Samicor Diamond Mining (Pty) Ltd

Final Updated Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) Report for Marine Diamond Exploration and Mining in Mining License (ML) No. 164, Lüderitz Area, //**KARAS REGION SOUTH NAMIBIA**

Samicor Diamond Mining (Pty) Ltd
7 Ruhr Street Northern Industrial Area
PO Box 23498
WINDHOEK, NAMIBIA

FEBRUARY 2019

This Report is Prepared By

Risk-Based Solutions (RBS) CC

(Consulting Arm of Foresight Group Namibia (FGN) (PTY) LTD)
41 Feld Street Ausspannplatz
Cnr of Lazarett and Feld Street
P. O. Box 1839, **WINDHOEK, NAMIBIA**

Contact / Responsible Person/ EAP: **Dr. Sindila Mwiya**
Tel: +264 - 61- 306058; **Faxmail:** +264-886561821
Mobile: + 264-812772546; **Email:** smwiya@rbs.com.na
Global Offices / URLs: www.rbs.com.na or www.foresight.com.na

---

CITATION: *Risk-Based Solutions (RBS), 2019. Samicor Diamond Mining (Pty) Ltd Final Updated Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) Report for Marine Diamond Exploration and Mining in the Mining License (ML) No. 164, Lüderitz Area, //Karas Region, Southern Namibia.*

PROPONENT, LICENSE AND RELATED INFORMATION SUMMARY

PROPONENT
Samicor Diamond Mining (Pty) Ltd

ADDRESS OF THE PROPONENT

Samicor Diamond Mining (Pty) Ltd
7 Ruhr Street Northern Industrial Area
PO Box 23498
WINDHOEK, NAMIBIA

LICENSE TYPE / NAME / No.
Mining License (ML) No. 164

MINING LICENSE (ML) VALIDITY
ML Application Pending

ENVIRONMENTAL CLEARANCE CERTIFICATE (ECC) VALIDITY
Granted 30th March 2011

LOCATION
Lüderitz Area, //Karas Region, Southern Namibia

TYPE OF ACTIVITIES
Mining and Exploration

ENVIRONMENTAL CONSULTANTS
Risk-Based Solutions (RBS) CC
(Consulting Arm of Foresight Group Namibia (FGN) (PTY) LTD)
41 Feld Street Ausspannplatz
Cnr of Lazarett and Feld Street
P. O. Box 1839, **WINDHOEK, NAMIBIA**
Tel: +264 - 61- 306058; Fax: +264 - 61- 306059
Cell: + 264-8114116429; Email: smwiya@rbs.com.na
Global Office / URL: www.rbs.com.na

ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP)
Dr. Sindila Mwiya
PhD, PG Cert, MPhil, BEng (Hons), Pr Eng

STATEMENT OF QUALIFICATIONS / SUMMARY CV /PROFILE OF THE ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP) – DR. SINDILA MWIYA

Dr. Sindila Mwiya has more than seventeen (17) years of direct industry experience in onshore and offshore resources exploration, extraction and utilisation covering general and technical specialist exploration support, Health, Safety and Environment (HSE) permitting for Geophysical Surveys such as 2D and 3D seismic and Gravity surveys, mining and drilling operations support, through to recovery and production. Through his companies Risk-Based Solutions (RBS) and Foresight Group Namibia (FGN) (PTY) LTD, which he founded, he has worked and continue to work for global reputable oil and gas / energy/ resources companies such as InnoSun Holding (PTY) LTD (Namibia / France), LL Namibia Phosphate (Namibia/ Israel), HopSol Power Generation (PTY) LTD (Namibia), Debmarine (Namibia), Namibia Underwater Technologies (NUTAM) (Namibia), Petrobras Oil and Gas (Brazil) / BP (UK), REPSOL (Spain), ACREP (Angola), Preview Energy Resources (UK), HRT Africa (Brazil / USA), Chariot Oil and Gas Exploration (UK), Serica Energy (UK), Eco (Atlantic) Oil and Gas (Canada / USA), ION GeoVentures (USA), PGS UK Exploration (UK), TGS-Nopec (UK), Maurel & Prom (France), GeoPartners (UK), PetroSA Equatorial Guinea (South Africa / Equatorial Guinea), Preview Energy Resources (Namibia / UK), Sintezneftegaz Namibia LTD (Russia) and INA Namibia (INA INDUSTRIJA NAFTE d.d) (Croatia). Dr. Sindila Mwiya is highly qualified with extensive experience in petroleum, mining, renewable energy (Solar, Wind and Biomass), applied environmental management (Scoping, EIA, EMP, HSE etc.), cleaner production, geoenvironmental, geological and geotechnical engineering fields.

