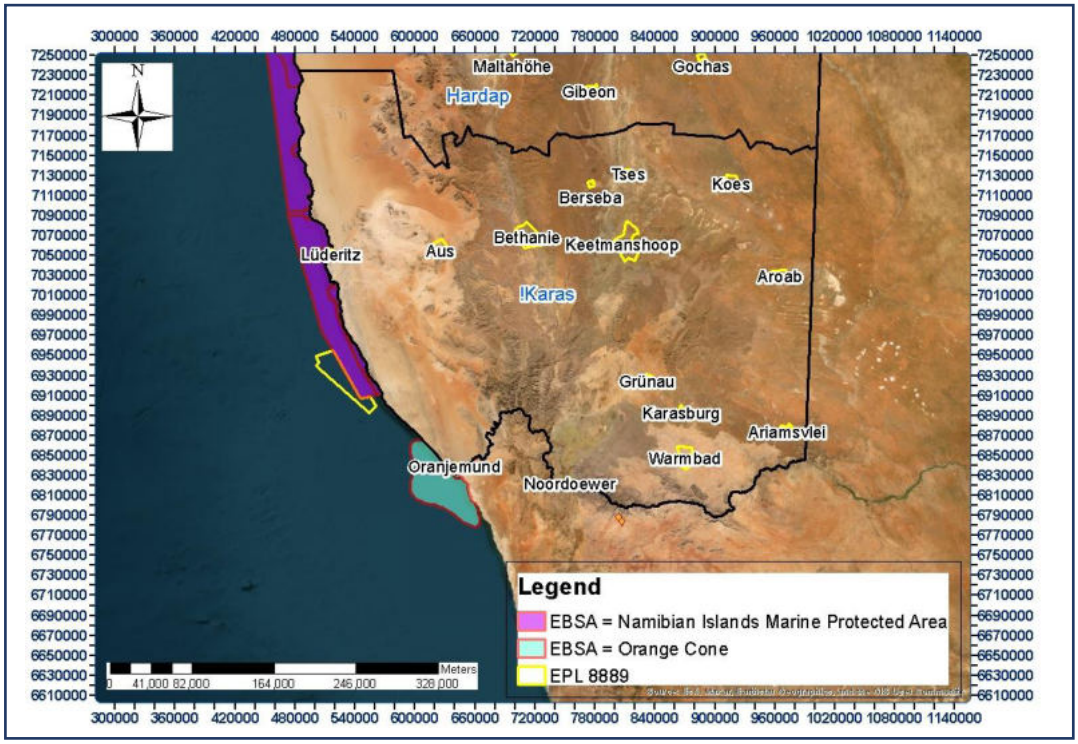
ENVIRONMENTAL IMPACT ASSESSMENT



TO

Support NEW APPLICATION for Environmental Clearance Certificate (ECC) for the proposed offshore geophysical surveying and bulk exploration sampling for precious stones (and to a lesser extent precious metals, base and rare metals) on EPL 8889 located off the south-western coast of NAMIBIA

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LIST OF ABBREVIATIONS

BCLME	Benguela Current Large Marine Ecosystem
DEAF	Department of Environmental Affairs and Forestry
EAP	Environmental Assessment Practitioner
EBSA	Ecologically or Biologically Significant Areas
ECC	Environmental Clearance Certificate
EIA	Environmental Impact Assessment
EMA	Environmental Management Act
EMP	Environmental Management Plan
EIA	Environmental Impact Assessment
I&APs	Interested and Affected Parties
IMDH	International Mining & Dredging Holding (Pty) Ltd
ICCAT	International Commission for the Conservation of Atlantic Tunas
MFMR	Ministry of Fisheries and Marine Resources
MEFT	Ministry of Environment, Forestry and Tourism
MURD	Ministry of Urban and Rural Development
NIMPA	Namibian Islands Marine Protected Area

1 INTRODUCTION

This chapter provides background to the project, describes the purpose of this report as well as the desirability of the project, and briefly outlines the structure of the report.

1.1 Brief Project Background

On the 13th of November 2023, Eland Mining and Prospecting cc (herein referred to as the project Proponent) was granted, by the Namibian Ministry of Mines and Energy (MME), a preparedness to grant exclusive prospecting rights for base and rare metals, precious metals and diamondiferous gravels within the offshore exclusive prospecting license (EPL) 8889. The EPL covers an offshore area of approximately 98 900 Ha and lies in the south-western coast of Namibia which has a history of successful prospecting and mining for marine diamonds. For this reason, the primary commodity targeted in the envisaged exploration program is offshore diamonds, and therefore the exploration techniques and methodology to be adopted will be those which are suited for this commodity. To optimize the exploration program, however, opportunistic sampling for subsequent geochemical essaying onshore will be undertaken on a selected number of fine sediment samples to evaluate the potential for base, rare and/ or precious metal mineralization.

Eland Mining and Prospecting cc has secured funding to undertake a phased exploration program which will entail geophysical surveying of the seafloor and sub-seafloor as well as bulk sampling of the seabed subsurface.

OMAVI Geotechnical and Environmental Services (referred to in this report as OMAVI) was appointed by the project proponent and their financial partner, to undertake the Environmental Impact Assessment (EIA) and formulate a pragmatic Environmental Management Plan (EMP) for the proposed activities. Ultimately, the EIA report together with the accompanying EMP will support the Proponent's application for Environmental Clearance Certificate (ECC) from the Ministry of Environment, Forestry and Tourism (MEFT) to allow the planned offshore prospecting activities to commence. This report will further assist the Ministry of Environment, Forestry and Tourism's (MEFT) Department of Environmental Affairs and Forestry (DEAF) in making an informed, knowledge-based decision on the issuance of the ECC for the proposed exploration program. In addition, a copy of the final EMP shall be furnished to the relevant Competent Authorities, the Directorate of Mines in the Ministry of Mines and Energy (MME) as well as the Department of Marine Resource Management in the Ministry of Fisheries and Marine Resources (MFMR).

1.2 Purpose of Report

The objectives of this report can be summarised as follows:

- Provide a background summary on the proposed offshore exploration program in terms of the concerned site locality, and a description of the offshore prospecting technology and methods to be employed, and the overall exploration program.
- Documentation of alternatives considered for the proposed activities.
- Present the transparent mechanisms that were adopted to ensure that Interested and Affected Parties (I&APs) are informed about the project activities and were availed adequate opportunity to express their views, comments, and inputs.
- Documentation of the baseline information about the receiving environment within and around the vicinity of the concerned licenses.
- Documentation of the major direct and indirect (including cumulative) environmental impacts which would likely be triggered by the proposed project activities, and
- Lastly, provide an independent judgement by the EAP on the key impacts which could be triggered by the project activities, and develop respective impact mitigation and/ or enhancement measures.

1.3 Assumptions and Limitations of Report

The following assumptions and limitations form the basis of this impact assessment report, including the overall outcomes and recommendations made:

- The proposed activities, exploration program, and coordinates of the EPL areas as received from the project proponent and her partners are assumed to be correct and valid at the time of conducting the assessment and preparing the report.
- The impact assessment outcomes, mitigation measures and recommendations provided in this EIA report and the accompanying EMP report are valid over the lifecycle of the proposed activities. In line with industry best practice the EMP shall be amended and updated regularly as and when significant changes are made to the exploration program so that it remains relevant and applicable at all times.
- There will be no significant changes to the proposed project description and activities or the affected environment between the period of completing this EIA and the commencement of the proposed project which could make the findings of this assessment irrelevant, and invalidate recommendations with respect to the mitigation, enhancement and overall management of identified potential impacts.

The environmental assessment is, to a large extent, based on a generic layout and description of the proposed geophysical surveying and bulk sampling activities in line with known and proven local practices. For this reason, a precautionary approach has been adopted regarding baseline data and impact assessment whereby insufficient or unavailable data or information is acknowledged at the time of preparing this report. Key areas where insufficient or unavailable data or information was observed form a crucial component of the recommended Adaptive Environmental Baseline and Performance Monitoring program section set out in the accompanying EMP to ensure that an inventory of baseline data is developed from the start of the envisioned exploration program.

1.4 About the Proponent

Eland Mining and Prospecting cc (Reg. no.: cc/2022/03026) is the sole holder and proponent of the concerned EPL, namely: EPL 8889. This proponent intends to work directly with its third-party partner who will provide the necessary financial and technical support for the implementation of the planned geophysical and seabed sediments bulk sampling activities.

1.5 About the Environmental Assessment Practitioner

OMAVI Geotechnical & Environmental Services was appointed by the licenses holder to undertake an Environmental Impact Assessment (EIA) and prepare the project-specific Environmental Management Plan (EMP) for the proposed offshore diamond prospecting activities, in accordance with the Environmental Management Act, 2007 and its 2012 EIA regulations.

OMAVI Geotechnical & Environmental Services is a specialist environmental consulting entity, with considerable industry experience in environmental compliance and environment management of exploration and mining projects, both onshore and offshore. Our team of scientists possesses the right set of technical and analytical skills which collectively ensure that we understand, in an integrated manner, how a set of planned activities would interact with the biophysical, socio-economic, and political landscape within which such activities are envisioned to take place. Additionally, OMAVI is robustly experienced in undertaking state of the art environment assessments, Waste Management Planning, Environmental Management Plans (EMPs), public participation, environmental rehabilitation and closure plans, as well as the management and co-ordination of all aspects of the Environmental Impact Assessment (EIA) value chain. OMAVI has been active in these fields, and in so doing has made a positive contribution towards environmental protection and sustainable development in Namibia.

At OMAVI we are grounded in the idea that a balance between development and environmental protection is achievable when proactive and integrated planning is adopted, whereby project activities are designed, planned (in terms of budgets and schedules, and implementation technologies) and executed with the affected environment as well as closure and rehabilitation requirements in mind.

In addition to the in-house team from OMAVI, one (1) specialist studies was undertaken as follows:

- A marine biology and fisheries study – to help establish the various costal and marine habitats, marine life associated with such habitats and the potential impacts on these.

1.6 Why is the Environmental Impact Assessment (ESA) required?

In terms of the Environmental Management Act (EMA), 2007 and the Environmental Impact Assessment Regulation, 2007 (No. 30 of 2011) gazetted under the Environmental Management Act, 2007, the proposed geophysical surveying and sampling activities entail exploration of mineral resources and associated activities, which are listed activities that may not be undertaken without a valid Environmental Clearance Certificate (ECC) issued by the Environmental Commissioner. The provision of such listed activities in the EMA is as follows:

Mining and quarrying activities

- **Activity 3.2:** *Other forms of mining or extraction of any natural resource whether regulated by law or not.*

- **Activity 3.3:** *Resource extraction, manipulation, conservation, and related activities.*

To support the application for an ECC, an Environmental Impact Assessment (EIA) study must be carried out to understand how the planned project activities will interact with the coastal and marine biological and physical environment as well as with the social setting and landscape, and what positive and negative impacts those activities could potentially trigger in the environment. Subsequent to the completion of the ESA study, a project specific EMP was developed which provides the necessary and appropriate impact mitigation measures for all significant impacts which could be triggered by the project. These two reports shall then be submitted to the Department of Environmental Affairs and Forestry (DEAF) for scrutinization to allow the DEAF to make an informed and knowledge-based decision on the issuance of an ECC. The same set of reports were also submitted to the Department for Marine Resources Management at the Ministry of Fisheries and Marine Resources (MFMR) to seek for recommendations on how best the proposed activities could be implemented without causing harm and general deterioration of the marine biophysical environment.

For this project, the competent authorities are the Ministry of Mines and Energy (MME) and the the Ministry of Fisheries and Marine Resources (MFMR).

1.7 Environmental Assessment Process Followed

The flow chart shown below in Figure 1.1 summarises the process followed in undertaking this impact assessment.

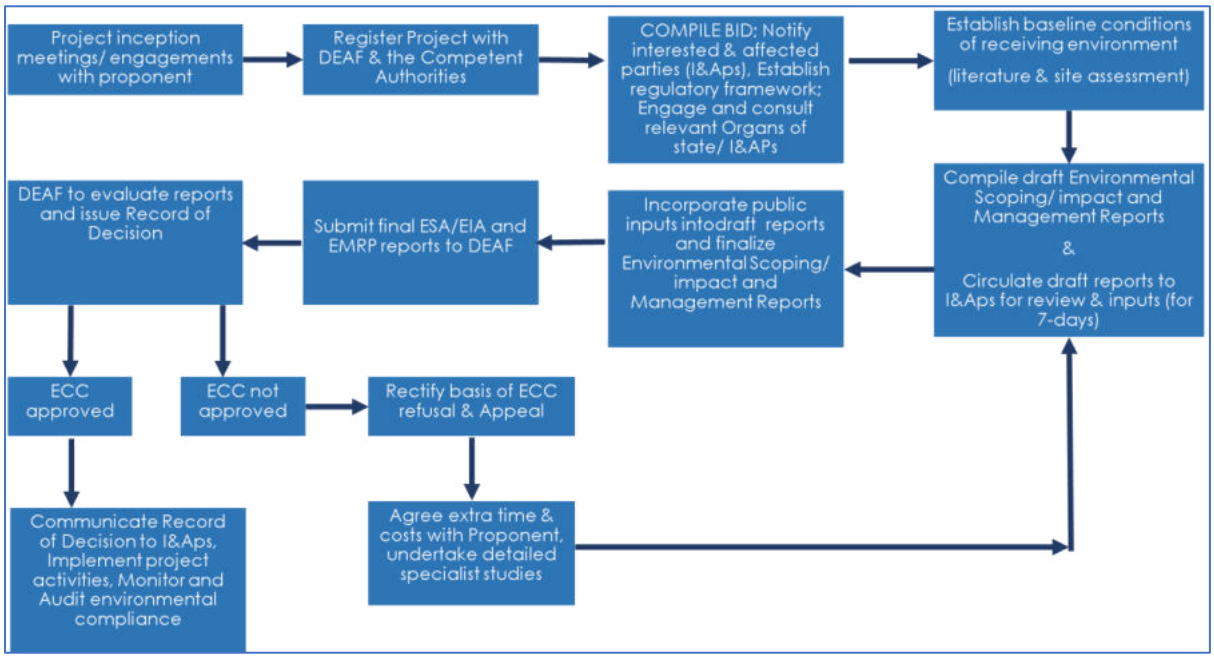

Figure 1.1. OMAVI's Environmental Impact Assessment process flow chart

1.8 Structure of the EIA Report

The structure of this report is summarised in Table 1-1. The broad content of each chapter is briefly outlined in this table.

Table 1-1. Summary of EIA report structure

Chapter	Brief Content
1	**Introduction** – provides brief project background; outlines the purpose of the report, details of the project proponent and the EAP, as well as the overall structure of this report
2	**Project scope and Description** – provides a description of the project with respect to the planned exploration program and activities, design intent of the proposed activities, and technology to be used.
3	**Project Alternatives** – considers the proposed project's alternatives with respect to location, technology and methods to be used, as well as operational support aspects such as waste management, tug services, helicopter services, etc.
4	**Project Legal Framework** – provides a comprehensive outline of the guiding local laws, policies and regulations which must be complied with by the project proponent and their partners
5	**Description of the Receiving Environment** – provides a description of the receiving biophysical and socio-economic environment that could be adversely or positively impacted by the planned project activities
6	**Stakeholder Consultation** – summarizes the overall consultation processes, platforms and activities undertaken to ensure inclusive and transparent engagement and consultation of interested and affected parties.
7	**Impact Assessment** – provides an outline of the systematic impact assessment methodology adopted to identify and evaluate the potential impacts on the receiving environment as triggered by the proposed project activities
8	**Conclusions and Key Findings** – provides a summary of the main findings from the impact assessment process in terms of the significance levels of the various probable impacts which are likely to be triggered by the proposed activities.
9	**References** – provides a list of references consulted in compiling this report

2 PROJECT SCOPE AND DESCRIPTION

2.1 Project Locality

The EPL concerned is located between the 50m and 200m water depth contour, off the south-western coast of Namibia. EPL 8889 is located approximately between 20km and 30km offshore directly west of Chameis Bay in the south and the Ghost Town of Bongenfels in the north. The license is bordered to the north-west by EPL 8054 whilst to the south-west and south the license is bordered by EPL 7548 and Debmarine's Atlantic 1 ML 47. The license falls outside, but right along the immediate western boundary of the so-called Ecologically or Biological Significant Areas (EBSAs), namely:

- The Namibia Islands Marine Protected Area

The Orange Cone which forms part of this complex of EBSAs and occurs as an isolated island covering the Orange river delta, and is located approximately 51km south of the EPL.

Exploration will primarily focus on unlocking potential marine diamond deposits in the area, with opportunistic sampling of the continental shelf overburden and footwall sediments to be taken in select areas for subsequent geochemical essaying for the other commodities listed.

From a jurisdiction standpoint, the EPL is situated within the Namibian waters Exclusive Economic Zone and is surrounded and/ or lie near other inactive and active offshore diamond, oil and gas prospecting and mining concessions as depicted in Figure 2.1. A regional locality map for these licenses is also provided in

Figure 2.2, while the approximate corner coordinates for the 2 license areas are provided in Table 2-1. The relative location of the licence area to the EBSAs is shown in Figure 2.3.

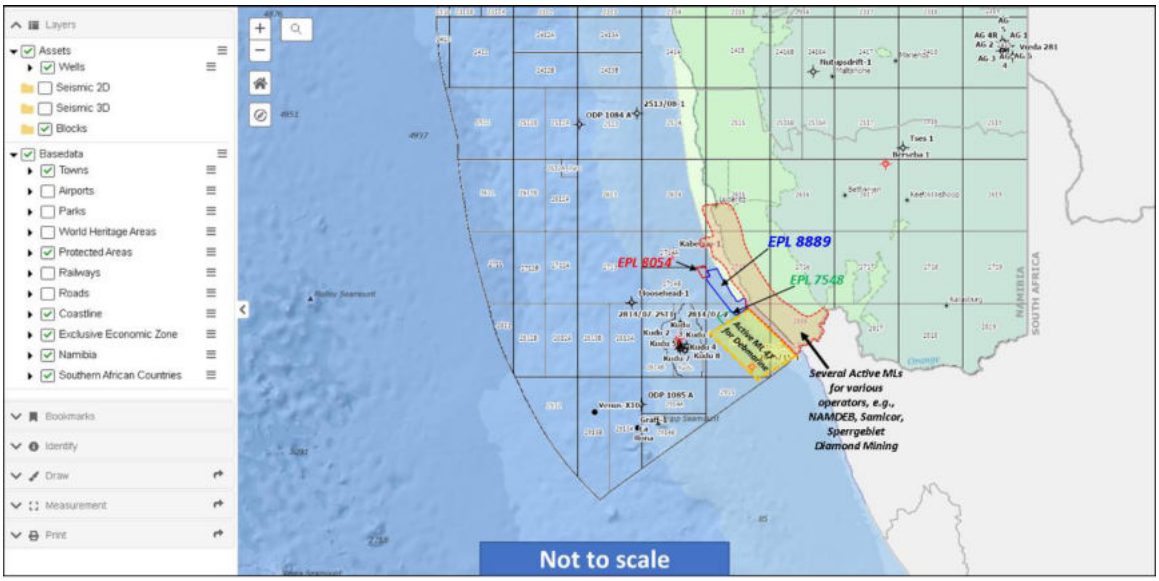

Figure 2.1. Location of EPL 8889 relative to active exploration and mining concessions for diamonds as well as Oil & Gas

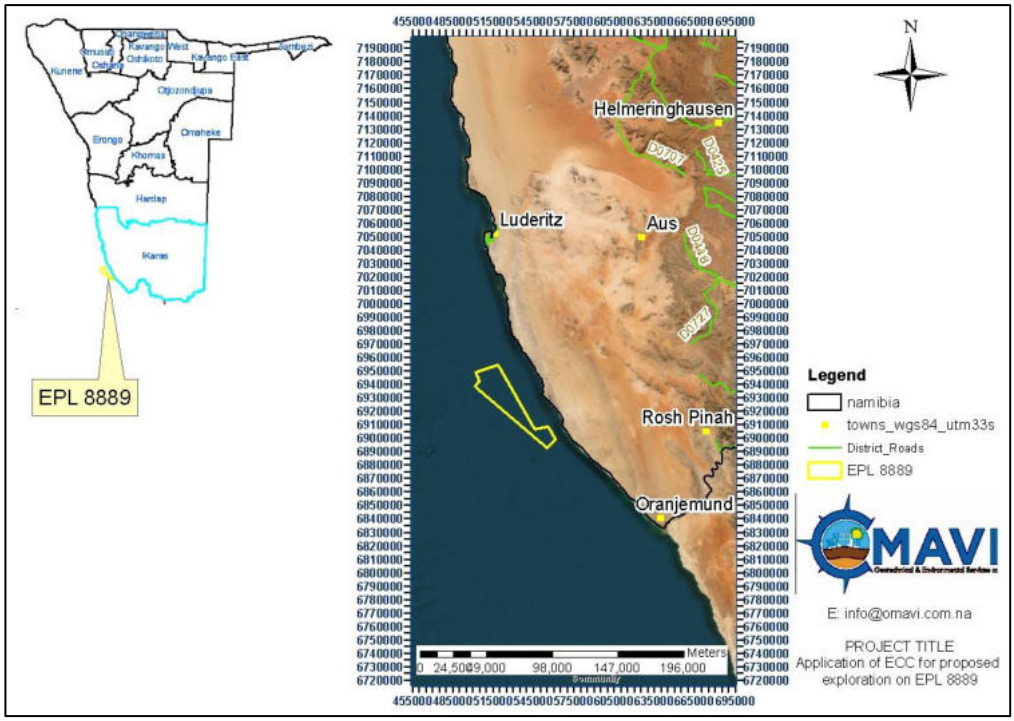

Figure 2.2: Regional and local locality map of EPL 8889.

Table 2-1. Approximate Corner Coordinates - EPL 8889

SITE NAME	LATITUDE	LONGITUDE
EPL 8889	-28.089167°	15.558333°
	-27.671517°	15.014669°
	-27.641672°	15.043600°
	-27.639342°	15.042633°
	-27.638611°	15.043333°
	-27.574722°	15.016111°
	-27.531389°	15.184444°
	-27.960025°	15.467456°
	-27.942500°	15.567778°
	-28.027500°	15.618611°

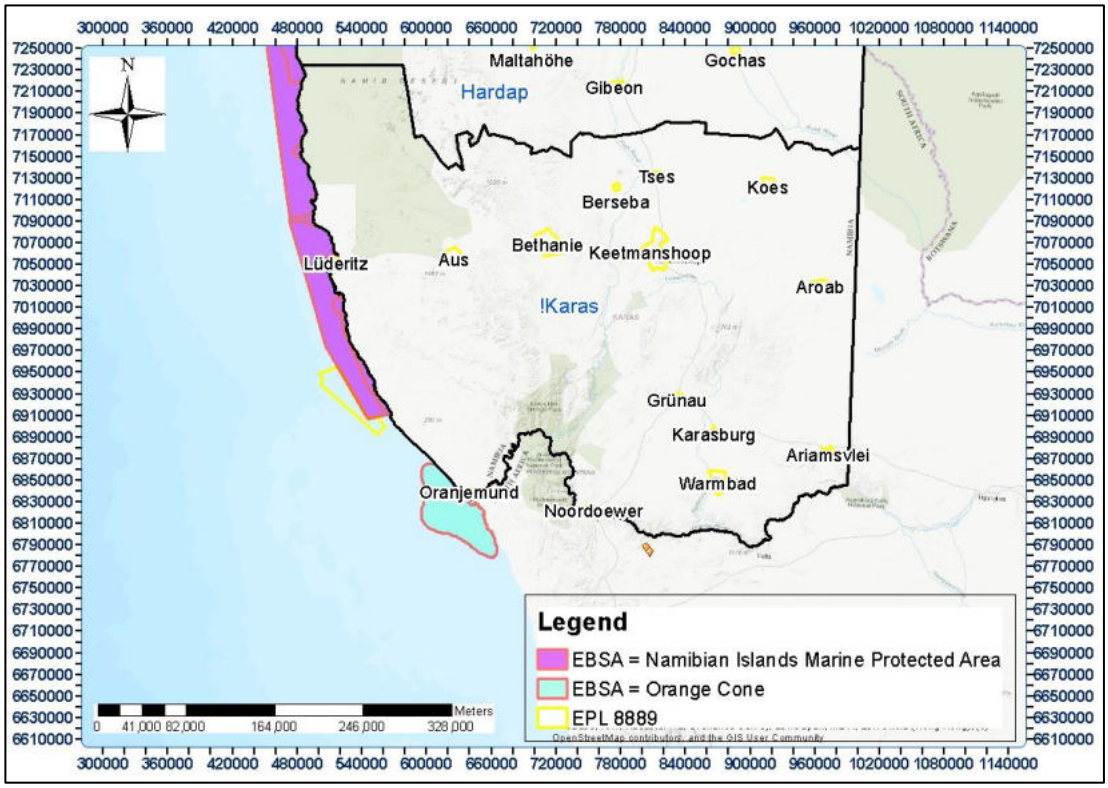

Figure 2.3. Location of EPL 8889 relative to the EBSAs

2.2 History of exploration and mining in the south-western coast of Namibia

The EPL concerned lies off the south-western coast of Namibia, forming part of a broad area which has been widely explored and mined for gem quality diamonds by several prospectors and miners over many decades. According to Schneider (2020), the first diamonds from the sea floor were recovered in shallow waters off the Namibian coast some 110 years ago. However, it took 50 more years, before any systematic sea floor diamond mining with purpose-built barges to prospect and recover diamonds from Namibian waters in the early 1960s. This was followed by a period of detailed exploration and mining tool development, which saw Namibia emerge as the leading nation in marine diamond mining in the late 1980s. Today, a fleet of several modern mining and exploration vessels is involved in the recovery of more than three quarters of Namibia's diamond production. As the process involves modification of the seafloor, careful monitoring of seafloor drilling, dredging and mining activities, as well as the resultant impacts and the formulation and continuous improvement in mitigation measures for such impacts are carried out in accordance with international best standards.

It is well documented that in 1961 an American entrepreneur by the name of Sammy Collins established a company known as Marine Diamond Company (Pty) Ltd in the then South-West Africa, to prospect and exploit diamond deposits offshore adjacent to the coastal mines then operated by Consolidated Diamond Mines (CDM) (Pty) Ltd onshore. He reportedly discovered economically viable deposits in the sea, close to the shore immediately to the north of Chameis Bay and thereafter commenced with production using specially constructed barges and a converted tank-landing craft. Offshore diamond prospecting and mining along the Namibian west coast has continued to this day, facilitated by continuous improvements in technologies utilized in the exploration, mining and recovery processes.

At present companies such as Debmarine Namibia (DBMN), Samicor/ Nutam, Sperrgebiet Diamond Mining (Pty) Ltd, and Namibia Diamond Company (Pty) Ltd remain big players in offshore/ marine diamond resource prospecting and the management of a fleet of vessels locally. Their current prospecting and production activities are conducted offshore between Luderitz and Oranjemund, in water depths up to just over 200m. Several smaller players are also active in this same area, but due to limited capacity their activities are largely constrained to the shallow waters, typically in water depths not exceeding 50 to 80m.

From an oil and gas resource point of view, the same area covered by the EPL also forms part of a potential oil and gas field, and based on the current licensing database falls within or in close proximity to Oil/ Gas blocks 2714A, 2715 and 2815 which are largely held by the Namibian National Petroleum Corporation (Namcor). According to the National Petroleum Corporation (NAMCOR), Namibia has four (4) offshore basins which cover a combined area of approximately 826 000 km^2 with water depths ranging from 0 to 400m and have undergone exploration activities over the years. These basins include the Orange Basin, the Luderitz Basin, the Walvis Basin and the Namib Basin. The EPL falls within the Orange Basin, which is currently the most active basin in terms of oil and gas prospecting activities. With an open licensing system adopted in 1999, Namibia experienced an influx in oil/ gas exploration activities from 2008 to date especially following the acquisition of 2D and 3D seismic surveys as more corporate entities showed interest in the hydrocarbon potential of the West African margin. Over this period numerous offshore exploratory wells were drilled by various operators, including:

- the Kunene-1 and Moosehead-1 wells drilled in 2013 by Sintezneftegas;
- the Welwitchia-1 Well in 2014 drilled by Repsol;
- the Mopane-1X and Mopane-2X wells drilled by Galp in 2023/ 2024 in PEL 83

- the Graff, La Rona, Lesedi and Jonker wells drilled by Shell; and
- several exploration wells by Total Energies

Some of these well results confirmed the presence of Lower Cretaceous clastic and carbonate reservoirs and also proved an oil-based working petroleum system with two thick, rich mature source rocks within the Aptian Interval. In 2018 two more wells were drilled in the Walvis Basin by Tullow Namibia (Cormorant-1) and Chariot Oil & Gas (Prospect S), respectively. Recent drilling campaigns in 2021 to 2023 by Shell Namibia (Graff-1), TotalEnergies (Venus-1X.T1) and Galp (the Mopane wells) made significant light oil discoveries with associated gas within the Orange Basin. These wells and associated license blocks are shown schematically in Figure 2.1 as well as in the figure below, together with the principal holders of those licenses and further portray their proximity to the concerned EPL.

