost twice as many nationalities, we work each day on innovating oil and gas, delivering digital at scale, decarbonizing industries, and developing and scaling new energy systems that accelerate the energy transition.

SLB has continuously led the industry in innovation and technical improvements that meet subsurface imaging challenges.

The company has pioneered depth migration technologies and broadband processing and continue to invest heavily in improving algorithms such as reflection full-waveform inversion, reverse time migration, and least-squares migration.

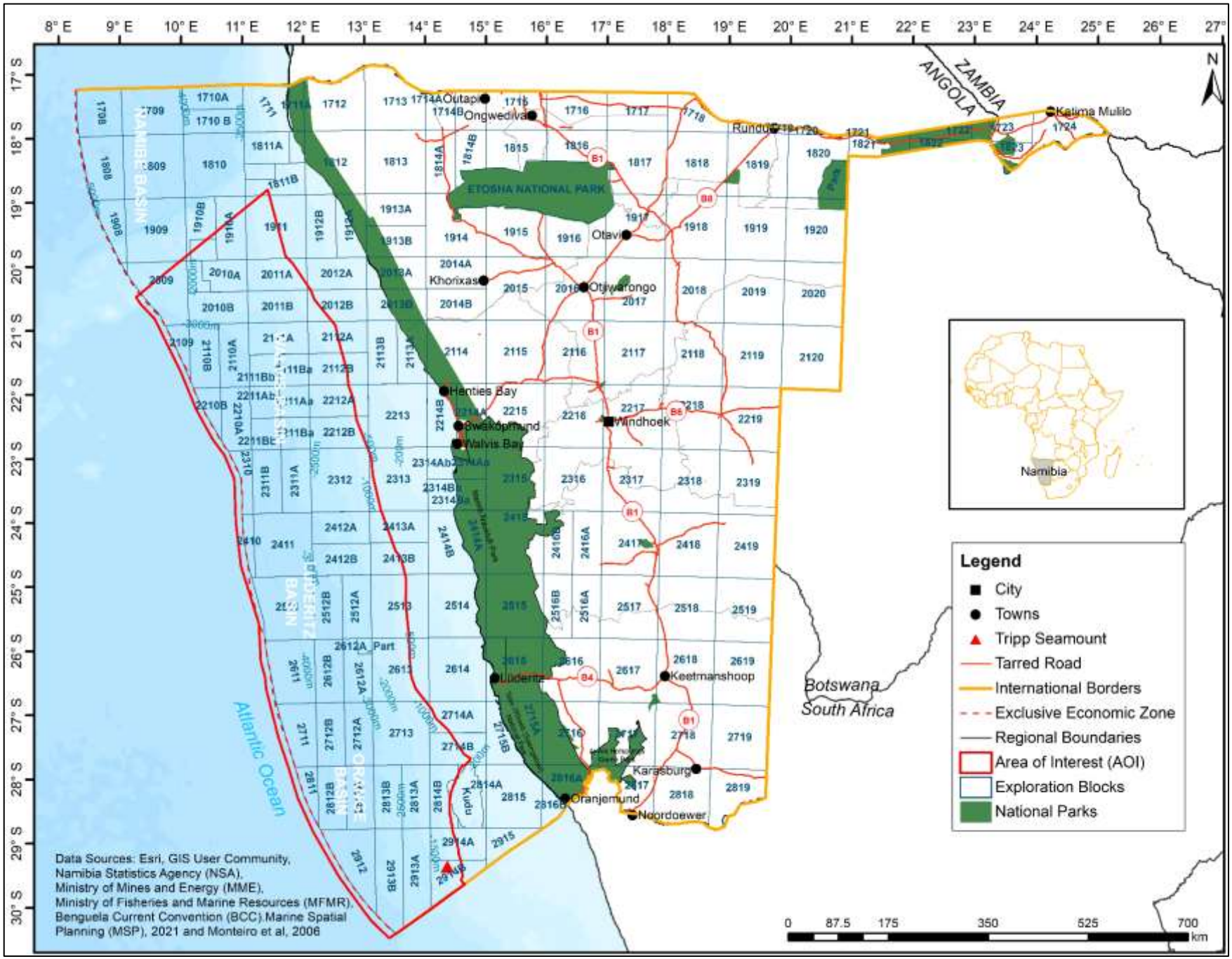

Figure 1.1: Regional location of the proposed 2D / 3D seismic survey coverage areas in the Walvis, Lüderitz and Orange Basins, offshore central Namibia.

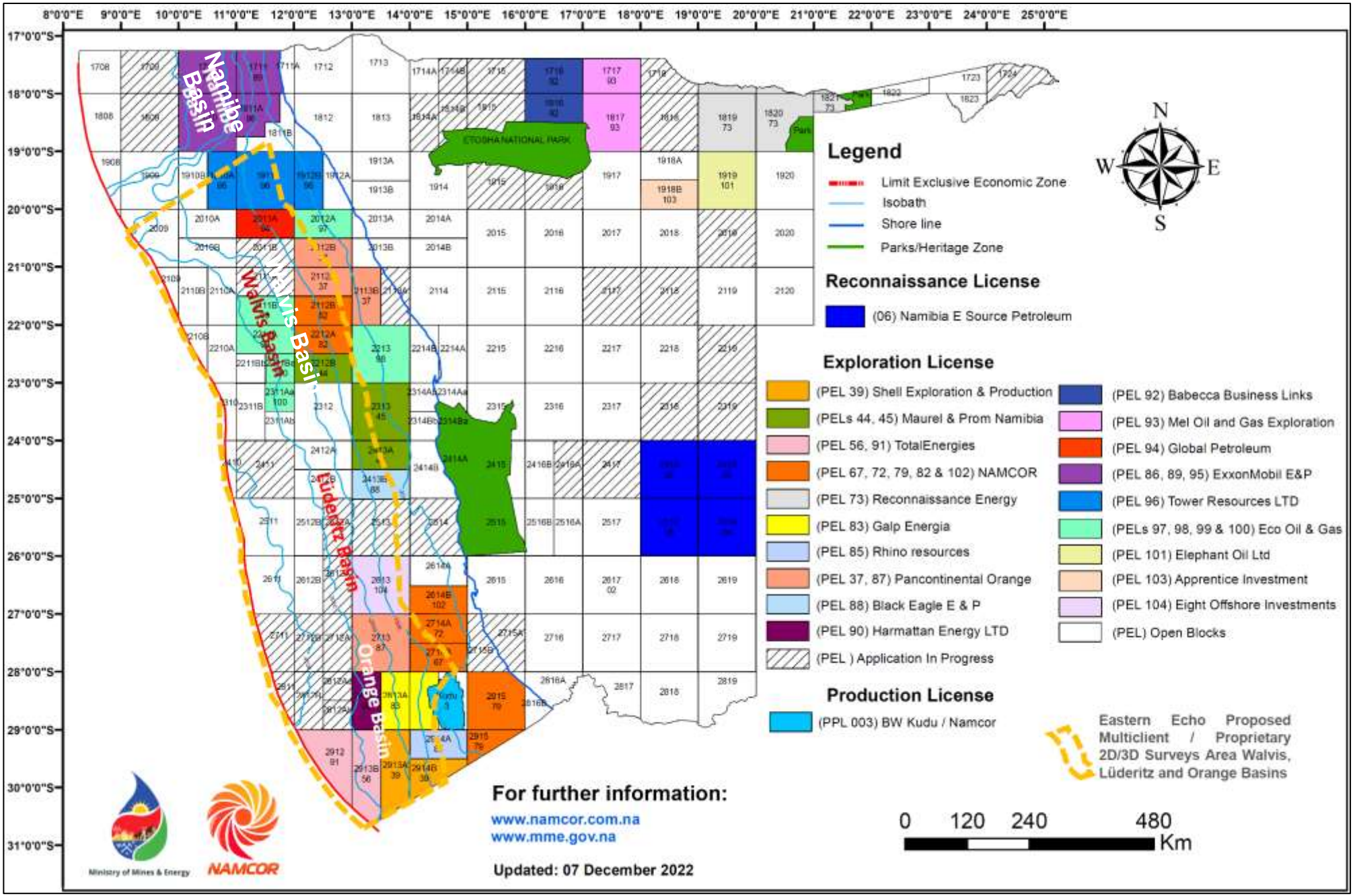

Figure 1.2: Hydrocarbon map of Namibia showing the proposed Multiclient/Proprietary 2D/3D seismic survey AOI falling in the Walvis, Lüderitz and Orange Basins, offshore Namibia (Modified Source: www.mme.gov.na).

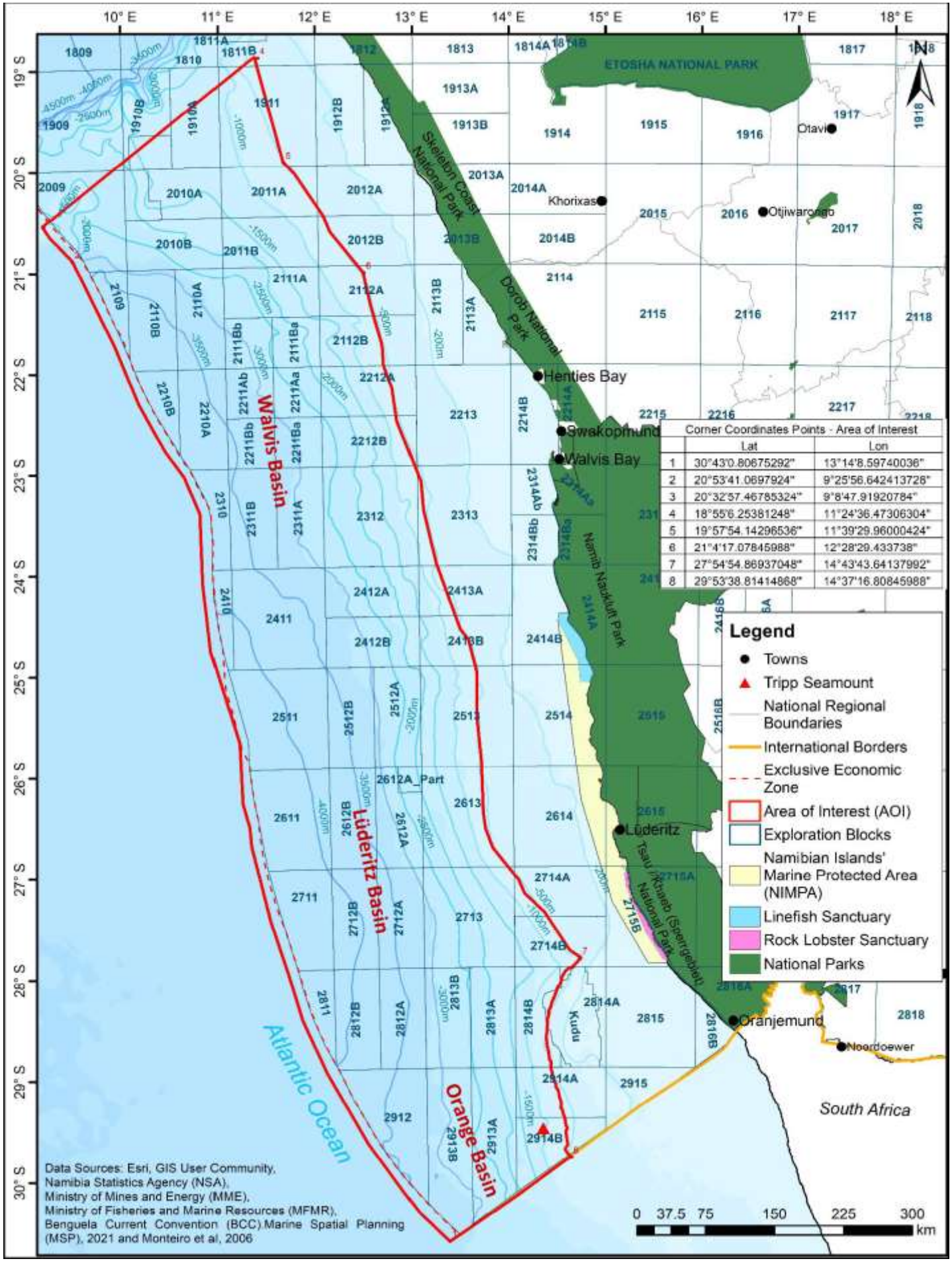

Figure 1.3: Eastern Echo proposed Multiclient/Proprietary 2D/3D seismic survey AOI covering Walvis, Lüderitz and Orange Basins offshore Namibia with water depths ranging from ca-500m to -4000m from east to west, respectively.

1.5 Needs, Desirability, Permitting and Regulatory Requirements

1.5.1 Proposed Project Needs, and Desirability

Although offshore seismic survey operations in Namibia began as far back as 1968, a lot more still need to be done to have a full understanding of the petroleum systems of the deep-water offshore Namibia (Figs. 1.4 and 1.5).

The datasets from the proposed 2D / 3D seismic survey by Eastern Echo will provide critical insight into the subsurface geological evolution, offshore basin architecture, depositional, structural history and delineate potential drill-ready subsurface geological structures. The data sets to be acquired will:

(i) Expand the overall offshore seismic survey data coverage for Namibia (Figs. 1.4 and 1.5), and.

(ii) Enhance the interpretation contrast, confidence, and overall quality of the results over the anticipated subsurface structures within the AOI.

The results and data from the proposed survey are likely to increase the interest by multinational oil and gas companies in conducting oil and gas exploration activities in Namibia. The increase in exploration activities could lead to additional commercial discovery of economic petroleum reserves. Recent discovery of light oil by TotalEnergies Venus prospect in Petroleum Exploration License (PEL) 56 and Shell Upstream Namibia BV Graff-1 in PEL 39 are likely to propel Namibia into an oil and gas producing country in the next six (6) to ten (10) years (Fig. 1.6).

The proposed 3D seismic survey can be classified as a small, short-term, local project aimed at supporting the development of fossil fuel opportunities offshore Namibia while at the same time will provide datasets that could support the development of other resources such as offshore wind energy, suitable industrial hydrogen sites and minerals resources.

1.5.2 Permitting Regulatory Requirements

Oil and gas exploration and production regulatory framework in Namibia provides for strict contractual obligations by a Proponent with respect to environmental performances. The proposed activities (2D / 3D seismic survey) fall under Petroleum (Exploration and Production), 1991, (Act No. 2 of 1991) is administered by the Petroleum Commissioner in the Ministry of Mines and Energy as the Competent Authority. Under Petroleum (Exploration and Production), 1991, (Act No. 2 of 1991) the implementation of a 2D / 3D seismic survey operations requires the Proponent to adhere to the Environmental Impact Assessment (EIA) Regulations, 2012 and the Environmental Management Act, 2007, (Act No. 7 of 2007) administered by the Environmental Commissioner in the MEFT.

Under the Environmental Impact Assessment (EIA) Regulations, 2012 and the Environmental Management Act, 2007, (Act No. 7 of 2007), the proposed 2D and 3D seismic survey cannot be undertaken without an Environmental Clearance Certificate (ECC). The Proponent (Eastern Echo) is required to have prepared EIA and EMP Reports to support the application for the ECC for the proposed seismic survey operations.

In fulfilment of the environmental requirements, the Proponent appointed Risk-Based Solutions (RBS) CC as the environmental / permitting de-risking Consultant, led by Dr Sindila Mwiya and supported by Ms Emerita Ashipala and Mr Samison Mulonga as the Environmental Assessment Practitioners (EAPs) to prepare this EIA and a separate Environmental Management Plan (EMP) Reports to support the application for ECC. This report has been prepared in accordance with the provisions of the EIA Regulations, 2012 and the Environmental Management Act, 2007, (Act No. 7 of 2007) (Fig. 1.7).

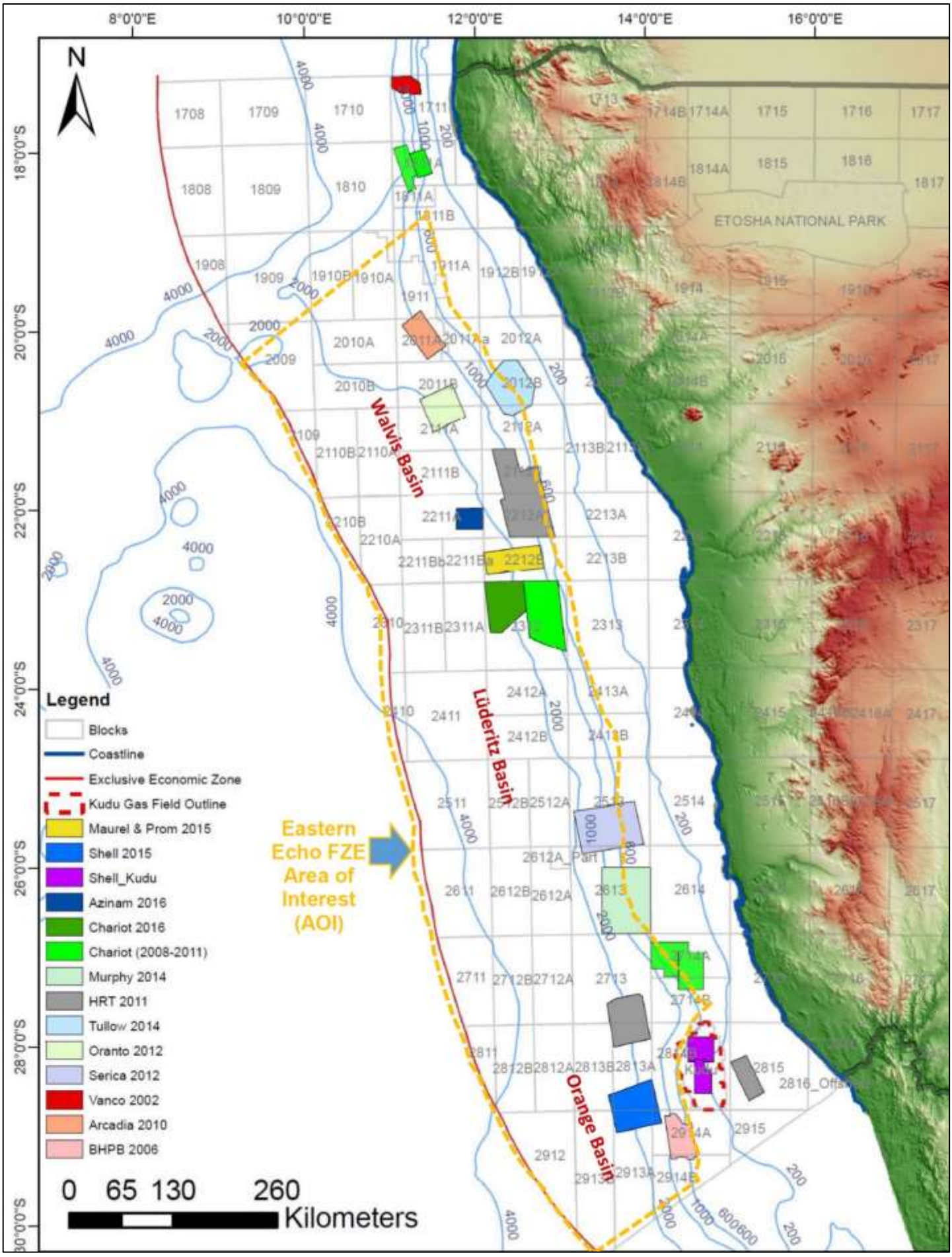

Figure 1.4: Overview of the 3D seismic survey database coverage of Namibia as of 2016 with respect to the proposed Multiclient/Proprietary 2D/3D seismic survey AOI covering Walvis, Lüderitz and Orange Basins offshore Namibia (Source: www.namcor.com.na).

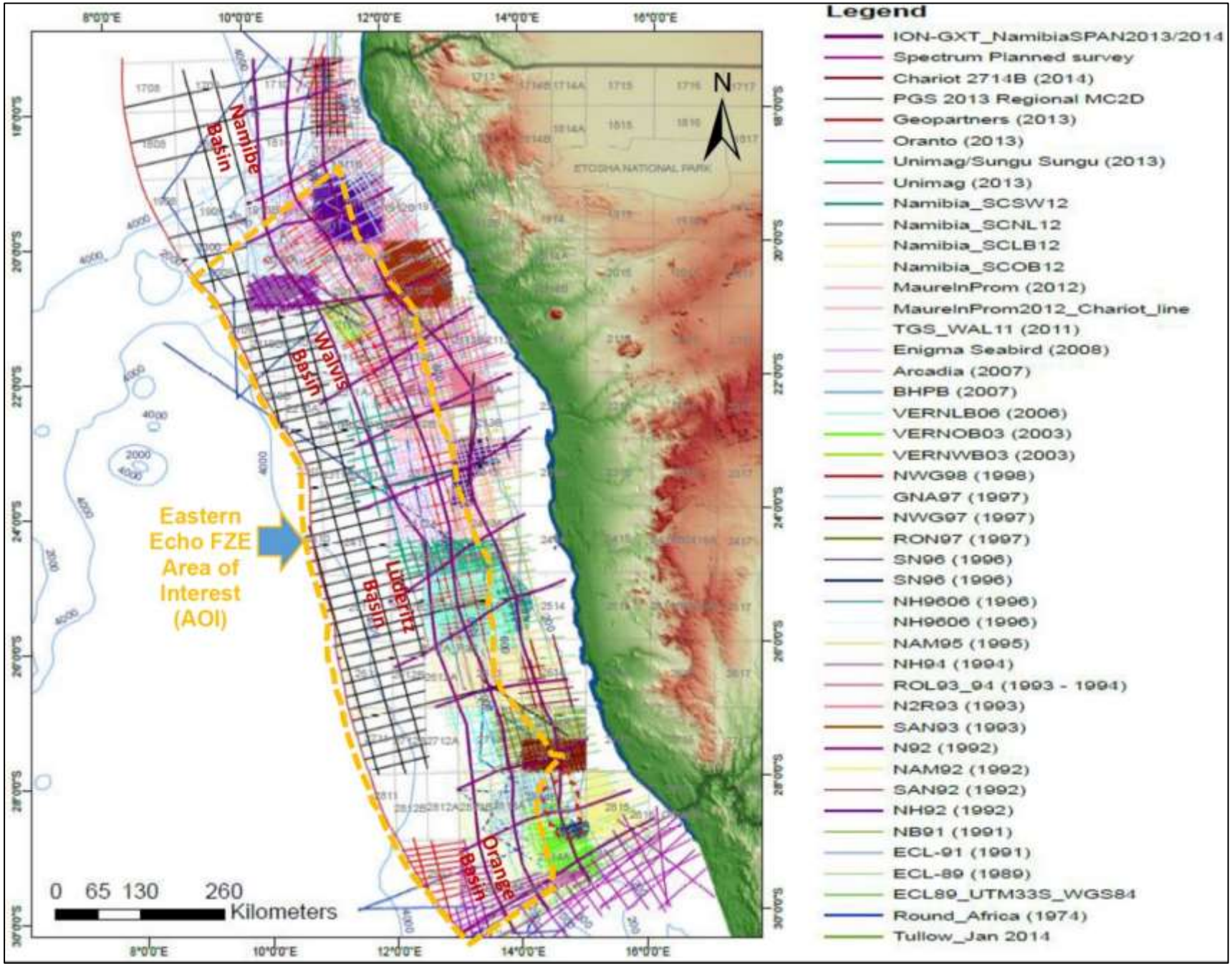

Figure 1.5: Overview of the 2D seismic survey database coverage of Namibia as of 2016 with respect to the proposed Multiclient/Proprietary 2D/3D seismic survey AOI covering Walvis, Lüderitz and Orange Basins offshore Namibia (Source: www.namcor.com.na).