He has worked as an Environmental Assessment Practitioner (EAP), Project Manager, Lecturer (University of Namibia), External Examiner/ Moderator (Namibia University of Science and Technology), Technical Consultant (RBS / FGN), National Technical Advisor (Directorate of Environmental Affairs, Ministry of Environment and Tourism / DANIDA – Cleaner Production Component) and Chief Geologist for Engineering and Environment Division and Geotechnician (Magnetics, Seismic, Gravity and Electromagnetics) for Geophysics Division, Geological Survey of Namibia, Ministry of Mines and Energy. He has supervised and continue to support a number of MSc and PhD research programmes and has been a reviewer on international, national and regional researches, plans, programmes and projects with the objective to ensure substantial local skills development for sustainable natural resources development, utilisation, management and for development policies, plans, programmes and projects financed by governments, private investors and donor organisations. Since 2006, he has provided extensive technical support to the Department of Environmental Affairs (DEA), Ministry of Environment and Tourism (MET) through GIZ and continue to play a significant role in the amendments of the Namibian Environmental Management Act, 2007, (Act No. 7 of 2007), preparation of new Strategic Environmental Assessment (SEA) Regulations, preparation of the updated Environmental Impact Assessment (EIA) Regulations as well as the preparation of the new SEA and EIA Guidelines and Procedures.

Among his academic achievements, Dr Sindila Mwiya is a holder of a PhD (Geoenvironmental Engineering - Development of a Knowledge-Based System Methodology (KBSM) for the Design of Solid Waste Disposal Sites in Arid and Semiarid Environments (Namibia)), MPhil/PG Cert and BEng (Hons) (Engineering Geology and Geotechnics), qualifications from the University of Portsmouth in the United Kingdom. During the 2004 Namibia National Science Awards, organised by the Namibian Ministry of Education, and held in Windhoek, Dr. Sindila Mwiya was awarded the Geologist of the Year for 2004, in the professional category. Furthermore, as part of his professional career recognition, Dr. Sindila Mwiya is a life member of the Geological Society of Namibia, Consulting member of the Hydrogeological Society of Namibia and a Professional Engineer registered with the Engineering Council of Namibia.

WINDHOEK, FEBRUARY 2019

CONTENT LIST

LIST OF FIGURES

LIST OF TABLES

LIST OF PLATES

NON TECHNICAL SUMMARY

1. Background

Samicor Diamond Mining (Pty) Ltd used holds mineral rights for precious stones (diamonds) under the Exclusive Prospecting License (EPL) No. 2027C which has now been converted to a Mining License (ML) No. 164 application. The ML 164 application is currently still pending approval by the Competent Authority (Ministry of Mines and Energy (MME). The ML 164 cover a total area of 9436.3671 Ha. The current Environmental Clearance Certificate (ECC) was granted on the 30th March 2011 was never renewed in line with current prevailing Environmental Regulations (Annex 1). The ML No. 164 is situated in the mid-shallow-water area, close to the coastline with water depths of up to -90 m, offshore of Lüderitz Southern Namibia. The ML falls within the Namibian Islands' Marine Protected Area (NIMPA), Lüderitz area, //Karas Region, Southern Namibia.

2. Activities Undertaken for ECC Period 2011 - 2019

No exploration or mining operations have been undertaken in the ML No. 164 for the since the granting of the Environmental Clearance Certificate (ECC) on the 30th March 2011 and for the period 30th March 2011 to 31st January 2019. The reason for the no action scenario is mainly due to low resources prices resulting in challenging global diamonds trading environments and the pending ML application.

3. Purpose of this Report

Samicor Diamond Mining (Pty) Ltd intend to apply for the renewal of its Environmental Clearance Certificate (ECC) granted on the 30th March 2011 in order to align it with the requirements and provisions of the Environmental Management Act, 2007, Environmental Impact Assessment (EIA) Regulations 30 of 2012, the Minerals (Prospecting and Mining) Act, 1992, (Act No. 33 of 1992) as well as all other related operational contractual obligations.

4. Exploration and Mining Activities

Exploration and mining are the main key main activities that Samicor Diamond Mining (Pty) Ltd will be undertaking in the ML No. 164. Exploration operations of Samicor Diamond Mining (Pty) Ltd comprising non-destructive geophysical surveys methods such as Echo-sounder and high resolution sidescan sonar and high-frequency, low energy (<12 kHz) seismic surveys, medium-penetration seismic surveys followed by sampling operations. The mining operations involves the extraction of seabed materials using subsea mining tools, on-board processing and diamond recovery process.

5. Summary of the Receiving Environment

The following is summary of the receiving environment with respect to the proposed exploration and mining operations:

- **Climate:** The southern Namibian coastline is characterised by the frequent occurrence of fog, which occurs on average more than 100 days per year at Oranjemund, with an average annual precipitation of between 16.4 mm at Lüderitz and 51.5 mm at Oranjemund. The coastal temperatures average around 16°C with the prevailing south-easterly winds (Annex 2);

- **Bathymetry and surficial geology:** The current exploration and mineable resource areas within ML No. 164 vary between -5 m – 90 m water depths. Sediment distribution

on the continental shelf is strongly influenced ocean currents and wave actions. The dominant role of wave action along the coastline is reflected in a subtle but definite fining of the sediments seaward (Annex 2);

- **Habitats and Biological Communities:** Marine habitats are sandy beaches, rocky intertidal shores, rocky subtidal habitats and kelp beds, mixed shores, marine benthos that comprises all organisms that live on, or in the top 20 cm, of unconsolidated sediments on the seabed, and marine fish communities that consist of pelagic and demersal species. Marine mammals off the southern Namibian coastline include 35 species of whales and dolphins. The coastline forms an important habitat for breeding and migrant seabirds as well as for wetland birds, which occur along the coastline and near shore areas within the ML Area. A number of these bird species are listed as Endangered and Near Threatened by the International Union for Conservation of Nature (IUCN);