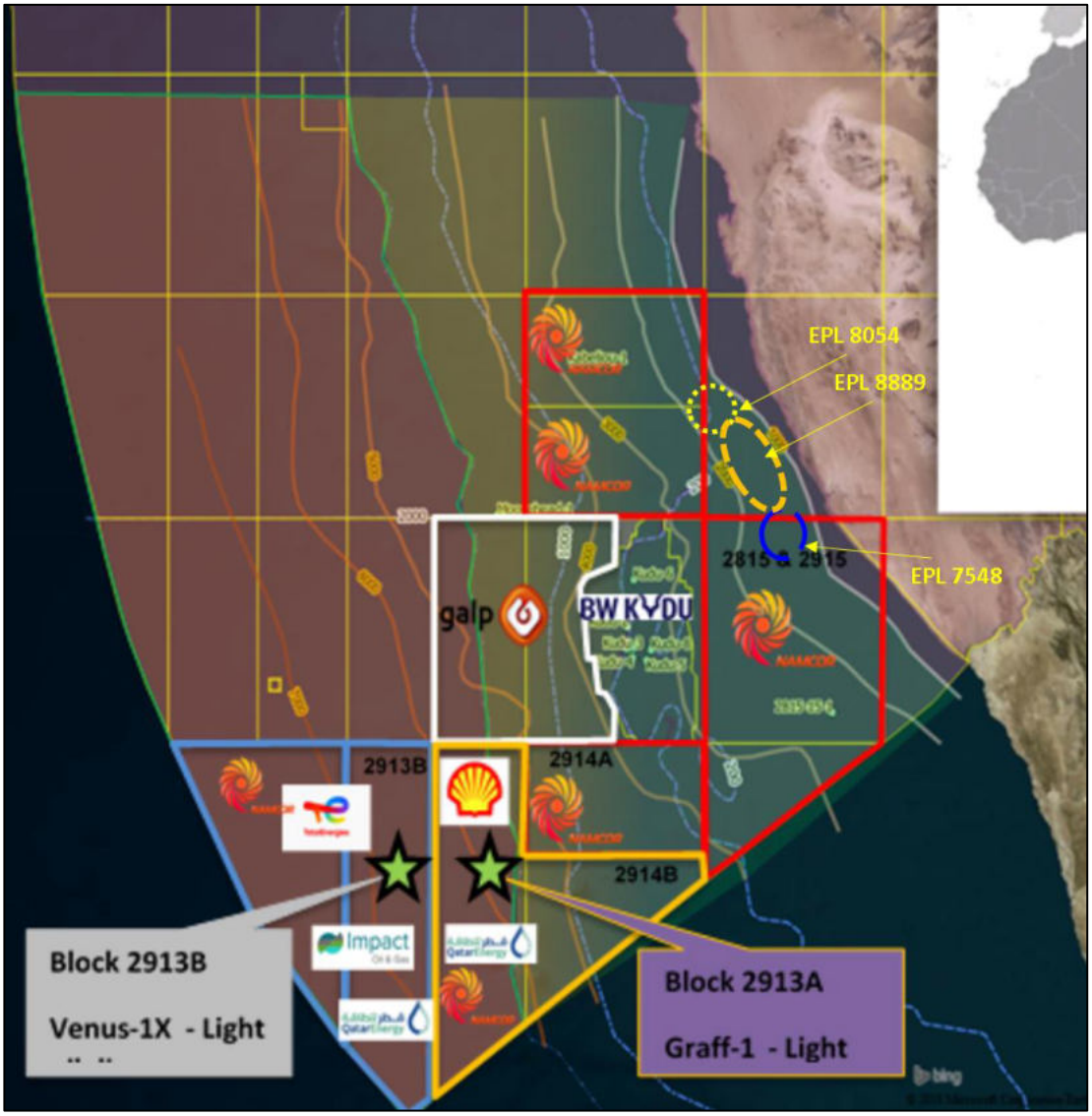

Figure 2.4. Oil/ Gas blocks coinciding with the concerned EPL as well as recent exploratory wells and associated operators

2.3 Scope of Planned Activities

The envisaged exploration program, which has been costed and was ultimately approved by the proponent and their third-party partners, would entail non-intrusive geophysical surveying followed by intrusive bulk seafloor subsurface sampling and onboard processing. A phased approach was deemed to be the most economical option as it would minimize and de-risk CAPEX requirements, and the overall objective is to search for potential occurrences of economic deposits of diamondiferous gravels and to a lesser extent metallic deposits (of rare, base and precious metals) for possible future mining using specialised exploration and mining vessels. The phased program will commence with the acquisition of seafloor and seafloor subsurface geophysical data, and based on the interpretation of such data targets for bulk sampling will them be generated. This approach will ensure that all bulk sampling and subsequent onboard sample processing activities are focussed on a select number of high potential areas, which in turn would ensure that the program is optimized. The bulk sampling component will be further split into 2 sub-phases, comprising:

- An initial phase during which as many of the reasonably sized gravel terraces identified from geophysical data would be sampled to ground-truth geophysics in terms of gravel occurrence and identify possible mineralization, and
- A follow up in-fill sampling phase
- During each of these sub-phases, opportunistic sampling for metallic deposits (i.e., rare, base and precious metals) such will be undertaken by collecting bagged samples of overburden and footwall material for subsequent geochemical essaying onshore.

Due to limited to non-existent local availability of suitable technologies, it is envisioned that either prospecting activities will be carried out using vessels chartered from IMDH or a similar organization, namely: the DP Star for geophysical surveying and the mv Explorer for bulk sampling. It is also important to mention that in addition to these two key activities, the proposed prospecting program will trigger other supporting activities which were equally considered in this EIA report.

Each of the planned prospecting and associated activities are elaborated on below.

2.3.1 Geophysical Surveying and Seafloor/ Sub-seafloor Modelling

As a first approach various non-destructive geophysical surveys such as Multibeam echo-sounder, high resolution side scan sonar and high-frequency low energy seismic data will be acquired to help understand the seafloor geomorphology and sub-seafloor geology and stratigraphy. This will in turn form the basis for delineating potential targets for exploration sampling with destructive tools.

The techniques to be used shall include the Multibeam echo-sounder and the high-resolution side scan sonar surveys. These will be conducted using an Autonomous Underwater Vehicle (AUV) deployed at constant height above the seafloor at a pre-defined line spacing. The transducers emit an acoustic signal in the form of a swath and depending upon the resolution of the data required a variable frequency of between 100 and 500Hz will be used to produce textural maps of the seafloor. The high-frequency low energy (<12kHz) seismic survey, on the hand, will be undertaken to profile the upper 10 to 15m subsurface of the seafloor sub-surface. During such surveys acoustic pulses are emitted from the AUV at constant height above the seafloor at specified line and the reflected signals are recorded digitally onboard the survey vessel. These survey data will then be utilized to develop seafloor and seafloor subsurface

textural and stratigraphic maps for purposes of delineating gravel pockets, overburden thickness, depths to footwall and potential trapsites. It is envisaged that the exploration program will start off with a **30-days** long geophysical data acquisition campaign using the chartered IMDH vessel, the DP Star or a similar alternative (refer to Figure 2.5), to survey approximately 6000-line kilometers of swath bathymetry and seismic data. The surveying vessel, DP Star, is equipped with a dynamic positioning (DP) system that does away with anchoring while on a sampling station. The vessel has hull-mounted geophysical equipment, including a Topas P40 parametric (high-resolution) seismic unit and a Kongsberg EM 710 multibeam echo-sounder, winch capacities to deploy towed geophysical systems (such as a sparker and a side-scan sonar) as well as an 8-m clearance A-frame vibrocore sampling unit: in short, the vessel has all the facilities required to provide full offshore geophysical support services. Furthermore, systems onboard vessels such as the DP star allow the vessel to sail very accurate pre-programmed survey line patterns to enhance the detection of depressions below the seabed, thereby allowing better identification of potential trapsites for heavy minerals.

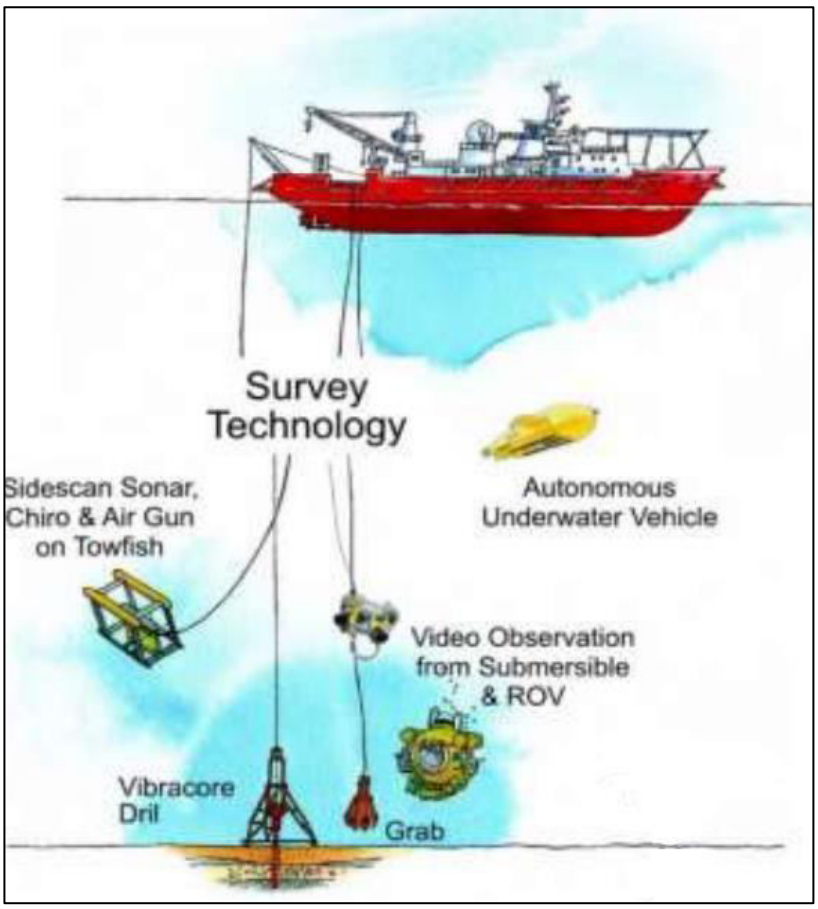

Figure 2.5. Schematic of some of the geophysical survey technology likely to be used on this project

Geophysical data will be collected over a grid of predetermined regularly spaced lines whose spacing will vary depending on the desired level of resolution of the survey data required. For this phase, the geophysical data to be acquired will include the following:

- An initial survey of North-South lines at **500m spacing** and East -West lines at approximately **2 to 3km spacing**. This data will be used to develop a preliminary geological model and to identify geological features of interest for follow-up survey.
- Survey data acquisition techniques will include swath bathymetry; shallow penetration seismic (Pinger/Topaz) data; as well as video and photographic equipment.

    - **Swath bathymetry data**: This type of data is typically acquired using Multibeam echo-sunders (MBES) and Side-Scan-Sonar (SSS) systems. The MBES produces a digital terrain model of the seafloor, backscatter data may be acquired as part of the process to determine textural models; while the SSS systems produce acoustic intensity images of the seafloor and are used to map the different sediment textures from associated lithology of the seafloor. Multibeam echo-sunders and high-resolution side-scan-sonar surveys will be carried out with the aim of producing the seabed topography and surface details in the form of digital terrain models and 2D images. It is proposed that for enhanced accuracy of the data a coupled hybrid survey comprising Side-Scan-Sonar (SSS) and Multibeam echo Sound (MBES) technology will be undertaken for this project. This technique is well described in Shang *et al*. (2019).

      Generally, Side-scan sonar (SSS) is used for obtaining high-resolution seabed images, but with low position accuracy without using the Ultra Short Base Line (USBL) or Short Base Line (SBL). Conversely, the Multibeam echo sounder (MBES) can simultaneously obtain high-accuracy seabed topography as well as seabed images with low resolution, especially in deep water. Based on the complementarity of SSS and MBES data, the proposed survey strategy has an advantage in that it allows the acquisition of high-resolution seabed topography and surface details which are difficult to obtain using MBES or SSS alone. These surveys will be carried out using Autonomous Underwater Vehicle (AUV) or a tow-fish which is flown at constant height above the seafloor at specified line spacing. The transducers emit an acoustic signal in the form of a swathe. Depending upon the resolution of the data required, a variable frequency of **100 to 500Hz** is used to produce textural maps of the seafloor. The swath bathymetry data resolution will be subject to water depth, but commonly, "z" resolution within 10's of centimetres and x y data pixels with 10 x 10m resolution can be achieved with the equipment onboard the DP Star or a similar platform. Once acquired, the data is recorded and mosaiced digitally onboard the vessel. The resultant 2D images of the seafloor and seafloor texture will subsequently be interpreted to map out zones of outcrops, coral reefs, depressions and any other significant objects or substrate which may occur on the seafloor. From a prospecting point of view, this data will be used to refine the license areas' global and local geological model, and delineate potential trap site zones (usually spatially confined depressions) where diamond-bearing gravels tend to be trapped.

    - **Sub-bottom profiler (seismic) data**: Sub-bottom profilers (typically boomer, chirp and sleeve gun) are low frequency echosounders that provide profiles of the upper layers of the ocean floor. They are basically seismic-acoustic systems that can detect and image sub-surface features up to depth ranges between 10 and 15m, including objects which may be buried in sediments. The 2D

acoustic survey involves transmitting acoustic energy to the seabed and recording energy reflected back from subsurface boundaries to acquire information on subsurface geology. In the case of the Chirp sub-bottom profiler the survey typically involves emitting acoustic pulses (chirps) from an AUV at constant height above the seabed along predefined lines. The reflected signals are recorded digitally. Chirp systems operate around a central frequency which is swept across a range of frequencies typically between 1.5 – 12.5 kHz. Penetrations are typically < 15m below the seafloor. On the other hand, the Boomer is an electromagnetically driven sound source. The source is usually mounted on a towed catamaran and a separate hydrophone array (single streamer) is used for a receiver. The sound is generated when a capacitor bank is discharged through one or more flat spiral coils and causes one or more copper or aluminium plates adjacent to the coil to flex away from the coil/s. This flexing creates an acoustic shock wave. The reflected signal from the acoustic pulse is then received by a towed hydrophone streamer. Depending on the subsurface material types and Boomer source frequency levels, a penetration depth from 25 to 100 m may be achieved (possibly deeper in very soft sediments). Once processed the resultant data from these surveys will be used to determine morphology of shallow bedrock, the thickness and seismic stratigraphy of unconsolidated sediments including the potentially diamond-bearing gravel ore body, and the thickness of overlying sterile sediments which have a substantial influence on the sampling, mining and metallurgical processing rates. The boomer system provides best results for coarser sediments, the pinger and chirp systems deliver greater detail for finer sediments. Because both coarse and fine sediments are anticipated to occur within the license area, a combination of all three (3) techniques is likely to be adopted for the planned geophysical campaign.

- **Video and photographic equipment**: this may be used for visualising the seabed as part of ground-truthing studies

- Where favourable seafloor textural and seafloor sub-surface stratigraphic features are observed, infill survey lines of 200m line spacing (of the same types of surveys) will then be completed over more focussed selected areas of exploration interest once the initial survey data has been captured, processed and subjected to preliminary interpretation. These detailed high-resolution geophysical surveys will utilise similar tools but at closer line spacings.

An array of the likely geophysical survey equipment to be used and their source frequencies plus source noise levels are summarized in Table 2-2 and Figure 2.6. These are based on experience and proven performance of such techniques drawn from acquiring similar types of data in the southern west coast areas near Ludertiz and Oranjemund, by companies such as Namdeb, Debmarine Namibia, Namibia Diamond Company, and Samicor.

Table 2-2. Specifications of acoustic equipment that may be utilised for geophysical survey data acquisition

SURVEY TYPE	FREQUENCY	SOUND/ NOISE LEVELS (dB re 1 µPa at 1m)
Multibeam Echo Sounder	70 -455 kHz	190 - 232
Sub Bottom Profiler - Chirp	1.5 – 12.5 kHz	195 – 220
Sub Bottom Profiler - Boomer	100 Hz – 5 kHz 300 Hz – 3 kHz	200 – 222 215
Sub Bottom Profiler - Sleeve gun system	100 – 800 Hz	≤225
Side Scan Sonar	100 – 850 kHz	190 - 242

The images shown in Figure 2.6 portray typical output data which is likely to be generated from the afore-described geophysical surveys.

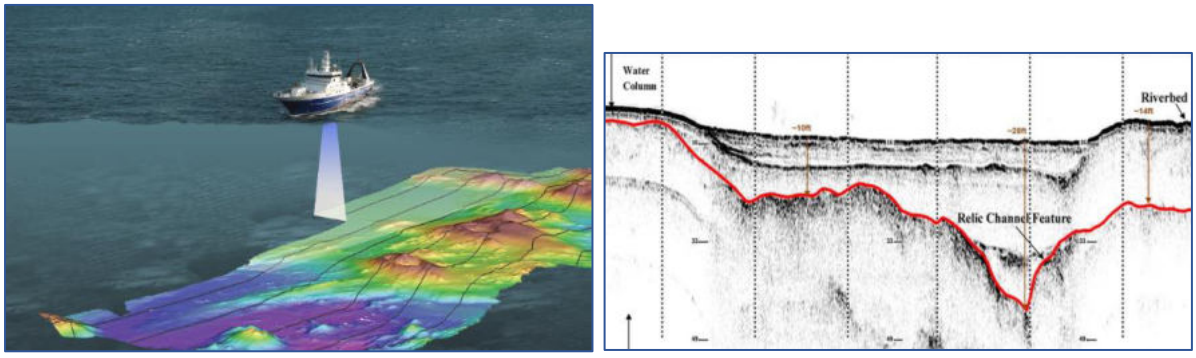

Figure 2.6. (Left image) Typical output of swath bathymetry data; (right image) typical output of seafloor sub-surface seismic survey

The swathe bathymetry and seismic data acquired during the geophysical survey program will then be integrated with any historical geophysical data acquired previously by others from surrounding areas to help update and refine the seafloor, sub-bottom and overall geological model within the license areas. Upon updating the conceptual geological model, targets for bulk sampling will then be generated for subsequent bulk sampling.

2.3.2 Bulk Sampling and on-board Processing

Once drill sampling targets have been identified from the refined seabed geomorphological and seafloor sub-surface geological models, bulk sampling using a large-diameter penetrating tool will be implemented to aid in ground-truthing key conceptual aspects such as gravel layers, overburden type and thickness, and footwall type and thickness. This process will entail 2 sub-phases, namely: an initial bulk sampling program with sampling to be undertaken at wider spacing and a follow-up campaign with sampling at closer line and sample spacing to help acquire in-fill data and close up information gaps. This will be accomplished by means of recovering continental shelf sediment samples. Similarly, to the acquisition of geophysical data, it is envisioned that a suitable sampling vessel of opportunity such as the MV the Explorer or a similar alternative will be chartered from IMDH or alternative service providers for an initial

45-days long voyage (split in half between the 2 licenses) to fulfil this purpose. This initial phase of sampling will be undertaken in a wider grid pattern to maximize the area coverage within the licenses and to ensure that as many of the conceptual targets identified from the updated geological model are verified with respect to stratigraphy, identified conceptual gravel layers, type of overburden sediments, depth to and type of footwall sediments, and the possible occurrence of mineralization. For the first phase of sampling, samples will be taken along east – west transverse lines. Depending on the outcomes of the preceding stage work (i.e., the refinement of the geological model based on geophysical data), samples may be collected in a fixed pattern over the identified target area. Samples may be taken along lines spaced anywhere between 50 m to 400-500 m apart, with sample spacing based on the geological nature of the targeted geological horizons..

The anticipated sampling vessel, The Explorer (shown in Figure 2.7) is equipped with a DP 2 dynamic positioning system (DP2) which enables the vessel to maintain position to within 1m without the need to deploy anchors, and then to move quickly to the next sampling location. The vessel possesses a fully integrated subsea drill tool with a $5m^2$ – 10 m^2 footprint area, capable of drilling up to 8 to 12m into unconsolidated sediments in water depths of 180m; a launch and recovery A-frame (SWL 200 Ton) handles the subsea drill tool through a central 8x10 m moonpool, with a spooling slurry-hose delivery system delivering the drilled material into the fully integrated in-line 20 ton/hour diamond DMS processing plant to and the final recovery of diamonds from X-ray concentrated material. Water depths in the EPL areas are anticipated to be less than 200m, which is well within the depth-of-reach capacity of this vessel.

Figure 2.7. IMDH's vessel, The Explorer, which is likely to be used for exploration sampling

During exploration bulk sampling, the seabed drill tool is deployed at discrete pre-defined positions all the way to the seabed using a slurry hose spooler equipped with a 200m flexible riser hose which is about 350mm in diameter (Figure 2.8). The tool interface has a grizzly opening generally large enough to pass cobbles and medium sized boulders. The riser hose remains suspended in a state of constant tension by means of a compensation system which ensures that the drill bit remains in contact with the seabed while the vertical motion of the ship is absorbed. The weight of the sampling tool frame helps to keep the sampling tool in position during drill sampling, thereby minimizing any lateral drift and keeping the footprint of the sample pit or hole within acceptable limits. Consequently, this prevents any over recoveries of sediments and contributes to minimizing disturbance of the benthic environment. Fluidized

and loosened overburden and gravels are fed along a semi-circular channel across the lower surface of the bit, extracted through apertures on the bit and airlifted to the surface through the riser hose onto a non-chemical processing plant onboard the vessel. The depth of sediment sampled can range from 0.5 m and 5 m below the seafloor surface. Depending on sea conditions at the time of sampling and the seabed geotechnical conditions encountered within a specific sampling area, up to 60 samples can be successfully taken per day. In so far as the safe operations of the vessel is concerned, the vessel would typically operate on a 3 or 4 anchor spread with unlit anchor mooring buoys whilst conducting marine sampling operations. For the duration of operations a coastal navigational warning would be issued by the Namibian Navy Hydrographic Office requesting a 1.5 nautical mile and 2 nautical mile clearance from the survey and sampling vessels, respectively. The safety zones aim to ensure the safety both of navigation and of the project vessel, avoiding or reducing the probability of accidents caused by the interaction of fishing boats and gears and the survey and sampling vessels.

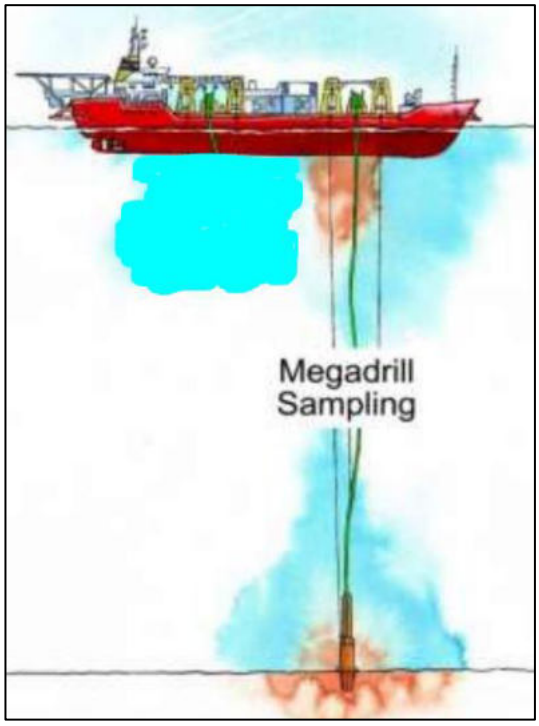

Figure 2.8. Schematic of typical seabed drill sampling and subsequent discharge of tailings

Typically, the exact nature of the metallurgical sample processing technology to be used fitted onboard the vessel will depend on the volume and nature of the seabed materials encountered in the area. Accordingly, metallurgical and processing parameters will be adjusted from time to time to help suit the geological conditions encountered.

During follow-up infill sampling, samples will be collected at a denser spacing (most likely 50m x 50m or denser), and such sampling will be exclusively focussed on areas which would have proven to be mineralized to better delineate the orebody and increase the confidence in the resource.

Because exploration campaigns are typically short (typically less than 40 to 50-days), the exploration crew will remain at sea throughout the planned sampling program. Boarding and

off-boarding of the crew is anticipated to take place at the Port of Luderitz, from where the vessel will sail to the project site. Support services such as support vessels, flights and offices may either be stationed in Luderitz or Oranjemund.

2.3.3 Supporting Activities

In addition to the primary activities, namely: geophysical surveying and drill bulk sampling plus onboard sampling, the following supporting activities will be undertaken and are also expected to trigger some impacts.

- **Office and general support base**: Over the duration of the exploration program an office and operational support base will be set up in Luderitz or Oranjemund. Hence, all support personnel (e.g., technical teams, logistics teams, etc.) assigned to the project will be based in one of these 2 towns.

- **Bunkering at sea and in port; Fuel supply, Transfer, Storage and Usage**: The fuel used by the DP Star and the Explorer, or similar alternatives, is likely to be typical Marine Gas Oil, which is a rapidly evaporating light diesel engine fuel. On the sampling vessel the fuel is also used for onboard generators which supply electricity for powering all the accommodation, sample processing plant and recovery. On the DP Star the same fuel is used to supply electricity to accommodation and office facilities, as well as to power up geophysical equipment. Both vessels are expected to have adequate capacity to be fully operational for long periods of time before bunkering. Similarly, to ongoing offshore diamond prospecting and mining activities by the likes of Debmarine Namibia (DBMN) and Samicor, fuel will be supplied to the vessels by refuelling from a tanker at sea. In the Namibian context, it is required that refuelling activities must be undertaken at distances more than 12 nautical miles from shore to reduce risk should any spillage occur. In the case of DBMN, each vessel is typically refuelled once every three months although for the proposed operation the re-fueling frequency is expected to be higher. ***The transfer of fuel from the tanker to a vessel is envisaged to be one of the biggest risks to the environment in so far as this project is concerned***. It is, however, worth stressing that because geophysical and sampling campaigns are typically conducted over short voyage durations, it is unlikely that there would be a need to refuel any of the proposed vessels during the proposed surveying and sampling programs. The oil is typically stored in large tanks onboard, and such tanks are kept under well controlled temperatures and pressures.

  In addition to marine gas oil, other oils such as hydraulic oils, used oils, sludge and lubricating oil will be kept and used onboard the vessels, and for this reason, there are always risks of oil spillages. Typically, in instances of spillages on deck a natural sphagnum peat moss product is used which is an oil absorbent that encapsulates the oil so that the hydrocarbons do not leach out once such oil is disposed off at designated landfills ashore. Lubricants such as grease will also be widely used onboard, but these are not a major concern because any spillage would be easily contained onboard. Due to the short duration of the proposed prospecting activities, it is not envisioned that a supply vessel would be necessary during the operations.

- **Discharges to Sea and Waste Management**: In summary this covers all forms of discharges as well as management of various wastes that are expected from the planned geophysical and bulk sampling and associated supporting activities. It is vital to emphasise that Namibia is a signatory to MARPOL, and therefore, all vessels operated within Namibia's marine shores are compelled to comply with the MARPOL standards. This includes:
    - Disposal of waste foods – In accordance with MARPOL Annex V the disposal of waste foods into the sea is permitted when the vessel is located more than approximately 6km from land, provided that the waste food has been comminated to a particle size finer than about 25mm. This is generally regarded as best practice in industry. In terms of the same Annex, overboard disposal without macerating can occur greater when the vessel is more than about 22km from the coastline. In terms of these international regulation, whichever vessels are ultimately hired by the project team are thus compelled and obligated to comply with these practices.
    - Discharges such as deck drainage, machinery wastewater – In terms of MARPOL regulation 21 standards (Annex I), it is explicitly stated that any oily water (fresh or seawater) discharged from a vessel should not contain more than 15ppm oil in water. Very often wastewater from decks and plant machinery have concentration levels more than this threshold. In such instances, standard practice is to process the wastewater through a suitable separation and treatment system onboard before discharging overboard.
    - Management of sewage, detergents, general waste (e.g., paper, plastic, glass), scrap metal, empty and used substance drums and containers, used lubricants and oils. These will be managed as follows:
        - Sewage – In accordance with MARPOL Annex IV the prospecting vessels to be used shall be equipped with sewage treatment plants that release inert sludge and chlorinated water.
        - Packaging materials – these waste will most likely be incinerated onboard to reduce volumes of waste to be stored onboard, and thereafter the reduced waste will be disposed off ashore at registered and designated landfills upon demobilization of the vessel. In the case of this project the likely disposal facility will be the Walvis Bay land fill as there is no designated landfill site in Luderitz where the operational base will be situated.
        - Waste glass, cans, plastic – these will be accumulated onboard over the voyage duration, in designated and well-labelled skips, and will then be donated or sold to registered recycling off-takers in Luderitz upon demobilization of the vessel.
        - Detergents – detergents are typically used for washing exposed decks. To ensure environmental safety, it is preferred that biodegradable detergents are used for such purposes on either of the 2 vessels to be chartered. Where non-biodegradable detergents are used such drainage should first be treated prior to discharge overboard in accordance with MARPOL regulation 21 standards (Annex I) requirements.
        - Scrap metals – all scrap metals will be accumulated and stored onboard over the voyage duration and will then either be disposed off at a designated marine scrap products scrap yard in Luderitz, from

where they will subsequently be donated/ sold to registered recycling off-take companies upon demobilization of the vessel.