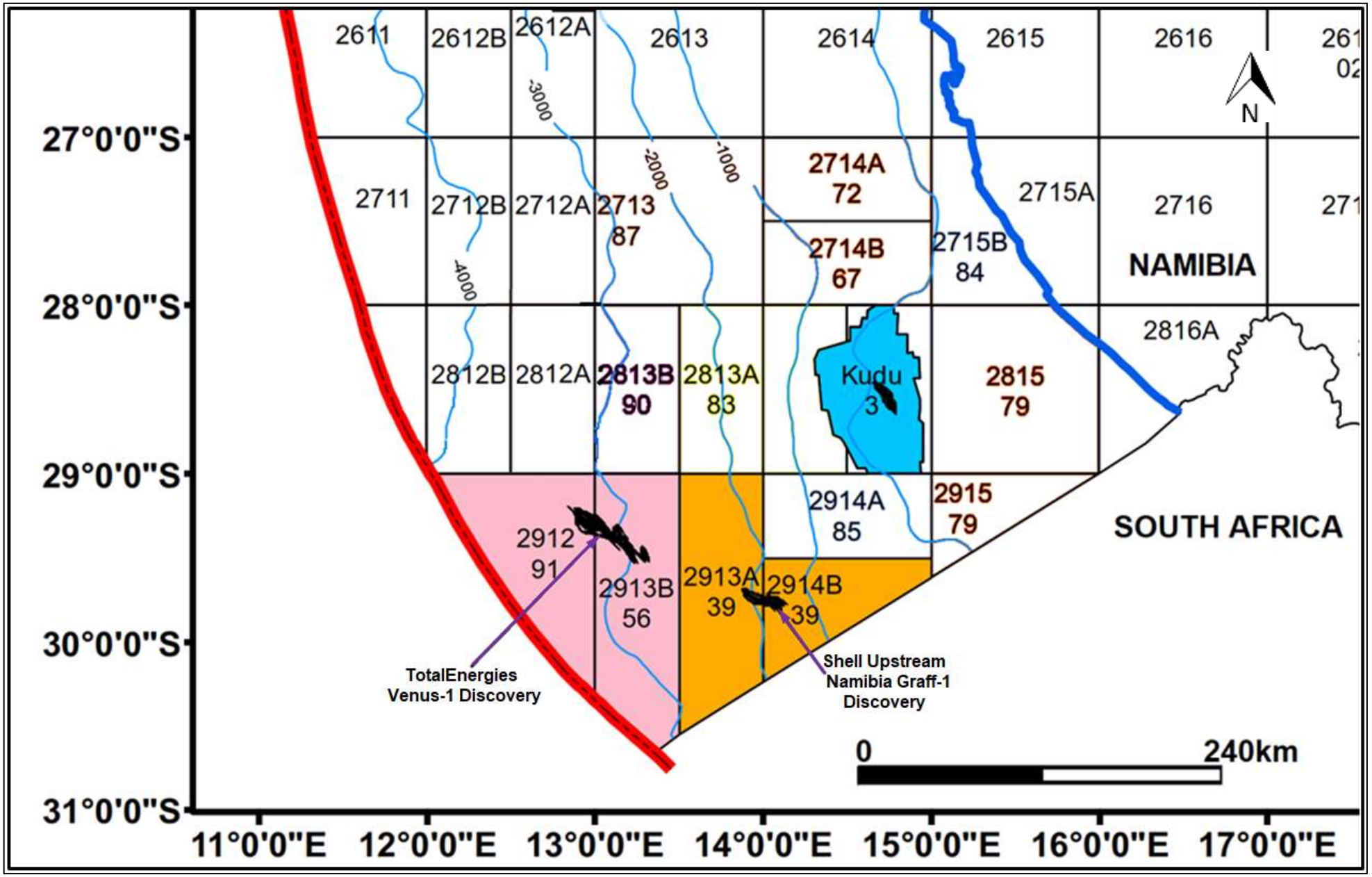

Figure 1.6: Locations of the known oil and gas discoveries offshore Namibia showing the Kudu Gas Field, the TotalEnergies Venus-1 discovery in Petroleum Exploration License (PEL) 56 covering Blocks 2912 and 2913B and the Shell Upstream Namibia BV Graff-1 discovery in PEL 39 covering Blocks 2913A and 2913B situated in the deep-water Orange Basin (Base map Source: www.mme.gov.na).

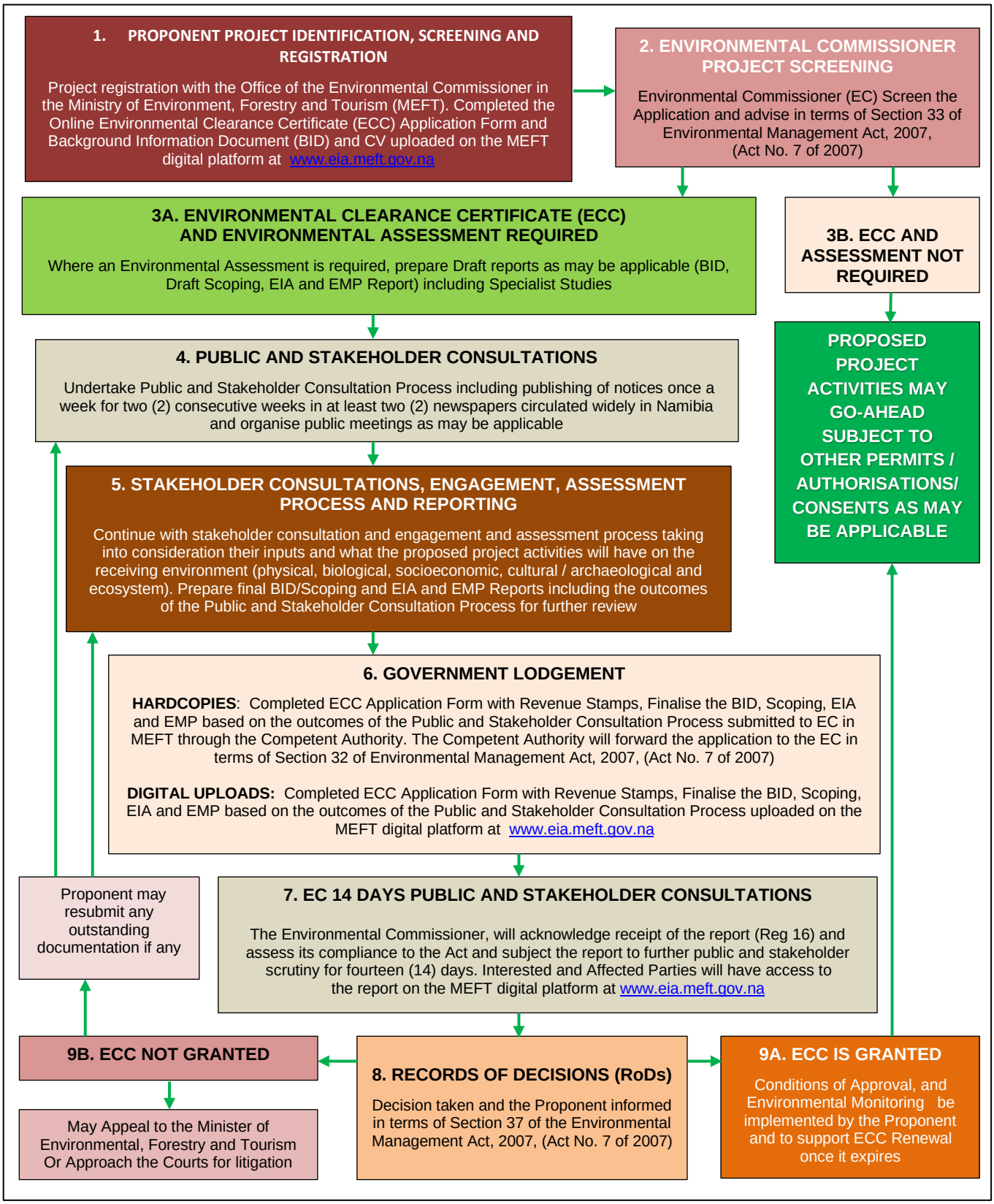

Figure 1.7: RBS schematic presentation of Namibia's Environmental Assessment procedure.

1.5.3 Summary of the Assessment Steps Undertaken

The environmental assessment process used for this project took into considerations the provisions of the Environmental Impact Assessment (EIA) Regulations, 2012 and the Environmental Management Act (EMA), 2007, (Act No. 7 of 2007) as outlined in Fig. 1.7. The following is the summary of the key environmental assessment process steps that have been undertaken:

1. Commenced with the proposed project screening process-Undertaken in June 2023.

2. Prepared the Draft BID and public notice- Undertaken in July 2023.

3. Prepared an internal Stakeholder Engagement Plan (SEP) document and not for distribution to stakeholder - Undertaken in July 2023.

4. Prepared the Scoping Report- Undertaken in July 2023.

5. Published notices / adverts in the local newspapers as follows:

   (i) 1st advert published in the New Era English language newspaper dated Thursday, 3rd August 2023.

   (ii) 2nd advert published in the Confidente language newspaper dated Friday, 4th –Thursday 10th August 2023, and.

   (iii) 3rd multiple adverts published in the Market Watch of the Namibian Sun (English language newspaper), Republikein (Afrikaans language newspaper) and Allgemeine Zeitung (Namibian German Newspaper language newspaper) dated Monday, 7th August 2023.

6. Organised the following public meetings:

   (i) Oranjemund: Wednesday, 9th August 2023, PLACE: Zacharia Lewala Community Hall, TIME: From 09hrs00-12hrs00.

   (ii) Lüderitz: Thursday 10th August 2023, PLACE: Benguela Community Hall, Lüderitz Town, TIME: From 09hrs00-12hrs00, and.

   (iii) Walvis Bay: Wednesday 16th August 2023, PLACE: Narraville Community Hall, TIME: From 14hrs00-17hrs00, and.

7. Placed public notices at strategic places in the towns of Lüderitz, Walvis Bay, Swakopmund and Henties Bay- Undertaken in August, 2023.

8. Conducted direct contact and engagement of other marine users, such as fisheries, fishing companies and associations, and other marine users' stakeholders in Walvis Bay, Swakopmund, Lüderitz, Oranjemund, and Henties Bay-Undertaken in August, 2023.

9. Prepared the Final Draft EIA and EMP Reports including the following Final Drafts specialist assessments reports - Undertaken in August and September 2023:

   (i) Living marine resources assessments covering the fishing industry including important commercial fish species, spawning areas and times and fishing seasons, marine birds, mammals, and related ecosystem variability of the proposed AOI, and.

   (ii) Underwater acoustic / sound modelling assessments.

10. Prepared the Final EIA and EMP Reports including the final specialist assessments reports as listed under point 8 (i) and (ii) above and all undertaken in September 2023, and.

11. The final EIA and EMP Reports, Annexes 1-4 and ECC application submitted to the Office Environmental Commissioner in the Ministry of Environment, Tourism and Forestry (MEFT) through the Ministry of Mines and Energy (Competent Authority) –Week starting 25th September 2023.

1.5.4 Multiclient (MC), Proprietary Surveys and the Environmental Clearance Certificate

1.5.4.1 Overview

Geophysical and geological related surveys and data sets are acquired, processed, owned, stored and sold on either a Multiclient (MC) or proprietary (Exclusive) contractual business arrangements.

1.5.4.2 Multiclient (MC) Surveys

Under a MC system, seismic survey is conducted by a seismic contractor company over an area that might be covering either a single or multiple Petroleum Exploration Licenses (PELs) and unlicensed areas. The collected MC datasets are licensed to a number of clients on a non-exclusive basis.

The data acquired is held under a MC seismic data library owned by the contractor and later may be transferred to a partner/s / Government depending on the contractual and confidentiality arrangements. The cost and findings from MC seismic survey data sets are shared among the different parties involved which may include: Seismic contractor, Government and Licence (PEL) holder/s.

1.5.4.3 Proprietary / Exclusive Surveys

Proprietary also called Exclusive seismic survey is undertaken for a single client or partnership, and the area of coverage is often limited to specific licensed (PEL) area. The cost of the survey and ownership of the data under a proprietary seismic survey business arrangement falls under the responsibilities of the individual license (PEL) holder.

On relinquishment of the petroleum exploration rights, the seismic data sets collected is handed over to the Government.

1.5.4.4 Environmental Clearance Certificate for Multiclient (MC) or Proprietary Surveys

An Environmental Clearance Certificate (ECC) granted to a Proponent who is a seismic contractor may be used to acquire both MC and Proprietary (Exclusive) seismic survey, on conditions that all the contractual arrangements and data ownership requirements among the various parties involved in the partnership including the Government have been agreed.

However, an ECC granted to a Proponent who is a license (PEL) holder may be used to acquire only Proprietary or Exclusive seismic survey data in line with provisions of the Petroleum Agreement with respect to the data ownership. The ECC applied for this project covers both MC and Proprietary (Exclusive) seismic survey business arrangements.

2. PROJECT SUMMARY AND REGULATORY REGISTER

2.1 General Description of Marine Seismic Survey Operation

Eastern Echo (Proponent) is proposed to conduct Multiclient/Proprietary 2D/3D seismic survey location specific projects that may be originated within the outlined AOI (Figs. 1.1 and 1.2). A marine Multiclient or Proprietary 2D/3D seismic survey operation is an advanced deep subsurface mapping technique which involves the sending of acoustic energy into the subsurface and using multiple acoustic energy wave-generating devices which are towed by a specialist seismic survey vessel (Figs. 2.1 and 2.2 and Plate 2.1).

2D seismic survey is a regional subsurface mapping / imaging methodology aimed at de-risking a project by establishing a validated Sedimentary Basin Scale Model of an exploration AOI. 3D seismic survey on the other hand, is a detailed local mapping / imaging methodology aimed at de-risking an exploration project by establishing a validated Prospect/s or Lead/s Scale Models of an exploration Area of Interest within a Sedimentary Basin.

2D/3D seismic survey are acquired on dense and widely spaced grids respectively. The dense grid of a 3D seismic survey provides high-resolution 3D images which reveal fine-scale geological structure for exploration in more complex settings with aim of delineating prospects or leads.

The basic principle of 3D or 2D seismic survey method is the application of controlled generation of sound / acoustic waves by a seismic source to obtain an image of the subsurface as illustrated in (Figs. 2.1 and 2.2). During the marine seismic survey operations, sources and streamers, which are arrays of receivers attached to a cable, are deployed off the back of a slowly moving survey vessel (Figs. 2.1 and 2.2). Seismic sources are usually in front of the streamers. As the ship moves, the sources activate at regular intervals, and the receivers record the signals. The ship typically traverses a grid pattern covering the survey area (Figs. 2.1 and 2.2).

The generated acoustic wave that travels deep into the earth, is reflected by the various rock formations of the earth, and returns to the surface where it is recorded and measured by receiving devices called hydrophones. Each receiver records a trace, which represents the amplitude of seismic signal and noise received during the recording time. Because multiple recording devices are activated when the source is triggered, multiple traces are produced.

The recorded wavefield contains all kinds of noise and useful information about the structure and composition of the subsurface. By analysing the travel times for the seismic waves to travel among the rock formations and the surface, geophysicists, geologists, and petroleum engineers use sophisticated software to create subsurface maps showing potential drill-ready subsurface geological structures called reservoirs that may contain hydrocarbons (Figs. 2.1 and 2.2).

Seismic survey datasets are not only important for oil and gas exploration and production, but also used in various other fields including in Deep Sea Minerals (DSM) exploration and production and the search for suitable Carbon Capture and Storage (CCS) terrains as one of the possible options for Climate Change long-term mitigations.

The general specifications of the proposed Multiclient/Proprietary 2D/3D seismic survey operations are provided as follows (Tables 2.1-2.9):

- 2D seismic survey source vessel specifications (Table 2.1).
- Proposed 2D seismic survey general layout specifications (Table 2.2).
- Proposed 2D seismic source equipment parameters and source characteristics (Table 2.3).
- 3D seismic survey source vessel specifications (Table 2.4).
- Proposed 2D seismic survey general layout specifications (Table 2.5).

- Proposed 3D seismic source equipment parameters and source characteristics (Table 2.6).
- Example of the survey vessel to be used for the proposed seismic survey operations (Table 2.7).
- Support Vessel Specification (Table 2.8), and.
- Chase Vessel Specification (Table 2.9).

2.2 Envisaged Logistical Arrangements Support

The vessel/s, helicopter and all other supporting equipment will to be used for the proposed Multiclient/Proprietary 2D/3D seismic survey will be in full compliance with all the requirements of the international convention on the prevention of pollution from ship (MARPOL) policies and practices as well as all the national marine related regulations administered by the Department of Maritime Affairs in the Ministry of Works and Transport (MWT) and Ministry of Fisheries and Marine resources (MFMR) (Plate 2.2 and Tables 2.7-2.9).

The Ports of Lüderitz and Walvis Bay will serve as the operations base as may be required for mobilisation, port requirements and services where needed.

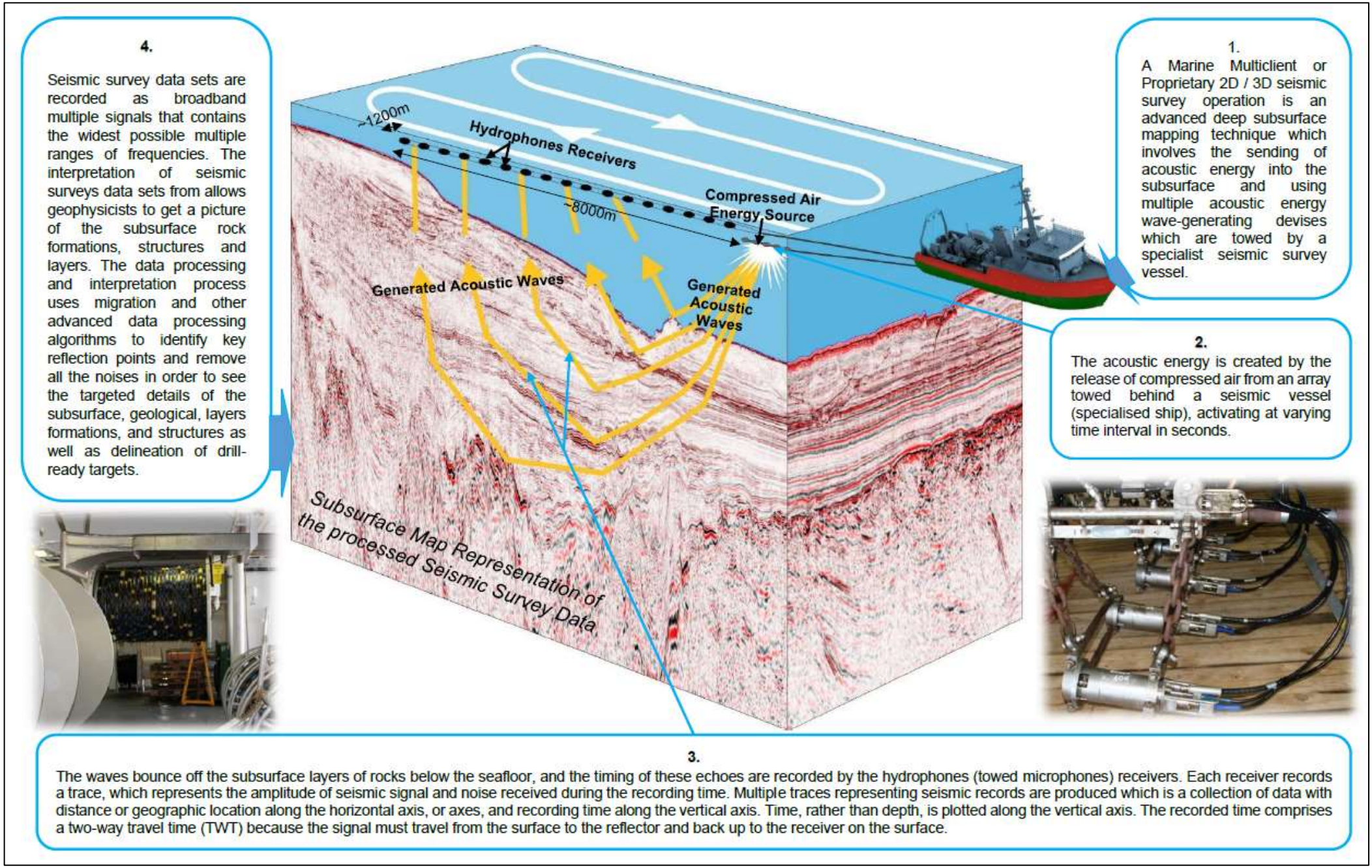

Figure 2.1: Illustration of marine seismic survey operations.