- **Namibian Islands' Marine Protected Area (NIMPA):** The ML No. 164 falls within the NIMPA. NIMPA was proclaimed in 2009 covers almost one million hectares (9,497 km^2) of marine and sea area where 16 small islands and islets or rocks outcrops provide sanctuary to a large variety of life. This area stretches over 400 km from Meob Bay, north of Lüderitz, to Chameis Bay south of the harbour town and 30 km into the Atlantic Ocean. It maintains essential ecological and life support systems, ensuring the sustainable utilization of species and ecosystems and preserving biotic diversity. Seabirds and seals dominate the islands' flora and fauna. Of the 14 seabird species breeding in Namibia, 11 species breed on the islands and inshore rocks, including Namibia's endangered African penguins Cape and Bank Cormorants amongst others (Annex 2), and;

- **Principal Fisheries:** A major feature of the dynamic and variable Benguela system is upwelling, and the consequent high nutrient supply to surface waters leads to high biological production and large pelagic and demersal fish resources (Annex 1). The commercial rock lobster fishery in Namibia is centred on Lüderitz and forms an important part of the coastal economy of southern Namibia.

6. Assessment Impact and Management

Detailed assessment table with management intervention measures have been provided. A summary of those impacts ranked as having either a "high" or "medium" significance and the appropriate management intervention measures to reduce the negative impacts are presented in Tables 1 and 2.

Table 1: Summary of impacts of high significance.

Impacts of High Significance	Management Intervention Measures
1. Mining in gullies and disposal of tailings back into the sea	Targeted monitoring/ research needs to be conducted to assess the biological significance and/or ecological sensitivity of benthic habitat and communities across the different types of rocky outcrops, especially in mining.
2. Grounding / sinking of vessel (marine pollution from spills)	Strict enforcement of vessel safety measures and stringent oil spill management systems are essential during all operations.
3. Mine Closure	It is essential that Samicor Diamond Mining (Pty) Ltd embark upon the development of a Mine Closure Plan, which includes social and labour issues, to manage the risks associated with the closure of operations.

Table 2: Summary of impacts of medium significance.

Impacts of Medium Significance	Management Measures and Mitigation
1. Sediment removal during seabed sampling 2. Benthic community impacts of mining 3. Tailings disposal (smothering of benthic communities) 4. Benthic community and higher order impacts through tailings disposal	No direct intervention possible other than the no-project alternative. Optional measures to reduce the risk include setting aside an appropriate (i.e. size and seabed composition) portion of the Mining Licence Area that will not be directly or indirectly impacted by mining operations in the foreseeable future. Such areas could also serve as unmined reference sites in long-term monitoring studies assessing mining impacts.
5. Habitat alteration	The alternative of no mining operations, and the option of not disposing tailings overboard while mining.
6. Release of H_2S from muds	For safety reasons it is essential that on-board air quality is monitored during the exploration and mining operations in the ML Area, if operating in muds. Prior to operations in areas of thick mud overburden it essential that a coring survey to determine the presence of H_2S pockets is conducted.
7. Repeat mining	Optional measures include no re-mining of areas.
8. Archaeological, paleontological and historical aspects	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.
9. Radioactive sources	Strict implementation of Radiation Management Plan (RMP)

6. Environmental Performance Monitoring

The proponent, Samicor Diamond Mining (Pty) Ltd must undertake research and monitoring of short and long-term impacts and including cumulative impacts of both exploration and mining activities on the receiving environment, such as disturbance of seabed habitats and communities. The following is summary of the environmental performance monitoring activities that must be implemented:

- **Implementation of the EMP monitoring plan**: The implementation of the EMP monitoring plan by Samicor Diamond Mining (Pty) Ltd will require allocation of sufficient resources to collect, analyse the required datasets and propose recommendations on what needs to be done for both the long-term and short (day to day) monitoring operations. The implementation could be done as an in-house activity or partly in-house (data collection during exploration and mining processes) and outsource (employ a consultant) to undertake the assessment and recommend measures to be implemented. Key aspects that need to be monitored include water quality, marine fauna and bathetic compositions and variability. There will be a need for a full range of laboratory and technical facilities to support the monitoring programme of water quality monitoring and benthic communities with respect to the proposed exploration and mining processes;

- **EMP Auditing**: On an annual basis, a written Environmental Performance Report will be submitted to the Mining Commissioner of the Ministry of Mines and Energy and Environmental Commissioner of the Ministry of Environment and Tourism demonstrating compliance with the provisions of the EMP, statutory requirements, as well as ongoing assessment of impacts and gathering of information, and;

- **EMS Auditing**: Personnel within Samicor Diamond Mining (Pty) Ltd are responsible for the management of these impacts through regular environmental audits to evaluate compliance and effectiveness monitoring programme in line with all the applicable national legal instruments;

It is important that environmental performance monitoring are undertaken before, during and after exploration and mining operations because this approach may make it possible to identify unpredicted effects and take the necessary precautions to eliminate the likely impacts before the effects become significant.