- Empty drums and containers – Empty drums and containers containing residues, which may have adverse environmental effects (such as solvents, used gear, oil, etc.), would be recycled / disposed of in a licenced landfill site at Walvis Bay upon vessel demobilization, or donated/ sold to registered recycling off-takers in Luderitz.
- Used oils and lubricants - All non-recycled waste oils and lubricants would be safely stored over the voyage duration, and ultimately disposed off at a licenced landfill site in Walvis Bay or a designated and approved site in Luderitz, or donated/ sold to licensed recycling off-takers.
- Infectious waste – this kind of waste typically includes bandages, dressings, surgical waste, and needles from persons treated onboard. Because IMDH has very strict occupational health and safety requirements for persons who are permitted to work onboard, only minor quantities of these are expected. When such waste are generated however, they will be incinerated onboard or stored over the voyage duration and brought onshore for disposal at designated sites in Luderitz where the town's hospital disposes off their medical waste.

- **Discharges to Air**: Based on ongoing similar operations by DBMN and Samicor in the southern Namibian west coast, it is known that daily emissions from incinerators and vessel engines include carbon dioxide, carbon monoxide, nitrous oxide, and sulphur. Compliance with the requirements of Marpol Annex VI - Prevention of Air Pollution from Ships will therefore be required for all vessel engines and where vessels are fitted with garbage incinerators. Specifically, **Annex VI** of MARPOL addresses air pollution from ocean-going ships. The international air pollution requirements of Annex VI establish limits on nitrogen oxides emissions and require the use of fuel with lower sulphur content, protecting people's health and the marine plus coastal environment by reducing ozone-producing pollution, which can cause smog and aggravate asthma.

- **Management of Ferrosilicon**: Every effort will be made to recover FeSi. However, experience has shown that FeSi loss can be inevitable, especially when the plantfeed being treated contains a high shell content because the FeSi tends to accumulate inside the shells and is consequently lost. The Explorer sampling vessel's plant is however fitted with ball mills which help to break and deflocculate the shells and any clumped clay materials; and in so doing, a significant amount of FeSi is recovered.

- **Airborne Services**: It is envisioned that the longest voyage duration for the geophysical surveying and sampling vessels that would be chartered will not exceed 65-days. For this reason, no crew change flights would be necessary during the exploration campaigns via helicopter transfers during any of the planned voyages. However, emergencies and program delays may arise during the planned voyages which may trigger the need for chartered helicopter services. Should such circumstances arise, a helicopter will be chartered to either transport any personnel or emergency goods to or from the vessel. The take off and offloading base for such flights will be Luderitz or

alternatively Oranjemund, For DBMN which operates in the Luderitz and Oranjemund areas, rotary wing helicopter services are supplied by Court Helicopters Namibia, although other similar service providers may be available. A key requirement which such service providers must meet is to have appropriately trained and experienced helicopter pilots who can manoeuvre through strong sea winds and at times thick fog.

- **Seaborne Services:** Although exploration voyage durations are likely to be short, there may always be a need to transport heavy and bulky supplies in order to tackle unforeseen breakdowns, or an unforeseen shortage of critical items such as engine components. Should such a need arise the services of a chartered smaller supply vessel would be sought.

The above listed activities are based on well-documented literature such as Waanders and Rabatho (2005), technical specifications on the IMDH's website, personal experience of the authors during their years of services in the offshore diamond mining sector, as well as information provided by proponent.

2.4 Project Justification

The need to commence with this project is justified on the following merits:

- In Namibia, the mineral resources sector and mining in general is the backbone of the local economy and contributes more than 25% of the country's income and is the largest contributor to the Namibian economy. For the future of the mining sector to be secured, especially considering the fast-depleting diamond resources along the southwestern coast and in Atlantic 1, there is a necessity to identify new resources through prospecting activities such as those proposed in this report.
- Based on the fact that there has been and there is currently ongoing successful mining of gem quality diamonds in close proximity to the license area, it is anticipated that there are potentially economically viable diamond reserves in the license area. From a geological point of view, it is perceived that these diamond deposits were deposited and concentrated through various oceanic processes over millions of years as a result of the erosion of non-sterile diamond-bearing kimberlites in the highlands of South Africa. The fact that proven deposits occur all along the southern west coastline of Namibia between Oranjemund and Luderitz gives merit that some of the diamondiferous sediments may have been carried further offshore onto the continental shelf where the concerned EPL is located.
- If exploration on the current EPL yields positive results, offshore diamond mining could commence in the 2-license area. In accordance with the Namibian Diamond Act (Act no. 13) of 1999 and its amendments (e.g., Government notice 104 of 2003) a portion of the annual production will have to be dispatched to local diamond cutting and polishing entities for further beneficiation. This will create new and sustained business opportunities for existing and new local diamond cutting and polishing entities, thereby contributing to sustained employment levels, skills acquisition, and increased revenue generation for the Namibian government.
- If the results and data from the planned exploration campaign are positive, this will trigger and motivate more license holders in the same area to commit funds for exploration along the west coast of Namibia. An increase in exploration activities will have direct socio-economic benefits to Namibia which could include:
    - An immense improvement of our local knowledge and understanding of the offshore subsurface deposits

- Increased security of product supply for local diamond cutting and polishing companies
- Increased procurement opportunities for local SMEs in the areas of Luderitz and Oranjemund
- Revenue generation for central government through the payment of loyalties and port charges via NAMPORT

3 PROJECT ALTERNATIVES

This section explores alternatives that were considered and weighed up, and lists those deemed to be most feasible in the context of this project. The viability of the selected alternatives/options is based on those that were found to be less damaging to the biophysical and socio-economic environment, while maximizing potential benefits from the proposed activities.

According to the 2012 EIA Regulations the definition of the "alternatives", in relation to a proposed activity, refers to different means of generally achieving the same purpose and requirements of a proposed activity, which may include alternatives to –

- (a) the location where the proposed activity is to be undertaken.
- (b the technology to be used in carrying out the activity; and
- (d) the operational aspects (or methods/ techniques) of the activity

The concept of considering alternatives thus ensures that the environmental assessment process is not reduced to the defence of a single project proposal that is to the desire of the proponent, and therefore, provides an opportunity for unbiased considerations of options, to determine the most optimal course of action from an environmental perspective.

For this project, alternatives were considered and weighed up with respect to:

- Location of prospecting area
- The marine diamond prospecting technology and methods to be adopted and,
- The ''No-action'' alternative

3.1 Alternatives to Project Location

The primary goal of the proposed phased exploration program is to determine and evaluate the presence of economically viable diamond deposits and other mineral commodities within EPL 8889. Although such deposits may occur elsewhere nearby or afar this is the area over which the project proponent has legal prospecting rights. For these reasons, no alternative locations were considered in this impact assessment.

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3.2 Alternatives to Project Technologies and Exploration Methods

Technological alternatives were considered for the planned bulk sampling activities. The technological and methodological options considered are provided in the table below.

Table 3-1. Comparison between different marine bulk sampling methods

ALTERNATIVES FOR OFFSHORE BULK SAMPLING	
Vertical (drill technology) bulk sampling	**Horizontal (crawler technology) bulk sampling**
Uses a combination of large diameter drill and a flexible airlift riser hose system. The flexible riser hose implies that the vessel does not need to be anchored directly over the sample hole and can instead advance behind the sample position, effectively making it possible to deposit discarded sediments away from the point of sampling	Uses a combination of an underwater crawler fitted with tracks and a flexible interior suction hose-head system. The flexible riser hose implies that the vessel does not need to be anchored directly over the sampling area and can instead advance behind the sampling position, effectively making it possible to deposit discarded sediments away from the lane of sampling
Bulk sampling involves breaking up of unconsolidated/ semi-consolidated and partially consolidated sediments in a systematic pattern of circular holes in a grid	Bulk sampling involves excavation of unconsolidated and partially consolidated sediments along unidirectional lanes with overlapping sweeps, thus resulting in optimized recoveries
Excavation achieved through interaction of wheel-cutters and hardened steel scrapers with the seabed and sub-bottom sediments	Excavation achieved through a combination of high suction power, water jets to loosen sediments and cutters to break up harder sediments while sorting bars filter out oversize materials
Uses dynamic winch positioning system and acoustic seabed imaging system to provide real-time visualization of the sampling ground.	Uses a highly accurate acoustic seabed navigation and imaging system to provide operator with real-time visualization of sampling area
Footprint of each bulk sample is confined to each discrete hole and is approximately 5m^2	Footprint of bulk sample is a lane along which the crawler advances in a horizontal sweeping action in a swathe of up to 22m width (based on current available technology by Debmarine Namibia)
Opportunity vessel available for chartering is the Explorer from IMDH	Opportunity vessel available for chartering is the ya Toivo from IMDH. Because this vessel is bigger, it is also more expensive to charter and mobilize
In addition to good performance in flatter areas it also performs well in rugged terrains, and is capable of operating in sediment thicknesses of up to 8m	Best suited for flatter areas and capable of operating in sediment thicknesses of up to 4 - 7m

Based on the above performance considerations, in addition to charter fees, the proponent intends to use the Explorer or similar alternative for the initial phase of sampling due to is lower

mobilization and operational costs and to manage risk on CAPEX. Thereafter, if mineable resources are discovered considerations to sample over larger areas in a more continuous fashion using horizontal sampling technology would be considered.

3.3 Alternatives and Options for Management of various forms of Wastes

Options for the management of various forms of wastes which could be generated onboard the vessels to be chartered are summarised in the Table below.

Table 3-2. Waste Management options for waste onboard

TYPE OF WASTE	OPTIONS FOR WASTE MANAGEMENT
Plastic in the form of sheets, wrapping, bottles, drums, synthetic ropes, plastic garbage bags and empty chemical containers	Keep separately onboard and deliver to port reception facility in Luderitz or Walvis Bay
	Incinerate, with the ashes being treated as incinerator ashes
Oily bilge water comprising a mixture of fresh water, sea water, oil, sludge, chemicals and various other fluids that drain into the Bilge	Retain it on-board in a tank and discharging it to a port reception facility
	Treat on-board with an Oil Water Separator to remove the oily part from the vessel bilge water prior to the discharge of the treated bilge water to sea. The removed oily part going to the waste oil tank or sludge tank
Oil residue (sludge) from the purification of fuel or lubricating oil or separated waste oil from oil water separators, oil filtering equipment or oil collected in drip trays, and waste hydraulic and lubricating oils	Manage on-board by retaining them in a tank and then delivering them to Port Reception facility
	Sludge can be treated on-board using an incinerator with a heating system (evaporator) prior to incineration to either evaporate the water fraction of the sludge or to reduce the amount of sludge
Sewage in the form of drainage and other wastes from any form of toilets and urinals; drainage from medical premises (dispensary, sick bay, etc.) via wash basins, wash tubs and scuppers located in such premises; or other waste waters when mixed with the drainages defined above. The discharge of sewage into the sea is prohibited under MARPOL IV, except when the ship has in operation an approved sewage treatment plant or when the ship is discharging comminuted and disinfected sewage using an approved system at a distance of more than three nautical miles from the nearest land	Keep sewage in holding tank
	Comminute and disinfect the sewage onboard
	Treat sewage in a sewage treatment plant to an effluent that can either be discharged directly to the sea or kept in a holding tank. The discharge of sewage into the sea is however prohibited under MARPOL IV, except when the ship has in operation an approved sewage treatment plant or when the ship is discharging comminated and disinfected sewage using an approved system at a distance of more than three nautical miles from the nearest land
Food waste in the form of fruits, vegetables, dairy products, poultry, meat products and food scraps generated on board ship	Discharge directly into the sea 12 nautical miles from the nearest land
	Comminute and then discharge into the at sea 3 nautical miles from the nearest land
	Store on-board separately for later disposal at sea or delivery to Port Reception Facility in case disposal at sea is not allowed due to regulation.

Domestic waste in the form of all types of waste not covered by other MARPOL Annexes that are generated in the accommodation spaces on board the ship. This typically includes paper, cardboard, fluorescent lamps, synthetic material, foils, metal cans, lids, glass, pantry packaging waste. Treatment of domestic waste differs depending on what types are generated and the amount of waste generated	Collect in bags or bins directly, store onboard and deliver to port reception facility
	Compact and/ or crush, then store onboard and deliver to port reception facility
	Incinerate (typically applied to paper and cardboard) and deliver ashes to port reception facility
Incinerator ashes	Collect in bags and deliver to port reception facility. *There is typically no further treatment of this waste*
Operational wastes in the form of oily rags and batteries, old ropes, used pipes, jerry cans, wood, scrap metals, ladders, wooden pallets, storage material, FeSi, rubber gloves and torn working clothes	Collect in designated bags and containers (practicing waste separation at source) and deliver to port reception facility for further handling either by recycling and or re-using. *This is typically the only option available for this form of waste*
Ozone depleting substances in the form of air conditioning appliances or cooling equipment replaced during maintenance.	Collected and removed following a well-documented procedure by a specialist engineer undertaking the maintenance work and then removed as waste for delivery to a port reception facility for further processing. *This is typically the only option available for this form of waste*

3.4 No-Go Alternatives for Offshore prospecting

The "no action" alternative implies that the status quo remains, and nothing happens.

This option was considered and a comparative assessment of the environmental and socio-economic impacts of the "no action" alternative was carried out to establish what benefits might be lost if the planned activities are not implemented. The key loses which may be incurred include:

- Loss of opportunity to establish whether economically viable marine diamond and other mineral resources deposits exist further west and offshore from areas such as Bogenfels and Chamais, as well as to the north of the currently active mining license for Debmarine Namibia.
- Loss of opportunity to acquire better understanding of the seafloor and sub-bottom geology in and near the concerned EPL areas.

- Loss of potential economic opportunities arising from procurement of goods and services from local business over the long terms, especially if this leads to a mineable deposit.
- Loss of opportunity for both marine geological and ecology research.
- Lost opportunity for possible revenue generation for key local entities such as NAMPORT and the central government at large.
- Lost opportunity to encourage and motivate other license holders to aggressively fund offshore exploration programs in order to unlock potential offshore mineral resources/ reserves.

The positive implications of the no-go option, however, are that there would be no disruption to the biophysical environment in the areas proposed for the bulk sampling activities.

Considering the above losses, the "no-action/go" alternative was deemed to be counter development and not in the best interest of the social and economic advancement of the country.

4 APPLICABLE LEGAL FRAMEWORK

In Namibia all aspects related to prospecting, mining, extraction and processing of mineral resources are vested in the state and are regulated by the Ministry of Mines and Energy (MME) whereas sustainable exploitation and management of the environment and use of natural resources is regulated by the Ministry of Environment, Forestry and Tourism (MEFT).

The Minerals Prospecting and Mining Act (Act No. 33) of 1992 is the principal act governing exploration, mining and beneficiation of mineral resources in the Republic of Namibia. From an environmental management viewpoint, this Act requires that an environmental impact assessment be undertaken prior to prospecting, mining/ quarrying and beneficiation operations, coupled with the development of implementable and measurable environmental management and monitoring plans where any physical and/ or functional changes to environmental conditions are anticipated. The Ministry of Mines and Energy is the custodian agency for administering and enforcing compliance to the Mining Act.

On the other hand, MEFT is the overseeing custodian agency for the administration and enforcement of the Environmental Management Act of 2007 (Act no. 7 of EMA), with the enforcement of the Environmental Impact Assessment Regulations of 2012 specifically being entrusted with the Department of Environmental Affairs and Forestry (DEAF) within MEFT. This Act requires that possession of an Environmental Clearance Certificate is a pre-requisite for the continuation of running or operating any activities that are listed under the Environmental Impact Assessment Regulations of 2012. The act further sets out under Section 58 and in the Government Notice No. 29 of 2012 a detailed framework and schedule for conducting Environmental Impact Assessments for mining and mineral processing companies or any entity which plans to undertake exploration, quarrying or mining, and/ or processing of mineral resources at any scale.

A review of the key legislations which would govern the proposed geophysical surveying, bulk sampling as well as subsequent on-board processing of seafloor sub-surface sediments are presented in Table 4-1 and Table 4-2.

Collectively, this review serves to inform the project Proponent, Interested and Affected Parties and the decision makers at the DEAF, MFMR and MME of the requirements and expectations, as laid out in terms of these legal instruments, to be fulfilled prior to, during and post the implementation of the proposed exploration activities.

Table 4-1. Key local legislations and policies relevant to this project

LEGISLATION CONSIDERED	CUSTODIAN ORGAN OF STATE	RELEVANCE TO CURRENT PROJECT
Relevant Acts		
Mineral Prospecting & Mining Act (Act no. 33 of 1992)	Mining Directorate	Sections 50, 52, 54, 57 and 130 of this Act sets out provisions for environmental management for activities arising from mineral exploration, quarrying/ mining and beneficiation, as follows: • Mineral license holders are required to prepare an ESA or EIA and an EMP and make revision of such EMP every 3 years • That any mineral prospector shall take all necessary remedial steps to reasonable satisfaction of the minister for any damage caused by any exploration operations on closure of such operations. • That the minister is empowered to direct any prospector to carry out good reconnaissance, mining and prospecting practices for the protection of the environment, and conservation of natural resources payment of liability fees and royalty and remedial steps for any damages and • That any prospector or miner shall report pollution in course of any operations and make remedial measures for such. The abovementioned provisions are all relevant to the proposed activities and were thus considered in the EIA process.
		Part 2 of the Act sets out 12 principles of environmental management, summarized as follows: • Community involvement in natural resources management, must be promoted and facilitated. • The participation of all I&APs must be promoted and decisions must consider the interest, needs and values of I&APs. • Equitable access to environmental resources must be promoted and the functional integrity of

LEGISLATION CONSIDERED	CUSTODIAN ORGAN OF STATE	RELEVANCE TO CURRENT PROJECT
Relevant Acts		
Environmental Management Act No. 7 of 2007 and its 2012 EIA Regulations Government Notice 28-30 (Government Gazette 4878	MEFT: DEAF	ecological systems must be considered to ensure sustainable systems. • Assessments must be undertaken for activities which may have significant effects on the environment or the use of natural resources. • Sustainable development must be promoted in all aspects relating to the environment. • Namibia's cultural and natural heritage including, its biological diversity, must be protected, conserved and respected to the extent practical. • The option that provides the most benefit or causes the least damage to the environment, at a cost acceptable to society must be adopted to reduce the generation of waste and polluting substances at source. • The reduction, re-use and recycling of waste must be promoted. • A person who causes damage to the environment must pay the costs associated with rehabilitation of damage to the environment and to human health caused by the pollution. • Where there is sufficient evidence which establishes that there are threats of serious or irreversible damage to the environment, lack of full scientific certainty may not be used as a reason for postponing cost-effective measures to prevent environmental degradation; and • Damage to the environment must be prevented and activities which cause such damage must be reduced, limited, or controlled. The proponent and their partners shall have the responsibility of ensuring that the proposed activities, as well as the proposed impact management measures, conform to the principles of this Act. By undertaking this scoping assessment and developing the accompanying project-specific EMP, OMAVI has been cognizant of these requirements, and accordingly the process that was adopted has been undertaken in conformance with this Act and the EIA Regulations (2012). Several listed activities in terms of the Act, are triggered by the proposed activities. **To comply with the requirements of this Act the proponent may only commence with the planned exploration activities once an ECC has been issued by the MEFT, and**

LEGISLATION CONSIDERED	CUSTODIAN ORGAN OF STATE	RELEVANCE TO CURRENT PROJECT
		Relevant Acts
		thereafter, stringent adherence to the terms and conditions of such ECC shall be enforced.
The Diamond Act, Act no. 13 of 1999 (and the regulations of 1 April 2000 and Amendment of the Diamond Regulations of 2003)	Ministry of Mines & Energy (MME): Diamond Affairs Division	Provides for the control measures in respect of the possession, the purchase and sale, the processing and the import and export of diamonds. Section 67 governs search of persons and things. Measures include examination by means of X-ray. Subsection 7 regulates interference with a person's fundamental right to privacy and the deprivation of personal liberty.
Petroleum Products and Energy Act (No. 13 of 1990) Regulations (2001)	Ministry of Mines & Energy (MME): Petroleum Affairs Division	Regulation 3(2)(b) states that "No person shall possess or store any fuel except under authority of a license or a certificate, excluding a person who possesses or stores such fuel in a quantity of 600 litres or less in any container kept at a place outside a local authority area. **This law is applicable to this project as bulk marine gas oil will be stored onboard the chartered vessels over the duration of the planned prospecting voyages**
Public Health Act (Act No. 36 of 1919) Public and Environmental Health Act No. 1 of 2015	Ministry of Health & Social Services (MoHSS): Occupational Health Ministry of Mines and Energy: office of chief inspector for Mine Safety under the Directorate of Mines	The Act serves to protect the public from nuisance and states that no person shall cause a nuisance or shall suffer to exist on any land or premises owned or occupied by him or of which he is in charge any nuisance or other condition liable to be injurious or dangerous to health. The proponent must ensure that exposure to noise, vibrations, and toxic pollutants which could be considered a nuisance and/ or a health risk to employees and or visitors are kept to acceptable levels.
		These set of regulations are aimed at ensuring that mines are operated in a safe manner to prevent fatalities, injuries, and long-term health hazards. The regulations make provision for: • Employee's right to leave unsafe working places • Obligation of a project or operations manager to provide for all safety measures onboard • Reporting of accidents to the chief inspector and keeping a record of such accidents • Requirements for the project or operations manager to provide occupational health services at area of exploration or mining activity

LEGISLATION CONSIDERED	CUSTODIAN ORGAN OF STATE	RELEVANCE TO CURRENT PROJECT
Relevant Acts		
Mine Health & Safety Regulations (under section 138A of the Mining Act, 1992)	MME: Mine Safety & Services Division MoHSS: Occupational Health Division	• Provision for safe discharge of tailings • Ensuring that all parts of a vessel where personnel are working are well ventilated with minimum standards of air quality • The project or operations manager's responsibility to formulate a scheme for safe movement of support vessels and flights to and from the surveying and/ or exploration vessel • The mine manager's responsibility to formulate a scheme for identifying hazards at the area of mining activity and provision of appropriate protective equipment • Ensure that the operations manager provides first aid and firefighting equipment and procedures onboard all vessels All the above-mentioned provisions are relevant to this project and were thus considered in the EMP
Atomic Energy and Radiation Protection Act (Act No. 5 of 2005)	Ministry of Health & Social Services (MoHSS): National Radiation Protection Authority (NRPA)	In accordance with this Ant authoritarian/ permitting for the use or industrial application of radiation sources such as X-Rays is required by the entity from which vessels with such sources would be chartered. In the case of this project this law is highly relevant since radiation sources such as X-Ray machines would be used in the diamond sorting and recovery process.
Prevention and Combating of Pollution of the Sea by Oil Act (Act no. 6 of 1981, and amended by Act no. 24 of 1991)	Ministry of Works and Transport (MWT). Directorate of Maritime Affairs	The Directorate of Maritime in the MWT is the government's custodian agency for National Oil Spill Contingency, organization and response, as well as all maritime regulations and authorizations. In the context of this project this law is highly applicable as it controls the prevention and management of pollution at sea, which would be the primary work space for the proposed activities.
Marine Resources Act (Act no. 27 of 2000)	Ministry of Fisheries and Marine Resources (MFMR)	The MFMR is mandated to control the well-being and sustainable utilization of all living marine resources within the Republic of Namibia. For projects which are to be undertaken at sea this ministry forms part of the EIA reviews
Marine Traffic Act (No. 2 of 1981) (as amended by the Marine Traffic Amendment	Ministry of Works and Transport Maritime Directorate	In Namibia the movement of maritime traffic is regulated through this Act. This Act has relevance to this project as the exploration vessels will be operating in Namibian waters

LEGISLATION CONSIDERED	CUSTODIAN ORGAN OF STATE	RELEVANCE TO CURRENT PROJECT
Relevant Acts		
Act (No. 15 of 1991)		
Namibian Ports Authority Act (No. 2 of 1994) and Port Regulations	Ministry of Works and Transport Maritime Directorate NAMPORT	This act has relevance to this project as the vessels to be used will dock in Namibia ports and all vessel operational support services will be provided through the port of Luderitz
Aviation Act 74 of 1962 (and the Aviation Amendment Act 27 of 1998) and the Namibian Aviation Regulations of 2001	Ministry of Works and Transport Aviation Directorate Namibia Airport Company	Through the Namibian Civil Aviation Authority this Act regulates all aviation activities within the shore and marine boundaries of Namibia. In the context of this project although it is not anticipated for helicopters to be flown on a regular basis as is the case on similar operations such as DBMN, the need to fly choppers out to and from the chartered vessels may arise in case of personnel and equipment/ spares emergencies. This Act has relevance to this project because flight support services will be required from Luderitz or Oranjemund on a regular basis
The Territorial Sea and Exclusive Economic Zone of Namibia Amendment Act (No. 30 of 1991)		The license areas are situated within the Territorial Sea and Exclusive Economic Zone of Namibia, and therefore, any law of Namibia which relates to the exploitation, exploration, conservation or management of the natural resources of the sea, whether living or non-living, shall apply.

A summary of the relevant permits and authorizations required for this project is provided in Table 4-2.

Table 4-2. Key permits required for marine/ offshore exploration

PERMIT/ AUTHORIZATION	AUTHORIZING BODY	GOVERNING LEGAL FRAMEWORK
Valid Exclusive Prospecting License (EPL)	Ministry of Mines and Energy: Directorate of Mines	Minerals (Prospecting and Mining) Act of 1992 (Act no. 33 of 1992)
Valid Environmental Clearance Certificate (ECC)	Ministry of Environment, Forestry and Tourism: Department of Environmental Affairs and Forestry	Environmental Management Act of 2007 *Act no. 7 of 2007) and the Environmental Impact Assessment (EIA) regulations no. 30 of 2012 The issuance of ECC will potentially stem from this exercise

PERMIT/ AUTHORIZATION	AUTHORIZING BODY	GOVERNING LEGAL FRAMEWORK
Radioactive Authorization permits for the use of radioactive sources	Ministry of Health & Social Services (MoHSS): National Radiation Protection Authority (NRPA)	Atomic Energy & Radiation Protection Act (Act no. 5 of 2005) and Radiation Protection & Waste Disposal Regulations (No. 221 of 2011) The vessel chartering entity will be required to obtain this permit before mobilizing to sea
Preapproval permit for usage of dispersant in lien with the Oil Spill Contingency Plan (OSCP) in the event of Accidental Spill	Ministry of Fisheries and Marine Resources (MFMR) Ministry of Works and Transport (MWT). Directorate of Maritime Affairs	Marine Resources Act (Act no. 27 of 2000) Prevention and Combating of Pollution of the Sea by Oil Act (Act no. 6 of 1981, and amended by Act no. 24 of 1991)
Pollution Safety Certificate for Vessels operating within Namibia's maritime environment	Ministry of Works and Transport (MWT). Directorate of Maritime Affairs	Prevention and Combating of Pollution of the Sea by Oil Act (Act no. 6 of 1981, and amended by Act no. 24 of 1991)
Permits and authorization for recovery, storage and trading of rough diamonds in Namibia	Ministry of Mines and Energy (MME): Diamond Affairs	Diamond Act (Act no. 13 of 1999) and the diamond control regulations gazetted on 1 April 2000 and Amended in 2003
Oil Spill Contingency Plan	Maritime Pollution Control and Directorate of Maritime Affairs in the Ministry of Works and Transport.	Prevention and Combating of Pollution of the Sea by Oil Act (Act no. 6 of 1981, and amended by Act no. 24 of 1991)
Emergency Response Plan for personnel and equipment at sea	Ministry of Mines and Energy: Office of chief inspector for mine safety under the Directorate of Mines	Minerals (Prospecting and Mining) Act, 1992, (No. 33 of 1992)

Namibia is a signatory to some of the maritime regional and international treaties and regulations, and therefore, these also need to be complied with. A summary of the key international obligations relevant to this project is provided in Table 4-3.