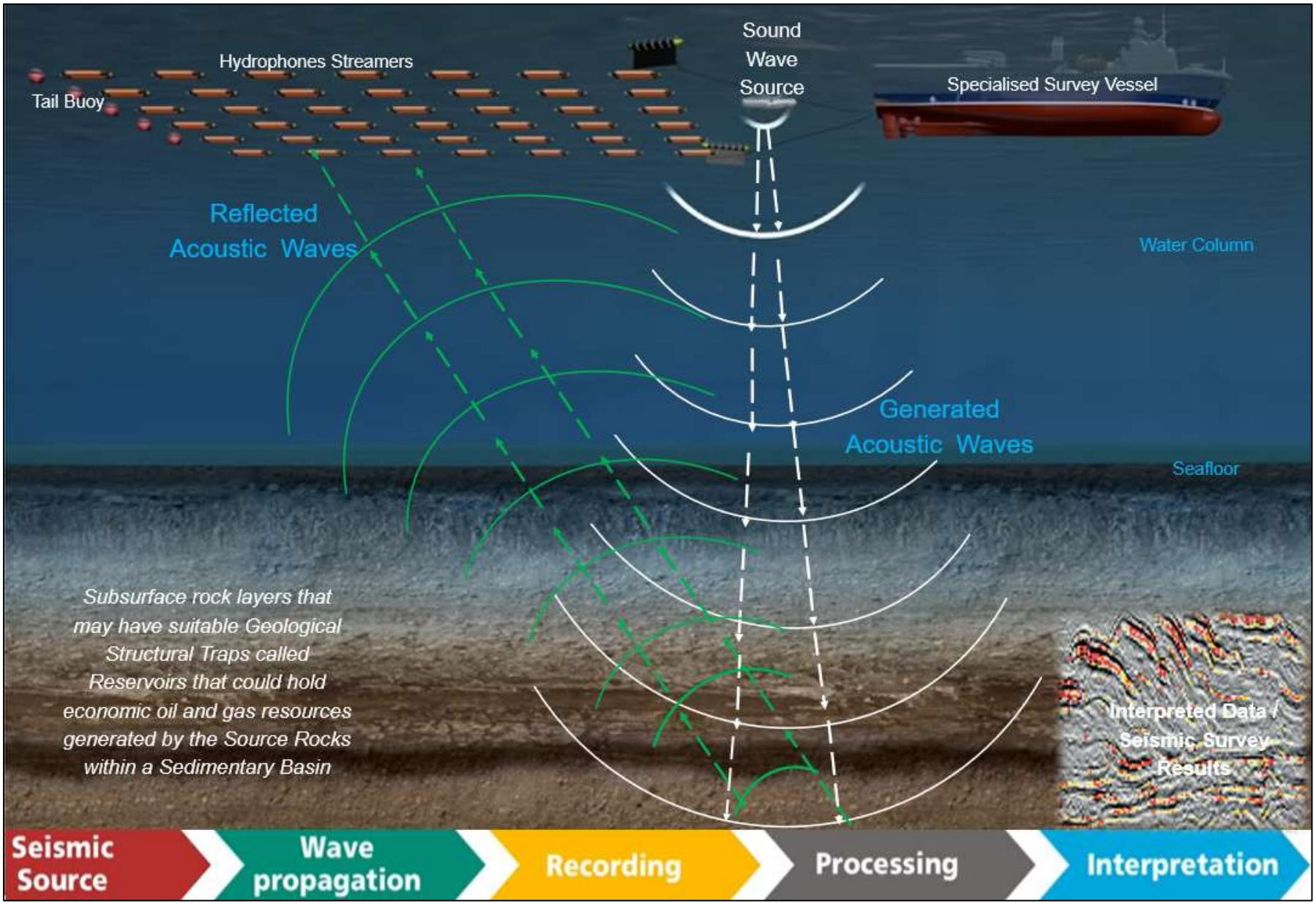

Figure 2.2: Illustration of the application of marine seismic survey method involving data collection and analyses of the times for seismic waves to travel between the various subsurface rock formations. Geophysicists, geologists, and petroleum engineers use sophisticated software to create subsurface images /maps showing potential drill-ready subsurface geological structures called reservoirs that may contain commercial hydrocarbons (Image Source: www.youtube.com/watch?v=FN8IAb0rG9A).

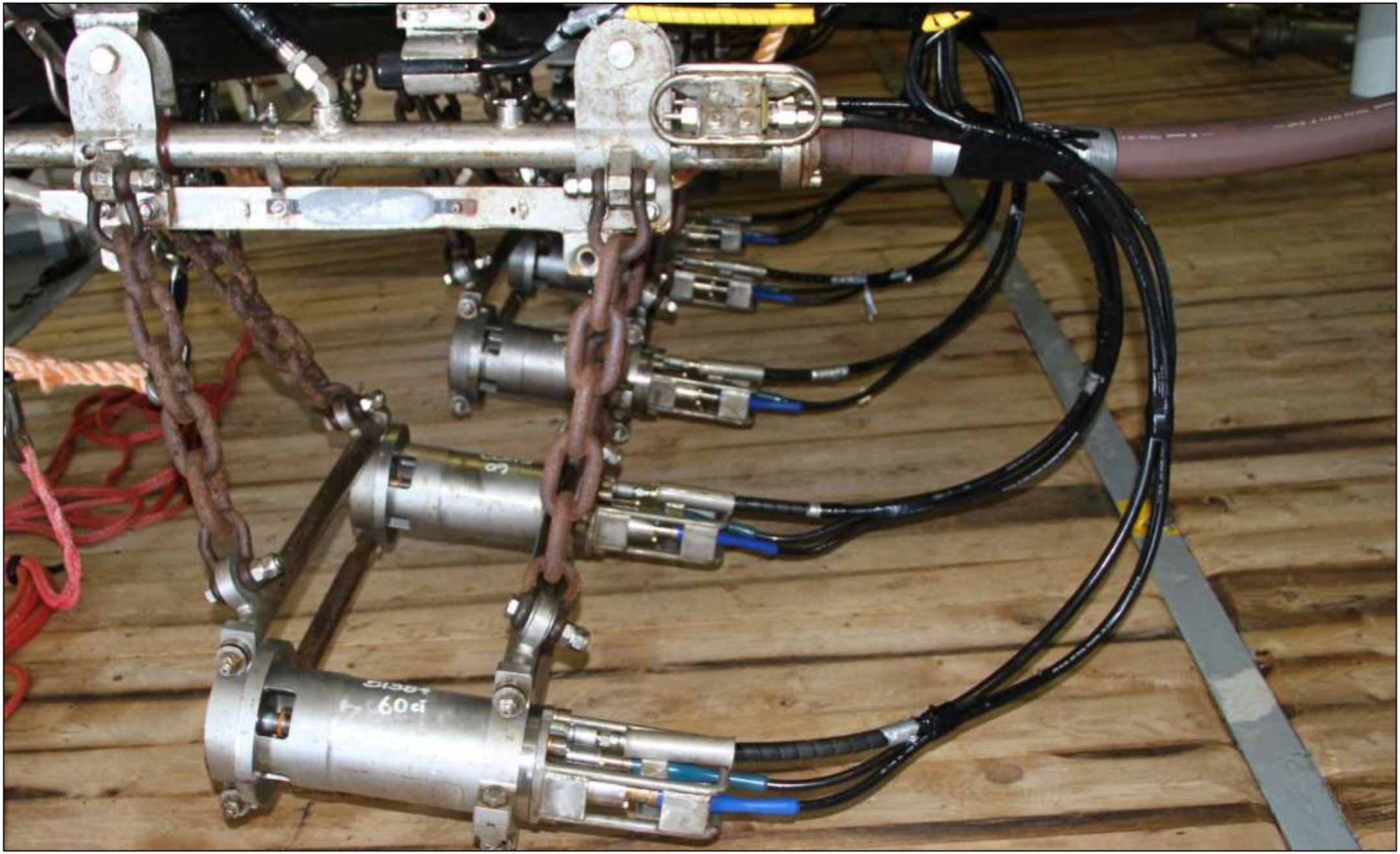

Plate 2.1: Example of the energy sources used in marine seismic survey operations.

Table 2.1: 2D seismic survey source vessel specifications (Source: Eastern Echo, 2022).

SEISMIC SOURCE VESSEL		
1.	Number of source vessels	1
2.	Type / typical size *E.g. Seismic survey vessel:* *Length* *Breadth* *Draft* *Endurance* *Cruising speed* *Operational speed* *Helideck – yes/no*	 BGP Challenger 55 m LOA 13.8 m 4.75 m 30 days 11.5 kts 4.5 kts No
3.	Mob / demob port + schedule	Walvis bay
4.	Typical Person on Board (POB) during surveying: • Party chief • Processors (geophysicists) • Observers (MMO/PAM/FLO) • Navigators Source technicians *E.g. 1 Party Chief* *1 Assistant Party Chief* *1 Chief On board processor* *2 On board processors* *1 Chief Observer* *2 Senior Observers* *2 Observers* *1 Chief Navigator* *2 Senior Navigators* *2 Navigators* *1 Chief Mechanic* *4 Mechanics* *2 MMO* *1 PAM operator* *1 FLO*	 *1 Party Chief* *1 Chief On board processor* *1 On board processors* *1 Chief Observer* *1 Senior Observers* *2 Observers* *1 Chief Navigator* *1 Navigators* *1 Chief Mechanic* *4 Mechanics* *2 MMO* *1 PAM operator (if required)* *1 FLO (if required)*
5.	Typical speed (eco, max, acquisition) *E.g. 4-5 knots during acquisition* *20 knot max* *12-15 knot cruising*	 Max /Economy /Operational Speed 13.1 /11.5 /4.5 kts
6.	Fuel consumption (per day)	Consumption of Fuel, Full Speed Approx. 12 tons per day Consumption of Fuel, Economy Speed Approx. 8 tons per day
7.	Combustible to be used – Sulphur % *E.g. MARPOL 0.5% max compliance*	 0.5% as per IMO 2020
8.	Sewage treatment onboard (yes/no)	Yes
9.	Incinerator onboard (yes/no)	Yes
10.	Minimum safety clearance required between survey vessel and other vessels (distance in km or nm)	Dependant on length of streamer cable deployed

Table 2.2: Proposed 2D seismic survey general layout specifications (Source: Eastern Echo, 2022).

1.	**Spread width *E.g. Min spread: 700 m Max spread: 1650 m***	**2D**
2.	Streamer length (m)	10,000
3.	Number of prime lines	62
4.	Overall spread length (back deck to tail buoy) *E.g. Min spread: 8750 m Max spread: 12750 m*	Max length 12,500 m
5.	Streamer depths *E.g. Min: 10 m Max: 20 m*	8-14 m
6.	Number of streamers *E.g. Min spread: 8 Max spread: 12*	1
7.	Streamer interval / receiver group spacing *E.g. Min spread:* *Max spread:*	12.5 m
8.	Type of streamers (Solid/Gel – 1C/2C/3C)	Solid 1C
9.	Streamer steering device and length between devices	TBD
10.	Streamer diameter	59.5 mm
11.	Channels per streamer *E.g. 648 - 960*	800
12.	**Spread visibility**	
12.1.	Tail buoys with light and radar reflector (Y/N)	Y
12.2.	Outer Tail buoys with AIS (Y/N)	NA – 2D
12.3.	Head buoys with light (Y/N)	Y
12.4.	Deflectors with light and radar reflector(Y/N)	N
12.5.	Number and length of streamers sections	67 x 150 m
12.6.	Number of traces /geophones per section	12
12.7.	Number of depth control unit per streamer	TBD
12.8.	Number of Acoustic positioning unit per streamer	TBD

Table 2.3: Proposed 2D seismic source equipment parameters and source characteristics (Source: Eastern Echo, 2022).

1.	**Number of sources**	**1**
2.	Number of sub-arrays	3
3.	Separation distance	8 m
4.	Source type	Bolt
5.	Energy Source total number, single /cluster	24
6.	Source Volume	5,085 cu in
7.	Source nominal operating Pressure	2,000 psi
8.	Source operating Depth	9m
9.	Maximum acoustic frequency output (dB re 1mPa@1m)	241 dB (RMS pressure for entire frequency window 0-25kHz)
10.	Maximum acoustic source level (dB re 1mPa@1m)	241 dB (RMS pressure for entire frequency window 0-25kHz)
11.	Frequency range of seismic source	0-4500Hz (within -60dB)
12.	Frequency range of maximum output	30-60Hz (within -3dB)
13.	Shooting sequence (mode, shot time and shot point interval, record length)	Distance, single source, 25 m, 10 seconds

Table 2.4: 3D seismic survey source vessel specifications (Source: Eastern Echo, 2022).

1.	**Number of source vessels**	**1**
2.	Type / typical size *E.g. Seismic survey vessel:* *Length* *Breadth* *Draft* *Endurance* *Cruising speed* *Operational speed* *Helideck – yes/no*	 PXGeo 2 100.1 m LOA 24 m 7.3 m 80 days 12 kts 4.5 kts Yes
3.	Mob / demob port + schedule	Walvis Bay
4.	Typical Person on Board (POB) during surveying: • Party chief • Processors (geophysicists) • Observers (MMO/PAM/FLO) • Navigators Source technicians: *E.g. 1 Party Chief* *1 Assistant Party Chief* *1 Chief On board processor* *2 On board processors* *1 Chief Observer* *2 Senior Observers* *2 Observers* *1 Chief Navigator* *2 Senior Navigators* *2 Navigators* *1 Chief Mechanic* *4 Mechanics* *2 MMO* *1 PAM operator* *1 FLO*	 *1 Party Chief* *1 Chief On board processor* *2 On board processors* *1 Chief Observer* *1 Senior Observers* *2 Observers* *1 Chief Navigator* *3 Navigators* *1 Chief Mechanic* *4 Mechanics* *2 MMO* *1 PAM operator (if required)* *1 FLO (if required)*
5.	Typical speed (eco, max, acquisition) *E.g. 4-5 knots during acquisition 20 knot max* *12-15 knot cruising*	 Max /Economy /Operational Speed 14 /12 /4.5 kts
6.	Fuel consumption (per day)	Consumption of Fuel, Full Speed Approx. 36 tons per day. Consumption of Fuel, Economy Speed Approx. 28 tons per day
7.	Combustible to be used – Sulphur % *E.g. MARPOL 0.5% max compliance*	0.5% as per IMO 2020
8.	Sewage treatment onboard (yes/no)	Yes
9.	Incinerator onboard (yes/no)	Yes
10.	Minimum safety clearance required between survey vessel and other vessels (distance in km or nm)	Dependant on length and number of streamer cable deployed

Table 2.5: Proposed 2D seismic survey general layout specifications (Source: Eastern Echo, 2022).

1.	**Spread width *E.g. Min spread: 700 m*** ***Max spread: 1650 m***	***Min spread: 1440 m*** ***Max spread: 1800 m***
2.	Streamer length (m)	**8,100 m**
3.	Number of prime lines	
4.	Overall spread length (back deck to tail buoy) *E.g. Min spread: 8750 m* *Max spread: 12750 m*	**8,866 m based on 8,100 m active streamer length**
5.	Streamer depths *E.g. Min: 10 m* *Max: 20 m*	**8-14 m**
6.	Number of streamers *E.g. Min spread: 8* *Max spread: 12*	**12**
7.	Streamer interval / receiver group spacing *E.g. Min spread:* *Max spread:*	**12.5 m**
8.	Type of streamers (Solid/Gel – 1C/2C/3C)	**Solid 1C**
9.	Streamer steering device and length between devices	**TBD**
10.	Streamer diameter	**59.5 mm**
11.	Channels per streamer *E.g. 648 - 960*	**648**
12.	**Spread visibility**	
12.1.	Tail buoys with light and radar reflector (Y/N)	Y
12.2.	Outer Tail buoys with AIS (Y/N)	Y
12.3.	Head buoys with light (Y/N)	Y
12.4.	Deflectors with light and radar reflector(Y/N)	Y
12.5.	Number and length of streamers sections	54 x 150 m per streamer
12.6.	Number of traces /geophones per section	12
12.7.	Number of depth control unit per streamer	TBD
12.8.	Number of Acoustic positioning unit per streamer	TBD

Table 2.6: Proposed 3D seismic source equipment parameters and source characteristics (Source: Eastern Echo, 2022).

1.	**Number of sources**	**3**
2.	Number of sub-arrays	2
3.	Separation distance	8 m
4.	Source type	Bolt
5.	Energy Source total number, single /cluster	16
6.	Source Volume	3,390 cu in
7.	Source nominal operating Pressure	2,000 psi
8.	Source operating Depth	9m
9.	Maximum acoustic frequency output (dB re 1mPa@1m)	238 dB (RMS pressure for entire frequency window 0-25kHz)
10.	Maximum acoustic source level (dB re 1mPa@1m)	238 dB (RMS pressure for entire frequency window 0-25kHz)
11.	Frequency range of seismic source	0-4570Hz (within -60dB)
12.	Frequency range of maximum output	15-61Hz (within -3dB)
13.	Shooting sequence (mode, shot time and shot point interval, record length)	Distance, triple source, 16.667 m, 10 seconds

Plate 2.2: BGP Challenger Example of the survey vessel to be used for the proposed Multiclient/Proprietary 2D/3D seismic survey AOI covering Walvis, Lüderitz and Orange Basins offshore Namibia (Source: Eastern Echo, 2023).

Table 2.7: Example of the survey vessel to be used for the proposed seismic survey operations (Source: Eastern Echo, 2023).

VESSEL GENERAL INFORMATION	
Ships Name	BGP CHALLENGER
Call Sign	3ETJ5
Flag State & Port Of Registry	Panama
Type	Seismic Research Vessel
Date Of Build	Mar 2007,China
Converted	Aug 2009,China
Owner	BGP Geoexplorer Pte Ltd
Classification Society and Class	CCS, ★CSA Geophysical Survey Ship ★CSM
Class ID No.	08T0287
IMO No.	9441532
MMSI No.	370580000
Safe Manning Certificate (Minimum)	12 Person
Gross Tonnage (Grt)	1987ton
Net Tonnage	596 ton
Length Over All (Loa)	55.00m
Length Between Perpendiculars	48.00m
Breadth (Moulded)	13.80m
Breadth (Extreme)	13.80m
Depth (Moulded) 1st deck	5.50m
Draft	4.75m
Air Draft (To Highest Antenna)	At fully loaded draft 22.9M
Max /Economy Speed	13.1Knots/11.5Knots
CAPACITY AND ENDURANCE	
Pulling Capacity, 5 Knots	28T
Capacity of accommodation	46 Person
Fresh Water Capacity	169.6m3.
Fresh Water Maker Production	10 Ton /day
Fuel Capacity, All Tanks Topped	500.00m3
Fuel, Useful For 100 % Consumption	425.00 m3
Fuel Type	MGO
Consumption of Fuel, Full Speed	Approx. 12 tons per day
Consumption of Fuel, Economy Speed	Approx. 8 tons per day
Operational Endurance	30 days
Safety Equipment Certificate	For 46 persons
BRIDGE NAVIGATION EQUIPMENT	
Radar No 1 and Radar No 2	Furuno FAR-1518 and Furuno FAR-2827
ECDIS	HIGHLANDER HLD-ECDIS 600
Gyro Compass	Anschutz STD22
Auto Pilot	Raytheon NP 60
GPS Receiver	Furuno GP-170
Speed Log	Walker 4020LOG
Echo Sounder	SKIPPER ED165
VHF, GMDSS, Sea Areas: A1+A2+A3	Sailor RT 6222 VHF DSC, Sailor 6110 mini-C GMDSS
Radio's, UHF	HC 4500
Weather Facsimile	Furuno FX-30
Navtex Receiver	JRC NCR-333
Weather station	WALKER Lilley & Gillie, Ninglu AM706
AIS	FURUNO FA-150

Table 2.7: ***Cont.***

COMMUNICATION EQUIPMENT	
Radio Station Licence No.	38322-F
Class / Corr. Category	F
Transmitter / Receiver, Main (MF)	SAILOR 6300 MF
Transmitter / Receiver, Reserve (MF)	N/A
Transmitter / Receiver, Main (VHF)	Sailor RT 6222 VHF
Transmitter / Receiver, Main (Dsc)	Sailor RT 6222 VHF DSC
Emergency Radio Beacon (Epirb)	McMurdo E5
Radar Transponder	2 x SART S4
Radio, Lifeboat, VHF	3 sets McMurdo R1
Satellite communication:	
Inmarsat Type C	Sailor 6110 mini-C GMDSS
Inmarsat FBB	Intellian FB500
VSAT	SEATEL 9797B-32
Inm.Sat.F Teleph. / Fax. No.	00870 7648 25850/00870 7648 25853#
Norsat-C. Online Tele Link to Oslo	NA
Telefax Machine	Panasonic KX-FT996CN
Internal E-Mail & Pc-Network	Yes, available
E-Mail Address to Vessel	bgp.challenger@bgpoffshore.com
VESSEL SAFETY EQUIPMENT	
Life rafts Type /Capacity	Throw over/6x20&2x10
Life raft Davits	N/A
Number of Life Rafts	8 sets
Lifejackets	Permanent buoyancy/114 sets + 5 (child size)
Survival Suits, Thermo Insulated	Insulated Immersion suits/66 sets
MOB Rescue boat (FRC-type)	JIANGSU JIAOYAN GJ6.0B-1
Work Boat (FRC-type)	NORSAFE AS MAKO 665 WATERJET
Engine and Speed of Work Boat	SE266E40, 750-3750RPM
Drive Type of Workboat	Water jet – Alamarin 230 Jet
Capacity of work boat	15 persons
Engine Power and Speed of work Boat	212HP, 25knots (18 knots-average tested speed by manufacturer)
Fixed fire-fighting equipment	
Engine Room	Fixed CO2 system
Compressor Room	Fixed CO2 system
Incinerator Room	Fixed CO2 system
Galley Ducting	Fixed CO2 system
Cable Store	Fire hoses & fire extinguisher
Steamer Winch Room	Fire hoses & fire extinguisher
Paint Store	Fixed CO2 system
Chemical Store	Fixed CO2 system
Main Fire Pump	150m3/hr
Emergency Fire Pump	25m3/hr
Fire Detection Monitoring System	Yes, smoke and heat detectors

Table 2.7: ***Cont.***

HULL OUTFITTING	
Decks Crane 1, Capacity/Reach/Location	3 tons at 12 m radius
Crew Accommodation, No of Bunks	46 persons
Single Berths Cabins	4
Double Berths Cabins	13
Four Berths Cabins	5
Conference and Training Rm	1
Hospital	1
Sauna and Fitness Room	1 Gym with equipment
INTERNATIONAL OIL POLLUTION PREVENTION (IOPP) EQUIPMENT	
Incinerator, Sludge and Waste Oil	Available
Bilge / Oily Water Separator	1.0m^3/hr, oil content less than 15ppm
Oily Water / Sludge Holding Tanks Cap.	10.2 m^3 /6.7 m^3
Oil Spill Absorbent / Damage Control	As per SOLAS/MARPOL regulations
MACHINERY EQUIPMENT	
Main Engine	Niigata 6MG25HX, 2x1323KW
Auxiliary Engines (Generator Drive)	Volvo D12, 2 x 310KW, Cummins KT38, 1 x 560KW
Redundancy Propulsion, Az-Thruster	N/A
Propeller Type, Main Propulsion	2 sets, Fixed pitch propeller in Kort Nozzles
Propeller and Thruster Control	Bridge and Engine control room
Propeller Blade, Spare	**N/A**
Generators / Alternators	2x245KW, 1x500 KW
UPS	2 sets, Galaxy PW,1 for backup
Emergency & Harbour Gen. Engine	Volvo D7AT
Emergency & Harbour Generator	116KW
Fuel Back-Up System for Aux. Eng.	Individual
Cooling System for Aux. Engines	Fresh water cooling system
Bow Thruster Engine	Volvo D12 MH 500HP (368kw)
Bow Thruster type	5.0 T fixed pitch
Fresh Water Generator (FWG)	Reverse osmosis 10tons/day
Steering Gear	Two Independent electro-hydraulic
Air Source/ Compressors	2 x LMF 31 / 138-207 D,
Air Capacity	3x31 (m3/min)
Hp Compressor Drive Motors	2xCaterpillar 3508B,1xCat C32 diesel engine driving

Table 2.8: Support Vessel Specification (Source: Eastern Echo, 2023).