7. Conclusions and Recommendations

Based on the results of this updated Environmental Impact Assessment (EIA) and Environmental Management Plan report, and the attached annexes, it's hereby recommended that the proponent (Samicor Diamond Mining (Pty) Ltd) be issued with new Environmental Clearance Certificate for the ongoing marine diamonds exploration (geophysical survey and sampling) and mining operations in its Mining License (ML) No. 164 situated to the south of the Port of Lüderitz.

1. BACKGROUND

1.1 Overview

Samicor Diamond Mining (Pty) Ltd used to holds mineral rights for precious stones (diamonds) under the Exclusive Prospecting License (EPL) No. 2027C which has now been converted to a Mining License (ML) No. 164 currently still pending approval by the Competent Authority (Ministry of Mines and Energy (MME). The ML 163 cover a total area of 9436.3671 Ha. The current Environmental Clearance Certificate (ECC) was granted on the 30th March 2011 was never renewed in line with current prevailing Environmental Regulations (Annex 1). The ML No. 163 is situated in the mid-shallow-water area, close to the coastline with water depths of up to -90 m, offshore of Lüderitz Southern Namibia. The ML falls within the Namibian Islands' Marine Protected Area (NIMPA), Lüderitz area, //Karas Region, Southern Namibia.

1.2 Purpose of this Report

This report has been prepared in order to support the application for the renewal of the Environmental Clearance Certificate. This report provide an updated scope of the Environmental Management Plan (EMP) with respect to the proposed mining and exploration operations in the ML No. 164. Samicor Diamond Mining (Pty) Ltd intend to apply for the renewal of its Environmental Clearance Certificate (ECC) granted on the 30th March 2011 in order to align it with the requirements and provisions of the Environmental Management Act, 2007, Environmental Impact Assessment (EIA) Regulations No. 30 of 2012, the Minerals (Prospecting and Mining) Act, 1992, (Act No. 33 of 1992) and other related operational contractual obligations.

1.3 Activities Undertaken for the Period under Review

The Environmental Clearance Certificate (ECC) for the ML No. 163 was granted on the 30th March 2011. No exploration or mining operations have been undertaken in the ML No. 163 for the period 30th March 2011 to 31st January 2019 mainly due to the pending ML application coupled with low global demand demand and prices.

1.4 Location and History of ML 164 Area

The ML 164 falls within the Namibian shallow marine environment around Lüderitz area, //Karas Region, Southern Namibia (Figs. 1.2 -1.4). The ML area borders other minerals licenses and all falling within the Namibian Islands Marine Protected Area (NIMPA) proclaimed and gazetted in 2009 by the Ministry of Fisheries and Marine resources (MFMR) (Government Gazette No. 4210 of 16 February 2009) (Fig. 1.2). In addition, the ML area falls within key marine and coastal environmental resources within the NIMPA (Figs. 1.1 -1.4). Regulations specific to the NIMPA have been developed and have been considered in this updated EIA and EMP Report for the proposed mining and exploration activities in the ML 164.

1.5 Project Objective and Motivation

The overall project objective is to mine diamond deposits already delineated within the ML area. The ML 164 area is situated in a highly prospective area for diamonds and boarders the diamond producing Mining Licenses (MLs) Nos. 44, 45, 128B and 128C for Namdeb Holdings and MLs Nos. 36B, 36C and 36D for Samicor Diamond Mining (Fig. 1.2). Within the ML area, diamonds are known to occur based on previous exploration activities undertaken by the

proponent. With current promising global diamond price recoveries, the start of the mining operations in the ML 164 area will have much greater and positive socioeconomic benefits to the local Lüderitz community. Additional socioeconomic benefits will also be realised at regional (//Karas Region) and national (Namibia) levels in terms of capital investments, value addition opportunities, license rental fees, royalty taxes payable to Government, direct and indirect contracts and employment opportunities, export earnings, foreign direct investments and various taxes payable to the Government.

1.6 Assumptions and Limitations

The following assumptions and limitations underpin the approach adopted, overall outcomes and recommendations for this updated EIA and EMP report:

- The previous EIA and EMP Report, all the plans, maps, EPL Boundary / coordinates and appropriate data sets received from the proponent, project partners, regulators, Competent Authorities and specialist assessments are assumed to be current and valid at the time of conducting the studies and compilation of this updated report;

- The impact assessment outcomes, mitigation measures and recommendations provided in previous EIA and EMP Report and adopted in this report are valid for the entire duration of the proposed activities;

- A precautionary approach has been adopted in instances where baseline information was insufficient or unavailable or site-specific information of the proposed project activities are not yet available, and;

- Mandatory timeframes as provided for in the EIA Regulations No. 30 of 2012 and the Environmental Management Act, (EMA), 2007, (Act No. 7 of 2007) are applicable.

1.7 Structure of the Report

The following is the summary structure outline of this environmental scoping report:

- **Section 1: Background** covering the proposed project location;

- **Section 2: Approach and Methods** summarises the approach and methodology adopted in the preparation of the report;

- **Section 3: Description of Exploration and Mining** covering the summary of the proposed exploration and mining operations;

- **Section 4: Regulatory Framework** covering the proposed exploration and mining;

- **Section 5: Receiving Environment** covering summaries of the physical, biological and socioeconomic environments of the proposed exploration and mining operations;

- **Section 6: Impact and Risk Assessment** covering criteria and results of the impact and risk assessment processes;

- **Section 7: Environmental Management Plan (EMP) and Monitoring Frameworks** detailing key mitigation measures, performance monitoring and reporting requirements;

- **Section 8: Conclusions and Recommendations -** Summary of the findings and way forward.