Table 4-3. Key regional and international obligations relevant to this project

INTERNATIONAL OBLIGATION/ CONVENTION	RELEVANCE TO THIS PROJECT
MARPOL 73/78	The international Convention for the Prevention of Pollution from Ships of 1972 and amended in 1978 (MARPOL 73/ 78) provides regulations for various sources of pollution from ships at sea. Namibia is a signatory to this convention, particularly to Annexures I, II, III, IV and V, and as a result this convention is highly applicable to the implementation of the activities proposed under the this project. Key aspects of this convention which apply to this project are briefly discussed below: • MARPOL Annex V: regulates the prevention of pollution by garbage from ships as well as the disposal of garbage outside special areas as stipulated under regulation 3(1)(b), (1)(b)(ii) and (1)(c) • MARPOL Annex V: deals with the management of solid waste at sea as stipulated under Regulation 3(1)(a) and (1)(b) • MARPOL Annex I: regulates the prevention of pollution by oil and other hydrocarbon substances as stipulated under regulation 9(1)(b) which deals with the control of discharge of oil. Any discharge into the sea of oils, including oily mixtures, from ships is prohibited under this regulation except when such substances have been effectively treated to acceptable levels as outlined under this regulation. • MARPOL Annex IV: regulates for the prevention of pollution by sewage from ships under regulation 8: Discharge of sewage. • MARPOL Annex VI: regulates the prevention of air pollution from ships under regulation 12 – Ozone Depleting Substances In the MARPOL Convention contains six Annexes relevant to this project, which in order are: • Annex I - Regulations on the Prevention of oil pollution • Appendix II. - The rules for pollution control of liquid substances transported by tankers • Annex III. - Regulations on the Prevention of pollution by harmful substances in packaged form • Annex IV. - Regulations on the Prevention of Pollution from Ships faeces • Annex V - Regulations on the Prevention of Pollution from Ships waste • Annex VI. - Regulations on the Prevention of Air Pollution from Ships, emissions of sulfur and nitrogen oxides

INTERNATIONAL OBLIGATION/ CONVENTION	RELEVANCE TO THIS PROJECT
The Abidjan Convention for the Co-operation in the Protection and Development of the Marine and Coastal environment of the West and Central Region, 1981	Protocol Concerning Co-operation in Combating Pollution in Cases of Emergency in the Western and Central African Region, 1985. The protocol provides for cooperation when responding to marine pollutions.
Benguela Current Convention	Benguela Current Convention creates the legal framework for Angola, Namibia and South Africa to promote integrated management, sustainable development and protection of the Benguela Current Large Marine Ecosystem (BCLME) using an eco-system approach to ocean governance focusing, inter-alia, on the management of shared fish stocks, environmental monitoring and early warning, biodiversity and ecosystem health, socioeconomics and governance

In addition to the above key national and international laws and regulations, other legal requirements relevant to this project are summarised in Table 4-4 below.

Table 4-4. Other national legal requirements of relevance to this project

LAW/ REGULATION/ ORDINANCE	RELEVANCE TO THIS PROJECT
Charter for Sustainable and Broad-Based Economic and Social Transformation in the Namibian Mining Sector 2014 – 2020 (The Namibian Mining charter)	This charter aims to facilitate meaningful participation of historically deprived Namibians in the mining and mineral beneficiation industry. It has effectively been developed as an instrument to effect transformation and sets specific targets for mineral license holders and Operators of mineral processing facilities active in Namibia. This is of relevance to this project to ensure inclusive and active participation of historically deprived Namibians in the minerals prospecting and mining industry.
The Mineral Beneficiation Strategy of Namibia	This national strategy was developed and launched in 2021through collaboration between Ministry of Mines and Energy and the German Corporation for International Cooperation (GIZ), and aims to facilitate the realisation of full social and economic potential that can be derived from Namibia's minerals and to promote investment, trade and industrial development. This document provisionally identifies a selection from diamonds, coloured gemstones, zinc, industrial minerals (gypsum, dimension stone, limestone), iron and steel foundry products, battery minerals (lithium and graphite) and salt as

LAW/ REGULATION/ ORDINANCE	RELEVANCE TO THIS PROJECT
	pilot projects for mineral beneficiation in Namibia. The envisaged project is well aligned with this strategy and could be used as a pilot project.
Atmospheric Pollution Prevention Ordinance 11 of 1975	This ordinance provides for the prevention of air pollution and is affected by the Health Act 21 of 1988. Under this ordinance, the entire area of Namibia, apart from East Caprivi, is proclaimed as a controlled area for the purposes of section 4(1) (a) of the ordinance.
Marine Traffic Act, Act no. 2 of 1981 (an the latest Amendment by the Namibia Ports Authority Act, Act no. 2 of 1994)	• Regulates the following: - entry and departures of vessels from Namibia waters, - Immobilization, laying up, stopping or anchoring of vessels outside harbors - Abandonment of ships or wrecks at sea
Territorial Sea and Exclusive Economic Zone of Namibia, Act No. 3 of 1990, 30 June 1990	• Determines, defines and regulates the territorial sea, internal waters, exclusive economic zone and continental shelf of Namibia; and further provides for matters incidental thereto
National Heritage Act, Act no. 27 of 2004 (and the 2005 Regulations)	The Act makes provision for the protection and conservation of places and objects of heritage and archaeological significance and the documentation and registration of such places and objects. Part V Section 46 of the Act prohibits removal, damage, alteration or excavation of heritage sites or remains, while Section 48 sets out the procedure for application and granting of permits such as might be required in the event of damage to a protected site occurring as an inevitable result of development. Part VI Section 55 Paragraphs 3 and 4 require that any person who discovers an archaeological site should notify the National Heritage Council. Section 51 (3) sets out the requirements for impact assessment. Under this Act, abandoned and sunk ships and wrecks at sea must be well documented and recovered to the extend practical whenever they are pre-detected or found by chance. **A key recommendation made in the accompanying EMP is that all seafloor scans should be further analysed by a qualified and experienced marine archaeologist to help detect any possible seabed wrecks prior to exploration drilling and sampling.**
Labour Act, Act no. 11 of 2007 (and the	Sections 3, 4, 5, 11, 16, 23-27, 44 and 135 make provision for the following: • That a person may not employ a child under the age of 14years • That children are prohibited for employment in a mine and other dangerous circumstances • That forced employment of persons is prohibited • That an employee is entitled to monetary remuneration daily, weekly, fortnightly, or monthly in cash, cheque, and direct deposit into a bank account

LAW/ REGULATION/ ORDINANCE	RELEVANCE TO THIS PROJECT
Labour Amendment Act, Act no. 2 of 2012)	• That the work hours of an employee are 45 hours in a week, over and above which an employee is entitled to additional payment overtime wage • That employees are entitled to (a) annual leave on the basis of the average number of days worked over the year, (b) a day's sick leave for every 26days worked, (c) compassionate leave for a period of 5days in 12 months which is fully paid, and (d) leave on public holidays, • That female employees that have completed 6 months of employment are entitled to 12 weeks of maternity leave, which can be extended for a further period of one month • That the minister is empowered to make regulations in relation to safety, health, hygiene, sanitation, and welfare of persons employed in or about mines, including sea-bed operations The proponent is expected to be compliant with the above provisions and for this reason the above provisions were accounted for in this report.

5 DESCRIPTION OF THE RECEIVING ENVIRONMENT (BASELINE)

This section provides a review of the receiving (or baseline) environment through the analysis of existing baseline data and information as deduced from literature, studies for similar projects from within the republic of Namibia, consultative engagements with stakeholders, specialist input from specialists (such as fisheries and marine biology), and the experience of the Environmental Assessment team from their involvement in similar offshore diamond prospecting activities. In this respect, baseline information is provided on the following receptors:

- The Physical Environment
- The Biophysical Environment and
- The Socio-economic Environment

In addition, key marine conservation and protected areas located off the Namibian shore and in close proximity to the license area were considered.

The aim of this section is to provide a baseline against which changes which may arise because of the proposed project activities could be measured, gauged and monitored over time.

5.1 Physical Environment

5.1.1 Geography

The license area concerned is located on the west coast of Namibia and fall within the Benguela Upwelling System (BUS). This region is characterized by a strong upwelling of cold, nutrient-rich water from the deep ocean, which fuels a productive marine ecosystem that supports various marine life, including fish, seabirds, and marine mammals. The upwelling is driven by the prevailing south-easterly winds that blow along the coast of South Africa, Namibia and Angola. These winds push the surface waters offshore, causing deep, nutrient-rich water to rise to the surface. Hence, the sea surface temperature (SST) along the coast is relatively cooler than in the open ocean. The Benguela system is separated into two subsystems by the Lüderitz upwelling cell, namely:

- the northern Benguela upwelling system (NBUS) and
- the southern Benguela upwelling system (SBUS).

The Lüderitz upwelling cell located at ~26.5°S is the central upwelling in the BUS (Shannon, 1985) and experiences intense upwelling throughout the year (Bakun, 1996).

5.1.2 Climate and wind conditions

The coastal region of Namibia is characterized by a unique wind regime strongly influenced by the interaction between the cool Benguela Current, the hot desert interior of the African continent and the South Atlantic Cyclone. The seasonality of the winds along the coast of Namibia can be broadly divided into two periods: the summer (October-March) and the winter (April-September). During the summer, the Benguela Current is weaker, the South Atlantic Anticyclone (SAA) is found southward, and the winds blow predominantly from the south and southeast (Figure 5.1 and Figure 5.3). These winds are generally light and variable, with occasional periods of stronger offshore winds. The summer winds are typically associated with the formation of dense coastal fog, which can significantly impact shipping and transportation in the region. In contrast, during the winter months, the Benguela Current is stronger, and the SAA shift northwards, resulting in generally stronger and more consistent than the summer winds (Figure 5.3), and are often accompanied by large swells and heavy surf.

The winter winds are also associated with cooler temperatures along the coast due to increased upwelling and seasonal cooling (Boyd, 1987; Hagen et al., 2001). The climate of the coastal areas of Namibia is also heavily influenced by the Benguela Current which results in a cool, foggy climate along the coast, with temperatures ranging from around 15°C to 25°C throughout the year. Precipitation is also quite low along the coast, with only around 10-50 mm of yearly rainfall (Potts et al., 2015).

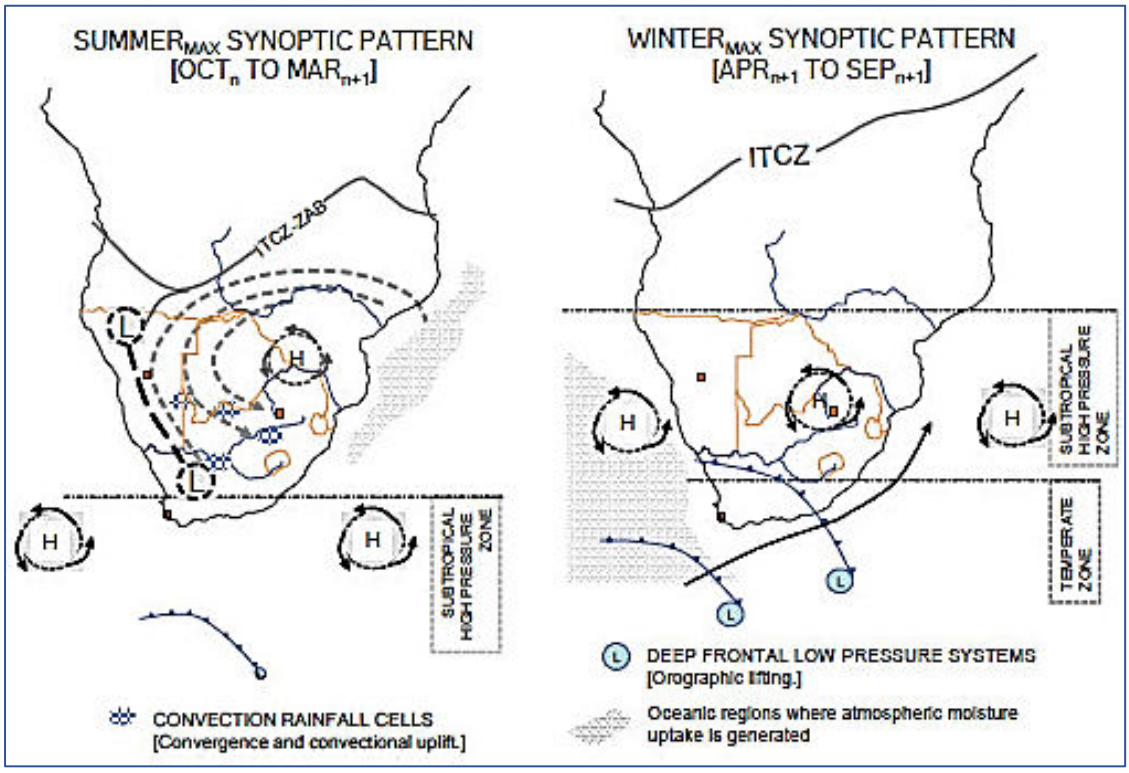

Figure 5.1. Synoptic patterns over Southern Africa during summer (left) and winter (right) seasons. The H over the ocean denotes the South Atlantic Anticyclone/High and South Indian Anticyclone/High, respectively. The ICTZ is the Intertropical Convergence Zone, and L is the Low-Pressure system. (referenced from: Lange, 2017)

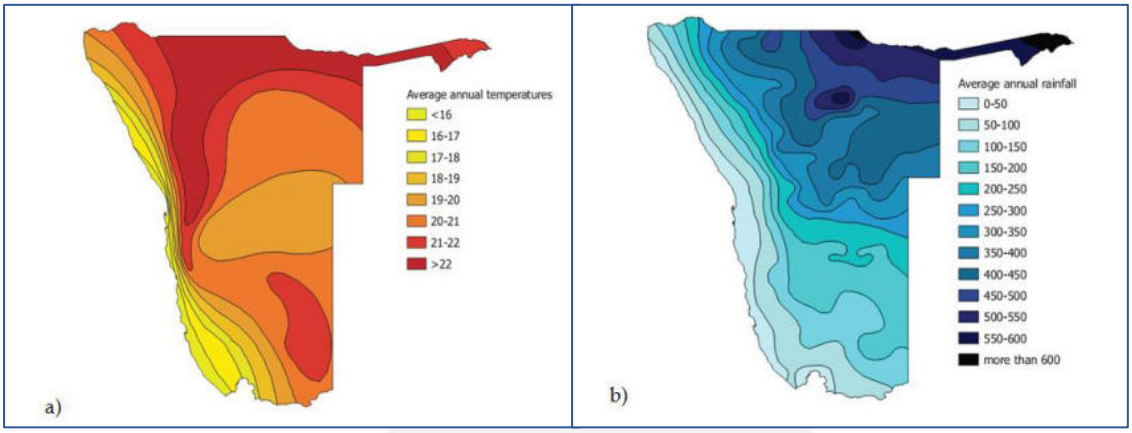

Figure 5.2. Annual mean (a) Temperature and (b) Rainfall of Namibia (Shikangalah, 2020).

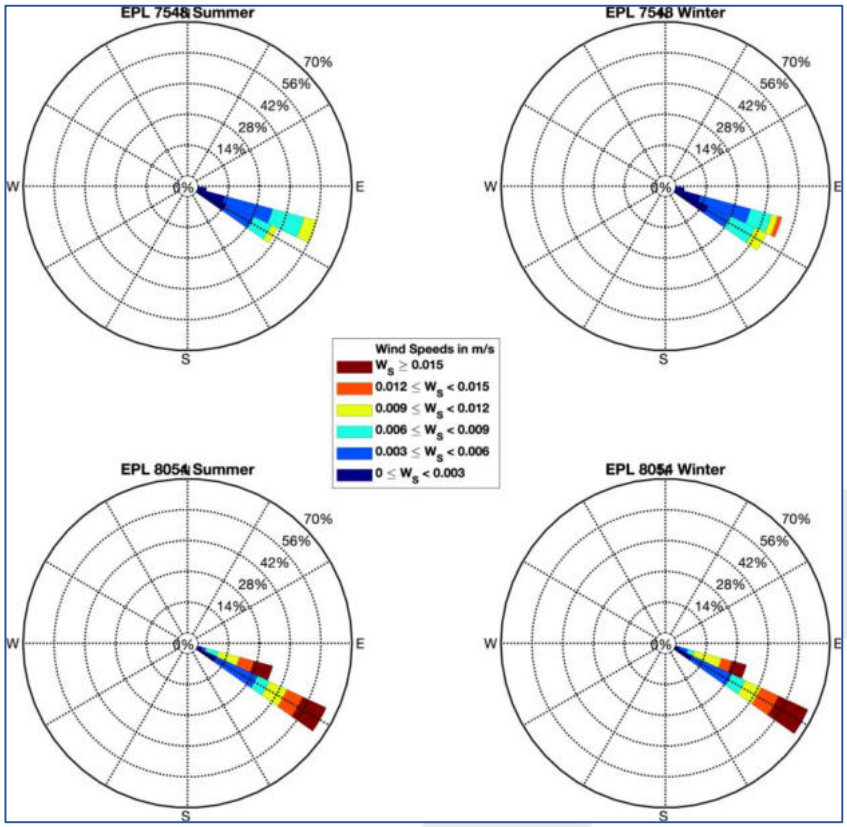

Figure 5.3. Seasonal wind roses (Unpublished) in the vicinity of the concerned EPL, specifically within nearby EPLs 7548 & 8054.

5.1.6 Ocean waves and tides

According to McLachlan (1980), most of the west coast of southern Africa is classified as exposed, experiencing strong wave action, rating between 13 and 17 on the 20-point exposure scale. Much of the coastline is therefore impacted by heavy south-westerly swells, as well as waves generated locally by prevailing southerly winds. Generally, the wave regime along the southern African west coast shows only moderate seasonal variation in direction, with nearly all swells approaching from the south-west and southern direction all year-round. The swells are typically strongest in the winter months, and the waves can exceed 2m heights, averaging about 3m and often attaining up to 5 m in height. Wave heights up 10m have however been recorded in the southern Namibian west coast in Debmarine Namibia's Atlantic 1 Mining License area and Namdeb's Southern Coastal Diamond Mine, and are thus a possibility for the concerned EPL areas. Wind speeds associated with these winter swells can reach a speed of 70 to 100km/hr.

According to McLachlan (1980), tides generally arrive almost simultaneously (within 5 to 10 minutes) along the whole of the West Coast and are typically weak, with a mean tidal range typically less than 2m.

Wave height, wave direction, wave/ wind speed and tide range have significant bearing on the productivity and safe operation of exploration vessels such as the DP Star and the Explorer. This is primarily because the waves and wind speeds generally destabilize the vessels and make anchoring of the vessels at sea difficult which in turn makes positioning of the vessels and associted surveying and sampling tools difficult due to dragging of the anchors and sampling tools, and difficulties to maintain the vessel in the same position for a reasonable period of time whilst surveying or sampling. This results in loss of production time and possible loss of equipment. As a general rule of thumb, the stronger and higher the waves the more unstable and usafe a vessel will be under operation. For optimal vessel stability, vessels typically need to be positioned and anchored along the wave direction. This implies that in the EPL area the exploration vessels would need to be positioned in such a manner that its long axis is more or less in a south-westerly and southerly direction during operations. Equally important, the tidal range has significant bearing on the effectiveness of geophysical and sampling data acquisition because the surveying and sampling tools to be deployed from the vessels need to have provision for sufficient compensation of water depth changes arising from tides.

To de-risk the project from loss of production time, potential occurrence of safety incidendents and potential compromize on the quality of exploration data acquired, it is recommended that either planned surveys be conducted during the non-winter months when waves are small, less frequent and the occurence of strong swells is minimal.

5.1.7 Bathymetry/ geomorphology and geology

Broadly, the region within the license areas are situated is characterized by a relatively shallow continental shelf, which slopes gradually downwards towards the deep ocean basin. The bathymetry of the northern Benguela is shaped by a variety of factors, including tectonic activity, sedimentation, and ocean currents. The region is located at the boundary between the African Plate and the South Atlantic Plate, which has resulted in a complex geological history and the formation of several geological features, such as submarine canyons, ridges, and seamounts.

The continental shelf along the northern Benguela is relatively narrow, with water depths generally ranging from around 20m to 200 m near the coast. The shelf is relatively flat, with some areas characterized by sand dunes, gravel beds, and rocky outcrops. Beyond the continental shelf, the seafloor slopes steeply downward towards the deep ocean basin, with water depths reaching more than 2000 m in some areas (Figure 5.4).

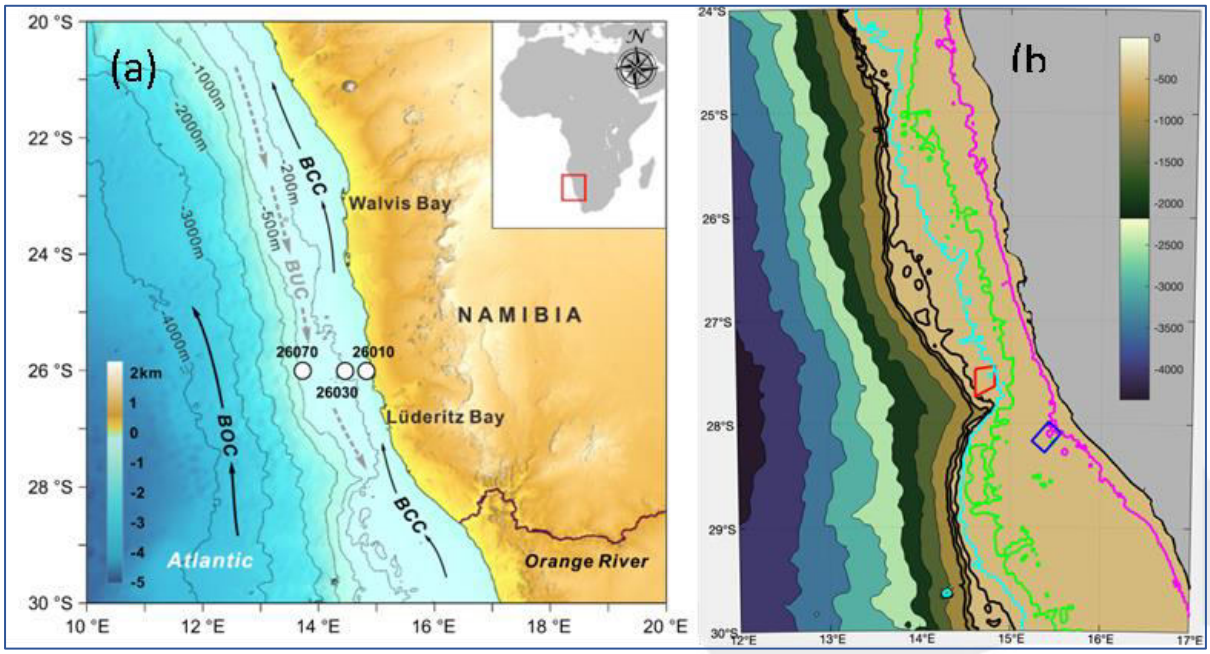

Figure 5.4. (a) Bathymetric map off Namibia (left) showing schematic currents modified from *Inthorn et al. (2006a)*. The black arrows mark the main surface branches of the Benguela current system, including the Benguela Oceanic Current (BOC) and Benguela Coastal Current (BCC). The poleward Benguela Undercurrent (BUC) over the outer shelf is marked by dashed grey arrows (Adapted from *He et al., 2023*). (b) The bathymetry off Namibia including the mining exploration areas, EPL (red box) and EPL (blue box). The 100 m, 200 m and 300 m depth are denoted respectively by the magenta, green, and cyan line (Unpublished).

According to Birch et al. (1976) and Rogers and Bremner (1991), the project area broadly forms part of the inner to middle continental shelf which are known to be underlain by Precambrian bedrock and Cretaceous and Tertiary sediments, respectively. It is known from numerous geophysical surveys and shallow water prospecting work that the bedrock profile of the inner shelf between Luderitz and the Orange River is largely characterized by an irregular erosional surface which is typically overlain by a thin cover of unconsolidated Quaternary sediments (silts – sand and gravels) of Orange River origin. These soft and semi-consolidated surficial sediments comprise the targeted deposits for prospecting. The exact texture of the sediments has a strong bearing on the potential impacts on marine life, both benthic and pelagic, as it significantly influences key aspects such as the intensity of life at a give site, plume size and dispersion rates, as well as the duration of sound and vibration disturbance at a given location during bulk sampling.

5.1.8 Ocean Circulation

Figure 5.5 below portrays the general bathymetry of the exploration area, EPL 8889, as well as the dominant direction and magnitude of surface ocean currents during summer and winter. Based on this maps, it is evident that the concerned areas generally lie between the 100m and 300m isobaths. The main circulation in the BUS and its seasonal variability are well documented by *Nelson and Hutchings (1983) and* are predominantly characterized by equatorward (i.e., northward) surface currents as shown in Figure 5.5. These equatorward (i.e., northward) surface currents are part of the broader Benguela Current which forms the eastern limb of the South Atlantic Subtropical gyre (*Peterson and Stramma, 1991*).

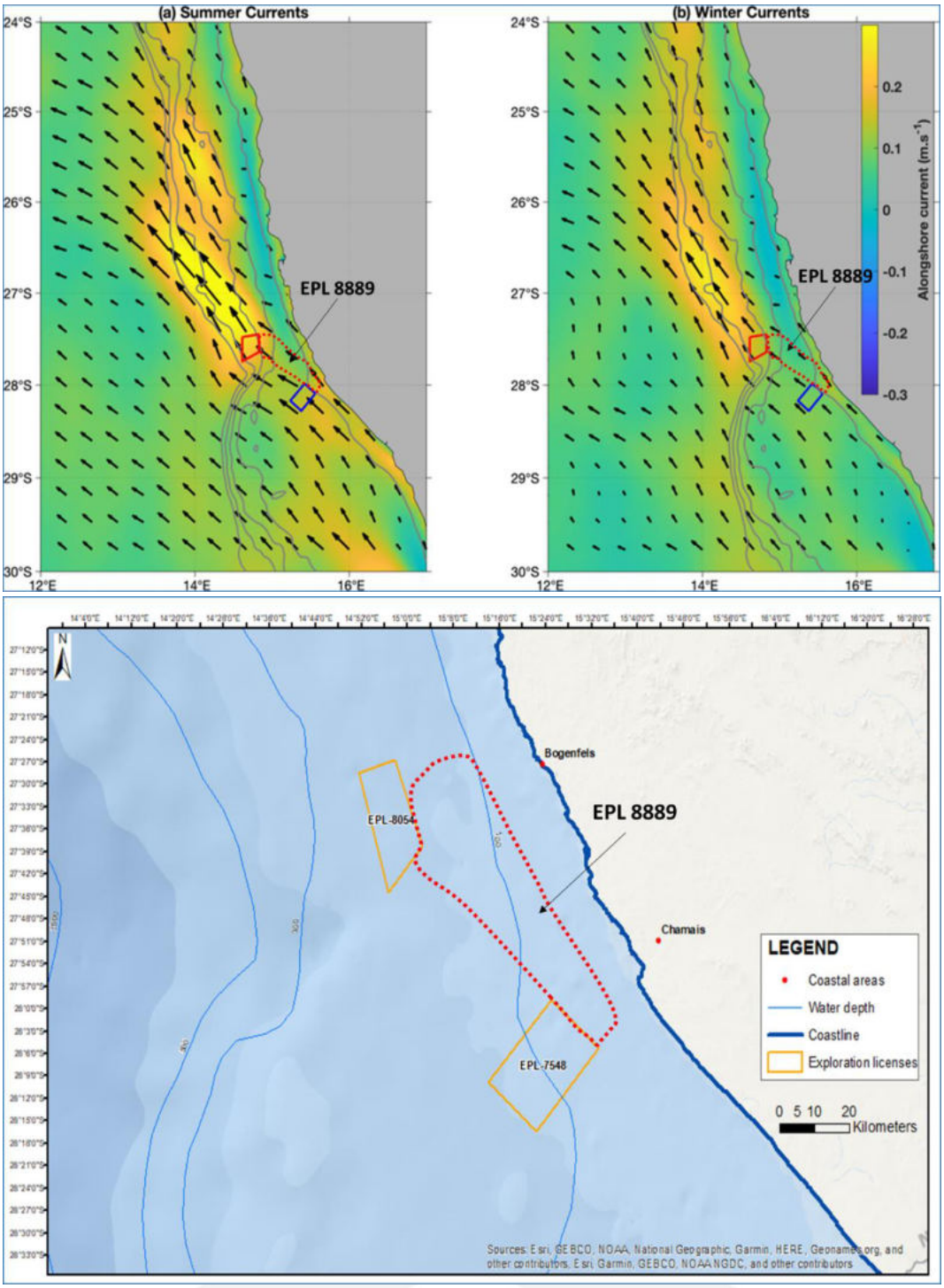

Figure 5.5. Map of mean surface currents: (a) summer and (b) winter. The colours shows magnitude and the vectors show direction of the surface ocean currents. The 100, 300 - 500 m isobaths are superimposed in grey (Unpublished).

In addition to the surface currents, the project area is known to comprise a poleward undercurrent which flows along the continental shelf-edge as shown in Figure 5.6 below.