GROEN
Offshore, Guard & Support

Main Details:
Specifications
Seismic Research Support
Vessel Sunrise-G

Year of construction: 2013
Vessel Name: Sunrise-G
Owner: Rederij Groen BV
Flag: Panama
IMO Number: 9628518
Call Sign: 3FKF6
MMSI: 354131000
Class : ABS A1, SPS code, AMS

Dimensions:
LOA : 59.90 Mtrs.
Width : 16.50 Mtrs.
Draught : 5.40 Mtrs
Net Tonnage : 658
Gross Tonnage : 2194

Generator(s):
Shaft Generator : 1x Leroy-Somer 800 kW
Emergency Gen. : 1x Cummins 80 kW/100 kW 240/415 V, 50 Hz

Main engine(s):
Caterpillar : 2x 2100 BHP @ 1600 RPM

Auxiliary Engines:
Cummins : 3 x 250 kW

Propulsion system:
2 x Controllable Pitch in fixed nozzles

Bow Thruster(s):
1x 9 tons Tunnel Thruster, 596 kW

Anchor(s):
2 x HHP Anchors c/w 10 shots of Anchor Chains 27.5m Dia 40mm U2.

Deck Equipment:
Anchor Windlass : 1x Double gypsies for 42mm dia. Grade 2 chain, Rating: 7.5T X 15m/min for anchor chain, 7.5T X 15m/min for centre declutchable mooring drum
Capstan : 2x 5.0 Ton
Reefers con. : 3 x 415V / 3ph / 50Hz
Twin Hose reel : 2 x 240Mtr 5" hose with 4"Todo
Cable Reel : 1 x 8000 Mtr
Towing Hook : 65 Tons SWL
Bollard pull : 52 Tons
Deck Crane : 25 Ton by 7.5 mtr
: Max outreach is 16.5 mtr
Workboat Davit : Vestdavit SW 12 Ton
Yoko Fenders : Noreqfender 4m x 2.5m x 2 nos.

Safety Equipment:
Rescue Boat : 6 Person Rigid Rescue Boat c/w A-Frame
Rudders : 2 x Highlift Rudder

Standard LSA as per SOLAS & flag administration rule. For 50 men

Communication Equipment:
GMDSS Compl. : A1 – A2 – A3
Sat Comm. : Broadband / VSAT

Cargo Handling Equipment:
Cargo FO pump : 1x 160 m³/h @ 9 bar (approx 96m head) Vertical Screw Pump
1x 120 m³/h @ 75m head Vertical Twin Screw Pump
Cargo FW pump : 1x 100 m³/h@60m Vertical Centrifugal pump
Ballast water pump
: 2x 100 m³/h@60m Vertical Centrifugal pump

HFO Boiler: Aalborg Thermal Fluid Heater x 1
Capacity 800kW, Max supply temp 220°C
Nominal flow 37m3/h Fuel cons 79kg/h

Bunker / Storage capacity:
Fresh Water : 611.3 m³
Drill Water/SWB : 904.7 m³
MGO : 324.7 m³
Heavy Fuel Oil
Cargo : 995.7 m³
Dirty Oil : 13.4 m³
Oily water : 30.3 m³
Lube Oil Storage : 21.2 m³
Sewage Holding : 30.3 m³
Grey water : 31.1 m³
Sludge : 19.1 m³
Thermal Fluid : 10.6 m³
Clear Deck : 300 m²
Deck Cargo : 800 m³

Speed:
Max Speed 11.5 knots
Eco Speed 10.0 knots

Accommodation (fully air conditioned):
Accommodation : 59 pers. total
Other : 1x Hospital

Rederij Groen BV
www.rederijgroen.nl
Email: info@rederijgroen.nl
Telephone +31 70 355 35 88

Version 2017-03-17

Table 2.9: Chase Vessel Specification (Source: Eastern Echo, 2023).

NAME: EMPRESS
TYPE: Workboat / Survey Vessel
M & H NO: 5010
BUILDER: Fine Entry Marine
DESIGNER: Gavin Mair
SURVEY LENGTH: 22.25m
LAST SLIPPED: June 2011
DRAFT: 1.8
BEAM: 6
LAUNCHED: 1999
HULL CONSTRUCTION: Aluminium
Displacement monohull

SURVEY
2B, permitted for operations out to 200 miles;
12 passengers, 3 crew
Exemptions for more passengers available

MACHINERY
Main Engines:
2 x 535 hp MTU Series 60
Gear Box
2 x twin disc MG 5144
Genset
40 KVA Isuzu
30 KVA Isuzu

CAPACITY
Fuel
Main Tanks 22,000L
Fresh Water
Main Tank 2000L
2 x Desalination Plant 90L per hr

SPEED & CONSUMPTION
Cruising Speed 11 knots 70L per hr
Maximum Speed 15 knots 130L per hr
Maximum Range 3,450 NM

DECK LOADING
Maximum load 13 tonnes
Work deck area 45m^2

DECK EQUIPMENT
3 ton marine hiab
2 ton deck winch

Survey Room / Wet Lab
Air-conditioned, UPS protected, full deck vision, stainless bench, sink, hot and cold running water. Large chiller and freezer room for specimen storage

WHEELHOUSE ELECTRICAL EQUIPMENT
Radar: Simrad RA40 ARPA radar
Echo Sounders: Simrad ES60
Chart Plotters: C-Plot
Transas pro Tsunami navigation system
Auto Pilot: Simrad AP50
Radios: VHF & SSB
Fleet 33 Satellite phone/fax
Internet access via Satellite phone & CDMA
AIS vessel identification and plotting system

GALLEY & ACCOMMODATION
Fully air-conditioned galley & accommodation for 8 pax with all amenities

GENERAL INFORMATION
Full Deck Canopy
3 steering positions
Dive platform across transom
Removable transom
Black water tank with lectrasan sewerage treatment plant
Fully equipped workshop

MANNING
Master 4, Mate, Engineer & Deckhand

2.3 Summary of Proposed Project Regulatory Register

The following is the summary of the regulatory register for all applicable legislations with respect to the proposed Multiclient/Proprietary 2D/3D Seismic Survey:

1. Namibian Constitution Articles 91(c) and 95.

2. Environmental Management Act, (EMA), 2007, (Act No. 7 of 2007) and Environmental Impact Assessment (EIA) Regulations No. 30 of 2012.

3. Petroleum Products and Energy Act 13 of 1990 (as amended by the Petroleum Products and Energy Amendment Act 29 of 2004, Act 3 of 2000 and Act 16 of 2003.

4. Namibian Ports Authority Act 2 of 1994 (as amended in 2000 and the accompanying 2001 Port Regulations).

5. Health Act (No. 21 of 1988) and Public and Environmental Health Act, 2015 (Act No. 1 of 2015).

6. Foreign Investment Act 27 of 1990.

7. Merchant Shipping Act 57 of 1951.

8. Water Act 54 of 1956 (as amended).

9. Sea Shore Ordinance 37 of 1958.

10. Aviation Act 74 of 1962 (as last amended by the Aviation Amendment Act 10 of 1991 and the Aviation Amendment Act 27 of 1998) (and the Namibian Civil Aviation Regulations 2001).

11. National Monuments Act 28 of 1969 (as amended by the National Monuments Amendment Acts 22 of 1970 and 30 of 1971, the Expropriation Act 63 of 1975, and the National Monuments Amendment Act 35 of 1979).

12. Hazardous Substance Ordinance 14 of 1974.

13. Atmospheric Pollution Prevention Ordinance 11 of 1976.

14. Dumping at Sea Control Act 73 of 1980.

15. Marine Traffic Act 2 of 1981 (as amended by the Marine Traffic Amendment Act 5 of 1983, the Marine Traffic Amendment Act 15 of 1991, and the Namibia Ports Authority Act 2 of 1994).

16. Prevention and Combating of Pollution of the Sea by Oil Act 6 of 1981 (as amended by the Prevention and Combating of Pollution of the Sea by Oil Amendment Act 59 of 1985, Act 63 of 1987, and Act 24 of 1991, and the Namibian Ports Authority Act 2 of 1994).

17. Territorial Sea and Exclusive Economic Zone of Namibia Act 3 of 1990 (and the Territorial Sea and Exclusive Economic Zone of Namibia Amendment Act 30 of 1991).

18. Nature Conservation Amendment Act 5 of 1996.

19. The Marine Resources Act 27 of 2000 (and the Regulations relating to the Exploitation of Marine Resources 2001).

20. Wreck and Salvage Act 5 of 2004.

21. National Heritage Act 27 of 2004 (and the Regulations/Appointments/Declarations made under the National Monuments Act 28 of 1969 and the Regulations 2005).

22. Atomic Energy and Radiation Protection Act 5 of 2005 (and the Radiation Protection and Waste Disposal Regulations 2011).
23. Labour Act 11 of 2007 (and the Labour Amendment Act 2 of 2012).

24. Tobacco Products Control Act 1 of 2010 (and the Regulations).

25. Disaster Risk Management Act 10 of 2012.

26. International Conventions and Protocols:

    a) International Plant Protection Convention (IPPC) 1951 (as last amended in 1997).

    b) Convention on Wetlands of International Importance, Especially as Waterfowl Habitat (The Ramsar Convention on Wetlands) 1971.

    c) Declaration of the United Nations Conference on the Human Environment 1972.

    d) Convention on the International Regulations for Preventing Collisions at Sea (COLREGs) 1972 (as amended).

    e) Convention on the Prevention of Marine Pollution by Dumping of Wastes and Other Matter 1972 (and amendments)

    f) International Convention for the Prevention of Pollution from Ships (MARPOL) 1973 (as modified by the Protocol of 1978.

    g) International Convention for the Safety of Life at Sea (SOLAS) 1974 (as amended).

    h) United Nations Convention on the Law of the Sea (UNCLOS) 1982.

    i) Vienna Convention for the Protection of the Ozone Layer 1985 and Montreal Protocol on Substances that Deplete the Ozone Layer 1987.

    j) Basel Convention on the Control of Transboundary Movements of Hazardous Wastes and their Disposal 1989.

    k) International Convention on Oil Pollution Preparedness, Response and Co-operation (OPRC) 1990.

    l) United Nations (UN) Framework Convention on Climate Change 1992 and Kyoto Protocol to the UN Framework Convention on Climate Change 1997.

    m) Convention on Biological Diversity (CBD), Rio de Janeiro, 1992.

    n) Stockholm Convention on Persistent Organic Pollutants (POPs) 2001 (as amended in 2009 and 2011).

    o) United Nations Educational, Scientific and Cultural Organization (UNESCO) Convention on the Protection of the Underwater Cultural Heritage 2001.

    p) Convention for the Safeguarding of the Intangible Cultural Heritage 2003.

    q) Convention on the Protection and Promotion of the Diversity of Cultural Expressions 2005.

    r) Revision of International Standards for Phytosanitary Measures No. 15 Regulation of Wood Packaging.

    s) Regional Agreements: Southern African Development Community (SADC) Protocol on Mining 1997 and on Energy 1998.

3. SUMMARY OF THE EIA RESULTS AND MITIGATIONS MEASURES

3.1 Introduction

The potential positive and negative impacts likely to eb associated with the proposed 2D/3D seismic survey have been identified, described, and assessed in the EIA Report. Mitigation measures are described in this EMP Report.

3.2 Summary Assessment of Positive Impacts

The following is summary of the key positive impacts that the proposed 2D/3D seismic survey activities will have on socioeconomic landscape of Namibia:

- Increased earnings by the State through rights' rentals and payment of direct and indirect taxes.
- Increased understanding and knowledge of the deep-water petroleum systems of Namibia that could finally led to the discovery of economic oil or gas resources that will change the economic landscape of Namibia for benefits of its people.
- Contributions to the national geosciences' skills development and knowledge transfer through on job training and short-term job attachments of Namibians.
- Contributions to the short and long-term strategies of attracting investments in the petroleum exploration sector in Namibia through new data acquisition, research, monitoring and management.
- Contribution to the long-term strategy that will promote the coexistence of petroleum operations with other marine users in Namibia.
- Direct contributions to the training of young Namibians through increased contributions to the national PetroFund which is currently offering several scholarships to Namibians to be able to study at foreign universities.
- Contributions to economic growth through ongoing exploration investments and potential future oil and gas discovery.
- Creation of employment opportunities through short and long-term contracts, and.
- Contribution to the development of local infrastructures and new businesses to support the ongoing oil and gas exploration opportunities particularly around the Ports of Walvis Bay and Lüderitz.

3.3 Summary Assessment of Negative Impacts

3.3.1 Sound Modelling Conclusions and Recommendations

Based on the results of the propagation and sound exposure modelling carried out by Seiche Ltd, 2023 (Annex 3 to the EIA Report), for this assessment, it is concluded that:

(i) There is potential for significant disturbance to marine mammals within up to 4.2 km of the source array and mild disturbance within up to 16.5 km.

(ii) Before mitigation measures are applied, there is potential for injury to low frequency cetaceans within a radius of 441 m, 15 m for high frequency cetaceans and 518 m for very-high frequency cetaceans. These injury zones will reduce to 84 m for low frequency cetaceans and 151 m for very-high frequency cetaceans once mitigation measures are applied, with high frequency cetacean injury thresholds no longer being exceeded.

(iii) These injury zones can effectively be monitored using MMOs. Based on the acoustic modelling results, a mitigation zone of 500 m is considered sufficient to effectively eliminate the risk of injury to marine mammals.

(iv) It is therefore concluded that it is unlikely that marine mammals will be injured as a result of the survey.

(v) Recoverable injury could occur in some fish at a range of up to 239 m from the source array (for fish with swim bladders and eggs and larvae). For fish without swim bladders, the potential range of effect reduces to a maximum of 127 m from the source array. TTS could occur to fish within 769 m of the source array, and.

(vi) Some sea turtles could be injured at ranges of up to 239 m from the source array.

According to the results of the sound modelling study undertaken for this project (Annex 3 to the EIA Report), without any mitigation measures in place, seismic survey activities have been identified as having the potential to cause injury to low frequency cetaceans at a range of up to 441 m from the source array and 518 m for very-high frequency cetaceans. However, the injury radius is only 15 m for high-frequency cetaceans (Annex 3 to the EIA Report). Given the potential for injury (and disturbance) from the survey, it is recommended that further mitigation measures should be adopted (Annex 3 to the EIA Report). The mitigation measures to be included in the EMP as recommended in Annex 3 to the EIA Report, are as follows:

(i) Marine Mammal Observers:

- Provision of qualified and experienced Marine Mammal Observer (MMO) to be present for the duration of the survey to undertake cetacean visual monitoring during all daylight hours.

- Passive Acoustic Monitoring (PAM) – if starting at night, and.

- PAM comprises of a short hydrophone array, a deck cable and data processing system which processes and stores selected data. The PAM system could be used for night-time and low visibility shooting to detect any cetaceans within close proximity to the survey.

(ii) Pre-shooting search:

- The MMO (or PAM operative) would begin observations 60 minutes before the commencement of the first use of the seismic source and the survey would be delayed if any cetaceans are detected within 500 m of the source array before work commences, and.

- If cetaceans are observed or detected within 500 m during this first observation, then the start of the seismic sources would be delayed until cetaceans have moved away (not sighted for at least 20 minutes).

(iii) Energy Source:

- To ensure that marine mammals are given the opportunity to move away from the source as they commence firing, energy should be slowly increased to the maximum level over a period of 20 minutes, in a process called ‘soft-start’.

According to the results of the acoustic specialist modelling study undertaken for this project (Annex 3 to the EIA Report), taking the effect of soft start into account, the potential injury range for very-high frequency cetaceans reduces to 151 m or less and 84 m for low frequency cetaceans.

The injury threshold for high-frequency cetaceans will not be exceeded with soft start. This effectively reduces the risk of injury to marine mammals to negligible levels.

3.3.2 Impact Assessment Summary on Marine Mammals, Birds, Fish and Fisheries

3.3.2.1 Summary of the Overall Impacts

Table 3.7 summarises the potential impacts discussed in detail in the specialist reports on marine mammals, birds, fish and fisheries (Annex 2 to the EIA Report) and the acoustic underwater sound modelling report (Annex 3 to the EIA Report). The assessment of the impacts in Table 3.1 are given without mitigation measures applicable. The impacts are considered at different levels, (such as physiological, perceptual and behavioural), but the overall impact is presented. The source of impact (noise, seismic vessel, support craft, pollution) and duration of the impact (short/long term) are also considered, as well as whether the impact is to an individual or at population level. In the end, population and long-term impacts are the defining criteria. Table 3.2 summaries the potential impacts if the suggested mitigation measures are applied.

3.3.2.2 Assessment of Potential Impacts on Cape Fur Seals

Noise from the seismic survey is expected to have no impact on seal populations. Noise disturbance from support aircraft, such as helicopters, can cause startle response and panic behaviour. The impact would be high in the immediate short term, however, in the long term, impact on marine mammals from the noise of low-flying aircraft related to the survey operations is considered negligible in comparison to other aircraft noise sources in the region. Individual seals may be impacted by discarded waste and gear lost overboard, but this will be equal to any similar threat posed by fishing or other vessels.

3.3.2.3 Assessment of Potential Impacts on Marine Mammals

Seismic source noise is only expected to impact low-frequency cetaceans within close range of the operating source. As there are no known resident low-frequency cetaceans, the impact will be on migrating mammals. The number of mammals migrating through the Namibian waters is relatively low and wide-spread. If mitigation measures such as soft-starts, visual observation and exclusion limits are applied, the impacts of seismic noise can be lessened to acceptable levels. Overall, the expected impacts at population level are considered low in the long-term.

Noise from support vessels will have an insignificant impact, because whales and dolphins are likely to display avoidance reactions at a distance of about 1 km. The communication and navigation sounds emitted by whales and dolphins should not be masked by noise emitted by supply vessels and therefore, it is considered to be of insignificant impact.

The impact of prey displacement as a result of seismic activities is considered to be of very low significance overall, as marine mammals have an adaptable diet and prey on more than one fish species. In addition, these creatures are highly mobile and able to follow prey in different directions. The impact of the seismic survey on feeding would be of very low significance.

3.3.2.4 Assessment of Potential Impacts on Sea Turtles

Although the occurrence of sea turtles in the region has increased in recent years, they are, by and large, still only occasional visitors. The likelihood of encountering turtles during the survey operations is moderate to low. None-the-less, should a turtle be in very close range of the seismic array, the potential impact on turtle physiology, behaviour and feeding is considered to be of high intensity in the short-term, but of low probability.

The impact on turtle mortality due to entanglement or garbage consumption can be high, but if turtle exclusion tail buoys are fitted to the hydrophone array and MARPOL 73/78 solid waste disposal procedures are followed this impact will be lessened to low significance. The impact of seismic noise on turtle migration is considered to be insignificant, since turtles make use of magnetic cues rather than acoustics for navigation.

3.3.2.5 Assessment of Potential Impacts on Sea Birds

Only a few sea bird species frequent deep, offshore waters and the likelihood of encountering significant numbers of endangered species is slim. The potential physiological impact of seismic pulses on non-diving birds is considered to be insignificant as birds would be expected to stay away from the noise source and the buoys of the seismic array.

The potential of pathological impact is considered to be of low-moderate significance on diving sea birds without mitigation and of very low significance with mitigation such as warning ramp-up procedures and if marine mammal observers are employed. In comparison to the impact of long-line fishing on pelagic birds, the potential impact of noise from this seismic survey on bird populations in the long term, is considered insignificant.

Avoidance behaviour would be limited to the immediate vicinity of the source array and only for the duration of the actual firing and vessel passage. The impact on behaviour is thus considered to be of MEDIUM intensity and of short duration, but overall, of very low significance in the long term. The impact of the seismic noise on non-diving bird behaviour is considered to be insignificant.

The impact of prey displacement as a result of the survey on the foraging of diving and non-diving birds is considered to be of moderate intensity in the medium term in the immediate vicinity of the shooting operations, and of very low significance overall. Research has shown that shoaling fish disturbed by seismic firing return to the area within a relatively short time period. In addition, the extent of prey species and wide ranges over which sea birds feed indicate that the impact of the seismic survey on feeding would be of very low significance.

Birds are generally only drawn to vessels to scavenge on discarded waste, or by lights at night. As long as the vessels comply with the International Convention for the Prevention of Pollution from Ships (MARPOL) regulations, general waste should not pose a threat to and have zero impact on marine bird populations.

There is the possibility of a sea bird becoming entangled in, or colliding with lines and structures, particularly at night when shipboard lighting may cause disorientation and temporarily lowered visual ability. However, if lighting is reduced to minimal onboard safety requirements, then such incidents are likely to be scarce and the significance level and impact is considered low.

Noise disturbance from aircraft can cause startle responses and avoidance behaviour. The impact can be high in the immediate short term, however, if aircraft avoid known breeding colonies the aircraft noise directly related to the survey operations is considered negligible in comparison to other aircraft noise sources.

Sea birds are most likely to be severely impacted by the seismic vessel in the event of an oil spill or other major water-borne pollution. Such an event could be of high intensity in a localised area for a short term. The fact that the survey activities are generally offshore and away from any large or sensitive breeding colonies, and that foraging birds will likely to be able to avoid any such spills, will lessen the impact. The chances of such an incident are equal to any other vessel operating within the Benguela Current Large Marine Ecosystem Programme. Thus, the overall impact of the survey on sea birds is regarded as low.

3.3.2.6 Assessment of Potential Impacts on Fish

The impact on larvae close to the surface in the vicinity of the source will be of high intensity in the short term, but in overall comparison with natural mortality, the impact of the seismic survey is considered to be of very low significance to larval stages, particularly if timing and spatial mitigating measures are employed.

Seismic noise disturbance may impact the spawning activities of certain fish species. However, most of the commercially important species spawn inshore and north of the proposed survey area, and in view of the relatively short duration of the disruption to species and the wide distribution of fish, the impacts of the survey on fish recruitment at the population level are considered to be of low significance.

The potential impact of physiological damage to pelagic species in close proximity to the noise source would be of high intensity. The potential impact would be limited to the short-term period of surveying activities in the population locale.

The overall impact of physiological damage to pelagic fish species is considered to be of low to very low significance dependant on the mitigation measures employed. However, the potential impact on demersal species and on species in shallow and inshore water would be insignificant as they are expected to be well out of the range of damage. Also, certain species of commercial importance (herring, mackerel, gobi, sharks) have under-developed or no swim bladders and there is little risk of injury from seismic noise. The physiological impact on large pelagic species is considered to be negligible.