REPUBLIC OF NAMIBIA

MINISTRY OF ENVIRONMENT AND TOURISM

Enquiries: Dr. F.M. Sikabongo
Tel.: 00264 61 249015
Fax. 00264 61 240339
freddy@dea.met.gov.na

FGI Building, 1st Floor
Post Street Mall
P/Bag 13346
Windhoek

OFFICE OF THE PERMANENT SECRETATRY

The Managing Director
SAMICOR Diamond Mining Pty Ltd
P.O Box 3498
Windhoek

Fax: +264 61 249 253

Dear Sir

Re: Environmental Clearance for the Environmental Assessment and Plan for the Proposed ML164 (EPL2027C), Luderitz, Karas Region

Thank you for your submission of the Environmental Assessment and Plan for the above-mentioned project. The assessment done is sufficient as it takes into account the key environmental issues concerning the proposed activities. It is recommended that once the project is implemented regular environmental monitoring and possible improvements should be conducted.

In view of the environmental sensitivity of the area, the MET reserves the right to attach further regulatory conditions during the operational phase of the project. From this perspective, we issue the clearance with the following condition: *all key stakeholders must be properly consulted and their consent taken into account prior to any development activities.*

On the basis of the above, this letter serves as a conditional environmental clearance for the project to proceed. However, this clearance letter does not in any way hold the Ministry of Environment and Tourism accountable of any wrong or insufficient information, nor any adverse effects that may arise from this project's activities. Instead, full accountability rests with the developer and his/her consultants.

Thank you once again for your kind co-operation.

Yours sincerely,

Ministry of Environment & Tourism
30 MAR 2011

Dr. K. Shangula
Permanent Secretary

All official correspondence must be addressed to the Permanent Secretary

Figure 1.1: Copy of the current ECC for ML 164 for Samicor Diamond Mining (Pty) Ltd granted on the 30th March 2011 and need to be renewed and aligned to the current prevailing EIA Regulations, 2012.

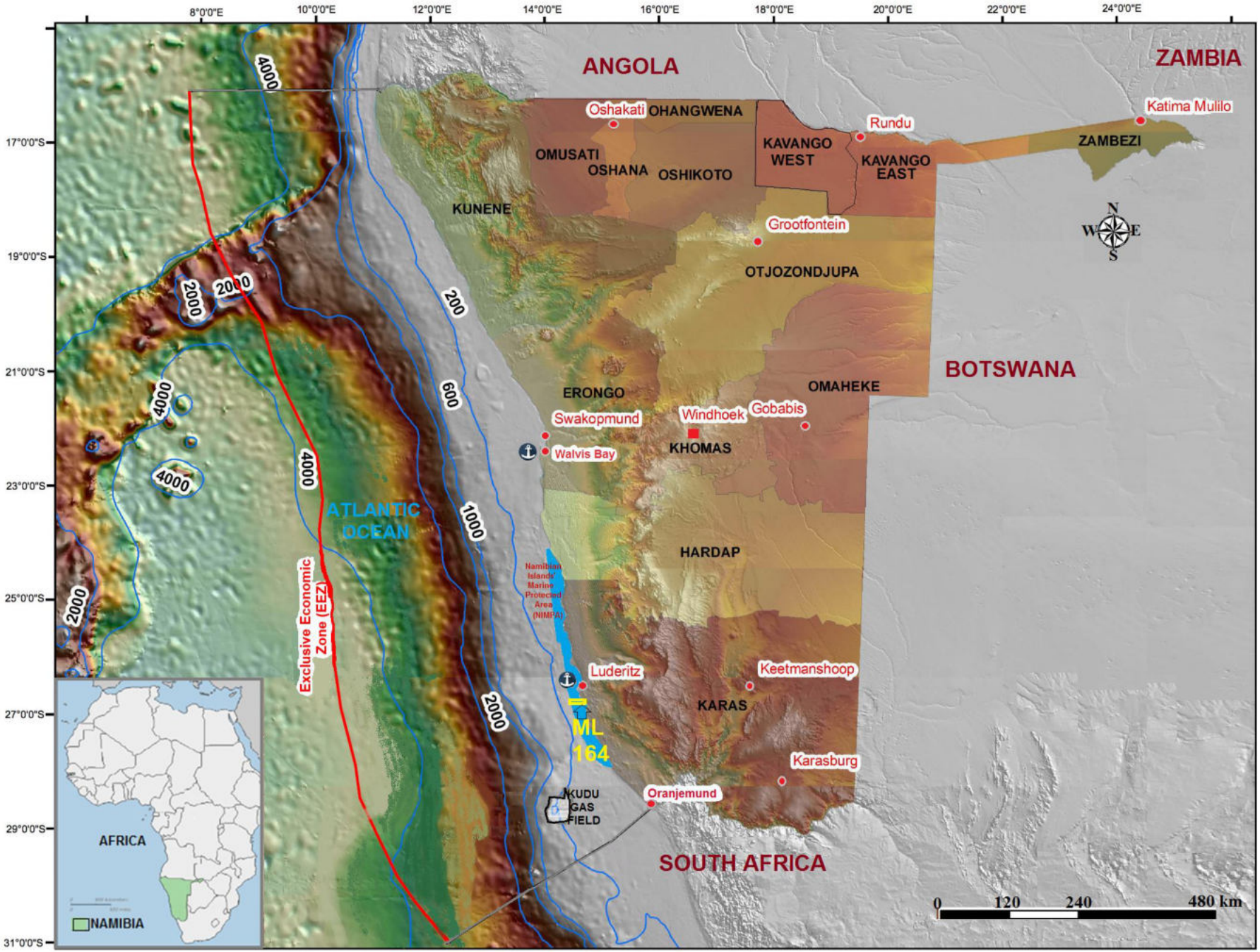

Figure 1.2: Regional location of the ML No. 164.