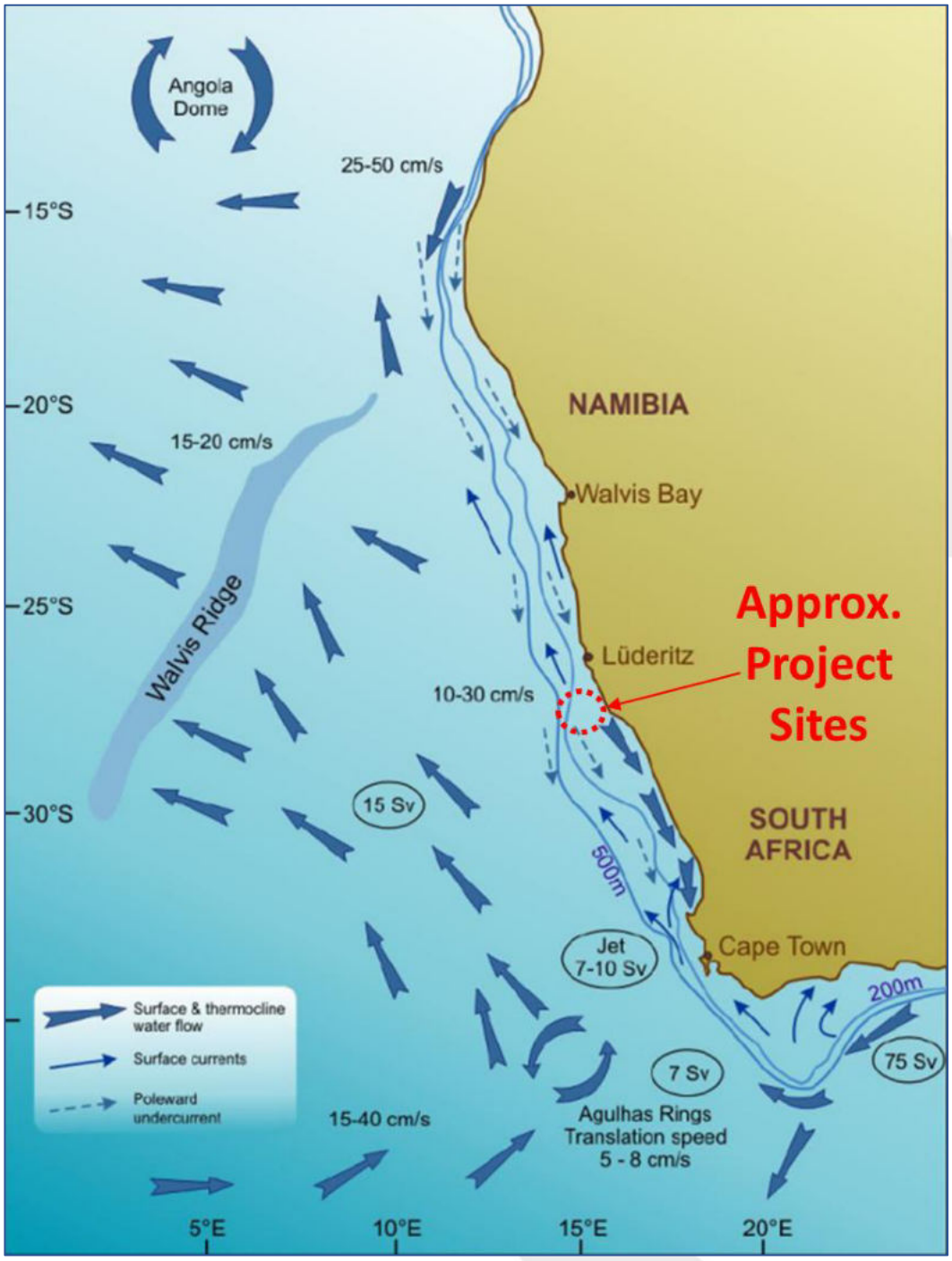

Figure 5.6. Circulation and volume flows of the Benguela Current (modified from Shannon & Nelson, 1996).

The magnitude and direction of both surface and bottom currents has a strong bearing on key environmental aspects such as plume dispersion and plume direction for sediments and any oil spills.

5.2 Offshore conservation and Marine Protected areas

The coastline of Namibia is part of protected areas that stretch along the entire Namibian coastline, a distance of about 1 570 km, from Southern Angola to the Namaqualand in South Africa.

Recently, the Namib-Skeleton Coast National Park was proclaimed to incorporate four (4) terrestrial Management Areas, namely: the Skeleton Coast National Park, the Dorob National Park, the Namib-Naukluft National Park and the Tsau//Khaeb-Sperrgebiet National Park. The southern component of the Namib-Skeleton Coast National Park are described briefly below as they bear significance to the proposed operation. In addition, three (3) areas of Ecological or Biological Significance, collectively referred to in this report as the Ecologically or Biologically Significant Areas (EBSAs) are described below due to their proximity to the project site.

5.2.1 Tsau//Khaeb-Sperrgebiet National Park

The Tsau//Khaeb park was proclaimed in 1908 to prevent public access to the rich surface diamond deposits occurring in the area and has largely remained closed off to the general public since then, until about 2019. It extends between latitude 26° in the north and the Orange River in the south, extending inland from the coast for 100 km, covering an area of approximately 22 000 km^2. As diamond mining has remained confined to the narrow coastal strip and along the banks of the Orange River, the area around Bongefels, Chamais and around Elizabeth Bay near Luderitz, most the area has effectively been preserved as a pristine wilderness. Large parts of the park have since been de-proclaimed from exclusive prospecting and mining licences, and reverted to un-proclaimed State land. Consequently, the Tsau//Khaeb-Sperrgebiet National Park was proclaimed in 2008. The park has been zoned in accordance with IUCN guidelines for Protected Area Management Categories.

5.2.2 Ecologically or Biologically Sensitive Areas (EBSAs)

There are three (3) EBSA to the immediate east of the concerned prospecting license; **however there is no overlap between the EBSAs and the concerned EPL**. The 3 EBSAs proximal to the license area are:

- Orange Seamount and Canyon Complex
- Orange Cone
- Namibian Islands

A map showing the spatial location and extent of these areas in relation to EPL 8889 is shown below.

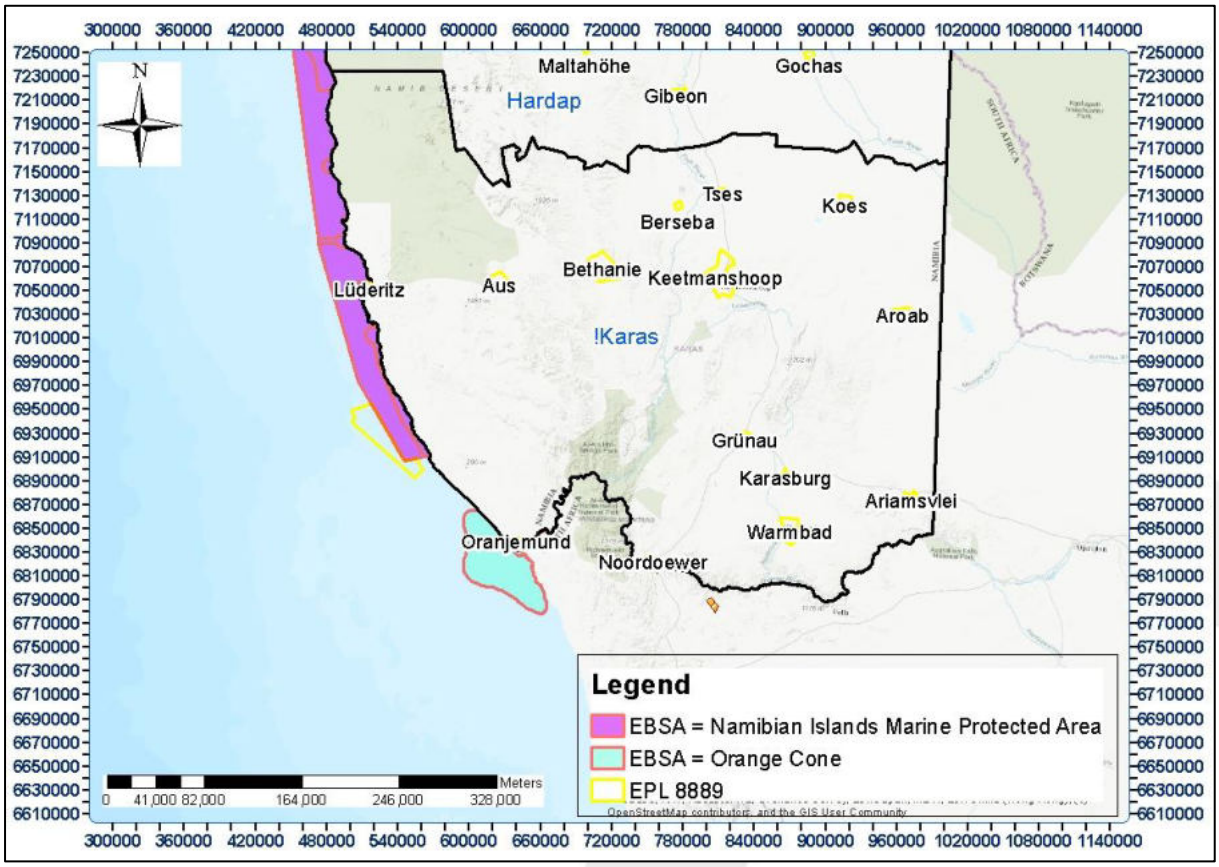

Figure 5.7. Ecologically or Biological Sensitive Areas in the Namibian southern Atlantic

5.2.2.1 Orange Seamound and Canyon Complex

The Orange Seamount and Canyon Complex occurs at the western continental margin of southern Africa, spanning the border between South Africa and Namibia. On the Namibian side, it includes Tripp Seamount and a shelf-indenting canyon. The EBSA comprises shelf and shelf-edge habitat with hard and unconsolidated substrates, including at least eleven offshore benthic habitat types of which four habitat types are "Threatened", one is "Critically Endangered" and one "Endangered".

The Orange Shelf Edge EBSA is one of few places where the threatened habitat types are in relatively natural and pristine condition. The local habitat heterogeneity contributes to the Orange Shelf Edge being a persistent hotspot of species richness for demersal fish species. Although focussed primarily on the conservation of benthic biodiversity and threatened benthic habitats, this EBSA also considers the pelagic habitat, which is characterized by medium productivity, cold to moderate Atlantic water temperatures and moderate chlorophyll levels related to the eastern limit of the Benguela upwelling on the outer shelf.

5.2.2.2 Orange Cone

The Orange Cone is a transboundary EBSA that spans the mouth of the Orange River. The estuary is biodiversity-rich but modified, and the coastal area includes many "Critically Endangered", "Endangered", and "Vulnerable" habitat types (with the area being

particularly important for the Critically Endangered Namaqua Sandy Inshore, Namaqua Inshore Reef and Hard Grounds and Namaqua Intermediate and Reflective Sandy Beach habitat types).

The marine environment experiences slow, but variable currents and weaker winds, making it potentially favourable for reproduction of pelagic species. An ecological dependence for of river outflow for fish recruitment on the inshore Orange Cone is also deemed likely.

5.2.2.3 Namibian Islands

The key ecological value of this site was recognized prior to the EBSA process, and in 2009, the Namibian Ministry of Fisheries and Marine Resources (MFMR) gazetted the Namibian Islands Marine Protected Area (NIMPA). The NIMPA covers nearly 1 million ha of coastal waters that encompass all the natural seabird breeding islands in Namibia and the key supporting seabird foraging areas in the surrounding sea that provide fish for the adult birds . It extends alongshore for about 400 km from Meob Bay to Chameis Bay and, on average, 30 km offshore from the high-water mark. It is located between the latitudes of 24°S and 28°S, within the national jurisdiction of Namibia. Feature description of the area.

The Namibian Islands are located offshore in the central region of the Benguela Current Large Marine Ecosystem (BCLME) within the intensive Lüderitz Upwelling Cell. These islands and their surrounding waters are significant for the life history stages of threatened seabirds species, as the Namibian Islands serves as important seabird breeding sites.

The intensive Lüderitz upwelling cell plays a significant role in regulating the biomass of fish stocks of central Namibia. Consequently, the islands and adjacent productive waters provide important breeding and foraging habitat for threatened seabirds and marine mammals, and includes important nursery grounds for the commercially important west coast rock lobster, Jasus lalandii.

The islands are crucial seabird breeding sites within the existing Namibian Islands Marine Protected Area (NIMPA). The Namibian Islands is also recognized as a foraging site for regionally Critically Endangered leatherbacks from the Western Indian Ocean that nest in South Africa. Thus, although the focus of this EBSA is on seabird breeding and foraging, there are several other important species for which this site is important.

The Namibian Islands EBSA is described for both benthic and pelagic features, primarily as a key breeding and foraging area for threatened seabirds, but also as breeding, nursery or foraging areas for several other species that are iconic, threatened or of commercial importance. Eleven seabird species breed on the islands, of which eight are endemic to southern Africa. Of these, the African Penguin (Spheniscus demersus), Bank Cormorant (Phalacrocorax neglectus) and the Cape Cormorant (P. capensis) are listed as globally Endangered; the Cape Gannet (Morus capensis) is listed as globally Vulnerable and locally Critically Endangered.

Three rock lobster sanctuaries, one linefish sanctuary and key calving areas of southern right whales were also included. This site is a foraging area for regionally Critically Endangered leatherbacks from the Western Indian Ocean that nest in South Africa. The NIMPA, which adjoins the Namib-Naukluft and Tsau//Khaeb national parks on the landward side, is sectioned into zones of increasing protection levels, with the highest protection status afforded to the islands. Six of the islands are also designated as Important Bird and Biodiversity Areas (https://cmr.mandela.ac.za/Research-Projects/EBSA-Portal/Namibia/Namibian-EBSA-Status-Assessment-Management).

5.3 Biophysical Environment

5.3.1 Marine habitats

As far as nearshore and continental self marine habitats are concerned, two broad categories of habitats were identified and assessed. These are:

- the unconsolidated seabed sediment (benthic) habitat and
- the water column (pelagic) habitat

The concerned project area lies along the southern Namibian continental shelf within a transitional zone between two large cool-temperate marine biogeographic provinces the southern Namaqua and northern Namib provinces (Emanuel et al., 1992). The productivity and functionality of all two habitats in the project area and the broader Namibian west coast is influenced to a significant extent by the southern Benguela regime. The southern Benguela regime is a typical coastal upwelling system with equatorward winds, cool water, high plankton biomass and moderate to high fish biomass, which is currently in a depleted state according to Hutchings, *et al.* (2009). As far as fishing (which is primarily part of the seawater column habitat) is concerned, for instance, a shift from sardines to horse mackerel occurred during the period 1970–1990, while hake have never fully recovered from intensive fishing pressure up to 1990 (Hutchings, *et al.* 2009). Within the same habitat (i.e., the seawater column habitat), there is generally a tendency for phytoplankton and winds to **peak in late winter–spring in the southern Benguela**. **In cognisance of this it is thus recommended to plan the proposed surveying and sampling campaigns to take place in the summer and autumn seasons when phytoplankton life and general organic productivity is low in this Benguela system.**

The marine communities which can be expected within each of these marine bio-habitats are described in subsequent sections.

5.3.1.1 Unconsolidated sediments (benthic) communities

Zoobenthos refer to the community of animals living on (epibenthic) or burrowing in (benthic) the sediments of a water body and are classified according to size, microbenthos < v0.1 mm, meiobenthos 0.1 – 1 mm, macrobenthos > 1 mm, and megabenthos > 10 mm. The Benguela ecosystem fauna is characterized by a low species diversity, high individual abundance, and limited endemism (Gibbons & Hatchings, 1996). Benthic communities in the region are widespread, but exhibit considerable spatial and temporal variability, depending on factors

such as substratum type, wave exposure, and depth zone, (Bustamante & Branch, 1996; Engledow, 1998). The largest proportion of macrofauna abundance and biomass constitute of polychaetes, crustaceans, and molluscs, with patchy distributions that reflect the high natural variability in space and time (Zettler et al., 2009; Steffani et al., 2015; Eisenbarth & Zettler, 2016). The physical environment, determined in part by water depth and sediment composition, plays a significant role in shaping the structure of macrofaunal biodiversity along the west coast of Southern Africa (Steffani et al., 2015). A summary of the typical benthic species which may be expected in the exploration area is provided in Figure 5.8 below.

The assessment of the benthic biodiversity along the Namibian coast was based on sporadic studies which mostly focused on the mining impacts along the coastal zone up to the inner shelf. Generally, species richness increases from the inner-shelf across the mid-shelf and is influenced by sediment type (Eisenbarth & Zettler, 2016). Offshore, the southern African shelf constitutes the most species richness and diversity of benthic invertebrates (Mateus, 2022). High biomass of crustaceans: *Squilla aculeata calmani*, *Funchalia woodwardi*, echinoderms: *Crossaster penicillatus, Brissopsis lyrifera capensis* and polychaetes: *Hyalinoecia tubicola*, can be found along the southern African shelf (Mateus, 2022). Intense bottom disruptions would therefore likely have a detrimental effect on these wide-ranging species (starfish, crabs, benthic prawns, sponges, and urchins) (Fleddum et al., 2013). These organisms all survive in sandy or soft sediments which can be expected to be of a similar character to sediments within the areas of interest. A measure of the impact of current velocity on sediments, oxygen concentration, productivity, organic carbon, and bottom temperature may also strongly influence the structure of benthic communities. Currently, however, there is there is no historic data on infauna communities for the project area, and therefore it is suggested that such site-specific data should form an integral part of the recommended Adaptive Environmental Monitoring Program for the project.

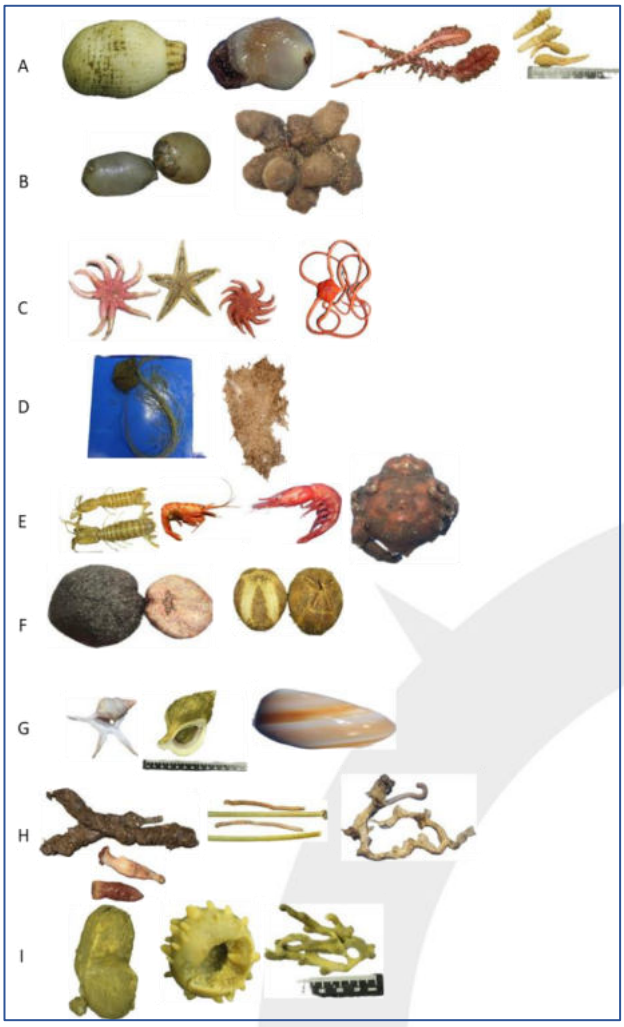

Figure 5.8. Benthic invertebrate diverse range of taxa off the Namibian southern continental shelf - A: Anthozoa, B: Ascidia, C: Asterozoa, D: Bryozoa, E: Crustacea, F: Echinoidea, G: Gastropod, H: Polychaeta and I: Porifera (Mateus, 2022).

5.3.1.2 Water column (pelagic) communities

5.3.1.2.1 Planktonic communities

There are various types of plankton, including single-celled bacteria, phytoplankton, zooplankton, and ichthyoplankton. Fish consume plankton, which is typical prey for seabirds, sharks, and seals. The latter in turn are eaten by larger predators like killer whales, thus forming part of the food chain. There is a wide range of phytoplankton abundances in the Lüderitz cell, with low levels around 27–28°S at its base and high levels downstream of this cell, due to nutrient retention and higher velocity (Barlow et al., 2001).

5.3.1.2.2 Fisheries and Fish

Namibia's marine environment is among the most productive in the Atlantic Ocean. This is because of the Benguela upwelling system, which provides abundant fisheries resources. Although upwelling happens almost throughout Namibia's coastline, the major upwelling

occurs for much of the year off Luderitz (Iyambo, 2001). The rich nutrient water support major fisheries of Namibia which include, Cape hake (*Merluccius capensis* and *Merluccius paradoxus*), monk (*Lophius vomerinus* and *Lophius vaillanti*), orange roughy (*Hoplostethus atlanticus*), deep-sea red crab (*Chaceon maritae*), west-coast rock lobster (*Jasus landii*), Cape horse mackerel (*Trachurus capensis*), southern African sardine (*Sardinops sagax*) and Cape fur seal (*Arctocephalus pusillus*). Furthermore, other commercially important species are also caught in most of the above-mentioned fisheries.

Even though most of these resources are still exploited, the majority of them had been depleted by the time Namibia gained independence in 1990 (Iyambo, 2001). Despite new management measures put in place after 1990, some resources faced difficulties to recover, which prompted the Ministry of Fisheries and Marine Resources to impose a moratorium on fishing for some of the fisheries such as orange roughy and sardine.

Economically, Namibia's fishery industry ranks among the top contributors to the country's GDP. The fishery industry employs a significant number of Namibians, primarily those living in the coastal towns of Luderitz, Walvis Bay, Swakopmund, and Henties Bay. However, employment in Namibia's fishing sector has been unstable over the years, with frequent reports of retrenchment and job losses, which may be a sign of stock depletion for some species.

The fish fauna of the cold BCLME region is supported by the high productivity of the Benguela upwelling ecosystem, with abundant fish stocks but relatively low diversity of species. The Namibian fisheries can generally be divided in three categories:

- Pelagic: Species that inhibit the water column
- Meso-pelagic: species that display extensive diurnal vertical movements being bottom dwellers during the day and rising into the epipelagic zone at night. Some mesopelagic specie such as horse mackerel display different habitat preference are different stages, such as with juvenile horse mackerel being pelagic whilst adults become demersal.
- Demersal: species that inhabit on or near the seafloor

The main commercial fisheries and gear types found in Namibia are presented in Table 5-1 below.

Table 5-1. List of Namibia Commercial Fisheries Sectors, Targeted Species and Gear Types.

SECTOR	GEAR TYPE	TARGET SPECIES
Small pelagic	Purse-seine	Sardine *(Sardinops sagax),* Horse mackerel *(Trachurus capensis)*
Mid-water trawl	Mid-water trawl	Horse mackerel *(Trachurus capensis)*
Demersal trawl	Demersal trawl	Cape hakes (*Merluccius paradoxus, M. capensis),* Monkfish *(Lophius vomerinus)*
Demersal long-line	Demersal long-line	Cape hakes *(Merluccius paradoxus, M. capensis)*
Large pelagic long-line	Pelagic long-line	Albacore tuna (*Thunnus alalunga),* Yellowfin tuna (T. albacares), Bigeye tuna (*T.*

		obesus), Swordfish (*Xiphias gladius)*, shark spp
Tuna Pole	Pole and line	Albacore tuna *(Thunnus alalunga)*
Deep – sea crab	Demersal long-line trap	Red crab (*Chaceon maritae)*
Deep – water trawl	Demersal trawl	Orange roughy *(Hoplostethus atlanticus),* Alfonsino (*Beryx splendens)*
Rock Lobster	Demersal trap	Rock lobster *(Jasus lalandii)*
Line-fish	Hand line	Silver kob (*Argyrosomus inodorus)*, Dusky kob *(A. coronus)*
Mariculture	Long-lines, raft	Pacific oysters, European oysters, Black mussel, Seaweed species

Cape Hake

The shallow-water Cape hake (*Merluccius capensis*), deep-water Cape hake (*Merluccius paradoxus*), and Benguela hake (*Merluccius polli*) are the three hake species found off Namibia. The shallow-water hake and deep-water Cape hake are the two most common species. The shallow-water Cape hake distribution covers the entire coastline off Namibia at depths ranging from 50 to over 1000 m, with higher densities between 150 and 450 m (Bianchi *et al*., 1999). Deep-water Cape hake, on the other hand, is found in deeper water than shallow-water Cape hake, typically at depths of 200 to 1000 m (Bianchi *et al*., 1999). In addition, the deep-water Cape hake is distributed along the entire coastline of Namibia from Cape Frio to East London, South Africa. Benguela hake is commonly found in northern part of the Namibian water at the depth of 50 to 550 m (Bianchi *et al*., 1999).

Hake spawning patterns vary by species, with the deep-water Cape hake thought to spawn off South Africa, with juvenile and older fish migrating to Namibian waters (von der Heyden *et al*., 2007). There is evidence of spawning shallow-water Cape hake off Namibia, with spawning occurring throughout the year but peaking in August (Bianchi *et al*., 1999). A closed season on hake fishing is implemented in October to enable for stock replenishment. Hake are opportunistic feeders that graze on a wide variety of fishes, from crustaceans and myctophids when juvenile to lanternfishes, horse mackerel, and juvenile hake as they grow. On the other hand, hake is preyed on by snoek, seals, sharks, and, on rare occasions, seabirds (Bianchi *et al*., 1999).

Hake stock is currently managed through TAC, minimum legal mesh size of trawl nets, and bycatch fees on monk catches in other fisheries. In terms of research, the Ministry of Fisheries and Marine Resources (MFMR) conducts an annual biomass survey, from January to February to estimate biomass and perform an overall model assessment of the stock, which allows the MFMR to set TAC and allocate fishing quotas to right holders.

Cape monk

There are two species of monk found in the Namibian water, the *Lophius vomerinus* and *Lophius vaillanti*. L vomerinus is the more common of the two species, and its spatial distribution extends from Namibia's northern border to South African waters (Froese and Pauly, 2023), mostly at depths ranging from 200 to 400 meters (Bianchi *et al*., 1999). *L. vaillanti*, on the other hand, is found primarily north of the central region of Namibia, with a depth range of 200 to

800m (Bianchi *et al*., 1999). The monk is an opportunistic feeder that feeds on benthic species and occasionally on pilchard, horse mackerel, and round herring (Bianchi *et al*., 1999).

Monk is presently managed through TAC, the minimum legal mesh size of trawl nets, and bycatch fees on monk catches in other fisheries. Every year in November, the Ministry conducts a biomass survey to estimate biomass and perform an overall model assessment of the stock, enabling the MFMR to establish TAC and allocate fishing quotas to right holders.

Orange roughy

Orange roughy is a long-lived, slow-growing species with low fecundity and mortality. The southern hemisphere's spawning season is thought to be between July and August. It is estimated that it takes 20-30 years for orange roughy to reach maturity, resulting in low stock productivity (Boyer et al., 2001). Orange roughy spawning takes place primarily at four known aggregation grounds off Namibia (Boyer et al., 2001). The species is distributed at the depth of around 400 to over 1 000 m but most abundant between 400 and 800 m (Bianchi *et al*., 1999). Current management measures for orange roughy resource include a fishing moratorium since 2009 and bycatch fees on species catches in other fisheries. Before the moratorium was implemented, the Ministry performed a series of biomass surveys from 1997 to 2007. The biomass survey was also carried out in some years following 2009 to ascertain whether the stock had recovered. However, the fishery has yet to resume. The survey is usually done in July when orange roughy is believed to be spawning (Boyer et al., 2001).

Deep Sea Red Crab

The deep-sea red crab is shared by Namibia and Angola. The species is found off the coast of central Namibia and into Angolan waters (Melville-Smith,1989). The deep-sea red crab inhabits muddy bottoms at depths ranging from 100 to 950 meters, but is most common between 300 and 700 meters, and can grow to a carapace width of 16 cm for males and 10 cm for females (Bianchi *et al*., 1999).

The deep-sea red crab is presently managed through the allocation of TAC and bycatch fees on other fisheries' catches. In terms of research, the Ministry of Fisheries and Marine Resources (MFMR) carries out an annual deep-sea red crab survey, in August to assess distribution patterns, determine biomass and stock status. Even though traps are used for commercial fishing, the survey is conducted using bottom trawls.

West coast rock lobster

The west coast rock lobster is found on the inshore rocky seabed at depths of up to 100 m. The species' main distribution extends from Walvis Bay in Namibia to East London in South Africa (DAFF, 2016). It is also believed that the west coast rock lobster migrates seasonally based on water temperature and oxygen levels (Tomalin, 1993). The species can reach a carapace length of 59 mm and survive for up to 40 years (Bianchi et al., 1999). Mating occurs after male lobsters molt between September and December, and females between April and May.

The west coast rock lobster harvest is regulated by a TAC that is allocated to fishermen. The TAC is primarily caught off the coast of Lüderitz at four known rock lobster hotspots between November and April while catching is prohibited between June and October (Shuuluka, et al., 2018). To establish the TAC, the Ministry of Fisheries and Marine Resources conducts research off the coast of Lüderitz. Anglers obtain permits for harvesting lobsters.