The fish of the are generally highly mobile and exhibit large migration patterns and ranges, so while the potential impact on fish behaviour could be of high intensity, this would be limited to shallow waters and /or close proximity to the source, and restricted to the short-term duration of the survey operating in the area., but limited to the survey area. The impact of fish behaviour is, thus, considered to be of low significance both with and without mitigation measures.

3.3.2.7 Assessment of Potential Impacts on Fisheries

The fishing industry in Namibia is arguably the most socio-economically sensitive of all the marine activities currently being undertaken in Namibian waters. The Namibian commercial fishing industry plays an important role in the general economy of the country and the numerous companies are a great source of employment.

Commercially exploited demersal species include both shallow- and deep-water Cape Hake, Monkfish and Kingklip. These species are fished on the continental shelf, between -200 m and -400 m, where the distribution varies seasonally. Data indicates that there is no long-term reduction in catch per unit effort for species such as hake and cod as a result of seismic surveys.

The proposed seismic survey may affect fish behaviour and distribution in the short-medium term; however, research shows that catch rates should be resumed to normal within 24 hours for long-liners and from 12 hours up to a maximum of 5 days for demersal trawling. Although there may be some disruption to fishing operations, it is expected that the fish populations and distribution will return to normal within a relatively short time period after cessation of seismic activities.

The expected impact of the seismic activity on commercial catch and effort is considered to be of LOW significance. The seismic survey vessel locations and timetable should be communicated to this fishery well in advance of the onset of proposed operations.

The most commercially valuable mid-water fish are adult Cape Horse mackerel and juvenile Hake. The Cape horse mackerel are exploited by two sectors of the fishing industry: juveniles are caught by purse seiners and adults by midwater-trawler. These fisheries operate inshore of the proposed AOI and so the proposed seismic operations should have no impact on this fishery.

The pelagic purse seine fishery targets small pelagic fish such as anchovy, pilchard, juvenile Cape horse mackerel and pelagic goby. The purse seine fishing grounds are inshore and north of the AOI, so will receive NO IMPACT from surveys within the AOI.

The AOI lies mostly north of the tuna fishery. While the seismic survey will not impact the species as a whole, seismic noise may cause the fish to alter their migration route and avoid the areas of seismic operations. This can have a direct impact on the fishing industry, which targets tuna species in known locations.

The pole-and-line fishery, in particular, is a very small and seasonal fishery, operating only a couple of months in the year. The effort is variable and dependent on fish availability. The fishery operates on windows of opportunity. When a shoal is located, many vessels will congregate at one location for a

number of days. Albacore tuna movement between South Africa and Namibia is poorly understood and there is no clear pattern.

Due consideration must be given to this fishery and negotiations regarding the timing of the seismic survey could lessen any negative associated impacts. Flexibility is paramount in limiting impacts on this fishery, which could be medium to high if no mitigation or consultation is undertaken, but low depending on the timing of the survey and fish stock availability.

Any proposed seismic survey could impact commercial fishing due to the safety zones required around the operational seismic vessel (commonly 500 m exclusion zone). Good communication and pre-notification practices will limit unnecessary disruption and delays to both parties. Due consideration should be given to the presence of all fishing vessels while running survey lines and communication channels should kept open to avoid close encounters.

Additionally, support vessels moving to/from Lüderitz and Walvis Bay may encounter commercial fishing vessels and potentially cause short-term disruption. Adherence to prescribed maritime communication procedures will limit any likely encounters.

Precautionary action needs to be initiated to avoid entanglement with fishing equipment, such as long-lines or purse seine nets. Damage and associated delays can be costly to both sectors. The overall potential impact of entanglement of seismic gear with fishing gear is considered negligible if the vessel operators are aware of the presence of other vessels, although any such incidents would be of high intensity, but limited to the immediate timing of the event.

In the interests of amicable co-use of the Benguela Current Large Marine Ecosystem (BCLME) resources, and also for marine safety, the following procedures should mitigate any negative interactions with fisheries:

- The surveyor must formally notify the Commissioner for Petroleum Affairs (MME) of the survey, stating the proposed location of the survey lines, the commencement date and the anticipated duration.

- This information should also be relayed to all affected parties (Directorate of Maritime Affairs, Namibian Ports Authority, South African HydroSAN and the MFMR Monitoring, Control and Surveillance Unit - Walvis Bay).

- In the interest of good relations, direct communication and facilitation with any vessels in the area at the time of the survey is important. Openness to the possibilities of adjusting survey lines, and trawling location to cause minimum disruption of operations to both parties.

- Good communications through MFMR to the fisheries (i.e., Association of Namibian Fishing Industries and the Namibian Large Pelagic and Hake Longlining Association) with pre-notification of survey activities and vessel paths (navigational co-ordinates of the survey area, timing and duration of proposed activities).

- Notices to Mariners should be distributed timeously to fishing companies and directly to fishing vessels, stating:

    a) the co-ordinates of the proposed survey lines.

    b) the proposed survey timeframes and day-to-day location of the seismic vessel.

    c) the proposed safe operational limits of the survey vessel, and.

    d) movements of support vessels.

- Radio Navigation Warnings and Notices to Mariners should be distributed via Navigational Telex (Navtext), and local Lüderitz and Walvis Bay Radio for the duration of the survey.

- ❖ It is recommended that updates of the scheduled weekly survey plan be circulated to the operators of affected fishing vessels on a daily basis and notify trawlers when the survey may move into trawling areas.

- ❖ Establish communications with the known long-line fishers if drifting buoys (with radar responders) are sighted, and.

- ❖ An experienced Fisheries Liaison Officer (FLO) should be deployed on board the survey vessel to initiate and facilitate radio communications with maritime vessels in the vicinity of the survey area. The FLO should report daily on vessel activity, ramp up procedures, environmental matters, fauna sightings, and respond and advise on action to be taken in the event of encountering fishing gear.

3.3.2.8 Overall Impact Assessment

Fishing areas, marine mammals (Cetacean migratory routes), and sensitive coastal environments with respect to the proposed are all shown in Fig. 3.1. Known commercial fishing grounds and MFMR stock assessment survey areas relative to the proposed 2D / 3D seismic survey area are shown in Fig. 3.2. Table 3.1 summarises the potential impacts detailed in the EIA Report, marine mammals, birds, fish and fisheries and underwater acoustic modelling specialist reports.

The assessment of the impacts is given without mitigation measures are shown in Table 3.1. The impacts have been considered at different levels, (such as physiological, perceptual and behavioural), with the overall impact also presented. The source of impact (noise, seismic vessel, support craft, pollution) and duration of the impact are also considered, as well as whether the impact is to an individual or at population level. In the end, population and long-term impacts are the defining criteria.

Table 3.8 summaries the potential impacts with mitigation measures applied. The overall impact of this proposed survey is regarded as being of moderate significance in the short-term and low significance in the long-term, assuming mitigation measures are applied (Table 3.2).

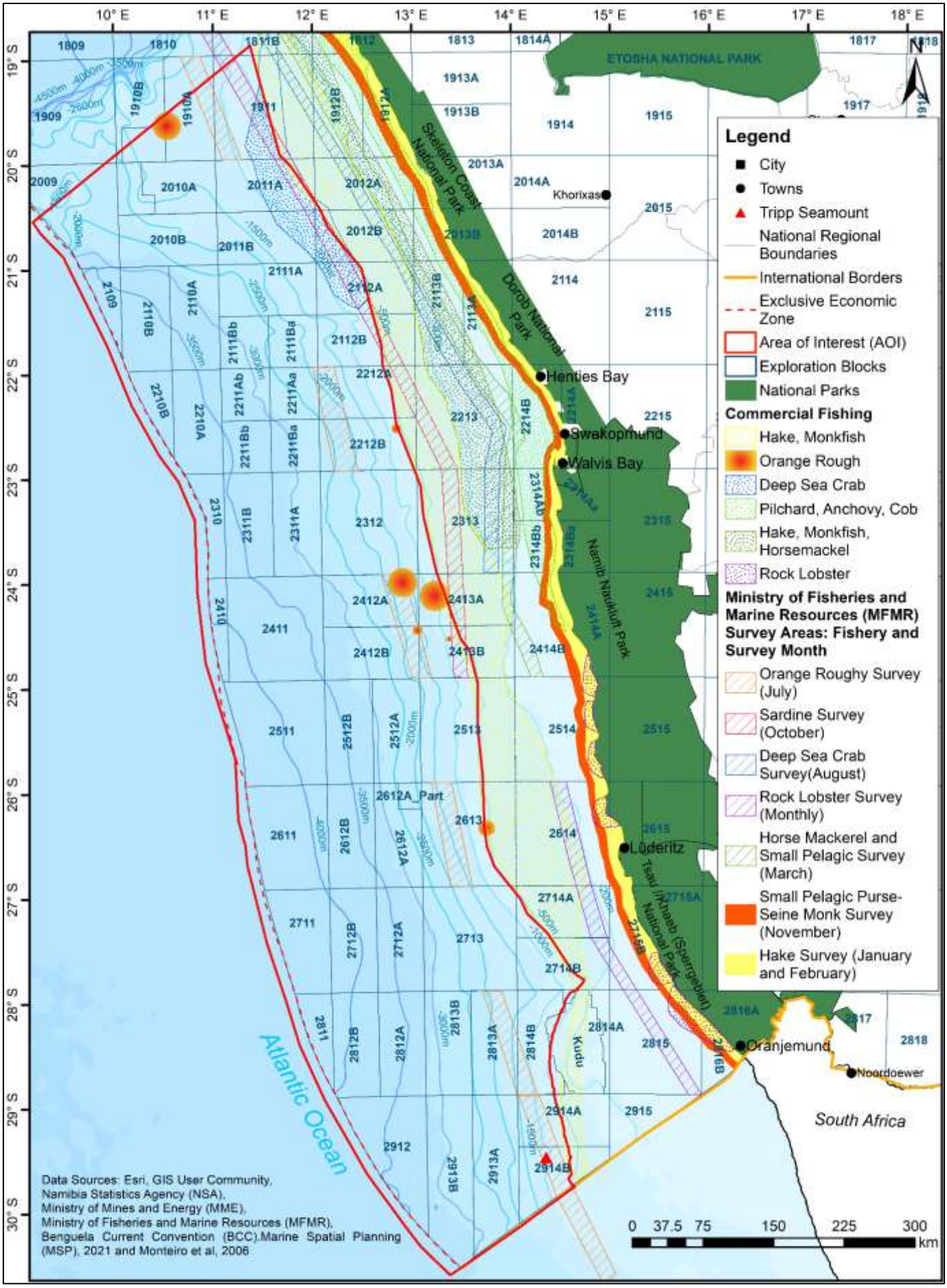

Figure 3.1: Fishing areas, marine mammals (Cetacean migratory routes), and sensitive coastal environments with respect to the proposed Multiclient or Proprietary 2D/3D Seismic Survey over the Area of Interest (AOI) (Data Source: Geological Survey of Namibia and National Marine Information and Research Centre, 2003).

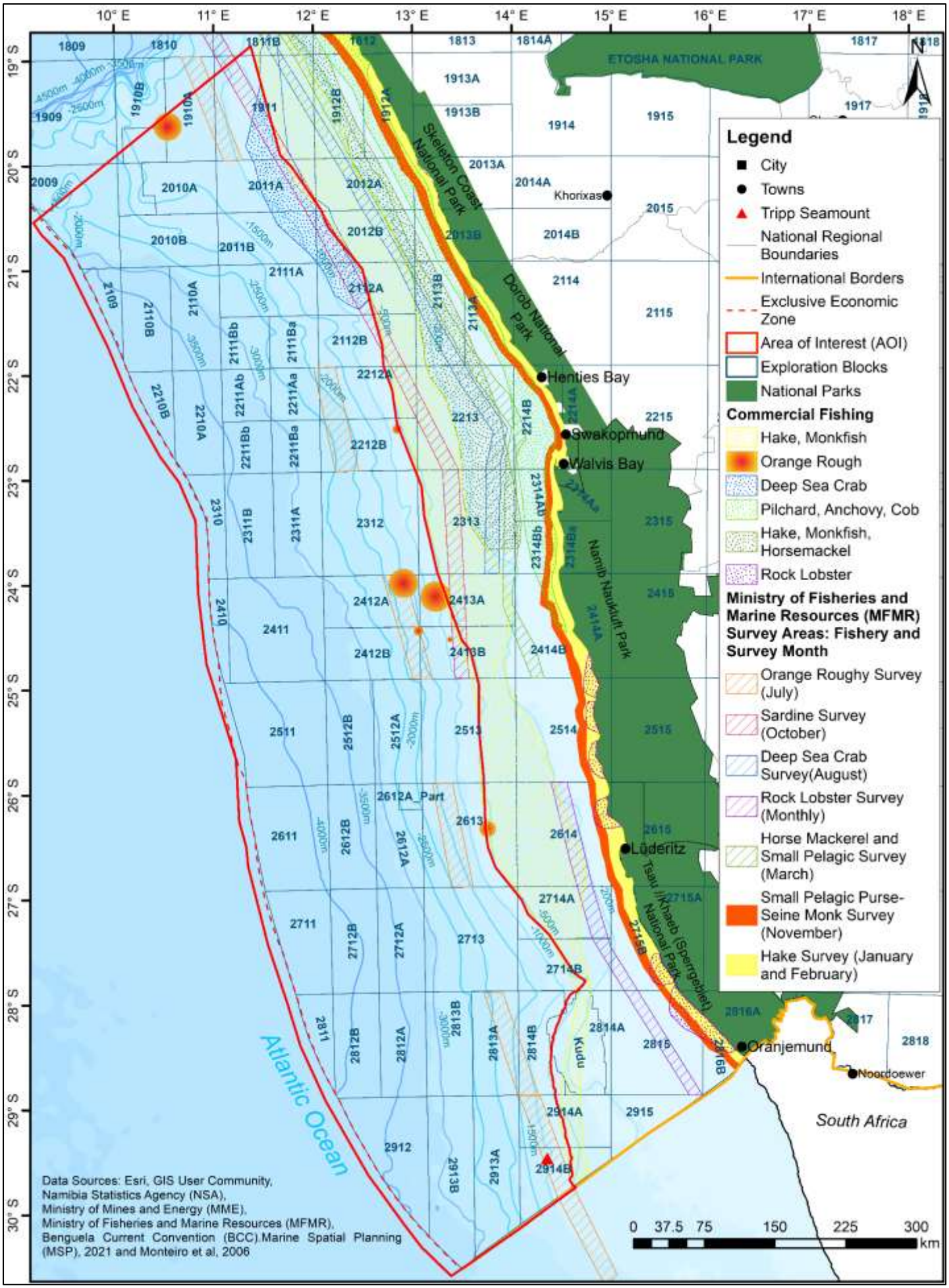

Figure 3.2: Known commercial fishing grounds and MFMR stock assessment survey areas with respect to the proposed Multiclient or Proprietary 2D/3D Seismic Survey over the Area of Interest (AOI).

Table 3.1: Summaries of the potential impacts without mitigation measures are applied with respect to the proposed Multiclient or Proprietary 2D/3D Seismic Survey over the Area of Interest (AOI).

Potential Impacting Factors	Impacted Sectors – WITHOUT mitigation measures applied – Survey Activities									
	Air quality	Water quality	Cape Fur Seal	Cetaceans	Sea Turtles	Sea Birds	Shore Birds	Fish	Fisheries	Tuna Fishery
Seismic Noise – short term	No impact	No impact	Insignificant impact	Moderate impact	Low-Moderate impact	Low-Moderate impact	No impact	Low-Moderate impact	Low-Moderate impact	Moderate - High impact
Seismic Noise – long term	No impact	No impact	Insignificant impact	Low impact	Insignificant impact	Insignificant impact	No impact	Low impact	Low impact	Low-Moderate impact
Light disturbance	No impact	No impact	No impact	No impact	No impact	Low-Moderate impact	No impact	No impact	No impact	No impact
Aircraft Noise –short term	No impact	No impact	Moderate - High impact	Low impact	No impact	Low impact	Moderate - High impact	No impact	No impact	No impact
Aircraft Noise –long term	No impact	No impact	Low impact	No impact	No impact	No impact	Low impact	No impact	No impact	No impact
Vessel exclusion zone – short term	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	Moderate impact	Moderate impact
Vessel exclusion zone – long term	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	Low impact	Low impact
Waste generation	No impact	Moderate impact	Moderate impact	Low impact	Moderate - High impact	Moderate impact	Low-Moderate impact	Low-Moderate impact	Low impact	Low impact
Air Emissions	Moderate impact	No impact	No impact	No impact	No impact	Insignificant impact	Insignificant impact	No impact	No impact	No impact
Major accidental spill of diesel/oil	Insignificant impact	High impact	Moderate impact	Moderate impact	Moderate impact	Low-Moderate impact	High impact	Moderate impact	Moderate - High impact	Moderate - High impact
Small accidental spills	No impact	Low impact	Insignificant impact	Insignificant impact	Insignificant impact	No impact	Insignificant impact	Insignificant impact	No impact	No impact
Ballast water	No impact	Moderate - High impact	No impact	No impact	No impact	No impact	No impact	Low-Moderate impact	Low impact	No impact

Table 3.2: Summaries of the potential impacts with mitigation measures are applied for the proposed Multiclient or Proprietary 2D/3D Seismic Survey over the Area of Interest (AOI).

Potential Impacting Factors		**Impacted Sectors – WITH mitigation measures applied – Survey Activities**								
	Air quality	**Water quality**	**Cape Fur Seals**	**Cetaceans**	**Sea Turtles**	**Sea Birds**	**Shore Birds**	**Fish**	**Fisheries**	**Tuna Fishery**
Seismic Noise – short term	No impact	No impact	Insignificant impact	Low impact	Low impact	Low impact	No impact	Low impact	Low-Moderate impact	Low impact
Seismic Noise – long term	No impact	No impact	Insignificant impact	Insignificant impact	No impact	Insignificant impact	No impact	Insignificant impact	Low impact	Low impact
Light disturbance	No impact	No impact	No impact	No impact	No impact	Low impact	No impact	No impact	No impact	No impact
Aircraft Noise – short term	No impact	No impact	Moderate impact	Insignificant impact	No impact	Insignificant impact	Moderate – impact	No impact	No impact	No impact
Aircraft Noise – long term	No impact	No impact	Insignificant impact	No impact	No impact	No impact	Low impact	No impact	No impact	No impact
Vessel exclusion zone – short term	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	Moderate impact	Low impact
Vessel exclusion zone – long term	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	Insignificant impact	Low impact
Waste generation MARPOL	No impact	Low impact	Insignificant impact	Insignificant impact	Low impact	Insignificant impact	Insignificant impact	No impact	No impact	No impact
Air Emissions MARPOL	Low-Moderate impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact	No impact
Major accidental spill of diesel/oil	Insignificant impact	Moderate - High impact	Low-Moderate impact	Low-Moderate impact	Low-Moderate impact	Low impact	Moderate - High impact	Low impact	Moderate impact	Moderate impact
Small accidental spills	No impact	Insignificant impact	Insignificant impact	Insignificant impact	Insignificant impact	No impact	Insignificant impact	Insignificant impact	No impact	No impact
Ballast water Control	No impact	Insignificant impact	No impact	No impact	No impact	No impact	No impact	Insignificant impact	No impact	No impact

3.3.1 Overall EIA Negative Impact Assessment Framework

The overall impact assessment framework adopted for this project used the Leopold matrix which is one of the best known internationally matrix methodology available for predicting the impact of a project on the environment. The Leopold matrix is a two-dimensional matrix cross-referencing the following:

- The activities linked to the project stages covering mobilisation and pre-survey preparations, actual survey operations, post survey operations, and non-routine or accidental events that are likely to have an impact on the receiving environment, and.

- The existing environments (physical, biological, and socioeconomic) that could possibly be affected by the project.

The activities linked to the proposed 2D/3D seismic survey operations are listed on one axis, while the receiving environments (physical, biological and socioeconomic) are listed on the other axis, and divided in following three (3) major groups:

- Physical conditions: marine and coastal air quality, change climate, seawater quality, seabed topography and sediment quality.

- Biological conditions: marine and coastal benthic ecology, fishes, turtles, seabirds, seals and cetaceans, and.

- Socioeconomic conditions and other users: marine and coastal fishing industry, tourism and recreation, minerals exploration and mining, other petroleum exploration licence.

The proposed 2D/3D seismic survey activities have the potential to affect the receiving environments in many ways. The first step in impact identification has been to identify the various types of activities associated with the mobilisation and pre-survey preparations, actual survey operations, post survey operations stages of the proposed survey, together with their associated emissions and discharges where appropriate.

At a high level, the main sources of impact of the proposed survey operations are:

- Planned or routine events: where an aspect (i.e., impact producing factor) is a result of routine Project activities. For example, the generation of atmospheric emissions from the survey and support vessels can be considered a planned event, and.

- Unplanned or non-routine (accidental) events: where an aspect is a result of mishaps or failures, including failure of equipment, procedures not being followed, human error, unforeseen events, or process equipment not performing as per design parameters. Typical examples are spills, leaks, emergency emissions, collisions, and explosions.

Overall, the following is the summary of the project related activities linked to planned/ routine and unplanned / accidental events of the mobilisation and pre-survey preparations, actual survey operations, post survey operations stages of the proposed survey:

1. Port of Walvis Bay or Lüderitz including onshore support operations and waste management.

2. Physical presence of survey and support vessels.

3. Physical disturbance of the survey operations.

4. Sound generation from 2D/3D seismic survey sources including sound of the survey and support vessels.

5. Increased light levels from routine vessels operations.

6. Atmospheric emissions from routine operations of the survey and support vessels.

7. Planned marine discharges.

8. Unplanned marine discharges (e.g., minor spillages of fuel, lubricants / maintenance oils.

9. Accidental event: Loss of vessel, equipment or material.

10. Accidental event: Collision with marine wildlife during vessel operations.

11. Accidental Event: Loss of Marine Gasoline Oil (MGO) containment on the survey or support vessels due to ship collision or another major event.

Accidental events can potentially lead to significant impacts, for example in the event of an oil spill. However, they are clearly not a part of the intended activity and their potential occurrence has a low probability of occurrence associated with it.

The activities / sources of potential impact due to the project and the receiving environment that could potentially be affected has been assessed in the EIA report and presented in form of a two-dimensional cross-referencing Leopold matrix covering the following:

- Sensitivity of receptors (Table 3.3).
- Impact magnitude (Table 3.4).
- Duration of exposure (Table 3.5).
- Geographical extent (Table 3.6).
- Probability, likelihood of occurrence (Table 3.7), and.
- Overall significant impacts (Table 3.8).

Table 3.3: Sensitivity of receptors (Physical, biological and socioeconomic receiving environment).