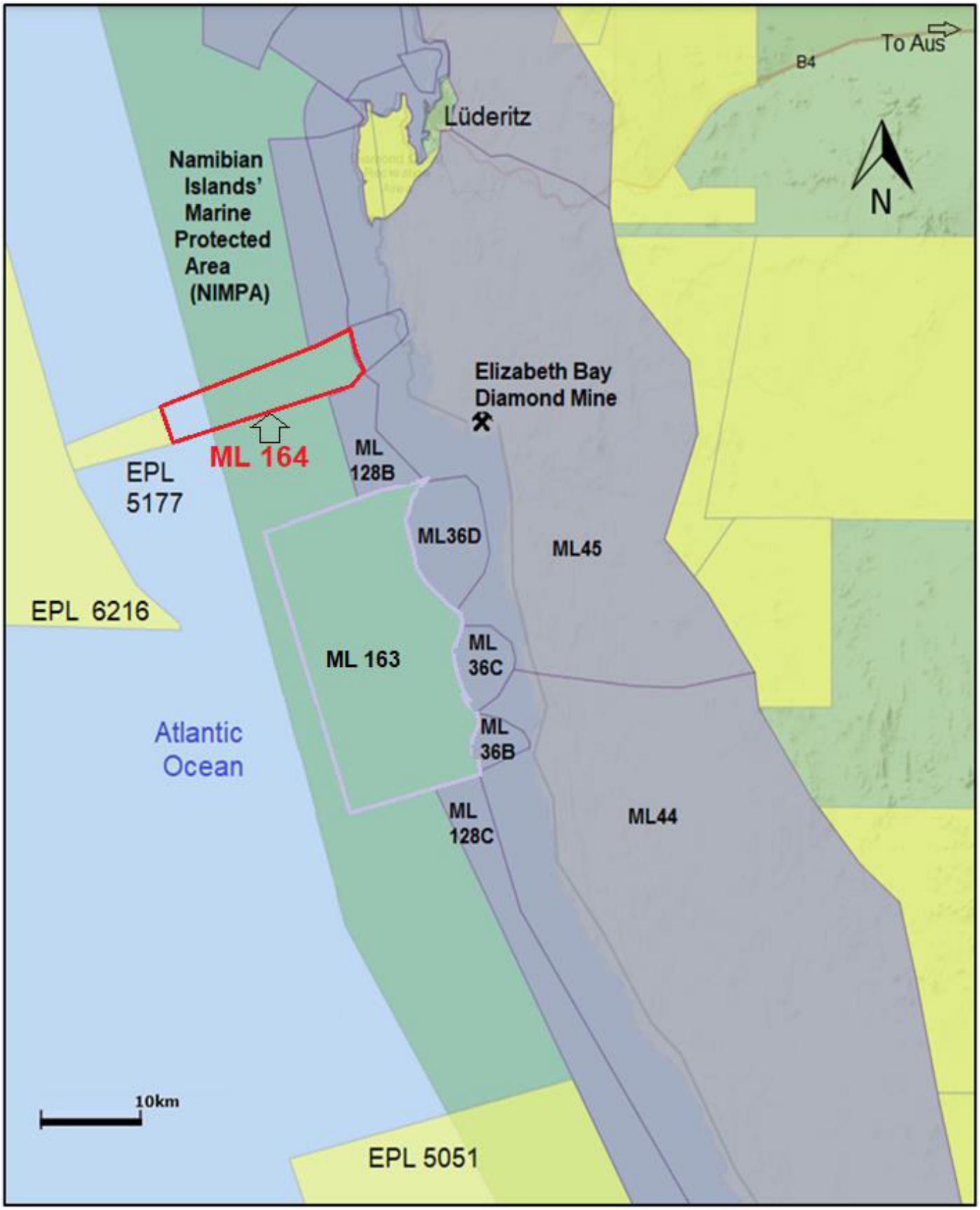

Figure 1.3: Sub regional location of the ML 164 (Source: http:// portals. flexicadastre. com/ Namibia).