Horse Mackerel

Horse mackerel (*Trachurus capensis)* from the Carangidae family is a schooling species mainly found over the continental shelf. Horse Mackerel dwells over sand bottoms, observed at the surface as well as down to a depth of 400 m; shoals rise to feed in surface waters at night while they are close to the bottom during daytime (Bianchi et al., 1999).

Horse mackerel is an opportunistic feeder, feeding on mainly on euphausiids (Boyer et al., 2001), and to a lesser extent on *Sufflogobius bibarbatus*, *Diaphus hudsoni*, *Diaphus meadi*, (Bianchi et al., 1999). Preyed on by Cape monkfish (Bianchi et al., 1999; Erasmus 2021), Cape fur seal *Arctocephalus pusillus* (Raja alba Lacepède, *M. capensis* (Bianchi et al., 1999). Horse mackerel generally have a protracted spawning season (up to eight months) across a wide area (Abaunza et al. 2003, Dransfeld etal. 2005), In Namibian waters, spawning of Cape horse mackerel occurs throughout the year, but with a spawning peak between December and March (Wysokinski1985)

The horse mackerel fishery is managed through a total allowable catch (TAC), control of fishing effort (minimum mesh size limits of 60 mm in the midwater fishery) and fishing is not allowed at depth shallower than 200m. TAC for the horse mackerel fishery is determined each year by adjusting the TAC from the previous year depending on whether the size of the resources have increased or decreased. The rate of change of the TAC depends on two indices, the commercial catch per unit of effort (CPUE) and the abundance index from scientific surveys.Annual horse mackerel acoustic surveys are conducted for biomass determination and to collect biological information. The annual horse mackerel and small pelagic survey take place in March.

Small Pelagic (Sardine)

Sardine are distributed from southern Angola to KwaZulu-Natal in South Africa to (Beckley and van der Lingen 1999). However, this population is separated into two discrete stocks by the perennial Lüderitz upwelling cell, which divides the Benguela Current into northern and southern sections (Boyd and Cruickshank 1983). Off the coast off Namibia, the sardine stock ranges along the entire Namibian coast, but in recent years predominantly from 25°S northwards to southern Angola, inshore of the 200 m bathymetric contour.

Historically, spawning occurred continuously from September to April with two seasonal peaks evident – the first from October to December in an inshore area between Walvis Bay and Palgrave Point and the second from February to March near the 200 m isobaths between Palgrave Point and Cape Frio. *Sardinops sagax* is an important forage species (Pillar and Barange, 1998; Crawford et al., 1999. Multiple predators depended on sardine as high-quality

food at the time when it was abundant. Feeding predominantly on phytoplankton and zooplankton (Crawford et al., 1987).

Sardine are surveyed annually during the horse mackerel and small pelagic survey conducted in March, and during the annual dedicated sardine and small pelagic survey conducted in October.

The fishery is currently closed following a moratorium that was implemented on 01 January 2018 due to a significant population reduction. The fishery remains closed (as at April 2023). Biomass surveys and research studies have shown small aggregations of the stock mostly located inshore of the 200 m isobaths.

Line Fish

Snoek (*Thyristsites atun)* are found off Namibia from November to March, thereafter the stock moves southwards towards the Western Cape of South Africa. The return migration commences between August and October (Crowford *et al, 1990*). The movement of the snoek stock correlates with the distribution patterns of some prey species such as small pelagic species (sardine, sardinella, juvenile anchovy) in the southern Benguela system.

Dusky kob (Argyrosomus coronus) and silver kob (*Argyrosomus inodorus* are members of the sciaenidae family, which lives in subtropical and temperate waters around the world. *Argyrosomus inodorus* is the most important fish species caught in the line fish fishery (Kirchner 1998). Silver kob is an ideal finfish for mariculture mostly due to its robust growth, ability to spawn in captivity as well as its market value (Tjipute, 2011). Silver kob is harvested by the line fish and ski boat fishery and recreationally by shore- and ski boat-anglers.

Dusky kob is mostly caught with handlines, although in fairly low numbers (Bianchi et al., 1999). This species is the most important in southern Angola's inshore recreational fishery (Cunene Estuary to Namibe) (Potts et al., 2010). Both species are heavily exploited in Namibia by an established recreational fishery that operates in the West Coast Recreational Area (a 200km stretch of coastline between the northern boundary of the Namib Naukluft National Park and the Ugab River) and contributes significantly to the local economy (Stage & Kirchner, 2005).

Dusky kob are distributed between northern Namibia (north of Cape Frio) and southern Angola (south of Lucira), although only few individuals have been observed as far south as St Helena Bay on the South African west coast (Lamberth et al. 2008). Silver kob feed primarily on euphausiids and small fish in the surf zone (Boyer and Hampton, 2001). Dusky kob is a fast growing, late maturing species (Potts et al., 2010).

Silver kob is a slower growing, early maturing species. Dusky kob a large species that can grow up to 200 cm (Bianchi et al., 1999). Silver kob spawn in summer and migrate to the south of Walvis Bay, the southern end of their distribution, returning northwards towards the end of summer (Boyer and Hampton, 2001).

Large Pelagic Fish

The largest pelagic fish to be encountered on the shelf and waters around the AOI are large pelagic species, including various tunas, billfish, and pelagic sharks. Many of these species are considered to be threatened by the International Union for Conservation of Nature (IUCN), due to overfishing. Tuna species are usually offshore at the shelf break, their distribution is related to the presence of shoaling pelagic fish. They diets include small fish, shrimp's crabs, cray fish larvae and squid. Tuna are classified to be highly migratory species and many of the stocks are a shared resource between coastal states of the South Atlantic.

Tuna is managed by regional fisheries management organizations, specifically the International Commission for the Conservation of Atlantic Tunas (ICCAT).

5.3.1.2.3 Cetaceans and Marine Mammals

The abundance of plankton and pelagic fish draws a variety of marine mammals to Namibian waters. Marine mammals occurring off the southern African coast includes several species of whales, dolphins and one resident seal species (Hutchings et al, 2021).

There are two main groups of cetaceans: Mysticetes or baleen whales and Odontocetes or toothed whales and dolphins. Mysticetes are largely migratory, while odontocetes are both migratory and resident. Although as many as 33 species of cetacean have been recorded in Namibian waters, as they have been observed from sightings or strandings. There is still only sparse data on abundance, stock structure and conservation status of most species within the region (Elwen et al., 2010).

Some cetaceans are semi-permanent residents within Namibian waters, others come to breed and still others are long-distance travellers, entering and leaving the Benguela continuously en route to preferred destinations. Heaviside's (or Benguela) dolphin is the only odontocete endemic to the Benguela Current. There are two main distributions of cetaceans in Namibian waters: inshore species living on the continental shelf in higher density, and oceanic or pelagic species, ranging over thousands of kilometres.

The seasonal distribution of sightings of the right whales in Namibian waters is from June to December with a peak in September. This is supported by the seasonal occurrence of southern right whales in other calving areas in Australia, Patagonia, and South Africa. Although aerial surveys of northern Namibia have not been undertaken consistently over time, there has only been one sighting of a cow-calf pair right whales seen at Conception Bay (23°57.75'S) on 19 September 2003. The present-day distribution of right whales therefore seems to be concentrated largely in southern Namibia. Additionally, southern right whales in Namibia are said to be an immigration from South Africa (Roux et al. 2020). They calve and nurse in bays protected from high winds and swell e.g. Conception Bay and Chameis Bay. Southern right whale (Eubalaena australis) and the pygmy right whale *(Caperea marginata)* have been recorded in Namibian waters, primarily off the continental shelf during winter months. The humpback whales are migratory species with a summer distribution in polar waters and a

winter distribution in lower latitudes. These whales have been found off the Namibian coast in summer (Pulfrich et al., 2020) but are not likely to use the proposed site as migratory route when they migrate between June and December.

Records of Dwarf (Kogia sima) and pygmy (K. breviceps) sperm whales, were investigated by Elwen et al., (2013), who found them to occur in pelagic waters around southern Africa, including Namibia. A further 11 species are resident within the offshore area of the Namibian coastline in water depths of over 500m. These include the long-finned pilot whale (Globicephala melaena), Grays beaked whale (Mesoplodon grayii), Layard's beaked whale (Mesoplodon layardii), Bryde's whale (Balaenoptera edeni), false killer whale (Pseudorca crassidens), sperm whale (Physeter macrocephalus), Cuvier's beaked whale (Ziphius cavirostris), Pygmy killer whale (Feresa attenuata) and killer whales (Orcinus orca) which are found throughout Namibian waters.

The endemic Heaviside's Dolphin (Cephalorhynchus heavisidii), and the dusky dolphin (Lagenorhynchus obscurus), are found in the extreme nearshore region between the northern Namibian border and Cape Point. Moreover, the Heaviside's dolphins are a common sighted cetacean along the Namibian coast in water less than 125 m deep, with most sightings occurring from Walvis Bay to the southern Namibian border, particularly through autumn, spring and summer in high waters. It has a restricted distribution to inshore waters, seen within 5 nautical miles off the shore. For the dusky dolphin, they are the least known of the 'coastal' dolphins of southern Africa. In Namibia, they hardly ever come close to shore (Namibian Dolphin Project, 2022). The majority of sightings were recorded in the Lüderitz area, within the Namibian Islands' Marine Protected Area (NIMPA). Most of the Namibian EEZ is predicted to be a suitable habitat for dusky dolphins, especially the NIMPA and north of the EEZ in autumn.

Other dolphin species that have been observed in Namibian waters include: Common dolphin (Delphinus, Southern right whale dolphins (Lissodelphis peronii) and the Common bottlenose dolphin (Tursiops truncatus).

The Cape fur seal (*Arctocephalus pusillus pusillus*) falls under the order of Pinnipedia which is composed of the families: Otariidae, Phocidae and Odobenidae (Wickens and York 1997). The fur seals are grouped under two genuses: *Arctocephalus* and *Callorbinus* with eight (8) and one (1) species, respectively. The species *Arctocephalus pusillus* has two (2) sub-species, *Arctocephalus pusillus pusillus* (Cape fur seal) and *Arctocephalus pusillus doriferus* (Australian fur seal). The Cape fur seal *Arctocephalus pusillus pusillus* is the largest population.

Cape fur seals occupy twenty-six colonies along the Namibian coastline Seals are generally known to roam over the continental shelf, but also in deeper waters up to 200 meters when feeding. Although the Cape fur seal is not considered to be migratory, studies have shown that some dispersion exists between seals from different colonies.

Currently, half the Namibian seal population occurs in southern Namibia, south of Lüderitz and It consists of about 300 000 seals, producing roughly 100 000 pups per year. Atlas Bay, Wolf Bay

and Long Islands (near Lüderitz) together represent the largest breeding concentration (about 68 000 pups) of seals in Namibia.

There is a controlled annual quota, determined by government policy, for the harvesting of Cape fur seals on the Namibian coastline. The Total Allowable Catch (TAC) currently stands at 60 000 pups and 5 000 bulls, distributed among right holders. The seals are exploited mainly for their pelts from the pups, blubber and genitalia from the bulls.

In so far potential impacts on marine fish and mammals are concerned, impacts from anthropogenic noise sources are typically considered. Slabbekoon *et al.* (2010) undertook a study where he compared the hearing ranges of selected marine living organisms to various common sources of anthropogenic noise. A summary chart from this study is provided in Figure 5.9 below. A comparison between the sound frequencies presented in Figure 5.9 and the hearing ranges provided in this chart reveals that the operating frequency range of 70 kHz and 455 kHz (ultrasonic) falls beyond the hearing range of most fish species. However, at a frequency range of 200 Hz to 3 kHz and source levels of up to 229 dB re 1 Pa at 1m, some sub-bottom profiling techniques (such as the boomer) would produce sounds detectable by crustaceans and fish and may be audible for considerable distances before attenuating to below threshold levels. Considering these figures, it is anticipated that possible trauma to fish and sea mammals due to sound pollution would likely only occur directly below (or within few meters) of the sources. The implication of this is that trauma levels to marine mammals and fish are unlikely to be significant. The risk of possible trauma is further lowered by the fact that most fish in the project area is migratory, and will likely flee from the sound sources before trauma can occur. Such levels of fleeing may however have adverse impacts on catch rates for fishing in the area.

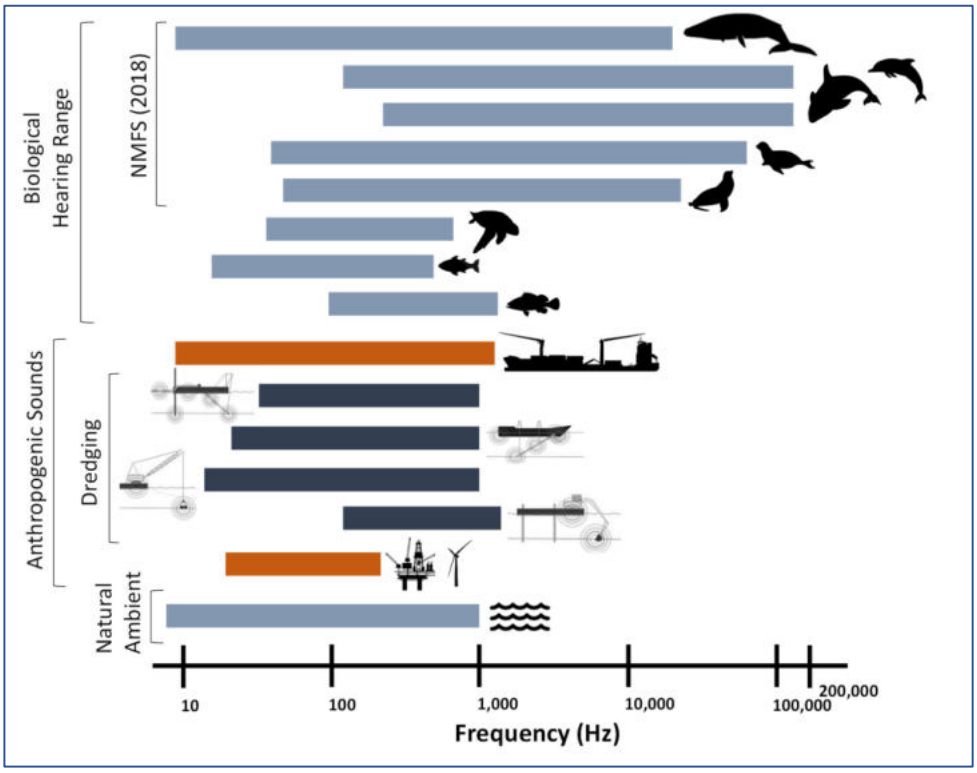

Figure 5.9. Hearing ranges of selected living marine life relative to anthropogenic noises (Source: Slabbekoon *et al.*, 2010).

Several threats to marine mammals and cetaceans exist from ongoing and future operations. These are summarised below:

- The increased interest in offshore mining of minerals and the latest discovery of large hydrocarbons reserves of the coast off Namibia, has led an increase in exploration seismic surveys and drilling for exploration. This has resulted in increases ship traffic in and out of the Lüderitz and Walvis Bay Harbours.
- Noise, light pollution and sediment plumes associated with shipping activities and seismic surveys, could have a negative effect on whales, that use noise, echolocation and bioluminescence to communicate, find prey and escape predators.
- Sediment Plumes will be created as the exploration and mining activities will stir up the seafloor and such plumes have a tendency to spread across the seafloor. This consequently affects filter feeds that support the larger marine life such as whales and dolphins.
- Wastewater containing sediments and mine tailings, that are pumped back into the ocean would form plumes, which may travel for miles which can be toxic and can cause water claudines, impacting species bioluminescence for basic human function such as to hunt or mate.
- Increasing numbers of marine tour operators in Lüderitz and Walvis Bay may be placing pressure on seals, dolphins and recovering whale populations.
- Impacts from aquaculture and mariculture can include pollution and the introduction of alien species. These farms also close off spaces previously accessible to wild marine life, possibly impacting habitat and feeding and breeding patterns. They can lie in the direct path of migrating whales and may trap and cause confusion to dolphins.

- All vessels, including exploration, mining and fishing vessels, pose a pollution threat and should be monitored by MET, MME and MFMR and port authorities. However, as long as MARPOL regulations are adhered to, the impacts from vessel traffic should be insignificant given the small volumes in Namibia.

5.3.1.2.4 Sea turtles

Five species of sea turtles are known to occur within the Benguela Current Large Marine Ecosystem (BCLME). Three of these species Green (*Chelonia mydas),* Olive Ridley (Lepidochelys olivacea), Loggerhead (Caretta caretta) are classified as endangered, while the remaining two turtle species, Hawksbill (Eretmochelys imbricata) and Olive Ridley (Lepidochelys olivacea) are classified as critically endangered species according to the IUCN red listing criteria (IUCN 2006)

In Namibia, the most frequent encountered turtle species are the green and leatherback turtles, both of which have been known to occur primarily on the north of 22° S. Large aggregations of juvenile and adult green turtles have been recorded at the Cunene River mouth on the Angola – Namibian Border. Satellite studies have shown the movement of leatherback turtles from their nesting sites in the South west Indian ocean into the West Coast of the Benguela system (Honing *et al, 2007)*.

5.3.1.3 Sea birds

The Namibian coastline sustains large populations of breeding and foraging seabird and shore bird species, which require suitable foraging and breeding habitats for their survival. There are 16 bird species that breed within the BCLME, and an additional 4.4 million birds migrate to or through the BCLME. Non-breeding migratory birds remain within the BCLME year-round. Table 5-2 provides a summary of breeding seabirds in Namibia which are likely to be found and encountered in the project areas.

Table 5-2. Summary of Namibian Breeding Seabirds

ENGLISH NAME	SCIENTIFIC NAME	GLOBAL IUCN CONSERVATION STATUS
African Penguin	*Spheniscus demersus*	Endangered
Cape Gannet	*Morus capensis*	Endangered
Cape Cormorant	*Phalacrocorax capensis*	Endangered
Bank Cormorant	*Phalacrocorax neglectus*	Endangered
Crowned Cormorant	*Phalacrocorax coronatus*	Least concern
White-breasted Cormorant	*Phalacrocorax lucidus*	Least concern
Hartlaub's Gull	*Larus Hartlaubii*	Least concern
Kelp Gull	*Larus dominicanus*	Least concern
Grey-headed Gull	*Larus cirrocephalus*	Least concern
Damara tern	*Sterna balaenarum*	Near threatened
Caspian tern	*Hydroprogne caspia*	Near threatened

Swift tern	*Sterna bergii bergii*	Least concern
African black oystercatcher	*Haematopus moquini*	Least concern
Roseate tern	*Sterna dougallii*	Least concern
Leach's Storm petrel	*Oceanodroma leucorhoa*	Vulnerable
Atlantic Yellow-nosed Albatross	*Thalassarche chlororhynchos*	Endangered
Southern Giant petrel	*Macronectes giganteus*	Least concern
White-chinned petrel	*Procellaria aequinoctialis*	Vulnerable
Blacked-necked Grebe	*Podiceps nigricollis*	Least concern

Most of the seabirds breeding in the Namibia are restricted to areas where they are safe from land predators, with exception of some specie that breed on the mainland coast in places that are not accessible. Most sea birds breed on islands, or manmade guano platforms at Cape Cross, Swakopmund and Walvis Bay.

Most of Namibia's islands lie offshore of the southern coast and fall within the Namibian Islands Marine Protected Area (NIMPA). The Area of Interest (AOI) is located to the immediate direct offshore of the islands, islets and rocks, (which all fall within the NIMPA) where several bird species are inhabited. The NIMPA lies north and east of the proposed survey grid. The central Namibian coastline between Lüderitz and Walvis Bay comprises predominantly sandy beaches backed by the dunes of the Namib Desert. Predators such as Black-backed Jackals and Brown Hyenas roam the strandline in search of food, making the mainland largely unsuitable for the establishment of breeding colonies.

Access to the NIMPA is very strict and is managed and controlled by the MFMR. The conservation status of seabirds breeding in the BCLME has deteriorated, consequently causing threats to the species, including food scarcity and loss of breeding habitats.

The highest densities of pelagic seabirds are seen north of Walvis Bay, offshore of the shelfbreak. Virtually all pelagic seabirds scavenge offal and fish discarded from fishing vessels and other vessel waste, and thus may be encountered by the vessels used in this exploration activity. Several coastal seabird plunge-dive for fish.

There a number of seabirds that feed some distance offshore and which may be impacted by the proposed activities. Of highest concern are the endemic, rare and endangered species. The following sensitive bird species are coastal and near-shore species: Lesser flamingo (Phoenicoparrus minor), Damara tern (Sternula balaenarum), African Black oystercatcher (Haematopus moquini), Bank cormorant (Phalacrocorax neglectus), Cape cormorant (Phalacrocorax capensis), Crowned cormorant (Microcarbo coronatus) and African penguin (Spheniscus demersus). These birds may be encountered by support services such as helicopter flights and tug vessels, especially those travelling from Lüderitz . These near-shore species are unlikely to be impacted directly by the proposed geophysical and sampling activities occurring more than 50 km offshore, outside the marine islands, and in the Central

Benguela Region. However, support vessels and helicopter flights travelling to and from Lüderitz, may encounter the endangered African Penguin, Bank Cormorant and Cape Gannet, which nest on the offshore islands.

Foreseeable potential threats to seabirds from ongoing and future human activities are summarised include:

- Habitat loss and encroachment by human settlement, development and expansion of industries.
- Disturbance or alteration of nesting and brooding sites by human activities (e.g. guano scraping, off-road vehicles and recreational pursuits).
- Displacement by other breeding species (e.g. seals and other birds).
- Predation by other birds, seals and land-based predators.
- Decreased food availability, due to overfishing (Crawford et al. 2001, 2006. Kemper, 2007).
- Pollution from increased shipping, both commercial and tourist.
- Oil pollution from ships discharging waste oil and wrecks leaking oil.
- Fish oil pollution from factories and fishing fleets (mainly affecting Cape and Australasian Gannets and gulls (Kemper, 2007),
- Entanglement in discarded fishing tackle (commercial gear and at recreational beaches).
- Entanglement in lobster traps and in aquaculture structures (MFMR unpubl.data).
- Collisions with ship cables.
- Hunting and trapping
- Invasive alien species
- Increased air traffic disturbance (industrial, commercial and tourist), and.
- Entanglement in fishing gear (particularly during demersal trawls or long-line fishing)

5.4 Socio-economic Environment

5.4.1 Socio-economic profile of Luderitz Area

The economy of Luderitz and Oranjemund depend primarily on fishing, tourism, diamond mining and logistics. Specifically for Luderitz, the local fishing industry provides more than 80% of the employment and comprises commercial fishing as well as subsistence fishing. Fishing activities center on white fish (hake), tuna, crayfish and oyster farming.

Various bed and breakfast establishments, a three-star hotel, tour operators and restaurants offer an attractive package of accessible amenities, activities and luxury accommodation for tourists, visitors and travelers. The local tourism industry has seen growth over the past few decades. The expansion of the waterfront, increased passenger liners, the international speed-week event and the Crayfish Festival and other tourism activities have contributed to this growth. However, the distance to and location of Luderitz makes it difficult to attract tourists traveling to Southern Africa by road.

The port of Luderitz has over the years attracted an increase in volume of exports of commodities such as Zinc, Lead and Manganese from the Northern Cape of South Africa as

well as grapes and dates destined for the international market. The port also serves as a major import handling hub for heavy machinery, equipment and chemicals which are used locally and in South Africa for mineral processing and metallurgical processes. Consenquently because of the increased volumes of exports and imports experienced over the years, there has been consideration to dredge and deepen the port to help promote the port as attractive logistics import and export alternative for SADC countries such as Botswana and South Africa.

Luderitz is expected to become a major logistics hub which would support the envisioned offshore oil and gas sector as well as the onshore green energy (e.g., wind energy, green hydrogen, Kelp farming, etc) activities in the region.

5.4.2 Other offshore economic activities

Other potential uses of the area covered by the EPL include the commercial fishing industry, and to a limited extent oil and gas exploration activities. Recreational use of the Licence Area is negligible due to the far offshore location of the area. The coastal area onshore of the EPLs falls within a national park and protected area where public access is generally restricted. There is active diamond exploration and mining from offshore gravels near the license by operators such as Debmarine Namibia and Samicor. The concerned EPL areas also lies within much wider oil and gas prospecting blocks (2714A, 2715, 2815) which are held by NAMCOR and other private entities. As stated above, there has been a growing interest to drill more exploratory wells and undertake more geophysical surveys on these oil/gas blocks. For this reason, there is likely to be a number of competing activities in the area including: fishing, support services (helicopter and support vessel) to oil & gas exploration rigs further offshore, etc.

5.4.3 Access to support infrastructure

For the planned exploration campaign to run smoothly, efficiently and with all personnel health and safety balances in check, several infrastructures would be utilized to support the proposed operations. Key support infrastructure required in this regard include the following:

- Airborne services
- Sea transport services
- Port and logistics support base facilities
- Emergency health facilities

The relevance of each of these services, in conjunction with available options for utlization during the proposed voyages, are discussed here.

5.4.3.1 Air services and associated supporting infrastructure

In a typical offshore diamond exploration and mining operation such as that of De Beers Marine, contracted helicopter services to and from the exploration and/ or mining vessels is provided every week to help deliver and pick up crew members, maintenance teams, supplies and light spares required onboard. This service is also typically used in cases of emergencies to send crew members off the vessel in cases of health or family emergencies. The helicopters would typically depart and land at a logistics base onshore not too far from the offshore area

of exploration such as an air strip. In addition to helicopter services, jet flights are typically used to fly crew members from a centralized location such as Windhoek to a designated helicopter deployment base. The same modus operadi will be adopted for the envisaged exploration campaign.

For this project reliance will be placed on the already well-established existing logistics base and port in Luderitz. Chartered aircraft and helicopter services would be deployed from Luderitz over the planned durations of the geophysical and sampling campaigns to provide logistical support for supplies, spares and personnel emergencies. Because of the envisaged short durations of the planned campaigns no crew changes are planned over the duration of these voyages, and therefore, air services are likely to be utilized for emergency and supplies purposes.

5.4.3.2 Seaboard services and associated supporting infrastructure

It is envisaged that for both voyages (i.e., the geophysical surveying and sampling campaigns) chartered exploration vessels will steam to the EPL areas from the port of Luderitz, subject to all maritime and rough diamond-handling permitting requirements being met and approved by mining and maritime inspectors. Once in the EPL areas, the vessels will then be positioned accordingly to carry out the envisaged scope of work over the duration of the voyages. A small supply services vessel will be chartered as and when required to transport heavy and bulky supplies to the exploration vessels at sea. The transfer at sea of such items onto the exploration vessels will be conducted by cranes whilst the vessels are near each other.

5.4.3.3 Port services and associated supporting infrastructure

The closest available port facilities to the EPL area is the Port of Luderitz, which is a world-class port with secure and efficient facilities. Heavy wind conditions are typically experienced all year round which sometimes causes delays for small support services vessels or boats to leave the harbour. Moderately deep-water anchorage is generally available inside the harbour, and is protected by the natural bay. Dry dock facilities with a lifting capacity which is adequate for the DP star and the Explorer vessels are not readily available at the port of Luderitz but are available within the port of Walvis Bay, which implies that as and when the need arises these exploration vessels would most likely be repaired to sail and dock to the Walvis Bay port in case of any emergencies that may require the vessels to undergo repairs underneath. The port is compliant with the International Ship and Port Facility Security code (ISPS).

In addition, the envisioned development of the offshore oil/ gas industry as well as major green energy projects such as Hyphen's Green Hydrogen project and Nampower's Wind Power projects are expected to increase access to port facilities which could be utilized during the mining phase if economically viable deposits are found in the license area concerned.

6 PUBLIC CONSULTATION PROCESS

The Public or stakeholder consultation process, which is undertaken as part of the broader impact assessment process, aims to ensure that all persons or organizations who may be affected and/ or interested in the project are kept informed of potential issues and benefits and can register their views and concerns during the EIA process. Building from there, the process provides stakeholders with an opportunity to influence the project 's design, planning and implementation so that its benefits can be maximized, and potential negative impacts minimized. The current best practice model is to engage in a process of continuous dialogue with the affected community and other stakeholders as plans for the project evolve and the environmental assessment is advanced.

During this process a high level of interaction is maintained, potential and actual socio-economic plus environmental impacts are identified, and stakeholder needs, and concerns are discussed and wherever justified those are integrated into the planned activities of the project as outlined in the impact assessment report, as well as in the decision-making and impact management practices provided for in the accompanying EMP.

Good and transparent consultation generally helps foster genuine and positive relationships with mutual respect, shared concerns and objectives between the entity pursuing or involved in the development and the directly affected community, and even parties from elsewhere who may have interest in the project.

The public participation facilitator for this project was the Environmental Assessment Practitioner (EAP), and their main role was to coordinate that process of dialogue to ensure there is transparency, inclusivity and accountability in decision-making and public confidence in the proposed activities and its management.