RECEIVING ENVIRONMENT SENSITIVITY			RECEPTORS / TARGETS THAT MAY BE IMPACTED (MARINE AND COASTAL RESOURCES)																	
SENSITIVITY RATING		CRITERIA	PHYSICAL ENVIRONMENT					BIOLOGICAL ENVIRONMENT						SOCIOECONOMIC ENVIRONMENT					
			Air Quality	Change Climate	Seawater Quality	Seabed Topography	Sediment Quality	Benthic Ecology	Fishes	Turtles	Seabirds	Seals	Cetaceans	Fishing Industry	Tourism and Recreation	Minerals Exploration and Mining	Other Petroleum Exploration Licence Holders	International Shipping Line	International Communication Lines / Cables
1	Negligible	The receptor or resource is resistant to change or is of little environmental value.																	
2	Low	The receptor or resource is tolerant of change without detriment to its character, is of low environmental or social value, or is of local importance.																	
3	Medium	The receptor or resource has low capacity to absorb change without fundamentally altering its present character, is of high environmental or social value, or is of national importance																	
4	High	The receptor or resource has moderate capacity to absorb change without significantly altering its present character, has some environmental or social value, or is of district/regional importance.																	
5	Very High	The receptor or resource has little or no capacity to absorb change without fundamentally altering its present character, is of very high environmental or social value, or is of international importance.																	
SOURCES OF POTENTIAL IMPACT																				
			ONSHORE / COASTAL																	
ROUTINE AND PHYSICAL PRESENCE OPERATIONAL ACTIVITIES	1.	Port of Walvis Bay including Onshore support operations and waste management	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
			OFFSHORE																	
	2.	Physical presence of survey and support vessels	1	1	2	1	1	1	2	4	2	2	4	4	1	1	1	1	1	1
	3.	Physical disturbance of the survey operations	1	1	1	1	1	1	2	4	2	2	4	4	1	1	1	1	1	1
	4.	Sound generation from the proposed 2D/3D seismic survey sources including sound of the survey and support vessels	1	1	1	1	1	1	4	4	4	2	4	4	1	1	1	1	1	1
	5.	Increased light levels from routine vessels operations	1	1	1	1	1	1	2	2	4	2	4	2	1	1	1	1	1	1
	6.	Atmospheric emissions from routine operations of the survey and support vessels	2	2	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
	7.	Planned marine discharges	1	1	2	1	1	1	2	2	2	2	3	2	1	1	1	1	1	1
ACCIDENTAL	8.	Unplanned marine discharges (e.g., minor spillages of fuel, lubricants / maintenance oils	1	1	2	1	1	1	2	2	2	2	3	2	1	1	1	1	1	1
	9.	Accidental event: Loss of vessel, equipment or material	1	1	1	1	1	1	2	2	2	2	3	2	1	1	1	1	1	1
	10.	Accidental event: Collision with marine wildlife during vessel operations	1	1	1	1	1	1	1	1	1	1	3	1	1	1	1	1	1	1
	11.	Accidental Event: Loss of Marine Gasoline Oil (MGO) containment on the survey or support vessels due to ship collision or other major event.	1	1	4	1	1	1	4	4	4	4	4	4	1	1	1	1	1	1

Table 3.4: Likely impact magnitude.

MAGNITUDE

SCALE	DESCRIPTION
0	no observable effect
1	low effect
2	tolerable effect
3	medium high effect
4	high effect
5	very high effect (devastation)

SOURCES OF POTENTIAL IMPACT			RECEPTORS / TARGETS THAT MAY BE IMPACTED (MARINE AND COASTAL RESOURCES)																	
			PHYSICAL ENVIRONMENT					BIOLOGICAL ENVIRONMENT						SOCIOECONOMIC ENVIRONMENT						
			Air Quality	Climate Change	Seawater Quality	Seabed Topography	Sediment Quality	Benthic Ecology	Fishes	Turtles	Seabirds	Seals	Cetaceans	Fishing Industry	Tourism and Recreation	Minerals Exploration and Mining	Other Petroleum Exploration Licence Holders	International Shipping Line	International Communication Lines / Cables
			ONSHORE / COASTAL																	
ROUTINE AND PHYSICAL PRESENCE OPERATIONAL ACTIVITIES	1.	Port of Walvis Bay including Onshore support operations and waste management	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
			OFFSHORE																	
	2.	Physical presence of survey and support vessels	0	0	3	0	0	0	3	3	3	3	3	2	1	0	1	1	0
	3.	Physical disturbance of the survey operations	0	0	0	0	0	0	3	3	3	3	3	2	1	0	1	1	0
	4.	Sound generation from the proposed 2D/3D seismic survey sources including sound of the survey and support vessels	0	0	0	0	0	0	3	1	1	1	3	2	1	0	1	1	0
	5.	Increased light levels from routine vessels operations	0	0	0	0	0	0	1	1	3	1	3	0	1	0	1	1	0
	6.	Atmospheric emissions from routine operations of the survey and support vessels	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	7.	Planned marine discharges	0	0	3	0	0	0	1	3	3	3	3	0	1	0	1	1	0
ACCIDENTAL	8.	Unplanned marine discharges (e.g. minor spillages of fuel, lubricants / maintenance oils	0	0	1	0	0	0	3	3	3	3	3	4	1	0	1	1	0
	9.	Accidental event: Loss of vessel, equipment or material	0	0	1	0	0	0	1	1	1	1	3	3	1	0	1	1	0
	10.	Accidental event: Collision with marine wildlife during vessel operations.	0	0	0	0	0	0	0	0	0	0	3	0	1	0	1	1	0
	11.	Accidental Event: Loss of Marine Gasoline Oil (MGO) containment on the survey or support vessels due to ship collision or other major event.	0	0	1	0	0	0	4	4	4	4	4	4	1	0	1	1	0

Table 3.5: Likely impact duration / time period of exposure.

DURATION OF IMPACT EXPOSURE

SCALE	DESCRIPTION
T	Temporary
P	Permanent

SOURCES OF POTENTIAL IMPACT			RECEPTORS / TARGETS THAT MAY BE IMPACTED (MARINE AND COASTAL RESOURCES)																	
			PHYSICAL ENVIRONMENT					BIOLOGICAL ENVIRONMENT						SOCIOECONOMIC ENVIRONMENT						
			Air Quality	Climate Change	Seawater Quality	Seabed Topography	Sediment Quality	Benthic Ecology	Fishes	Turtles	Seabirds	Seals	Cetaceans	Fishing Industry	Tourism and Recreation	Minerals Exploration and Mining	Other Petroleum Exploration Licence Holders	International Shipping Line	International Communication Lines / Cables
			ONSHORE / COASTAL																	
	ROUTINE AND PHYSICAL PRESENCE OPERATIONAL ACTIVITIES	1. Port of Walvis Bay including Onshore support operations and waste management	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
		OFFSHORE																		
		2. Physical presence of survey and support vessels	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
		3. Physical disturbance of the survey operations	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
		4. Sound generation from the proposed 2D/3D seismic survey sources including sound of the survey and support vessels	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
		5. Increased light levels from routine vessels operations	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
		6. Atmospheric emissions from routine operations of the survey and support vessels	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
		7. Planned marine discharges	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
	ACCIDENTAL	8. Unplanned marine discharges (e.g., minor spillages of fuel, lubricants / maintenance oils	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
		9. Accidental event: Loss of vessel, equipment or material	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
		10. Accidental event: Collision with marine wildlife during vessel operations.	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T
		11. Accidental Event: Loss of Marine Gasoline Oil (MGO) containment on the survey or support vessels due to ship collision or another major event.	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T	T

Table 3.6: Likely impact geographical coverage / extent.

GEOGRAPHICAL COVERAGE

SCALE	DESCRIPTION
L	limited impact on location
O	impact of importance for municipality;
R	impact of regional character
N	impact of national character
M	impact of cross-border character

			RECEPTORS / TARGETS THAT MAY BE IMPACTED (MARINE AND COASTAL RESOURCES)																	
			PHYSICAL ENVIRONMENT					BIOLOGICAL ENVIRONMENT						SOCIOECONOMIC ENVIRONMENT						
			Air Quality	Climate Change	Seawater Quality	Seabed Topography	Sediment Quality	Benthic Ecology	Fishes	Turtles	Seabirds	Seals	Cetaceans	Fishing Industry	Tourism and Recreation	Minerals Exploration and Mining	Other Petroleum Exploration Licence Holders	International Shipping Line	International Communication Lines / Cables
SOURCES OF POTENTIAL IMPACT			**ONSHORE / COASTAL**																	
	ROUTINE AND PHYSICAL PRESENCE OPERATIONAL ACTIVITIES	1. Port of Walvis Bay including Onshore support operations and waste management	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
			OFFSHORE																	
		2. Physical presence of survey and support vessels	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
		3. Physical disturbance of the survey operations	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
		4. Sound generation from the proposed 2D/3D seismic survey sources including sound of the survey and support vessels	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
		5. Increased light levels from routine vessels operations	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
		6. Atmospheric emissions from routine operations of the survey and support vessels	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
		7. Planned marine discharges	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
	ACCIDENTAL	8. Unplanned marine discharges (e.g., minor spillages of fuel, lubricants / maintenance oils	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
		9. Accidental event: Loss of vessel, equipment or material	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
		10. Accidental event: Collision with marine wildlife during vessel operations.	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L	L
		11. Accidental Event: Loss of Marine Gasoline Oil (MGO) containment on the survey or support vessels due to ship collision or another major event.	L	L	O	L	L	L	O	O	O	O	O	O	L	L	L	L	L	L

Table 3.7: Likely impact probability, likelihood of occurrence.

PROBABILITY, LIKELIHOOD

SCALE	DESCRIPTION
A	Extremely unlikely (e.g. never heard of in the industry)
B	Unlikely (e.g. heard of in the industry but considered unlikely)
C	Low likelihood (egg such incidents/impacts have occurred but are uncommon)
D	Medium likelihood (e.g. such incidents/impacts occur several times per year within the industry)
E	High likelihood (e.g. such incidents/impacts occurs several times per year at each location where such works are undertaken)

SOURCES OF POTENTIAL IMPACT			RECEPTORS / TARGETS THAT MAY BE IMPACTED (MARINE AND COASTAL RESOURCES)																	
			PHYSICAL ENVIRONMENT					BIOLOGICAL ENVIRONMENT						SOCIOECONOMIC ENVIRONMENT						
			Air Quality	Climate Change	Seawater Quality	Seabed Topography	Sediment Quality	Benthic Ecology	Fishes	Turtles	Seabirds	Seals	Cetaceans	Fishing Industry	Tourism and Recreation	Minerals Exploration and Mining	Other Petroleum Exploration Licence Holders	International Shipping Line	International Communication Lines / Cables
			ONSHORE / COASTAL																	
ROUTINE AND PHYSICAL PRESENCE OPERATIONAL ACTIVITIES	1.	Port of Walvis Bay including Onshore support operations and waste management	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
			OFFSHORE																	
	2.	Physical presence of survey and support vessels	A	A	C	A	A	A	C	C	C	C	C	C	A	A	A	A	A	A
	3.	Physical disturbance of the survey operations	A	A	A	A	A	A	C	C	C	C	C	C	A	A	A	A	A	A
	4.	Sound generation from the proposed 2D/3D seismic survey sources including sound of the survey and support vessels	A	A	A	A	A	A	C	C	C	C	C	C	A	A	A	A	A	A
	5.	Increased light levels from routine vessels operations	A	A	A	A	A	A	A	A	C	A	A	A	A	A	A	A	A	A
	6.	Atmospheric emissions from routine operations of the survey and support vessels	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A	A
	7.	Planned marine discharges	A	A	B	A	A	A	B	B	B	A	A	A	A	A	A	A	A	A
ACCIDENTAL	8.	Unplanned marine discharges (e.g., minor spillages of fuel, lubricants / maintenance oils	A	A	B	A	A	A	B	B	B	B	B	B	B	A	A	A	A	A
	9.	Accidental event: Loss of vessel, equipment or material	A	A	A	A	A	A	A	A	A	A	A	B	A	A	A	A	A	A
	10.	Accidental event: Collision with marine wildlife during vessel operations.	A	A	B	A	A	A	B	B	B	B	B	B	A	A	A	A	A	A
	11.	Accidental Event: Loss of Marine Gasoline Oil (MGO) containment on the survey or support vessels due to ship collision or other major event.	A	A	B	A	A	A	B	B	B	B	B	B	A	A	A	A	A	A

Table 3.8: Likely impact significant of impacts.

SIGNIFICANCE

IMPACT SEVERITY (Magnitude, Duration, Extent, Probability)	RECEPTOR CHARACTERISTICS (SENSITIVITY)				
	Very High (5)	High(4)	Medium (3)	Low (2)	Negligible (1)
Very High (5)	Major [5/5]	Major [4/5[	Moderate [3/5]	Moderate [2 /5]	Minor 1/5
High (4)	Major [5/4]	Major [4/4]	Moderate [3/4]	Moderate [2/4]	Minor[1/4]
Medium (3)	Major [5/3]	Moderate[4/3]	Moderate[3/3]	Minor[2/3]	None[1/3]
Low (2)	Moderate [5/2]	Moderate[4/2]	Minor[3/2]	None[2/2]	None[1/2]
Negligible (1)	Minor [5/1]	Minor [4/1]	None [3/1]	None [2/1]	None [1/1]

SOURCES OF POTENTIAL IMPACT			RECEPTORS / TARGETS THAT MAY BE IMPACTED (MARINE AND COASTAL RESOURCES)																
			PHYSICAL ENVIRONMENT					BIOLOGICAL ENVIRONMENT						SOCIOECONOMIC ENVIRONMENT					
			Air Quality	Climate Change	Seawater Quality	Seabed Topography	Sediment Quality	Benthic Ecology	Fishes	Turtles	Seabirds	Seals	Cetaceans	Fishing Industry	Tourism and Recreation	Minerals Exploration and Mining	Other Petroleum Exploration Licence Holders	International Shipping Line	International Communication Lines / Cables
		ONSHORE / COASTAL																	
	ROUTINE AND PHYSICAL PRESENCE OPERATIONAL ACTIVITIES	1. Port of Walvis Bay including Onshore support operations and waste management	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		OFFSHORE																	
		2. Physical presence of survey and support vessels	2/1	1/1	2/1	1/1	1/1	1/1	1/1	1/1	2/1	2/1	2/1	4/1	1/1	1/1	1/1	1/1	1/1
		3. Physical disturbance of the survey operations	2/1	2/1	2/1	2/1	2/1	2/1	4/1	3/2	3/2	3/2	3/2	4/1	1/1	1/1	1/1	1/1	1/1
		4. Sound generation from the proposed 2D/3D seismic survey sources including sound of the survey and support vessels	1/1	1/1	1/1	1/1	1/1	1/1	4/2	4/2	2/1	2/1	4/2	4/2	1/1	1/1	1/1	1/1	1/1
		5. Increased light levels from routine vessels operations	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	4/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		6. Atmospheric emissions from routine operations of the survey and support vessels	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1
		7. Planned marine discharges	1/1	1/1	3/2	1/1	1/1	1/1	3/2	3/2	3/2	3/2	3/2	2/1	1/1	1/1	1/1	1/1	1/1
	ACCIDENTAL	8. Unplanned marine discharges (e.g. minor spillages of fuel, lubricants / maintenance oils	1/1	1/1	3/2	1/1	1/1	1/1	3/2	3/2	3/2	3/2	3/2	3/2	1/1	1/1	1/1	1/1	1/1
		9. Accidental event: Loss of vessel, equipment or material	1/1	1/1	1/1	1/1	1/1	1/1	1/1	3/2	3/2	3/2	3/2	4/1	1/1	1/1	1/1	1/1	1/1
		10. Accidental event: Collision with marine wildlife during vessel operations.	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	1/1	4/1	1/1	1/1	1/1	1/1	1/1
		11. Accidental Event: Loss of Marine Gasoline Oil (MGO) containment on the survey or support vessels due to ship collision or other major event.	1/1	1/1	4/1	1/1	1/1	1/1	3/2	3/2	3/2	3/2	3/2	3/2	3/2	1/1	1/1	1/1	1/1

4. EMP IMPLEMENTATION AND MITIGATION MEASURES

4.1 Aims and Objectives of the EMP

This EMP Report has the following specific objectives:

1. Ensure that the key environmental impacts identified and assessed in the EIA Report are addressed.

2. Ensure compliance with all applicable national regulations and MARPOL (marine pollution) regulations and waste disposal procedure and all legal frameworks and other requirements that must be adhered to.

3. Promote environmental management and communicate the aims and goals of the project EMP to all stakeholders, contractor, subcontractor and all key employees of the Proponent who will be involved in the proposed 2D/3D seismic survey activities operations.

4. Incorporate environmental management principles into project design and operational procedures.

5. Ensure all workers, contractors, sub-contractors and all those who are involved in the project are meeting all requirements with respect to environmental management.

6. Address issues and concerns raised in the EIA process.

7. Serve as an action plan for environmental management.

8. Provide a framework for implementing commitments to address all the key impacts identified in the EIA Report.

9. Provided a framework for preparing and maintaining records of project environmental performance (i.e., monitoring, audits and compliance tracking), and.

10. Provide an environmental monitoring plan whose aim is to ensure that the mitigation measures during the project mobilisation and pre-survey preparations, actual survey operations, post survey operations, and non-routine or accidental events are effectively implemented, and the positive impacts are enhanced, and.

11. Provide a basis for preparing the “close out” report to be submitted to the Government (Ministry of Mines and Energy, (MME), Ministry of Environment, Forestry, and Tourism (MEFT), Ministry of Fisheries and Marine Recourse (MFMR) and the Ministry of Work and Transport (MWT), Department of Maritimes Affairs) once the proposed 2D/3D seismic survey activities operations have been completed.

4.2 Principles of Environmental Management

The following principles of environmental management, as stated in Part II, Section 3 of the Environmental Management Act, 2007, Act No. 7 of 2007 have been considered in the preparation of this EMP for proposed 2D/3D seismic survey activities in the Walvis, Lüderitz and Orange Basins, offshore Namibia:

1. Use renewable resources on a sustainable basis for the benefit of present and future generations.

2. Involve the community in natural resources management and promote and facilitate the sharing of benefits from the use of resources.

3. Promote public participation in decisions affecting the environment and ensure that their interests, needs and values are considered.

4. Promote equitable access to all environmental resources and consider the functional integrity of ecological systems so that the sustainability of systems is ensured and that harmful effects are prevented.

5. Undertake environmental assessments for all projects that may adversely impact on the environment, or the use of natural resources.

6. Promote sustainable development in all aspects relating to the environment.

7. Protect and respect Namibia's cultural and natural heritage, including its biological diversity, for the benefit of present and future generations.

8. Reduce the generation of waste and polluting substances at source by adopting the option that provides the most benefit or causes the least environmental damage, at costs acceptable by society, in the short- and long term.

9. Promote the reduction, re-use and recycling of waste.

10. Adopt the "polluter pays" principle.

11. In cases where there is enough evidence to conclude that there are threats of serious or irreversible damage to the environment, the lack of full scientific certainty may not be used as an excuse for postponing cost-effective measures to prevent environmental degradation, and.

12. Prevent damage to the environment. if this is not possible, reduce, limit, or control activities that may cause damage to the environment.

4.3 The EMP Framework

The following is the summary of the EMP Framework based on the precautionary principles and principles of environmental management as detailed in the Environmental Management Act, 2007, Act No. 7 of 2007 for the proposed offshore 2D/3D seismic survey activities:

- The proposed 2D/3D seismic survey activities can only be implemented once the MEFT has issued an Environmental Clearance Certificate.

- All interested and affected parties (I&APs), particularly other users of the marine environment, must be notified prior to the survey start.

- Attempts must be made to reduce the likelihood of possible cumulative impacts through co-ordination of activities with other operators / users of the marine environment.

- All communications and public consultation should be channelled through a single interface, usually the Proponent's Representative (PR) / Operations Manager (OM).

- Conditions and provisions as detailed in this EMP shall be adhered to for conservation and preservation of the natural environment.

- The Proponent's Representative (PR) / Operations Manager (OM) is responsible for the implementation of the remediation of any environmental damage in accordance with the recommended methodology and/or the best available procedures / practices.

- Vessel crew should be trained in good environmental practices and onboard supervision shall always be applied.

- A Marine Mammal Observer (MMO/ Fisheries Liaison Officer (FLO) and /or Independent Marine Observer (IMO) who is familiar with fisheries sectors in the area and experienced in seabird and marine mammal identification and observation techniques must be appointed to be onboard thought the survey period, and.

- In the absence of any specific mitigation measures being provide in this EMP, the Proponent shall always adopt the precautionary approach.

4.4 Hierarchy of Mitigation Measures Implementation

A hierarchy of methods for mitigating significant adverse effects has been adopted in order of preference and as follows:

(i) Enhancement, e.g., protection of habitats through operational approaches.

(ii) Avoidance, e.g., flexible implementation timing to avoid effects on ecological receptors.

(iii) Reduction, e.g., limitation of effects on receptors through design or operational changes, and.

(iv) Compensation, e.g., community benefits.

4.5 Roles and Responsibilities

4.5.1 Overview

Management and monitoring of the environmental elements that may be affected by the different activities of the 2D/3D seismic survey through the allocation of resources, roles and responsibilities is an important element of the mitigatory process. This EMP provides for the human resources roles and responsibilities necessary for the implementation and monitoring of the key components of the mitigation measures.

4.5.2 Proponent's Representative (PR) / Operations Manager (OM)

The proponent shall appoint a **Proponent's Representative (PR) / Operations Manager (OM)** with responsibilities not limited to the following with respect to the EMP implementation:

- Act as the PR and implementing agent on behalf of the proponent.
- Ensure that the proponent's responsibilities are executed in compliance with the relevant national and international regulations and best practices.
- Ensure that all the necessary environmental authorisations and permits have been obtained before the implementation of the proposed activities.
- Assist any contractor / subcontractor and monitoring specialists in finding environmentally responsible solutions to challenges that may arise during the survey.
- Should the operations manager believe a serious threat to, or impact on the receiving environment may be caused by the seismic survey activities, he/she may stop work and the proponent must be informed of the reasons for the stoppage as soon as possible.
- The OM has the authority to issue fines for transgressions of basic conduct rules and/or contravention of the EMP.
- Should any contractor / subcontractor and monitoring specialists or his/her employees fail to show adequate consideration for the environmental aspects related to the EMP, the operations manager can have person(s) and/or equipment removed from the vessel or work suspended until the matter is remedied.

- ❖ Maintain an open and direct lines of communication between the stakeholders and proponent, as well as any other identified Interested and Affected Parties (I&APs) with regards to environmental matters, and.

- ❖ Attend regular meetings / daily briefings and inspections as may be required.