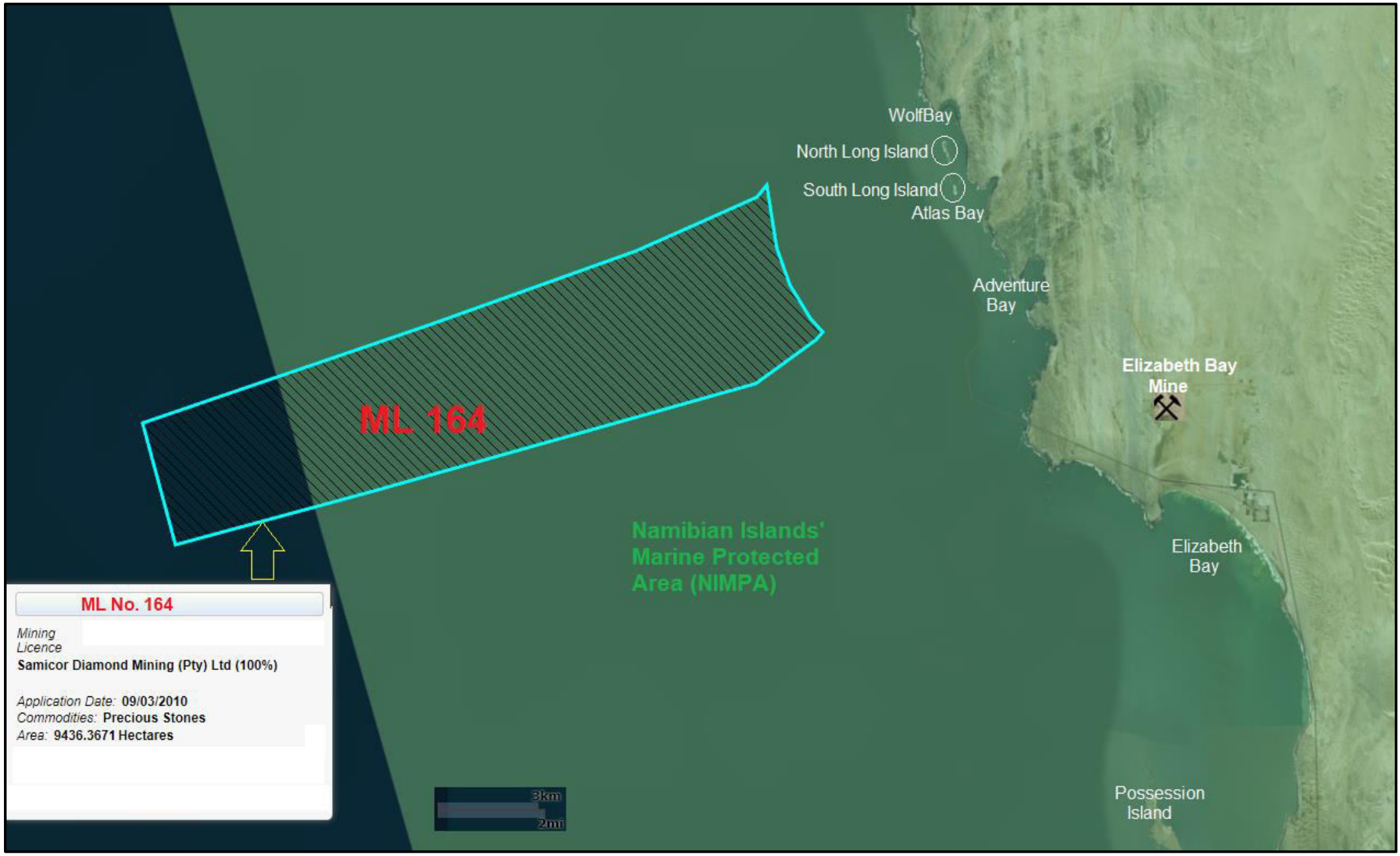

Figure 1.4: Detailed location of the ML No. 164 with respect to key Islands with NIMPA (Source: http://portals.flexicadastre.com/Namibia).

2. APPROACH AND METHODS

2.1 Overview

Environmental assessment process in Namibia is governed by the Environmental Impact Assessment (EIA) Regulations No. 30 of 2012 gazetted under the Environmental Management Act, (EMA), 2007, (Act No. 7 of 2007) and in line with the provisions of the Cabinet approved Environmental Assessment Policy for Sustainable Development and Environmental Conservation of 1995. Fig. 2.1 summarises the Environmental Assessment process in Namibia.

This updated report has taken into consideration all the requirements for preparation of all the supporting documents and application for renewal of Environmental Clearance Certificate and lodgement of such application to the Environmental Commissioner (EC), Department of Environmental Affairs (DEA) in the Ministry of Environment and Tourism (MET).

The review and updating of the report previous reports, took into considerations all the relevant provisions of the Environmental Management Act, 2007, the Environmental Impact Assessment (EIA) Regulations, 2012 and the DEA Directive dated 22nd January 2015 titled "New Reporting Guidelines for Environmental Assessment (EA)".