6.1 Identified and Registered Interested and Affected Parties (I&APs)

At the beginning of the impact assessment process, a list of the obvious potentially interested and affected parties was drawn up. As the public participation process evolved, this list was continuously updated. A complete summary of the I&APs identified and registered for the project is appended/ attached to this report. The pre-identified I&APs and public were notified about the planned activities by means of email, advertisement in local newspapers, and display of printed notices at strategic publicly accessible locations in Luderitz (I.e., the envisioned likely base of operation).

Amongst key stakeholders identified and registered for this project were (as presented under the **Proof of Consultation APPENDIX, attached):**

- **Central or national government:** Ministry of Mines and Energy (Directorates of Mines and Diamond Affairs); Ministry of Environment, Forestry and Tourism (Directorates of Parks); Ministry of Fisheries and Marine Resources (Office of the Executive Director; Directorate of Resources Management; and Public Relations Officer); Ministry of Defence (Offices of the Executive Director and Navy Directorate), Ministry of Works and Transport (Directorate of Maritime Affairs, Namibian Civil Aviation Authority as well as Directorate of Transportation Policy and Regulations), Ministry of Health and Social Services (Atomic Energy & Radiation Protection Authority)
- **Regional government:** //Kharas Regional Council including the Luderitz Constituencies
- **Local authority and Parastatals**: Luderitz Town Council, Sperrgebiet National Park, Namport, National Heritage Council of Namibia.
- **Business community**: Adjacent EPL, Mining License (ML) and Oil/ Gas block area holders; Local fishing companies
- **Members of the public**: A number of interested and affected parties registered for this project as identified from stakeholder lists of other nearby licenses (such as for EPL 7548 and 8054).

6.2 Public consultations: summary of activities carried-out

To ensure that the I&APs were timeously and openly informed of the planned project activities, the following tasks were carried out:

- A list of pre-identified I&APs was compiled. This list included representatives from government institutions (ministries, regional and local authorities) and representatives from non-governmental organisations (NGOs) as outlined above.
- A notification email was circulated to all pre-identified and registered I&APs on the 7th of January 2024 announcing the commencement of the EIA process and extending a formal invitation to officially register as I&APs, share the project background information document with any other parties who may have interest in the project, as well as to provide written inputs, suggestions and/ or comments on any key aspects of the proposed activities which they may interest in. Included in this email was the Background Information Document (BID) and project site locality maps which provided a brief description of the proposed activities, the envisaged EIA process, and how I&APs can participate in the impact assessment process.
- Formal public notices announcing the commencement of the Environmental Assessment process and extending a formal invitation to the public to register as I&AP as well as to attend or participate in the public consultation process for the project were placed in *Die Republikein, The Sun Newspaper* and *Allgemeine Zeitung* local newspapers (dated 7th and 12th December 2023, please refer to the **PROOF OF CONSULTATION APPENDIX**, attached).
- Printed formal written site notices were placed at various publicly accessible locations as outlined below.

In addition, provision was made to circulate/ distribute the BID and project locality maps upon request throughout the environmental assessment process.

6.3 Public site notices

Written official site notices/posters informing the public and the affected communities about the planned activities as well as notifying them of the ongoing public engagement/ consultation process were placed at the following locations:

- !Namu#Nus Constituency in Luderitz
- Luderitz Waterfront
- Official notice board of the Ministry of Fisheries and Marine Resources in Luderitz
- Official notice board of the Ministry of Mines and Energy in Luderitz
- Official notice board of the Luderitz Town Council and
- Luderitz Nampost

Photos of the site notice displays at these publicly accessible strategic locations are presented in the **Proof of Consultation APPENDIX**, attached.

7 IMPACT ASSESSMENT

The planned offshore geophysical surveying and sub-surface bulk sampling, coupled with onboard material processing activities, would trigger numerous potential (positive and negative) impacts. These impacts were identified through a rigorous process of considering each key activity and how that activity would likely interact with the physical, biophysical and socio-economic receptors of the spatial zone in which it would be undertaken.

The aim of this chapter is to assess the potential impacts which are likely to be triggered; evaluate their significance levels; and develop management and mitigation measures to avoid and or reduce and/ or enhance their significance levels to acceptable performance levels.

7.1 Impact Assessment Methodology

An impact assessment matrix was used to evaluate the possible impacts of the project on the receiving environment. In accordance with the EMA (Act No. 7 of 2007) and the Environmental Impacts Regulations (GN 30 in GG 4878 of 6 February 2012) the following (refer to Table 7-1) impact assessment criteria was applied.

Table 7-1. Impact evaluation criteria adopted for this project

ASPECT	DESCRIPTION
Nature	Focuses on the type of effect that the proposed project will have on environmental components. Addresses questions related to "what is the triggering activity(s); what will be affected; and how?"
Extent	Spatial extend of the project and anticipated spatial extend of impacts indicating whether the impact will be confined within a limited area (e.g., on site where the activities are to take place); local (limited to within a 15km radius of the activity's

ASPECT	DESCRIPTION
	area); regional (limited to ~100km radius); national (Impact is confined to the country as a wholes); International (Impact extends beyond the national scale)
Duration	This looks at the temporal aspect in terms of the duration of the impact e.g., whether the impact will be temporary (i.e., during the surveying or bulk sampling campaign only), short term (lasting for up to approximately 1 year after operations have ceased), medium term (lasting for between 1 and 5 years after operations have ceased), long term (lasting longer than 5 to 20 years after operations have ceased) or permanent (i.e., the impact will last in excess of 20 years).
Intensity	Establishes whether the magnitude (as indicated by Key Performance Parameters) of the impact exceeds set standards/ thresholds and is described as: - **Zero – Very low** – Negligible change, disturbance or nuisance. The impact affects the environment in such a way that natural functions and processes are not affected. People / communities are able to adapt with relative ease and maintain pre-impact livelihoods. - **low** – Slight change, disturbance or nuisance. The impact on the environment is not detectable or there is negligible change to people's livelihood - **medium** - Moderate change, disturbance or discomfort. Where the affected environment is altered, but natural functions and processes continue, albeit in a modified way. People/communities are able to adapt with some difficulty and maintain pre-impact livelihoods but only with a degree of support - **high** - Prominent change, disturbance or degradation. Where natural functions or processes are altered to the extent that they will temporarily or permanently cease. Affected people/communities will not be able to adapt to changes or continue to maintain-pre impact livelihoods.
Probability	Considers the likelihood of the impact occurring and is categorised as follows: - **improbable** (unlikely/ or where the possibility of the impact to materialise is very low either because of design or historic experience, i.e. ≤ 30% chance of occurring - **possible** (Where there is a distinct possibility that the impact would occur, i.e. > 30 to ≤ 60% chance of occurring), - **probable** (Where it is most likely that the impact would occur, i.e. > 60 to ≤ 80% chance of occurring), - **definite** (Where the impact would occur regardless of any prevention measures, i.e. > 80% chance of occurring).
DEGREE TO WHICH IMPACT CAN BE MITIGATED	This refers to the degree to which an impact can be reduced / enhanced, and ratings are as follows: - **None** – No change in impact after mitigation

ASPECT	DESCRIPTION
	- **Very low** – Where the significance rating stays the same, but where mitigation will reduce the intensity of the impact. - **Low** – Where the significance rating drops by one level, after mitigation - **Medium** – Where the significance rating drops by two to three levels, after mitigation - **High** - Where the significance rating drops by more than three levels, after mitigation

Table 7-2 criterion was then used to determine the significance of the potential impacts identified pre- and post the implementation of the recommended impact management measures.

Table 7-2. Significance rating criteria for impacts

SIGNIFICANCE RATING	CRITERIA
Low	Where the impact will not have an influence on the decision or require to be significantly considered as part of the project designs (and operations), project budgets and management strategy, and the impact will have a negligible influence on the environment and no modifications or mitigations are necessary to the project design/ operations. This could be allocated to impacts of any severity/ magnitude if it is localised and is of temporary duration/time.
Medium	Where the impact could have an influence on the environment, which will require modification of the project activities' design and/or consideration of alternatives. This could be allocated to impacts of moderate severity/magnitude, locally to regionally, and those with short term effects.
High	Where the impact could have a significant influence on the environment and, in the event of a negative impact the activity(ies) causing it, should not be permitted (i.e., there could be a 'no-go' implication for the development, regardless of any possible mitigation), or a define "go" implication (in the case of positive impact). This would be allocated to impacts of high magnitude/ intensity, locally for longer than a month, and/or of high magnitude regionally and beyond.

Furthermore, the following aspects were considered in evaluating each potential impact:

- Impacts are described both **before** and **after** the proposed mitigation/ enhancement and management measures have been implemented;
- Impacts were evaluated for all project primary activities which can be categorized into:
    - **exploration (both geophysical and bulk sampling) activities,**
    - **general operation of vessels,**
    - **waste and materials management,**
    - **onshore logistical support and**

    - **socio-economic aspects**
- The impact evaluation further takes into consideration the **cumulative effects** associated with the primary activities as well as those associated with associated operational facilities and processes which are either already developed (i.e., existing) or are in the process of being developed in the region, if relevant. Cumulative impacts are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts;
- Impact management (mitigation or enhancement) actions: Where negative impacts were identified, practical mitigation measures (i.e. ways of avoiding or reducing negative impacts) were deduced. Where no mitigation is feasible, this is stated and the reasons are provided. Where positive impacts were identified, management actions to enhance the benefit are recommended

Impacts which are likely to be triggered by the planned geophysical surveying and bulk sampling activities are assessed in the next section.

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7.2 Systematic assessment of potential POSITIVE impacts

Generally, potential benefits can be lost or their full potential can be compromised if a project is not properly designed, planned and implemented. The potential positive impacts anticipated from the proposed geophysical surveying and bulk sampling phases are described and assessed in Table 7-3 below. Pragmatic impact management actions and measures recommended to optimize these potential benefits are briefly outlined here but are presented in more detail in the accompanying Draft Environmental Management Plan (EMP). If the recommended impact enhancement measures are effectively implemented, the significance level of these impacts can be elevated.

Table 7-3. Evaluation of potential POSITIVE impacts from the proposed project activities

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact enhancement measures	Post Mitigation
Revenue generation to the national economy	- Payment of EPL annual levies to central government (MME) - Payment of income and VAT taxes to central government from sales of rough diamonds recovered during sampling and from general operations by proponent's team - Payment of port and harbour fees to government via Namport will contribute to government's revenue	National	Short term to long term (as some revenue generation streams will last for the duration of the voyages such as port fees, while others such as license	Low during the exploration phase (could elevate to medium - high if economically viable resource is discovered)	Probable	Medium	- MME to enforce compliance on payment of license levies - NAMPORT to ensure that port and harbour fees are collected as and when required - NAMRA to ensure that all parties (e.g., proponent and any third party partners) involved in the honour all state tax obligations - MME to ensure they have full-time onboard representation in the form of a diamond inspector to regulate rough diamond recoveries -Work with high-quality technical consultants to ensure that exploration data is collected and correctly interpreted	High

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact enhancement measures	Post Mitigation
	- Successful exploration will have the cumulative impact of stimulating foreign direct investment in exploration for offshore mineral deposits in Namibia		fees and potential upsurge in foreign investments could last for duration longer than 3 years or more)					
Employment opportunities	- Technical personnel with experience in west coast geology and exploration, and general geology will be required over the entire exploration phase to manage, validate, analyse and report exploration data. - Additional support services such as logistics management will be required for the operation. This may also open new	National	Medium Term (the EPL is valid for 3 years, and will be renewed if exploration result justify further investigation)	Low (because the exploration voyages are generally to be executed on a tight and strict schedule there will not	Probable	Low	- Given the fact that the exploration phase shall be constrained by financial resources and time, at least until such time that initial exploration results have substantiated the need to expand the project's budget and duration, there is not much which can be changed in terms of the project's design to increase the number of employment opportunities - Minor modifications can however be made to the project's modus operadi by proponent to ensure that employment opportunities are biased towards Namibians and	Low

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact enhancement measures	Post Mitigation
	opportunities for employment			be much room for on-the-job training. Hence, employment opportunities that will be availed during the exploration phase will generally be limited. Employment opportunities will primarily be for general work and			more so towards inhabitants of the //Karas region.	

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact enhancement measures	Post Mitigation
				specialised technical skills only (e.g., west coast geology, environmental, geostatistics). Preferrance shall be given to Namibians				
Procurement opportunities for local SMEs and corporations	- The need for supply of mechanical spares and other supplies, as well as for provision of services such cleaning, cooking, specialised mechanical maintenance, customs clearance, security services, flight services, support vessel services, work visa/ permits,	National (if a national open bidding process is endorsed)	Temporary (over the duration of exploration phase, but with high possibility to	Medium	Probable	Medium	- Only local and competent companies should be shortlisted to provide supplies, technical advisory, administrative support services, advisory & maintenance services - Preference to be given to local companies operating in the //Karas Region region, provided that they have demonstrated sound capacity and reliability	High

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact enhancement measures	Post Mitigation
	technical and legal advisory services would open new opportunities for revenue generation to SMEs in the country		elevate to medium term if further exploration is justified)					
Use of Luderitz harbour/ port and airport as logistics bases would generate income for their operators and stimulate investments for further development of these bases		Local to Regional	Short to medium term (depending on exploration results)	Medium (because volume and frequency of human/ goods movements are limited during prospecting). This could however elevate if economically viable deposits are	Probable	Medium (as these facilities are already widely being used by fisheries & exisitng diamond miners)	- the proponent must ensure that if any helicopter support services would be required, local companies must be invited to provide such a service first - all efforts must be explored by the MME and proponent to make use of the Luderitz port and airport as the logistical bases for the project.	High

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact enhancement measures	Post Mitigation
				discovered				
Knowledge + skills transfer and development	- The use of advanced offshore geophysical and megadrill system sampling technology onboard the DP Star and the Explorer would require any new employees to be trained, thereby promoting skills transfer to locals	National (as positions will be publicly advertised)	Short-term (as for now employment will be limited to the duration of the exploration phase only)	Low (because the number of potential employee to be hired will generally be limited during exploration)	Probable	Low	- Considering the tight schedule and limited financing allocated for the exploration phase, IMDH or similar organizations would be required to come with its technical personnel from South Africa; especially operators of sophisticated machinery. Hence, there will be limited room to train new locals during the exploration phase. However, if an economically viable deposit is discovered and the project is justified to proceed to mining phase, then the significance of this impact can elevate to very high	Low
Sponsorship for research and educational projects	The recommended environmental monitoring program, and sponsorship for both geological and biodiversity research will result in improved knowledge and awareness of the economic and biological value of the area	Regional	Medium-term	Medium	Definite	Medium	- Where possible supply research/exploration data to the marine science and fisheries research communities to help stimulate research on geological and natural resource management in the area - Where possible, sponsor Namibian research and education to contribute to public understanding of relevant environmental issues and environmental management practices e.g., invite scientists and	High

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact enhancement measures	Post Mitigation
							experts to participate in environmental monitoring programmes and share knowledge on findings including contributions to marine biodiversity conservation, migration patterns of pelagic fauna, and habitat characteristics	
Stimulation of research & design for suitable prospecting tools and systems, with subsequent improved wisdom	- Analysis of new geophysical and initial bulk sampling data	International	Medium -term to long-term (likely over duration of exploration and possibly mining phase)	Medium	Probable	High	- The Research & Development (R&D) division of the proponent must work closely with the R&D department of IMDH to help conduct research and development in designing appropriate tools/ technologies for offshore mineral prospecting, mining and metallurgical processes that would be suited for the specific geology in the concerned EPL area. Such efforts and synergies must always strive to integrate exploration/ mining technologies with environmental baseline and monitoring data acquisition	High
Contribution to stimulated growth in local economy for the town of Luderitz	- If exploration results are positive and the project advances to mining stage, this will contribute positively to the growth of Luderitz economy and the //Karas region at large. Such growth will be	Local - Regional	Medium (during exploration), Long-term (during mining if explorati	High	Probable	Medium	- Employ and contract Namibians and Namibian companies to stimulate local buying power	High

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact enhancement measures	Post Mitigation
	further supplemented by the highly likely oil/ gas exploration and green energy projects in the area		on is successful)					

7.3 Systematic assessment of potential NEGATIVE impacts

Generally, potential adverse impacts would arise if the planning, design, and implementation of a project is not properly carried out with a proactive approach. Additionally, sometimes the planning and design may have been carried out adequately, and environmental management measures provided to avoid and/or minimize adverse impacts. However, if such management measures are not effectively implemented, monitored and enforced during the project's execution stage, then potential adverse impacts would be inevitable.

The potential adverse impacts anticipated from the proposed geophysical surveying and bulk sampling phases are described and assessed in the Table below (Table 7-4). The identification of impacts is based on a range of technical literature, combined with the experience and professional judgement of the authors. Practical impact mitigation and reduction measures are also briefly provided here but are described in more details in the accompanying Draft Environmental Management Plan (EMP).

Table 7-4. Evaluation of potential NEGATIVE impacts from the envisaged project activities

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
IMPACTS FROM GEOPHYSICAL SURVEYING AND BULK SAMPLING ACTIVITIES								
	Nuisance of marine mammals, fish, seabirds and benthic organisms by light projected from underwater spotlights associated with	Local	Very short-term (limited to the duration	- Medium (during geophysical survey	Definite	High (especially on benthic communities & seabirds	- No direct intervention possible other than the no-go alternative. The impact is highly reversible and short-lived over duration of the survey or sampling	(A) Medium (B) None

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
Pollution of marine ecosystems by artificial lighting	underwater geophysical surveying tools such as sidescan sonar, chiro & air gun on townfish, underwater video equipment, autonomous underwater vehicle (AUV). Although limited it has been conducted worldwide to understand the influence of artificial light on marine organisms, research is ongoing and some early findings from such research is that some marine organisms use natural light spectra to identify optimal habitats. Hence, artificial lighting reduces optimal		of the geophysical survey)	due to high frequency of using high intensity underwater light emitting equipment) - Low (during bulk sampling due to low frequency of utilizing light emitting		because of their anticipate high population in these areas)		

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
	performance of organisms in this regard over the duration of such surveys			equipment)				
Underwater vibration & noise disturbance of fish (e.g., Large Pelagic), cetaceans, marine mammal leading to abandonment of feeding habitats, reduction in fish catch rates (especially for Longline Sector) and Physiological stress (refer also to the 2014 Acoustical Society of America (ASA) Technical Report *Sound Exposure Guidelines for Fishes and Sea Turtles (ASA, 2014)*). During bulk	- The presence and operation of the survey & sampling vessels will introduce a range of underwater noises into the surrounding water column which may potentially contribute to and/or exceed ambient noise levels in the area. Envisioned anthropogenic sources for noise pollution in the ocean will include running engines, multi-beam sonar systems, seismic acquisition, seabed drilling and overboard deposition of tailings. These can cause: (1) direct	Local (within a few km from the source)	Temporary to short-term (lasting only over duration of surveying). The impacts are highly reversible	Medium (but not well understood due to limited research in this area and consequently significant knowledge gaps)	Definite	Medium	- Regulators must enforce airgun alternatives & quieting technologies such as Marine Vibroseis, and promote quieter operations such as slow steaming - Shutdown of airgun when marine mammals are observed within the safety zone of 500m or during line changes - Promote usage of sonars, echosounders and multibeams which have frequencies above at least 200kHz. - Consider providing specialised marine mammals observer training to environmental personnels onboard to help monitor behaviours - As part of the recommended adaptive monitoring program, implement a research programme	(A) Low to Medium (significance of impact will likely reduce slightly after mitigation until monitoring & research proves otherwise). Considering that the geophysical surveying and sampling activities will

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
sampling drilling high amplitude pressure field impulses are generated in the water column as well as sediment borne pressure and shear waves. Also dynamic position, which is used by exploration vessels, is generally loud.	physical injury to hearing or other organs, including permanent (PTS) or temporary threshold shifts (TTS) in hearing; (2) interfering with other biologically important sounds (e.g. communication, echolocation, signals and sounds produced by predators or prey); (3) disturbance to the receptor resulting in behavioural changes or displacement from important feeding or breeding areas. It is known from literature that loud, low frequency sounds such as those emitted in seismic surveys for sub-bottom profiling are						on the noise impact of sonar, echosounding surveying on fish, cetaceans and marine mammals	generally be short-lived (at least over the exploration phase), cumulative impacts are unlikely during the exploration phase. (B) None (at this stage)

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
	most deleterious. The noise generated by the acoustic equipment utilized during geophysical surveys falls within the hearing range of most fish, and at sound levels of between 190 to 232 dB re 1 µPa at 1 m, will likely be audible for considerable distances (in the order of tens of km) before attenuating to below threshold levels. Similarly, the sound level generated by sampling operations fall within the 120-190 dB re 1 µPa at 1 m range at the sampling unit, with main frequencies between 3 – 10 Hz. The noise generated by sampling							

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
	operations thus falls within the hearing range of most fish, and depending on sea state would be audible for up to 20 km around the vessel before attenuating to below threshold levels							
Risk of destruction and alteration of reefs, rock outcrops with sensitive biota with subsequent disturbance	- Bulk sampling - Disposal of tailings	Local	Long-term (reefs are build over very periods)	High (because sites with reefs must be avoided as no go areas, especially during drill sampling)	Possible (after the scanning of the seafloor with geophysical & video tools, better understanding on whether or not	High	- After the acquisition of high-resolution seabed surveys and underwater videos, specialist input should be sought to delineate out areas of rocky outcrops and conduct targeted coupled research and monitoring on those sites to help determine their biological significance and ecological sensitivity. Delineating such sites and establishing buffer zones around them would minimize their exposure to disturbance/ destruction	(A) Low (B) Medium (because even if a buffer is formed some acoustic noise and artificial sedimentati

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
					there are reefs will arise)		-	on will likely still occur)
Direct mortality of unifaunal and epifaunal organisms, fish, and phytoplankton; and disturbance/ alterations of benthic and plankton habitats due to disturbance of the benthic ecosystem during bulk sampling	- Sucking up of fish and benthic fauna and phytoplankton with seafloor sediments during bulk sampling - Reduction in food sources, loss of benthic habitat, possible loss of fishing grounds	Local	Medium-term (the potential disturbance will go on over duration of project, but cumulative impacts may persist over a long period)	Medium, but likely to elevate to high during infill sampling	Probable to Definite	Medium	- No direct intervention possible other than the no-go alternative. Optional measures to reduce the risk include setting aside an appropriate (i.e. size and seabed composition) portion of the EPL area that will not be directly or indirectly impacted by bulk sampling operations in the foreseeable future; preferably low grade areas or areas with little to no mineralisation. Such areas could also serve as undisturbed reference sites in long-term monitoring studies assessing offshore sampling impacts - Conduct high resolution geophysical surveys (sidescan sonar, bathymetry and seismic profiling) prior to bulk sampling over the EPL area to determine the depth, wall steepness and infilling	(A) Medium - requires implementation of monitoring to understand effectiveness of mitigation measures (B) Very low – To be evaluated after implementation of recommended

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
							and recovery rates of sampling excavations - Conduct benthic macrofaunal surveys to record seabed topography and types of marine life present to gain an understanding of the marine environment, using a suitable sampling devices such as Grab sampling or box-coring surveys, video footage collected from a Remotely Operated Vehicle, or Submersible video footage (when submersible equipment such as Jago is available). Monitor benthic communities through periodic sampling at sample positions as part of the environmental monitoring program	monitoring program
Depletion of water column and near-bottom oxygen concentration through bacterial Decomposition of	- Overboard discharge of tailings and dead organisms	Local	Short-term (sampling will take place at	Medium (most marine biota in the inner & mid-	Improbable (due to the discrete nature and low	Low	- No direct intervention possible other than the no-go alternative. Optional measures to reduce the risk include setting aside an appropriate (i.e. size and seabed composition) portion of the EPL area	(A) Low (B) To be evaluated after

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
organic matter deposited with the tailings spoil			discrete sites, hence likelihood of prolonged effects due to accumulation of organic matter at one site is very low)	shelf of the Benguela are well adapted to cope to large fluctuations in dissolved oxygen because of the seasonal / periodic upwelling system. Considering the discrete	volumes of organic matter (e.g., dead organisms) discharged overboard during sampling. This may change for the mining phase)		that will not be directly or indirectly impacted by bulk sampling operations in the foreseeable future; preferably low grade areas or areas with little to no mineralisation. Such areas could also serve as undisturbed reference sites in long-term monitoring studies assessing offshore sampling impacts - Based on results of bottom-oxygen levels, consider undertaking field/laboratory studies regarding the physiological oxygen tolerance for some large benthic species in the areas as part of the adaptive monitoring program	implementation of recommended monitoring program

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
				nature of sampling, disturbance levels are envisioned to be low)				
Disturbance of benthic communities & habitat due to seabed sediment sample removal and vibrations on seabed; sediment recovery system suction; geological and environmental grab sampling activities		Local	Very short (for vibrations as this process take place within minutes during sampling) to medium-term	Very low (vibrations) and Very Severe (during sampling and sediment removal)	Definite (impact will occur regardless of prevention measures)	Low (vibrations) Medium (during sampling, sediment removal and overboard tailings deposition)	- No direct intervention possible other than the no-go alternative. Optional measures to reduce the risk include setting aside an appropriate (i.e. size and seabed composition) portion of the EPL area that will not be directly or indirectly impacted by bulk sampling operations in the foreseeable future; preferably low grade areas or areas with little to no mineralisation. Such areas could also serve as undisturbed reference	(A) remains unchanged until monitoring data from post-sampling scans and grab sampling proves otherwise

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
			(during sampling as excavations into benthic habitat takes some time to recover)				sites in long-term monitoring studies assessing offshore sampling impacts	(B) To be evaluated after implementation of recommended monitoring program
Alteration of sediment structure / seabed habitat due to drilling into seafloor sediments and overboard discharge of tailings, and resultant effects on the structure of pelagic (water column) and benthic communities. The benthos inhales many solid suspended particles during respiration and are therefore likely to inhale a lot of other foreign particulate as a result of sediment disturbance and overboard tailings discharge. Benthic invertebrates such as Cephalopods, some bivalves, echinoderms, and crustaceans have structures called statocysts, which contain a statolith and		Site specific	Permanent; infill rates by naturally depositing sediments are slow and changes in seabed geomor	Medium; Being dependent on the infill rate, recovery through natural recolonisation and establish	Definite (impact will occur regardless of prevention measures)	Medium	- No direct intervention possible other than the no-go alternative. Optional measures to reduce the risk include setting aside an appropriate (i.e. size and seabed composition) portion of the EPL area that will not be directly or indirectly impacted by bulk sampling operations in the foreseeable future; preferably low grade areas or areas with little to no mineralisation. Such areas could also serve as undisturbed reference	(A) remains unchanged until monitoring data from post-sampling scans and grab sampling proves otherwise

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
associated sensory hairs sensitive to low frequencies and are responsive to particle motion in the sound field			phology will persist in the long-term, possibly over decades/ generations	ment of succession communities is slow and although ecological processes will ultimately be re-established, community structure may be different			sites in long-term monitoring studies assessing offshore sampling impacts - No intrusive exploration will be allowed to take place in areas where bed rock is exposed. Hence, bedrock areas should be delineated and flagged as no-go areas after completion of the bathymetry survey	(B) To be evaluated after implementation of recommended monitoring program
Disruption of biogeochemical processes due to the excavation of mud belt sediments (if the mud belt exists in the EPL areas)		Regional	Short-term; settling rates of	Low (because samplin	Probable	Low (considering the spatially	- Consider conducting a coring survey to determine the presence of H_2S pockets before sampling is	(A) Low (B) To be re-evaluated

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
			the suspended sediments will depend on the proportions of silt and clay fractions in the muds	g will take place at discrete sites only)		discrete nature of exploration sampling)	conducted in thick mud overburden areas	after implementation of recommended monitoring program
Suspended sediment plumes caused by loosening/ disturbance of sediments on the seabed and from overboard discharge of fine sediments causing both a visual impact of the area from air, decrease in light penetration	- Due to overboard discharge of fine tailings (causes plumes near surface of water column) - Due to mobilization of fine sediments on the seafloor during drill sampling (causes a plume near the seabed)	Local (the extent and area over which plumes disperse will depend on the strength and	Short-term (plumes will be rapidly dispersed and drift away from the vessels, however	Medium (Experience of IMDH from sampling/ mining in the southern west coast of	Definite	Medium on plankton Negligible on fish stocks	- No absolute mitigation is possible - If the levels recorded in the sacrificial mixing zone exceed set water quality criteria (e.g. turbidity levels), conduct an ecological hazard assessment on the suspended sediment plumes - Have the monitoring results scientifically evaluated by an appropriate expert	(A) remains unchanged (B) None to Low: To be re-evaluated after implementation of recommen