4.5.3 Safety, Health and Environment (SHE) Officer / Environmental Coordinator

The proponent shall appoint a Safety, Health and Environment (SHE) Officer / Environmental Coordinator with responsibilities not limited to the following with respect to the EMP implementation:

- ❖ Assist the OM in ensuring that the necessary environmental authorisations and permits have been obtained and any subsequent fillings are prepared and lodged accordingly.

- ❖ Assist the OM and Contractor in finding environmentally responsible solutions to challenges that may arise.

- ❖ Conduct daily safety and environmental management briefings as per EMP requirements or as may be required.

- ❖ Carry out regular site inspections (on average once per week) with regards to compliance with the EMP. report any non-compliance(s) to the OM as soon as possible.

- ❖ Continuously review the EMP and recommend additions and/or changes to the EMP document as may be required and in consultations with the OM and monitoring specialists.

- ❖ Monitor the Contractor's environmental awareness training for all new personnel joining the operations.

- ❖ Keep records of all activities related to environmental control and monitoring. the latter to include a photographic record of all the major incidents / incidences, and.

- ❖ Attend regular meetings.

4.5.4 Other Contractors and Subcontractors

The responsibilities of the **Contractors and Subcontractors** that may be appointed by the proponent to undertake certain activities of the proposed include but not limited to the following with respect to the EMP implementation:

- ❖ Comply with the EMP provisions of relevant national and international regulations and best practices.

- ❖ Preparation and submission to the proponent through the Project HSE of the following Management Plans:

    - o Environmental Awareness Training and Inductions.

    - o Emergency Preparedness and Response.

    - o Waste Management, and.

    - o Health and Safety.

- ❖ Ensure adequate environmental awareness training for senior site personnel.

- ❖ Environmental awareness presentations (inductions) to be given to all personnel prior to work commencement. the Project HSE shall provide the content and topics that should be covered the awareness materials and should not be limited to the following guidance:

- The importance of complying with the EMP provisions.
- Roles and responsibilities, including emergency preparedness.
- Basic rules of conduct (Do's and Don'ts).
- EMP: aspects, impacts and mitigation.
- Fines for failure to adhere to the EMP, and.
- Health and safety requirements.

❖ Record keeping of all environmental awareness training and induction presentations, and.

❖ Attend regular meetings and environmental reviews /inspections of the operations.

4.5.5 Environmental Monitoring Specialist (MMO and FLO)

The proponent shall appoint a Marine Mammal Observation (MMO) and Fishery Liaison Officers (FLO) with responsibilities not limited to the following with respect to the EMP implementation:

(i) MMO:

❖ Record a written physical description of a marine mammal.

❖ Log which direction it is travelling in.

❖ Describe its behaviour.

❖ Log the time.

❖ Inform the contractor's seismic observers that they need to stop firing until further notice (which will be when the marine mammal has exited the exclusion zone).

❖ Track the marine mammal and keep the seismic observers informed.

❖ Attend regular meetings and environmental reviews /inspections of the operations, and.

❖ Prepare daily, weekly, monthly / final closure monitoring report as may be applicable.

(ii) FLO:

❖ Act as the link between fishing vessels in the seismic survey area and seismic vessel.

❖ Work closely with the OM and the fishing industry to minimise any potential impact of the project upon local fishing. The objective is to facilitate as far as possible, an arrangement based on coexistence.

❖ Keeps local fishing vessels informed of ongoing work on major projects within that area. This allows local fishermen to understand the potential hazards and to plan their fishing activities accordingly. It also enables the seismic survey project to proceed unhindered by fishing vessels, saving significant time and money for the client or seismic contractor.

❖ Attend regular meetings and environmental reviews /inspections of the operations, and.

❖ Prepare daily, weekly, monthly / final closure monitoring report as may be applicable.

4.6 Specific Mitigation Measures

4.6.1 Specific Mitigation Measures Implementation

Based on the findings of the impact assessment as detailed in the EIA Report and summarised in Table 3.1-3.6 in this report, Table 4.1-4.3 provides the detailed specific mitigations measures to be implemented by the proponent with respect to the proposed 2D/3D seismic survey operations. The following is the summary of the key project stages linked to the migration measures:

(i) **Mobilisation and Pre-Survey Preparations (Table 4.1):**

- ❖ Pre-survey planning.
- ❖ Emergency and Contingency planning.
- ❖ EIA submission and approval.
- ❖ Environmental mitigation.
- ❖ Compliance with EIA and EMP.
- ❖ Notification of and coordination with relevant parties., and.
- ❖ Appointment of MMO and FLO.

(ii) **Actual Survey Operations (Table 4.2):**

- ❖ Adherence to EMP.
- ❖ monitoring of effects and performance assessment.
- ❖ Pollution control and waste management.
- ❖ Equipment management.
- ❖ Seismic source operation.
- ❖ Communication and notification to other vessels.
- ❖ Exclusion of other vessels.
- ❖ Prevention of emergencies, and.
- ❖ Emergency management procedures including oil spills.

(iii) **Post Survey Operations (Table 4.3):**

- ❖ Survey vessels to leave.
- ❖ Inform relevant parties of survey completion.
- ❖ Final waste disposal.
- ❖ Final observation reports, and.
- ❖ Close-out reports.

Table 4.1: Mobilisation and Pre-Survey Preparations.

ACTIVITY	RATIONALE and MOTIVATION	COURSE OF ACTION TO FULFIL EMP PROVISOS	DESIGNATED PERSON RESPONSIBLE	CONTROL and VERIFICATION	TIMING	REQUIREMENT FOR "CLOSEOUT" REPORT
Pre-survey Planning	Allocate provisions for Environmental monitoring and Liaison with fishing, mining, petroleum industries and other users of the sea.	1) Make provision for including Marine Mammal Observation (MMO) and Fishery Liaison Officers (FLO) as crew on board the seismic vessel. 2) Notify relevant government departments Ministry of Mines and Energy (MME), Ministry of Environment, Forestry, and Tourism (MEFT), Ministry of Fisheries and Marine Recourse (MFMR) and the Ministry of Work and Transport (MWT) Department of Maritimes Affairs Search and Rescue, Namibian Ports Authority and port captains 3) Determine the extent of local fishing, petroleum and mining activities within the survey area. 4) Notify other marine users, fishing industry (Namibian and foreign), marine petroleum, mineral prospecting and mining licence holders. - Notification must include ➢ navigational co-ordinates of the survey area ➢ timing and duration of proposed activities ➢ designated safety zone around the seismic vessel (500 m) 5) Finalise negotiations and resolve any conflict over the allocation of user rights prior to the commencement of operation. 6) Charter a local vessel to act as chase boat	Eastern Echo FZE, Operations Manager Seismic Contractor Environmental Coordinator	Copies of all correspondence	Prior to commencing survey operations	Minutes of meetings Copies of all correspondence MMO / FLO /SHE reports
Emergency and Contingency Planning	Preparation for any emergency that could result in an environmental impact	1) Company (or representative) Emergency Response Plan. 2) Seismic & support vessel Contractor Emergency Response Plan (including. MEDIVAC) 3) Helicopter Operator Emergency Response Plan. 4) Oil Pollution Emergency Plan should refer to the National Marine Pollution Contingency Plan (NMPCP) 5) Ensure there is adequate protection and indemnity insurance cover for oil pollution 6) Produce vessel's seaworthiness certificate and/or classification stamp	Seismic Contractor SHE Officer			Confirm compliance and justify any omissions
EIA submission and Approval / Environmental Clearance	Compliance with legislative requirements – Namibian EA Policy	Submit EIA and EMP to Ministry of Environment, Forestry, and Tourism for approval and issuing of Environmental Clearance Certificate (ECC)	Eastern Echo FZE / Subcontractor		Prior to commencing survey operations	Final EIA and EMP Reports with ECC issued
Environmental Mitigation	Minimise impact on cetaceans and turtles	1) Employ an MMO 2) Use visual monitoring during daytime 3) Use passive acoustic monitoring system for detections. 4) Initiate soft-start procedure. 5) Use 'turtle-friendly' tail buoys. Alternatively, the existing tail buoys should be fitted with either exclusion or deflector 'turtle guards'.	Eastern Echo FZE, Seismic Contractor Environmental Coordinator		Prior to commencing survey / appointment contractors	None

Table 4.1: *Cont.*

ACTIVITY	RATIONALE and MOTIVATION	COURSE OF ACTION TO FULFIL EMP PROVISOS	DESIGNATED PERSON RESPONSIBLE	CONTROL and VERIFICATION	TIMING	REQUIREMENT FOR "CLOSEOUT" REPORT
Compliance with EIA and EMP	Eastern Echo FZE and contractor to fulfil requirements set by MEFT, MME and MARPOL and Commit to adherence to EMP	1) Ensure copies of ECC, EIA and EMP Reports are onboard throughout survey period 2) Ensure that a copy of the EIA report is provided to the Seismic contractor. 3) Elucidate all personnel of the EMP requirements and motivation. Assign duties appropriately. 4) Ensure availability of relevant personnel and suitable equipment to meet EMP requirements. 5) Notify other marine users and promote cooperation to minimise cumulative impacts.	Seismic Contractor Operations Manager, Environmental Coordinator, Equipment Quartermaster, SHE Officer	Minutes of meetings Copies of all environmental awareness training manuals and schedules Self-audit	Prior to commencing survey operations	Minutes of meetings Signed acknowledgment of receipt of EIA by Contractor Confirm compliance and justify any omissions
Notification of and coordination of activities with relevant parties	Ensure that other users are aware of the seismic survey. Promote cooperation and coexistence with other users to minimise cumulative environmental impacts	1) Notify relevant government ministries and departments – MFMR, MEFT, MME and MWT / Maritimes Affairs (SAR) 2) Notify other marine users, fishing industry (Namibian and foreign), marine petroleum, mineral prospecting and mining licence holders. - Notification must include ➢ Navigational co-ordinates of the survey area ➢ Timing and duration of proposed activities ➢ Designated safety zone around the seismic vessel (500m). 3) Notify fishing operators through recognised fishing associations, MFMR, fishing companies, agents or through MME ➢ Notify operational fishing vessels directly where required or encountered 4)Transmit Daily Radio Navigation Warnings and Notices to Mariners the survey vessel's position and operation progress	Seismic Contractor Operations Manager, Environmental Coordinator	Copies of all correspondence Copies of notices sent	Notice to Mariners at least 24 hours before start of survey Daily positional updates throughout survey	Copies of notices and list of recipients/ addressees
Appointment of FLO / MMO	Ensure compliance with EMP Minimise impacts	Appoint trained FLO who are familiar with fisheries operational in the area and MMO must have experience in seabird, turtle, seal and marine mammal identification and observation techniques.	Seismic Contractor	FLO / MMO contract and reports	Prior to commencing survey	Monitoring reports

Table 4.2: Actual survey operations.

ACTIVITY	RATIONALE and MOTIVATION	COURSE OF ACTION TO FULFIL EMP PROVISOS	DESIGNATED PERSON RESPONSIBLE	CONTROL and VERIFICATION	TIMING	REQUIREMENT FOR "CLOSEOUT" REPORT
Adherence to EMP and Industry Best Practices	Operate in an environmentally responsible manner	1) Comply fully with the EMP (compliance means all activities are undertaken successfully and details recorded). 2) Abide by terms of internationally recognised Environmental Management Policy ➢ Include environmental awareness training, waste management, environmental monitoring, procedure and data recording. 3) Comply with the Joint Nature Conservation Committee (JNCC) "guidelines for minimising the risk of injury and disturbance to marine mammals from seismic survey" 4) Comply with "*Environmental Guidelines for Worldwide Geophysical Operations*" as issued by the Energeo Alliance's, formerly known as the International Association of Geophysical Contractors (IAGC)	Operations Manager and Seismic Contractor, FLO and MMO	Self-audits	During the survey period	Copies of self-audit reports FLO and MMO reports
Helicopters Crew changes, Services or in an event of an Emergency as may be required	Minimise noise impact to coastal fauna	1) Instruct helicopter operator and pilots not to overfly Ramsar sites, islands, coastal reserves, bird and seal breeding colonies. If not possible ➢ Minimum altitudes of 600 m over nature conservation/breeding areas ➢ No-fly zone 3km seaward and 1km landward of sensitive area ➢ Avoid seabird colonies on the numerous offshore islands 2) Brief all pilots on the ecological risks associated with flying over seabird and seal colonies and at a low level parallel to the coast. 3)Avoid prolonged coast-parallel flights within 1 nautical mile of the shore) 4) Maintain reasonable altitude over sea (600 m) if cetaceans are spotted. 5) Report any deviations from pre-set flight paths.	Operations Manager Environmental coordinator Helicopter operator	Report deviation from prescribed flight path	Ad Hoc As required	Log of flight paths
Equipment management	Minimise equipment loss overboard and minimise hazards on seafloor or floating	1)Keep a record of all items lost overboard including time and location 2) Inform relevant authorities (MEFT, MFMR, MME), and other users in the area (mining houses, fishing companies). 3) When any items that constitute a seafloor or navigation hazard are lost a standard form must be completed including: ➢ Date and cause of loss ➢ Details of equipment (Type, Size) ➢ Vessel ➢ Location ➢ Sea state and weather ➢ Nature of the Seafloor	Seismic Contractor Operations Manager Equipment quartermaster Environmental officer	Incident records	During the operation	List of lost equipment Copy of record sheet

Table 4.2: *Cont.*

ACTIVITY	RATIONALE and MOTIVATION	COURSE OF ACTION TO FULFIL EMP PROVISOS	DESIGNATED PERSON RESPONSIBLE	CONTROL and VERIFICATION	TIMING	REQUIREMENT FOR "CLOSEOUT" REPORT
Pollution control and Waste Management	Minimise marine pollution Maximise recycling Adherence to MARPOL 73/78	1) Minimise pollution and maximise recycling by implementing and maintaining a company waste management policy. 2) Comply with legal requirements for waste management and pollution control (for air and water quality levels at sea) by educating crew, adhering to MARPOL policies and monitoring practices. 3) Ensure all crew is trained in spill management. 4) Ensure that a waste disposal contractor disposes of waste returned to port at a licensed landfill site. 5) Ensure waste disposal is carried out in accordance with appropriate laws. 5) Supply vessels must comply with internationally agreed MARPOL standards **MARPOL Procedures and Guidelines** • *General waste*: Minimise waste generation -No disposal overboard. • *Galley waste*: Reduce to < 25 mm prior to disposal overboard if < 12 NM from shore - No disposal within 3 NM of the coast. • Disposal without macerating – vessel must be >12 nautical miles from shore. • *Medical waste*: Seal in aseptic containers for disposal onshore. • *Deck drainage*: Use biodegradable, non-toxic cleaning agents • Ensure that weather decks are kept free of spillage. Mop any spill immediately. Collect in oily water separator systems. • *Machinery space drainage*: Collect used oil and oily water • Filter oily water and release water of < 5ppm oil in water • Dispose of sludge in appropriate facility at port. • Return waste oil to shore for processing • *Solid waste:* Incinerate onboard or store and transport to port for disposal on land. • *Hazardous waste:* record volume and type brought onboard • Store in dedicated waste containers • Dispose of in the designated site at port. • *Sewage:* use approved treatment plants set to MARPOL standards. Discharge only where the high wind and wave energy is expected to result in rapid dispersal. Discharge treated sewage between 4 and 12 NM from the coast. No sewage discharge within 4 NM of the coast. No treatment needed if beyond 12 NM from coast, However, vessel must be moving at ≥4 knots before discharging at a moderate rate. • *Metal:* Send to shore for recycling or disposal. • *Minor oil spill*: Use oil absorbent. • *Atmospheric emissions*: Maintain and tune all hydraulic hoses, engines, motors, generators to minimise soot and unburned diesel.	Seismic Contractor Operations Manager Environmental coordinator	Self-audit Registers Record books Daily reports	Throughout survey operations	Summary of waste record book Waste disposal schedule Receipts from disposal agents/sites Record destination of waste for on land disposal Report occurrence of minor oil spills

Table 4.2: *Cont.*

ACTIVITY	RATIONALE and MOTIVATION	COURSE OF ACTION TO FULFIL EMP PROVISOS	DESIGNATED PERSON RESPONSIBLE	CONTROL and VERIFICATION	TIMING	REQUIREMENT FOR "CLOSEOUT" REPORT
Communication and notification to other vessels, Coordination with other users	Minimise disruption to other users. Promote cooperation Promote safe navigation Minimise cumulative impacts	1) Notify relevant government ministries and departments – MFMR, MEFT, MME, Namibian Ports Authority. Port Captains and Commissioner for Petroleum Affairs 2) Notify other marine users, fishing industry (Namibian and foreign), marine petroleum, mineral prospecting and mining licence holders. - Notification must include ➢ Navigational Coordinates of the Survey Area ➢ Timing and Duration of Proposed Activities ➢ Designated safety zone around the seismic vessel (500 m). 3) Notify fishing operators through recognised fishing associations, MFMR, fishing companies, agents. ➢ Notify operational fishing vessels directly 4)Transmit Daily Radio Navigation Warnings and Notices to Mariners re the survey vessel's position and operation progress 5) Co-operate with other users to minimise disruption of their activities. 6) Co-operate with other legitimate users of the sea to minimise cumulative impacts on marine life.	Seismic Contractor Operations Manager Environmental Coordinator FLO	Copies of written notices and correspondence	Notice to Mariners at least 24 hours before start of survey Daily positional updates throughout survey During survey operations as required	Copies of notices and list of recipients/ addressees/ FLO Reports / notes/ minutes
Exclusion of other vessels	Minimise probability of collision or contact incidents	1) Use communication channels (radio and email) to inform all other potential users about the survey locations, timing, priority of passage, safety exclusion zones. 2) Keep constant watch for approaching vessels during operations. 3) Warn by radio and chase boat if required. 4) Communicate any delays or equipment loss. 5) Record any unusual incidents	Survey Contractor Environmental Coordinator Operations Manager FLO Officer of the watch Chase boat skipper	Daily Reports Copies of written communication Incident Report	During the survey operations	Copies of written communication Incident Reports/FLO Reports / notes/ minutes
Prevention of emergencies	Minimise potential emergency Minimise environmental damage Minimise extraneous costs	1) Prevent collisions by ensuring good communications with relevant parties. 2) Ensure seismic and support vessels display correct signals by day and lights by night (including twilight) 3) Set watches – visual, radar and standby vessel. 4) Identify any long-line activity in survey area and communicate with fishers as to location of gear. 5) Service equipment regularly 6) Conduct weekly emergency drills. 7) Establish lines of communication with emergency response: ➢ MEFT, MFMR, MWTC, Sea Rescue Institute of Namibia, Ports Captains.	Survey Contractor Environmental Coordinator Operations manager FLO Officer of the watch Chase boat skipper	Daily Reports Copies of written communication Incident Report	Throughout survey operations	Copies of written communication Incident Reports/ FLO Reports / notes/ minutes

Table 4.2: *Cont.*

ACTIVITY	RATIONALE and MOTIVATION	COURSE OF ACTION TO FULFIL EMP PROVISOS	DESIGNATED PERSON RESPONSIBLE	CONTROL and VERIFICATION	TIMING	REQUIREMENT FOR "CLOSEOUT" REPORT
Emergency management procedures (include. Oil Spills)	Minimise environmental damage Minimise distress and tragedy	1) Adhere to code of conduct and Law of the Sea obligations regarding other vessels in distress. 2) In the event of an onboard crisis implement health and safety procedures in accordance with emergency plans. 3) In the event of an oil spill immediately notify NAMPORT and the Commissioner for Petroleum Affairs. Information required when reporting a spill includes: ➢ The type and circumstances of incident ➢ Ship name, type, port of registry ➢ Nearest agent representing the ships company ➢ Location (lat, long), distance offshore and extent of oil spill ➢ Prevailing weather conditions and sea state ➢ Persons and authorities already informed of the spill. Where diesel, which evaporates relatively quickly, has been spilled, the water should be agitated or mixed using a propeller boat to aid dispersal and evaporation. Dispersants are most effective: ➢ On fresh crude oils. under turbulent sea conditions (dispersants require mixing). ➢ When applied within 12 hours or at a maximum of 24 hours after the spill. The volume of dispersant application should not exceed 20-30% of the oil volume. Dispersants should not be used without authorisation by MFMR. Dispersants should not be used: ➢ On diesel or light fuel oil or on heavy fuel oil. ➢ On slicks > 0.5 cm thick. ➢ On any oil spills within 5 nautical miles offshore ➢ In water depths < 30 m ➢ When spill is so far offshore there is little chance of oil reaching the shore.	Survey Contractor Environmental Coordinator Operations manager/ SHE Officer of the watch	Daily Reports Copies communication Incident Report	Throughout survey operations	Copies of communication Incident Reports

Table 4.2: *Cont.*

ACTIVITY	RATIONALE and MOTIVATION	COURSE OF ACTION TO FULFIL EMP PROVISOS	DESIGNATED PERSON RESPONSIBLE	CONTROL and VERIFICATION	TIMING	REQUIREMENT FOR "CLOSEOUT" REPORT
Seismic source Operation	Minimise impact of seismic noise on marine fauna	1) Maintain continuous watch for marine life within 500 m of vessel and energy source. PAM should be used at night and in periods of poor visibility. 2) Use of the lowest practicable source volume as defined by the operator. 3) Implement the following procedures before and during shooting: • No seismic activity if birds and/or animals are observed within 500 m of the vessel or the source array. • Commence "soft-start" procedures if no animals or diving birds have been sighted within the safe zone (500 m) for at least 30 minutes. If after 30 minutes, small cetaceans (dolphins) and seals are still in area, normal "soft start" procedures may commence • Re-initiate "soft starts" after a cessation in firing of 20 minutes or longer. Ramp-up proportionally if break was shorter than 20 minutes. • Activate low level warning shots during turns and repositioning, unless using PAM. Temporarily terminate seismic shooting when: • Negative behaviour indicating distress directly related to the source is observed • Animals and/or birds are observed within 500 m of the operating source or the vessel (except dolphins and seals) • Animals and/or birds approach the source (except dolphins and seals) • Injury occurs as a direct result of the survey. • Natural avoidance behaviour is over-ridden by feeding response near the seismic array (e.g. Due to the presence of stunned fish) • There is mass mortality or evidence of mass disorientation or injury of fish and/or invertebrates. At night: • PAM will be used. • Lighting on board survey vessels should be reduced to the minimum safety levels to minimise the potential stranding of pelagic seabirds • Any stranded seabirds must be retrieved and released according to appropriate guidelines 4) Record sightings of any injured or dead protected species, regardless of whether the injury or death was caused by the seismic vessel itself. If the injury or death was caused by a collision with the seismic vessel, the date and location (lat, long) of the strike and the species and a description of the animal and/or bird should be recorded.	Survey Contractor Environmental Coordinator Officer of the watch MMO	Self-audit Daily Reports Shut-down logs IMO/MMO reports Incident Report Records of marine fauna observations and "soft-start" procedures	Prior to and throughout survey operations	IMO/MMO reports Copies of completed marine fauna observation forms and seismic activity log showing "soft-start" Initiation. Log of shutdowns, including all decisions and discussions relevant to the termination.

Table 4.2: *Cont.*

ACTIVITY	RATIONALE and MOTIVATION	COURSE OF ACTION TO FULFIL EMP PROVISOS	DESIGNATED PERSON RESPONSIBLE	CONTROL and VERIFICATION	TIMING	REQUIREMENT FOR "CLOSEOUT" REPORT
Ongoing monitoring of effects	Ongoing monitoring programmes (in conjunction with government if required	1) Initiate monitoring programmes as per specific indication by authorities, 2) Monitor performance against objectives and targets 3) Document all activities and findings for internal and external audits 4) Undertake daily monitoring and recording of the following: ➢ Marine mammals and sea birds sighted ➢ Record species and numbers in relation to survey activities ➢ Responses of animals and birds to seismic activity ➢ Fish or invertebrate mortality associated with source firing ➢ Record sound levels and "soft start procedures" ➢ Record changes in behaviour (swimming motion, feeding, diving patterns, change in swimming direction and speed, startle responses) ➢ Record vessel interaction, particularly if chase boat was used to maintain safe operational zone ➢ Details of unattended fishing gear ➢ Document communication with other vessels	Seismic Contractor Environmental Coordinator MO	Daily Reports	During survey operations	Daily reports MMO reports
Performance assessment	Ongoing monitoring programme and EMP Performance Assessments	1) Implement the ongoing monitoring programmes and EMP Performance Assessment as determined by MME 2) Submit Environmental Performance Assessment reports to MME and MEFT 3) Performance assessment based on successful implementation of EMP Data recorded should include: ➢ Species and numbers ➢ Location (lat, long) ➢ Relation to vessels (distance, approaching/retreating) ➢ Swimming direction and speed ➢ Change in swimming direction/speed as a result of survey activities ➢ Stunning or mortality as a result of survey activities Take note of: • Seismic source activities, including sound levels, "soft-start" procedures, shut-down and pre-firing regimes, night-time survey, relocation • Meteorological conditions and sea state • Compliance with (MARPOL 73/78 regulations 4) Submit reports to ministries weekly and to research institutes such as the National Marine Information and Research Centre (NatMirc) in the MFMR for analyses of survey impacts in local waters.	Seismic Contractor SHE FLO and MMO	Daily reports MMO reports	During survey operations and after completion of survey Required regularity of performance assessment to be determined by MEFT and MME	Monitoring reports Provide all recorded information

Table 4.3: Post survey operations.

ACTIVITY	RATIONALE and MOTIVATION	COURSE OF ACTION TO FULFIL EMP PROVISOS	DESIGNATED PERSON RESPONSIBLE	CONTROL and VERIFICATION	TIMING	REQUIREMENT FOR "CLOSEOUT" REPORT
Survey vessels to leave area	Leave area in state that it was prior to survey operations	Ensure that all deployed equipment is retrieved.	Seismic Contractor Operations Manager SHE Equipment Quartermaster	Self-Audit Equipment records	On completion of survey operations	SHE / Environmental Coordinator Report
Inform relevant parties of survey completion	Ensure all relevant parties are aware of completion of survey operations	1) Inform MEFT, MME and MFMR of completion of survey operations 2)Inform other users of completion of survey operations (Fishing Industry Mining Companies) • Inform fishing companies and vessels through recognised fishing associations.	Seismic Contractor Operations manager SHE Environmental Officer	Records of communication	Within a fortnight of survey completion	Copies of communication and notification documents
Final waste disposal	Minimise pollution, maximise recycling Ensure correct disposal of all waste brought to port	1) Dispose of all waste retained onboard at a licensed waste site through a licensed waste disposal contractor.	Seismic Contractor operations manager SHE Environmental Officer	Receipts from waste disposal contractor	In port	Receipts from waste disposal contractor and sites
Final observation reports	Share information with interest groups	1) Share faunal observation reports with relevant parties/associations and MFMR, MEFT.	MMO and FLO	Reports	After completion of survey	FLO and MMO monitoring reports
Close-out report	Ensure corrective action and EMP compliance	1) Compile a seismic survey "close-out" report on completion of the survey. 2) Base "close-out" report on the monitoring requirements and the EMP. 3)Provide information / records asked for in "close-out" report column of EMP 4) Submit copies to MEFT and MME	Eastern Echo FZE / External Consultant such as Risk-Based Solutions (RBS) CC		Three (3) months after survey close	Above information, records and reports

5. MONITORING AND REPORTING

5.1 OVERVIEW

The current Namibian environmental assessment and management procedure requires the submission of biannual Environmental Monitoring Reports (EMRs) or as the Environmental Clearance Certificate (ECC) additional conditions that may be stipulate.

It recommended that the EMRs as submitted when due even if no activities did take place. The EMRs are used to support the renewal of the ECC once it expires after three (3) years.

The EMRs shall comprise the summary description of the activities undertaken for the period under review, the EMP implementation and the submission of the monitoring datasets collected. The regular submission of EMRs and collation of data may facilitate recognition of effects and impacts not previously foreseen and allow for the implementation of precautionary measures and mitigation before the impacts become significant.

The monitoring programme acts as a quality assurance check list on all environmental procedures and environmental performances with respect to the implementation on the EMP. The following is the summary of the key general component of the EMP monitoring framework that shall be monitored and documented in addition to the specific reporting by the SHE / Environmental Coordinators, FLO and MMO activities:

1) I&AP consultation and communication records:
    a. Pre-survey meetings.
    b. Communication with I&APs, and.
    c. Notice to Mariners.
2) Port calls.
3) Vessel operations:
    a. Fuel consumption.
    b. Oil consumption, and.
    c. Water consumption.
4) Weather and Climate:
    a. Atmospheric weather conditions, and.
    b. Sea state.
5) Marine Fauna sightings and interactions
    a. Invertebrates (sightings / reaction to survey).
    b. Turtles (sightings / reaction to survey).
    c. Sea Birds (sightings / reaction to survey /landing on vessel).
    d. Seals (sightings / reaction to survey).

e. Baleen whales (sightings / reaction to survey).

f. Toothed whales and dolphins (sightings /reaction to survey).

g. Cetaceans (sightings /reaction to survey), and.

h. Fish / fishing vessel/s (sightings / reaction to survey).

6) Incidents involving other marine users:

a. Daily updates (survey position and progress).

b. Fishing industry interaction (incident record – vessels / gear), and.

c. Other Vessels (incident record).

7) Onboard environmental awareness:

a. Environmental training.

b. Waste management:

i. Discharge to atmosphere (volume).

ii. Discharge to sea:

- Sewage (volume), and.
- Galley waste (tonnage).

iii. Disposal at port:

- Solid waste (tonnage/ disposal site).
- Hazardous Waste (volume/ disposal site), and.
- Other waste (volume/ disposal site)

8) Emergencies:

a. Service record.

b. Major Oil/ Chemical spills.

c. Emergency Drills / Training, and.

d. Health and Safety Briefings.

6. CONCLUSIONS AND RECOMMENDATIONS

6.1 EMP Conclusions

This EMP report has been prepared based on the findings and recommendations of the EIA Report to mitigate the significant potential negative impacts that the proposed Multiclient / Proprietary 2D/3D seismic survey activities may have on the receiving marine environments covering physical, biological, and socioeconomic components). If the mitigation measures are implemented and monitored, any likely negative impacts that the proposed Multiclient / Proprietary 2D/3D seismic survey activities may have on the receiving environment are likely to be reduced significantly, thereby promoting the coexistence of petroleum exploration activities with natural marine environment and other marine users such as fisheries. The mitigation measures presented in this EMP merged the Proponent's international best practices mitigations measures with local species events such as the whale migration corridors and timings, key fish spawning areas and timing, key fishing seasons, breeding and feeding areas as well as several unique marine ecosystems of the Walvis, Orange and Lüderitz Basins, offshore Namibia.

The overall EMP framework and mitigation measures presented in this report are tailored-made to Namibia's southern offshore environment and considered the peak primary and secondary Whales migration periods in Namibia are May-July and October–November, respectively, as well as the probability of encountering whales outside these peak migration periods.

Offshore seismic survey, especially 3D survey, can only be undertaken in the Namibian waters during calm weather window months between November-March. Temporary, operational and other key avoidance mitigatory measures have been considered in this EMP to mitigate for the likely overlaps with marine mammals migratory periods and other marine users with the suitable weather window for undertaking seismic survey in the Namibian marine environment. In addition to the company's strict compliance with all the relevant national regulations and standards, the Proponent shall always consider international standards of protection developed through the Joint Nature Conservation Committee (JNCC) "guidelines for minimising the risk of injury and disturbance to marine mammals from seismic surveys", and the Energeo Alliance's, formerly known as the International Association of Geophysical Contractors (IAGC)'s "recommended mitigation measures for cetaceans during geophysical operations". These international best industry practices have proved to be effective in several different countries like Canada, Australia, Norway, and the United States. These guidelines have been developed based on noise attenuation modelling, international experiences during seismic acquisition and a cautious approach to the disturbance of marine mammals from seismic surveys.

6.2 EMP Framework Recommendations

It is hereby recommended that the proposed Multiclient / Proprietary 2D/3D seismic survey activities covering the Walvis, Orange and Lüderitz Basins, offshore Namibia, shall go-ahead and be granted with an ECC. The proposed Multiclient / Proprietary 2D/3D seismic survey can coexist with other proposed and ongoing marine related activities in the AOI and precautionary principles and actions shall be exercised by the Proponent at all times.

Based on the findings of the EIA Report and the mitigation measures provided in this EMP, the first annual survey event for the proposed Multiclient / Proprietary 2D/3D seismic survey activities is recommended to start from December where possible, if the ECC is granted by the Environmental Commissioner (Table 5.1). However, if the survey has to start before December, due to the limited favourable weather window for conducting seismic survey in the Namibian waters which is from November-March, the Proponent shall implement the precautional principles, and mitigation measures linked to international best practices as recommended by the JNCC of the IAGC for protecting cetaceans during geophysical operations in addition to the other key mitigation measures as detailed in the EMP Report.

Notifications to marinas shall be issued before the start of the proposed 2D/3D seismic survey to be supported by continuous communications and monitoring during the actual survey operations. Seismic survey operations within the proposed AOI should not coincide with the MFMR stock assessment survey as shown in Table 5.1.

Table 5.1: RBS developed coexistence Knowledge-Based System Model Methodology (KBSMM) log framework fully validated and populated during the EIA process in identifying suitable window/s of opportunities for undertaking the proposed Multiclient/Proprietary 2D/3D seismic survey activities with respect to the receiving environment in the Walvis, Lüderitz and Orange Basins, offshore Namibia..

MONTH	KEY FISHING SEASON (KEY SPECIES)	MAIN SPAWNING ACTIVITIES (KEY SPECIES)			MINISTRY OF FISHERIES AND MARINE RESOURCES STOCK SURVEYS		KEY CETACEOUS PRESENCES / MIGRATORY TIMES		OTHER KEY USERS	WEATHER WINDOW	COMMENTS ON OFFSHORE SEISMIC SURVEY OPPORTUNITY WINDOW
January	Pole and line Tuna, Hake Longline, Hake Trawl, Surface Longline, Monk, Rock Lobster		Hake spawning occurs throughout the year with main spawning period between July -October	Cape Monk spawn throughout the years, with peaks in Jul & Sep for females & Aug for males	Hake Stock Survey	Rock Lobster Monthly Stock Survey		Cetacean including Whales may be found in the Namibian waters	❖ Marine Diamond Exploration and Mining in shallow water less than -200m. ❖ The Survey area covers an area which is a busy international shipping lane	Good	Impact – Hake Stock Survey (less than-1000m), Tuna migrating (Trip Seamount) SURVEY PLANNED TO START 2024
February	Pole and line Tuna, Hake Longline, Hake Trawl, Surface Longline, Monk, Rock Lobster										Impact – Hake Stock Survey (less than-1000m), Tuna migrating (Trip Seamount)
March	Pole and line Tuna, Hake Longline, Hake Trawl, Surface Longline, Monk, Rock Lobster										Impact – Tuna migrating (Trip Seamount)
April	Pole and line Tuna, Hake Longline, Hake Trawl, Surface Longline, Monk, Rock Lobster									Moderate Mixed	Impact – Tuna migrating (Trip Seamount)
May	Hake Trawl, Monk						Whales Migration Primary Peak Period				No Impacts but unfavorable weather
June	Snoek, Hake Trawl, Monk	Snoek, and Orange Roughy								Very Poor	No Impacts but unfavorable weather
July	Hake Trawl, Monk										Impact – Orange Roughy spawning (shallow waters), Snoek migrating in deepwater
August	Hake Trawl, Monk										Impact – Orange Roughy aggregated spawning, Snoek migrating in deepwater
September	Surface Longline, Hake Trawl, Monk	Rock Lobster					Whales Migration Secondary Peak Period			Poor	Impact – Snoek migrating in deepwater
October	Pole and line Tuna, Surface Longline, Monk				Rock Lobster Stock Survey					Moderate Mixed	Impact – Shallow water rock Lobster Stock Survey, Tuna migrating (Trip Seamount)
November	Pole and line Tuna, Hake Longline, Hake Trawl, Surface Longline, Monk, Rock Lobster				Monk Stock Survey					Good	Impact – Monk Stock Survey (less than-1000m), Tuna migrating (Trip Seamount)
December	Pole and line Tuna, Hake Longline, Hake Trawl, Surface Longline, Monk, Rock Lobster										Impact – Tuna migrating (Trip Seamount)

6.3 EMP Recommendations

Additional detailed mitigation measures are provided in the specialist reports Annex 2 and 3 to the EIA Report. The following is the summary of the EMP recommendations to be implemented and monitored by the Proponent with respect to the proposed Multiclient / Proprietary 2D/3D seismic survey activities over the Walvis, Lüderitz and Orange Basins, offshore Namibia:

9. **Procedure for Commencement of Operations:**

(i) Exclusion zone:
- 500 m horizontal radius from centre of source array.

(ii) Visually monitor the exclusion zone:
- In water depths of greater than 150m, for at least 30 minutes prior to activating seismic sources, observer(s) should visually survey the 500 m exclusion zone for cetaceans.

- Observer(s) assigned to visual observations during commencement of operations:
  - Observer(s) should be trained to an acceptable standard.
  - Observer(s) may be crew members, other employees, or third-party contractors, and.
  - All visual observations and operations should be electronically documented and made available for evaluation and study.

- If cetaceans are present within the 500m exclusion zone, delay the start of soft-start procedure until at least 20 minutes after the last sighting of a cetacean, and.

- If there are no cetaceans present, initiate soft-start procedure.

(iii) Soft Start Procedure:
- To achieve the soft start principle of commencing with the smallest volume element in the array and progressing to the full operating volume of the source over a specified period, the following key elements will be implemented:

  - The first stage of soft start will involve activating the smallest volume element in the array.

  - Subsequent stages will involve doubling the number of active elements at the commencement of each stage.

  - All stages should ideally be of approximately equal length.

  - The total duration of the soft start should be at least 20 minutes.

  - As there will generally be one stage in which doubling the number of elements is not possible (due to the number of elements in the full array not being, for example, 8, 16 or 32) it is preferable to make this stage the last one of the soft start sequences (as opposed to adjusting the increments of other stages or placing a lower increment early in the soft start sequence).

  - To minimise additional noise in the marine environment, a soft-start (from commencement of soft-start to commencement of the line) should not be significantly longer than 20 minutes (for example, soft-starts greater than 40 minutes are considered to be excessive, and an explanation should be provided within the MMO report), and.

  - Operators should avoid unnecessary firing at full power before commencement of the line.

(iv) Periods of poor visibility and darkness:
- Initiate soft-start procedure as above, and.
- Use passive acoustic monitoring system for detections.

10. **Procedure for Ongoing Operations:**

(i) If seismic sources are silent for 5 minutes or more, use soft-start procedure.

(ii) Report immediately to MMO or FLO if there is any animal in distress, animal carcasses, etc.

(iii) The vessels involved in the project must not move towards cetaceans whenever it is possible. Wherever possible the vessels must avoid and distance themselves from these animals.

(iv) Whenever possible the speed of the project vessels must be limited to a maximum of 13 knots.

(v) Whenever protected marine mammals are observed within the exclusion zone, **the shots must be interrupted** and thereafter a slow-start procedure followed, and.

(vi) If marine mammals are detected within 500 metres of the centre of the source array whilst the sources are firing, either during the soft-start procedure or whilst at full power, **there is no requirement to stop emitting the sources**.

11. **Procedure for Testing Source Elements:**

(i) If a source test is necessary whereby each source element must be activated individually.

(ii) Visually monitor the exclusion zone before any instances of seismic source testing.
- At least 30 minutes prior to activating seismic sources, observer(s) should visually survey the 500m exclusion zone for cetaceans.
- Observer(s) assigned to visual observations during commencement of operations
  - Observer(s) should be trained to an acceptable standard.
  - Observer(s) may be crew members, other employees, or third-party contractors.
  - All visual observations and operations should be electronically documented and made available for evaluation and study.
- If cetaceans are present within the 500m exclusion zone, delay the start of soft-start procedure until at least 20 minutes after the last sighting of a cetacean.
- If cetaceans are absent from the 500m zone, initiate the seismic source, starting with the smallest volume source element and working up to the larger volumes, and.
- If the intention is to test a single source on low power, then a soft start is not required.

12. **General Practices:**

(i) Environmental awareness programmes must be organised for all crew members to explain the conservation status of the cetaceans and turtles and to highlight the importance of the mitigation measures.

(ii) Ensure that the support vessel(s) are in watch of the safety zone established around the seismic vessel (5.5km ahead and abeam and 13 km as clearance from the vessel) this

measure will allow the reduction of potential safety risks associated with the seismic operations especially with the fishing vessels while working in the shallow waters.

(iii) High intensity unnecessary noise must be avoided where possible.

(iv) Any occurrence of large marine mammals should be brought to the attention of MMO or FLO.

(v) MMO and FLO observations shall always be made when the vessel is moving (not only during seismic acquisition).

(vi) Regular maintenance must be performed on the project vessels and the maintenance team must pay special attention to the noise produced by the vessels.

(vii) Whenever possible, ensure that the towed exploration materials (buoys, air cannons, etc.) do not have gaps (or these must be covered or reduced) in which the animals (e.g. turtles) can get stuck.

(viii) All crew members must be forbidden from killing or causing injuries to marine fauna. Any crew member that deliberately kills or causes any damage to marine fauna must be immediately dismissed, reported to the relevant authorities and sent to shore.

(ix) There must be someone in the support vessels who is responsible for watching out for the possible occurrence of these animals in the vicinity of ships.

(x) In the event of entanglement, all activities must stop and the rescue actions to rescue the animal must be put into practice.

(xi) Through the Petroleum Commissioner in the Ministry of Mines and Energy or directly, request from the Namibian Maritime Search and Rescue (SAR), Department of Maritimes Affairs in the Ministry of Works and Transport in their capacity as the national maritime authority, for instructions on the rules and procedures that shall be adhered to, prior-to and during the seismic operations in Namibian territorial (jurisdictional) waters, and.

(xii) It shall be ensured that the "Navigation Warnings" are issued and disseminated through the Petroleum Commissioner in the Ministry of Mines and Energy or directly through Namibian Maritime Search and Rescue (SAR), Department of Maritimes Affairs in the Ministry of Works and Transport maritime communications network, as well as through other means of dissemination as may be avaiable while at sea.

13. **Pollution Prevention and Management:**

(i) The procedures for deposition applied must comply with national legislation (e.g., Regulation for the Prevention of Pollution and Marine and Coastal Environmental Protection, Decree No. 45/2006 of 30 November) and international best practices (eg. International Convention for the Prevention of Pollution by Ships – Marpol 73/78).

(ii) The treatment of sewage must be done before it is discharged into the sea, according to the recommendations by Marpol 73/78.

(iii) The ships must perform the treatment of the bilge waters onboard or do the transhipment offshore, in compliance with the recommendations by Marpol 73/78.

(iv) Implement a Pollution Control Programme, including the treatment, adequate disposal and minimizing waste, according to the recommendations by Marpol 73/78.

(v) The frequent monitoring of the disposed waters, as a means of ensuring that the levels of pollutants are within the recommended standards.

(vi) The seismic vessel shall possess a manual of procedures to deal with domestic garbage that if correctly applied, prevent and minimize the potential negative effects of this impact.

(vii) The Proponent shall ensure that the seismic vessel possesses a Plan for Domestic Residues Management that is in conformity with Annex V of the MARPOL Convention: Prevention of Pollution by Garbage from Ships.

(viii) All atmospheric pollution emissions shall comply with the Mozambican Laws and International Guidelines.

(ix) According to Annex VI of the MARPOL 73/78 Convention, the content of the oils sulphuric shall have a maximum value of 4.5% m/m except in cases that the seismic vessel is equipped with an approved cleaning system for the treatment of exhaustion gases or any other technical method that is verifiable and that reduces the SO_2 emissions to a maximum of 6.0 g/kWh1, and.

(x) The incineration of packaged contaminated materials on board the seismic vessel and Polychlorinated Biphenyls (PCBs) is prohibited. Furthermore, the deliberate emission of substances that are prejudicial to the Ozone Layer, including halon and the chlorofluorcarbonates (CFCs) is also prohibited.

14. **Spills Prevention and Management:**

(i) All equipment and machinery that could potentially leak or spill fuel must be regularly maintained, inspected and tested.

(ii) An Emergency Response Plan for Oil Spills must be prepared and must include, at least, the requirements specified by the World Bank related to Health, Safety and the Environment during Offshore Petrol and Gas operations (World Bank Group, 2015).

(iii) In the event of fuel spills or other chemicals, an Emergency Response Plan for Oil Spills must be put into action /implemented. The capacity to implement that plan must be proven before the start of any activities.

(iv) The Emergency Response Plan for Oil Spills must consider the best measure and the state-of-the-art methods for containing spills or loss of fuels, oil and chemical products, in all the vessels involved in the Project.

(v) Regular adequate training must be provided for all Project workers, related to the prevention, containment and response to spills.

(vi) All equipment involved in the response to spills must be frequently maintained, inspected and tested.

15. **Overall Compliances:**

(i) Compliance to all relevant national, regional and international (MARPOL) marine pollution prevention regulations, standards, guidelines and procedures, and.

16. **Adoption of the Precautionary Principles:**

(i) In the absence of any specific mitigation measures being provide in this EMP Report, the Proponent and / or Contractor shall always adopt the precautionary principles / approaches.