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
and high sediment loading (increased turbidity) thereby negatively affecting primary production and lethal or sub-lethal effects on marine phytoplankton and consequently zooplankton and benthic as well as demersal fish. Because both pelagic and demersal fishes are highly mobile, they are likely to migrate out of areas affected by such plumes to avoid the elevated sediment loads. This may thus induce changes in available fish stocks that would		direction of the prevailing currents and winds, and the particle size of the material in question)	, potential effects will extend over the duration of the sampling campaign). The impact is reversible over a period of time as the sediments dissipate	Namibia suggests that adverse effects are experienced generally at suspended sediment concentrations higher (>100 mg/l) than those expected during mining operatio			- Consider hiring an expert to model rates of dispersal and diffusion of suspended sediment plume around sampling vessel - Monitor patterns of fish stocks in areas surrounding the EPLs to assess trends in available stocks - Consider quantifying the clay content of sampled seafloor sediments as that will help provide insights on risks posed by sediment plume	ded monitoring program

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
be available for catching in certain areas within or proximal to the EPL area. Experience from other offshore prospecting and mining operations along the Namibian and south African west coast have shown that the suspended sediment plume in the water column dissipates with time.				ns, or to longer exposure periods (>2 days) than typical life times of suspended sediment plumes.)				
		Regional (impact on the seabirds and marine mammals is restricted	Medium (over the duration of the activities and possibly months	Medium (Noise pollution for marine mammals whose acoustic commu			- Determine what marine mammal species are likely to be present in the survey area, identify if the survey is to occur within or near an area of importance for marine mammals, and assess the likelihood of deliberately injuring or disturbing marine mammals and include this	

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
Impacts on marine mammals and sea birds		to areas of the seismic surveys and possibly extending to areas around the area, the NIMPA)	after ceasing such operations)	nications may be affected could cause them to avoid the area. The impact is reversable)			assessment as part of the application or notification - As part of the recommended adaptive monitoring program, assess any seasonal considerations, such, seal pupping, migration periods and migrating routes; and seasonal considerations - Maintain a standard radius of the mitigation zone referred to of 500 metres (m) from any mammals spotted. - Maintain a bridge watch for large mammal species - Carry out "soft starts" for any equipment of source levels greater than 210 dB re 1 µPa at 1 m over a period of 20 minutes to give adequate time for marine mammals to leave the vicinity. - Try to avoid planning geophysical surveys during the movement of migratory cetaceans (particularly	

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
							baleen whales) from their southern feeding grounds into low latitude waters (beginning of June to end of November	
Potential destruction of unknown wrecks / damage of sites of archaeological and/or palaeo-environmental value during prospecting activities		Site specific	Medium -term (the risk will persist over the duration of exploration period)	High (if ship wreck or archaeological artefacts or historical sites are permanently destroyed)	Possible	Medium (during bulk sampling)	- Specialist archaeologists to be hired to analyse high-resolution seafloor texture and sub-bottom geophysical data for possible wrecks, and delineate such sites out for further investigation prior to sampling - It is essential that the relevant managers and specialists be informed on finding of historical material that artefacts are retained and mining ceases within 500 m from the centre of the site until the area has been surveyed and clearance has been received from the relevant authorities. The Namibia National Heritage Council's procedures on Chance Finds should be strictly adhered to	(A) Low (B) Low to medium

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
Potential loss of ground and/ or exclusion of alternative resource users (e.g., fisheries, oil/ gas exploration, shipping) and potential hazard if vessels are not adequately visible to each other due to the poor weather conditions and lack of coordination amongst vessels operating in same area. Under the Convention on the International Regulations for Preventing Collisions at Sea (COLREGS, 1972, Part A, Rule 10), a vessel that is engaged in surveying is defined as a "vessel restricted in its ability to manoeuvre" which requires that power-driven and sailing vessels give way to a vessel restricted in her ability to manoeuvre. Furthermore, under the Marine Traffic Act, 1981 (No. 2 of 1981), a vessel used for the purpose of exploiting the seabed falls under the definition of an "offshore installation" and as such it is protected by a 500 m safety zone. It is an offence for an unauthorised vessel to enter the safety zone. The exclusion of vessels from entering the safety zone poses a direct impact to fishing operations as well as hydrocarbon resources exploration		Local, due to spatial limitations imposed by the safety zone	Short-term (impact will persist over duration of exploration only). The impact is fully reversible	Medium (as it may conflict with and result in accessibility of the site to fishing activities). Not likely to interfere with petroleum exploration activities as these activities will be concentrated	Possible	Low (on those that set fishing gear for extended periods such as demersal longlines) High (on those that set fishing gear for short periods) High (on Gas/ oil prospecting vessels as they also have to operate in	- A process of notification and information-sharing should be followed with key identified fishing and Oil/ Gas industry associations as well as the Namibian Navy Hydrographic section. The required safety zones around the survey and sampling vessels should be communicated via the issuing of Daily Navigational Warnings for the duration of the sampling operations through the Namibian Naval Hydrographic Office - In the vessel logbook, record sightings of and interactions with other vessels to note potential conflicts over rights of passage and access to resources - At least 21 days prior to commencement of exploration activities Notify: (1) the Executive Director of MME, (2) the Executive Director of MWT, (3) the Executive	(A) Low (specifically in regards to possible conflict with oil & gas exploration, the EPLs only cover a small portion of the offshore oil/gas blocks and surveys can be planned at different times under worse-case circumstances. Hence, the 2 activities should be able to co-

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
operations in the form of loss of access to fishing grounds or displacement of fishing effort into alternative fishing grounds, and loss of access to ground for oil/ gas drilling or surveying for oil/ gas exploration. It is envisaged that the type of gear used by the particular fishery, the mobility of fishing operations and the probability that the fishing operation can be relocated away from the affected area (the safety / exclusion zone) into alternative fishing areas will determine the sensitivity of the fishing type to possible exclusion. For instance, those that set fishing gear for extended periods (i.e., rock lobster traps anchored at seabed or drifting long-lines) are more susceptible to exclusion than those more mobile operations (i.e. trawl nets are towed directly behind the vessel). Therefore, the sensitivity of the pole-and-line, linefish and small-scale sectors is rated as low due to their mobile nature. The sensitivity of fisheries research surveys is considered to be medium and that of the demersal longline sector, high.				further offshore)		stationary mode)	Director of MFMR, (4) the Chief of Namibian Defence (Navy), and (5) Namport's head of sea traffic, (6) Association of Namibian Fishing Industries and the Namibian Large Pelagic and Hake Longlining Association in writing providing particular details of the intended dates of crew boarding at Luderitz, the destination location, nature and extent of such operations, and which lines of sight the vessels will be using for communication. Also notify other potential user groups with similar details such as fishing / aquaculture industry, NamPort, Association of Namibian Fishing Industries, Namibian Large Pelagic Longlining Association, affected fishing operators, oil/ gas entities, and neighbouring operators such as Debmarine Namibial, Spergebiet National Park in writing, providing particulars regarding the location, nature, extent and duration of such	exist if good coordination is maintained. The same applies to fisheries (B) Medium

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
							operations. Lastly, notify Walvis Bay and Luderitz radios of intended vessel activities, light buoys and exclusion zones well in advance, and perform a comprehensive risk assessment prior to sailing; covering the steaming and establishment in the EPL areas - The daily survey schedule is circulated to key fishing associations, and other neighobouring vessel and platform operators - A Fisheries Liaison Officer (FLO) must be present on board the seismic vessel or guard vessel for the duration of the survey in order to facilitate communications between the seismic and fishing vessels in the project area - Delay vessel activity when marine biota is observed inside the 500m safety zone	

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
IMPACTS FROM GENERAL OPERATION OF VESSELS								
Blocking of vessel seawater intake system by dense surface aggregations of jellyfish may occur; thus, resulting in production delays	Dense surface volumes of jellyfish have been known to block the seawater intakes. This incoming seawater is used to cool the vessel's engines and any blockage of the intake system could cause the engines to overheat and fail, if remedial action is not taken promptly	Local (The extent is limited to the immediate vicinity of the vessel during all operations)	Temporary (The duration is limited to the period of time when dense aggregations of jellyfish are around the vessel: probably no more than a few	Low with no lasting effect (This impact would involve a relatively limited number of jellyfish and is more likely to have adverse impact to the	Probable (Although it is not possible to predict exactly when dense jellyfish aggregations may appear around the vessel, they do tend to occur more commonly during late winter	Medium	- Forward looking sonar could be installed on the vessel to identify dense masses of sub-surface jellyfish during operations. A "jellyfish observer" on deck should be able to identify jellyfish aggregations at the surface - Use a Passive Acoustic Monitoring (PAM) system to detect jellyfish and marine mammals in low visibility conditions - In the case of blockage, jellyfish will have to be physically removed or flushed from the system immediately	(A) Low (B) Very low

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
			hours in duration)	vessel if not mitigate d)	/ early spring: it is inconceiv able, given how many jellyfish there off Namibia that this threat will not arise.			
Marine pollution in event of accidental spillage of fuels and lubricants during re-fuelling at sea as well as during other normal operations	- Rupture of re-fuelling pipes or valve failure - Accidental spillage on deck of grease, oils during operations especially during rough weather conditions	Local to Regional (dependi ng on volume of spillage, and how quickly the spillage plume could be contained	Tempor ary to Short-term (becaus e gas oil used by vessels is rapidly evapora ting light oil)	Low to medium	Improbabl e to possible (IMDH has extensive experienc e and follows internatio nal standards and procedur	Low to medium (dependin g on volumes involved, how early enough leakages are detected, etc)	- The vessels must obtain specific exemption from the Namibian Directorate of Maritime Affairs before refuelling within 200 nautical miles of the coast - In the event of an oil spill, do the following: (1) follow approved procedures as set out in the Oil spill contingency plan, (2) Immediately (within 12 hours) inform the relevant competent authorities such as the Maritime Division at MWT, the	(A)Low (due to long years of experience) (B)High

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
		, as well as on the type of oil involved)			es to be able to manage such risks promptly and effectively)		Resource Management Division at MFMR, Chief of the Navy, and the Luderitz/ Walvis Bayharbour masters	
Deterioration of fish stocks due to illegal fishing for crew consumption and due to fleeing of fish from the area due to noise pollution and vibrations		Local (within the EPL areas as fish tend to jet-skied from areas of operation due to excess artificial noise and vibrations)	Medium -term (could occur over the duration of the exploration phase)	High (as depleted stocks will not be quantified, making it impossible to keep account of stocks; escape of fish	Possible	Medium	- Conduct environmental awareness program for conservation of marine biota for all staff - Take stringent disciplinary action and penalties for any transgression - After the initial set of surveys and once some environmental monitoring data has been acquired, plan surveys in a manner that avoids areas and periods of high abundance and key seasons - Prior to the commencement of survey activities, the Association of	(A) Low (B) Medium (due to some residual degree of uncertainty on how fish populations would react)

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
				into deep waters may lead to increased operational costs for fishing companies in the area)			Namibian Fishing Industries and the Namibian Large Pelagic and Hake Longlining Association should be informed of the navigational co-ordinates of the proposed survey acquisition area, timing and duration of proposed activities and any implications relating to the exclusion zone that would be requested, as well as the movements of support vessels related to the project	
Air pollution	From incinerators, waste treatment plants and burning of engine fuels	Regional (likely to extend beyond the border of the EPL areas)	Medium-term (the impact will persist over and beyond the duration	Medium (In accordance with MARPOL requirements, strict usage of low Sulphur	Definite (as the vessels will release emissions)	Medium	- Strictly enforce compliance to atmospheric emissions as set out under Annex VI of MARPOL - Usage of low sulphur marine gas oils must be adhered to at all times	(A) Medium – residual emission levels need to quantified during the initial phase of operation to quantify

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
			of exploration but the anticipant extent of pollution is lower because of the low sulphur content of these fuels)	fuels is mandatory and IMDH complies with these)				concentrations of gas emissions from engines and incinerators
Exposure of marine birds, animals to hazardous hydrocarbons (oil, lubricants, grease) and other chemicals (FeSi) due to accidental spillages on decks, overboard release of excess quantities of FeSi entrapped in sea shells, and exposure to such substances from unsealed containers		Direct exposure is local but the impact could be regional due to movemen	Short-term (IMDH has experience to rapidly dilute and	Medium to High (depending on period and amount of	Possible	High (especially to sea birds due to close proximity of project area to protected	- Continue initiatives to use shell crushing equipment to maximise retrieval of ferrosilicon where operating in shelly substrates as this compound accumulates in shells - All containers containing hazardous substances should remain properly sealed and be	(A) low (B) High

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
		t of affected species	control spillages)	exposur e)		islands and coastline where population of such species are expected to be high)	stored in designated enclosed areas where birds, seals cannot go	
Occupational and public health and safety (injuries and fatalities)	- From unsafe working conditions during bad weather associated with poor visibility, unstable vessel and wet decks which may result in fall and trips, collision with other vessels - Exposure of personnel working in the recovery component of the treatment plant to radiation from x-rays - Accidental fires	Site specific; limited to the vessel	Short to Medium -term (over duration of explorati on)	Medium (in case of injuries only with some lost producti on time) to High (in case of perman ent injuries and	Possible (due to strict controls implemen ted in line with various operating procedur es such as the Fire Fighting and Radiation Manage ment	Medium	- At all times vessels must maintain a safe clearance distance between each other, with their respective Masters ensuring clear communication at all times - The lighting on the seismic vessel and support vessels should be managed to ensure that they are sufficiently illuminated to be visible to fishing vessels, as well as ensure that it is reduced to a minimum compatible with safe operations - All safe working procedures should be strictly adhered to and must be	(A) Low (B) High

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
	- Sea sickness under extreme weather conditions - Trips and falls due to slippery decks			fatalities)	procedures; emergency response procedures; close out procedures; working at height procedures, etc.)		continuously updated to reflect the prevailing conditions at a given area of work - Ensure that risk assessments are conducted prior to starting any work	
Irretrievable loss of sampling equipment and vessel anchors, resulting seafloor hazards with potential entanglement of marine mammals and interference with demersal fishing vessels	- Bad weather resulting in rupture of anchor chains and wires - Malfunctioning tool recovery system	Site specific	Long-term to permanent (if unrecovered)	Medium	Possible (IMDH has extensive experience in the recovery of equipment but circumstances do	Medium (because these pose a significant risk to future prospecting/ mining operations, and other	- Develop and continuously update a hazards database for the license area listing the type of gear left on the seabed, dates of loss, locations (GPS coordinates) and where applicable, the dates of retrieval	(A) Low (B) High

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
					occur when recovery is not practicall y possible)	resource users)		
Air pollution	From exceedance of international standards for exhaust emissions of by the exploration and supply vessels	Local	Site-specific to short-term (IMDH has experien ce and mechan isms to rapidly dilute excess emission)	Negligibl e (becaus e vessels are required to meet MARPOL minimu m require ments prior to mobilizin g to sea)	Improbabl e (due to the usage of control gas oils with capped emissions in accordan ce with MARPOL requireme nts)	Low	- Vessels must strictly use marine gas oil which has a low sulphur content - Implement emissions monitoring over the first voyage, and adjust emission levels accordingly if threshold values in accordance with MARPOL are exceeded	(A) Low (B) High
Artificial disturbance and nuisance to marine biophysical	- Noise pollution due to running of engines, deployment of	Local	Predomi nantly Medium	Low (studies by	Definite	Medium (due to precaution	- No direct intervention exists to completely eliminate this impact, other than the no-go alternative.	(A) Require s implement

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
environment (fish, plankton, marine mammals, seabirds, turtles) from encroachment of vessels in their natural environment	underwater tools with lighting at sea, burning of fuels, overboard discharge of organics and tailings + FeSi, circulation of heated water near the vessels, vibration from drilling		-term (noise, lighting pollution will prevail over duration of exploration project). Any cumulative release of FeSi may however be Long-term)	Debmarine Namibia which utilizes same type of technology have shown that most of the noise generated by sampling operations is at a frequency that does not interfere with		ary measures being in place well in advance)	Optional measures to reduce the risk include setting aside an appropriate (i.e., size and seabed composition) portion of the EPL areas that will not be directly or indirectly impacted by bulk sampling operations in the foreseeable future; preferably low grade areas or areas with little to no mineralisation. Such areas could also serve as undisturbed reference sites in long-term monitoring studies assessing offshore sampling impacts - Strictly implement other practical measures as outlined above for noise, vibrations, lighting, pollution of habitats, etc.	ation of focussed research post initial phase of sampling to develop an inventory of baseline data, to understand response of the natural environment after project implementation and to understand nature and extent of impacts

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
				marine mammals)				
Lack of local empowerment of communities and SMEs through procurement of goods and services, including procurement opportunities related to onshore waste collection & handling, waste re-use, recycling	The supplying of required project goods and services by foreign entities may lead to conflicts as local suppliers (businesses) may develop an attitude of feeling overlooked and undermined	Regional	Short to Medium -term (this will persist over the duration of the exploration phase). May become long-term if exploration is successful	Medium (As procurement policies for the proponent may need to be tweaked to align with national drive to procure goods and services locally)	Possible (but requires stringent enforcement by regulators such as MME, Namra, Chan=mber of Mines, etc)	Medium	-The supplying of goods and services for the project should be given to local suppliers to boost local business development. Policies and regulations to enforce this need to be monitored quarterly by regulators such as Namra, Namport and MME, and corrective actions taken for non-compliance.	(A) Low (B) High

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
Disputes with stakeholders such as fishing companies, fishing associations, other mineral explorers, and the oil/gas sector players	- Lack of cooperation with other operators such as fishing companies, fishing associations, as well as oil/ gas players	Regional	Medium (over the duration of the exploration operations)	Low to High (depending on how disputes are ultimately managed and	Possible	Low	- Establish a functional grievance mechanism that allows stakeholders to register specific grievances related to operations, by ensuring they are informed about the process and that resources are mobilized to manage the resolution of all grievances, in accordance with the Grievance Management procedure	(A) Low (B) High

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
				resolved)			- Prior to the commencement of survey activities, the Association of Namibian Fishing Industries and the Namibian Large Pelagic and Hake Longlining Association, the oil/ gas associations should be informed of the navigational co- ordinates of the proposed survey acquisition area, timing and duration of proposed activities and any implications relating to any exclusion zone that would be requested, as well as the movements of support vessels related to the project - When vessels are time-sharing, i.e. where two or more vessels are operating in adjacent areas and take turns to shoot to avoid causing seismic interference, the guidelines apply on all vessels involved and clear communication channels are required to ensure effective mitigation.	

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
IMPACTS FROM MANAGEMENT OF WASTE AND MATERIALS								
Marine pollution from discharge of pollutants in bilge water		Local to Regional (if not promptly controlled or contained)	Very short-term (because dispersal and dilution of contaminants in discharged water will be rapid. Generally, water passes through oily water separat	Negligible	Improbable due to strict adherence to MARPOL requirements pertaining to discharge of oily water	Low	- Comply with all legal requirements for waste management and pollution control, and employ "good housekeeping" and monitoring practices as set out under the MARPOL requirements - Conduct environmental awareness programmes and trainings for waste management with the voyage crew prior to commencement of work, and on a regular basis during safety talks	(A) Low (B) High

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
			ors and only water < 15ppm of the oil is released on the IMDH vessels)					
Marine pollution from disposal of organic waste (sewage and waste food)	Non-adherence to MARPOL requirements on disposal of waste foods and sewage at sea, or accidental spillage	Site specific to local (if not contained immediately)	Very short to short-term (provided the treated sewage of waste foods gets treated rapidly)	Negligible	Improbable if preventive measures are implemented in accordance with MARPOL requirements	Low	- Ensure that safe onshore waste disposal arrangements are in place throughout the operations - Comply with all legal requirements for waste management and pollution control, and employ "good housekeeping" and monitoring practices as set out under the MARPOL requirements - Develop an emergency response procedure for accidental release or spillages of organic waste and strictly adhere to it	(A) Low (B) High

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
Accidental marine pollution from transfer of waste and hazardous substances to shore, either whilst transferring waste/ substances from one vessel to the other at sea or during transportation to shore		Local	Short-term if released during transfer from exploration vessel (IMDH has rapid response mechanisms) Possibly long-term if the support vessel capsizes	High	Improbable if preventive measures are implemented in accordance with MARPOL requirements	Medium to High (depending on extent of spillage)	- Ensure that a certified waste collection service provider is appointed to collect, transfer and handle all waste (e.g., scrap metal, used oils, FeSi) and hazardous substances that needs to be transferred to land for disposal, re-use and/ or recycling - An emergency response plan pertaining to this should be available to the exploration vessel and the transfer vessel, and all staff involved must be familiar with this plan. A refresher session must always be given prior to implementing such waste/ substance transfer - A logbook of all waste and hazardous substances dispatched from a vessel at any given time should be kept. Such records should include type and quantity of waste,	(A) Low (B) High

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
			during transportation to shore				details of off-taker, destination location - Ensure that offshore bunkering is not undertaken in the following circumstances: During helicopter operations; During the transfer of in-sea equipment; At night or times of low visibility - In the event of the fuel spills or other chemicals, an Emergency Response Plan for Oil Spills must be put into action and implemented. This Emergency Response Plan for Oil Spill must consider the best measures and the state-of-the-art methods for containing spills or loss of fuels, oils and chemical products	
IMPACTS RELATED TO ONSHORE LOGISTICAL SUPPORT								
Disturbance of coastal birds, seals at the and biologically significant coastal areas (i.e., the Marine Protected Islands) by noise caused by		Local	Short-term (limited	Low	Probable	High	- re-route helicopter routes to avoid the Biologically sensitive areas	(A) Medium

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
the use of helicopters during transfer of crew and supplies			to occur over the duration of flights only and on specific days of the week and provided route taken coincide with the protected isalnds)				outlined in this report and any other sensitive coastal sites - Helicopters must be made to fly at a certain minimum height above the ground/ seawater level to minimize noise levels at ground level - Helicopters to fly only when visibility conditions are favourable to avoid collision with birds	(B) Medium (risk cannot be eliminated completely because helicopters will likely still interfere with birds on helidecks and during landing and take-off, etc)
IMPACTS RELATED TO SOCIO-ECONOMIC ASPECTS								
Sinking of exploration or support vessel, or of helicopter, resulting in marine	- Possible engine failure - Bad weather conditions	Local to international	Short-term (for gas oil because	Medium to High	Possible	High	- Stringent enforcement of vessel and aircraft safe operating procedures, including adherence to regular maintenance	(A) Low

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
pollution from oils, waste + hazardous substances onboard and radioactive material on seabed	- Collisions with vessels or with helicopter or oil/ gas platforms		it is light and would be broken up in a short period of time) Long-term (for radioactive substances such as X-rays)				- Strict enforcement of vessel and aircraft oil spill management system during all operations - Strict enforcement of vessel and aircraft safety operating procedures - Strict adherence to and enforcement of procedures set out in the company's Radiation Management Plan	(B) Medium (risk not as high due to long years of experience)
Termination of all exploration activities and relinquishing of the EPLs, resulting in loss of license levies, taxes, limited	Poor exploration results resulting in termination of exploration campaign	Local to Regional	Long-term to Permanent	Low (because this is a new project which	Possible (results from initial phase of bulk sampling	Low (as there are currently no tangible benefits having	- To eliminate risk of walking away from a potential mine, thorough analysis and interpretation of geophysical and sampling data should be carried out by competent persons	(A) Low (B) High (provided that exploration

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
employment and support to secondary industries such as diamond cutting factories				had not made any significant dent in local society prior to its commencement)	will dictate)	being realised or realised from the project yet. Likely to elevate to Medium after some investment commitments have been made following initial phase of exploration)	- The proponent's onboard representatives in collaboration with the MME diamond inspector should closely monitor recoveries of diamonds from all samples to eliminate risk of under declaring the number and size of diamonds recovered	results are handled and analyzed by competent persons)
Risk of ignoring, or not implementing or ignoring the impact management measures as well as the adaptive	- Lack of employee awareness on the requirements of the EMP and on responsible environmental stewardship	National	Short to medium term (over duration of	High can result in major financial,	Possible	High	- All managers of the proponent must be full made aware of the legal, reputational and financial implications of non-compliance	(A) low (B) High

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
monitoring program recommended	- In adequate allocation of human, financial & other physical resources to implement the EMP -Lack of awareness of legal requirements as outlined under the regulatory framework of these reports - Lack of appreciation of the adverse impacts that non-adherence to the requirements of the EMP could have on the reputation and future success - Loss of opportunity contribute to environmental data collection and building		campaigns)	reputational, legal flaws and actions			- Responsible regulators need to take the lead in ensuring effective implementation of the EMP through regular independent inspections - Pragmatic corrective actions must be taken immediately and monitored accordingly - Submit environmental monitoring reports to MEFT and MFMR on a 6-monthly basis - Strictly implement the adaptive monitoring program to ensure that high quality environmental baseline data is collected. To ensure good QA/QC controls of such data collaboration with marine sciences and fisheries communities should be arranged to provide guidance on how best and effectively to capture key data such as records of marine mammals, sea bird sightings, weather patterns, jelly fish clusters,	

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
	a knowledge base for the affected areas						fish sightings on screens in the onboard treatment plant, benthic community compositions in unconsolidated sediments at selected control sites during geophysical surveying stage	
Post-decommissioning environmental deterioration; disputes with alternative resource operators (e.g., from fisheries, oil and gas exploration); and disputes with employees	- Inappropriate planning and inadequate budgeting for project closure/ termination, and where necessary, rehabilitation - Sudden unforeseen termination of exploration activities due to poor exploration results, bankruptcy, lack of financial resources to fund the exploration program, or termination of key operating permits arising from a major	Regional	Long-term to permanent	Medium	Improbable (if recommended measures are effectively implemented and maintained)	Medium	The proponent and their partners must appoint an independent interdisciplinary committee to undertake the following aspects in regards to project closure/ termination: - Develop a closure plan for the project - outline relevant decommissioning and rehabilitation monitoring programmes for post closure - develop and manage a fund for project post-closure monitoring	(A) Low (B) High

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
	violation of maritime or any other relevant laws - Ineffective internal communication about the EMP's requirements						- account for social and labour welfare post closure - ensure that closure planning continues throughout the life of the operation - allocate resources to gather relevant information throughout the life of the project to ensure that environmental risks are quantified and managed proactively - make provision as part of ongoing environmental management for post-prospecting surveys of selected areas to demonstrate recovery (3-5 year intervals) - maintain adequate Protection and Indemnity (P&I) Insurance Cover to allow for Closure, Rehabilitation and Aftercare liabilities and	

Impact	Triggering activity and potential Impact	Extent	Duration	Intensity	Probability	Significance of an Impact		
						Before Mitigation	Impact mitigation measures (high-level)	Post Mitigation (A) & Degree to which impact can be mitigated (B)
							- Ensure that the following documentation is submitted to the Mining and Environmental Commissioners prior to end of the exploration campaign: (1) the Project Closure Plan, (2) the Final Environmental Performance Assessment Report, (3) all bi-annual environmental monitoring reports	

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8 CONCLUSIONS

Based on the systematic impact assessment carried out in the aforementioned section, the main sources of potential adverse impacts on the physical, bio-physical and socio-economic environment can be summarised as follows:

- Intrusive lighting from various geophysical and other survey equipment, likely causing disturbance and nuisance to marine biota.
- Circulation of heated seawater near the exploration vessel(s).
- Noise and vibration emissions from geophysical survey tools, interaction of the sampling tool with the seabed, and general operations of vessels (e.g., from running engines)
- Mobilization of excess fine sediments and subsequent loading of such sediment (into the water column) from sampling on the seabed and overboard discharge of tailings
- Onboard processing of marine sediments which entails usage of FerroSilicon (FeSi) and overboard discharge of tailings which may carry some FeSi.
- Waste storage and handling onboard the vessels
- Usage of radioactive source (X-ray machines) in the recovery plant with subsequent repeated exposure of humans to radiation source
- Possible supporting activities at sea (e.g., refuelling, exchange of waste and supplies with support vessels; landing/ flying/ taking off of helicopters)
- Bad sea weather conditions (e.g., poor visibility, rough sea) which tend to result in poor health and safety conditions
- Requirements for strict adherence to maintaining safe operational distances of approximately 1.5 nautical from a survey vessel and 2 nautical miles from a sampling vessel has the implication that some commercial activities such as fishing and oil/ gas exploration may be excluded from taking place in the EPL area
- Irretrievable loss of sampling tools or anchors on the seabed.
- Reduction in fish stocks available for catching due to fleeing of fish to other areas, possibly to deeper waters.
- Possible conflict of ground with other industrial players in other marine sectors (e.g., in fishing, oil/ gas prospecting)
- Possible non-compliance with deliberate local content requirements in so far as procurement of goods and services are concerned.

Drawing from Namibia's strong data and information heritage on offshore diamond exploration and mining activities, it is generally known that potential adverse impacts which could arise from the above sources would predominantly classify as having a medium level of significance prior to mitigation. Additionally, most impacts are expected to be either of a short-term nature (i.e., prevailing over the duration of the exploration campaign) and/ or reversal. This, coupled with the possible National benefits (as highlighted in this report) that could be realised from the proposed activities provide merit that the proponent may be issued with an Environmental Clearance certificate (ECC) to commence with offshore prospecting in EPL 8889. It is however very crucial that such ECC be granted with the correct set of

implementation terms and conditions as deemed necessary by the office of the Environmental Commissioner.

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