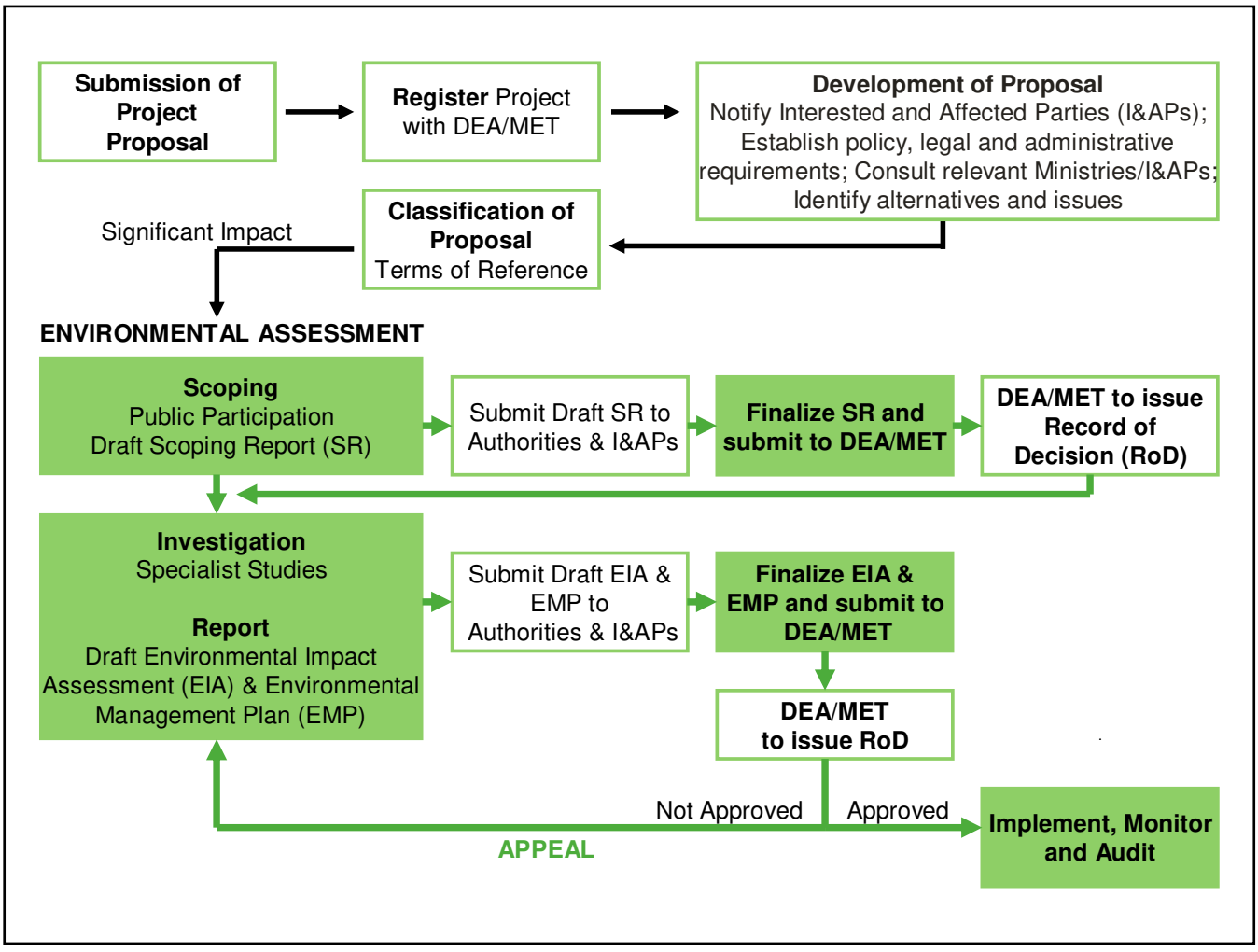

Figure 2.1: Summary of the environmental assessment process in Namibia.

2.2 Review of All Key Documents and Processes

The following processes and documents related to the environmental assessment process undertaken in last fifteen (15) years have been reviewed and updated as part of the preparation of this updated EIA and EMP report:

(i) Compliance of the environmental assessment process adopted as described in the methodology these reports with respect to the prevailing environmental assessment process in Namibia at the time when the reports were prepared;

(ii) Specialist studies undertaken;

(iii) Impact Assessment ;

(iv) Management plan;

(v) Samicor Diamond Mining (Pty) Ltd Policy;

(vi) Risk assessment and Gap analysis, and;

(vii) Terms of Reference for this Report.

2.3 Review of the Environmental Assessment Process Adopted

The environmental assessment as described in the methodology of the previous environmental assessment fully complied with the prevailing requirements for environmental assessment process in Namibia at the time of preparation. This updated EIA and EMP Report has been prepared in line with the provisions of the Environmental Management Act, 2007, Act No. 7 of 2007 and EIA Regulation 2012.

2.4 Review of Specialist Studies Undertaken

A number of research and monitoring activities and project-specific studies have been undertaken by Samicor Diamond Mining (Pty) Ltd as part of the EIA and EMP reporting undertaken in 2010 (Annexes 2 and 3).

2.5 Public Consultations Process

There are no new fundamental changes to the exploration and mining operations of Samicor Diamond Mining (Pty) Ltd since the previous EIA and EMP reporting in 2010. This report has been prepared to support the application for the renewal of the Environmental Clearance Certificate (ECC) grated on 30th March 2011. This updated EIA and EMP report has not been subjected to public consultation process. There is no legal requirements for undertaking stakeholders consultation when applying for renewal of the ECC.

2.6 Management Plan

The previous EMP reports for prepared in 2011 as well as this EMP, all provided mitigation measures associated with exploration and mining operations risks of medium to high significance impacts. A hierarchy of methods for mitigating significant adverse effects has been adopted in order of preference and as follows:

(i) Enhancement, e.g. provision of new habitats;

(ii) Avoidance, e.g. sensitive design to avoid effects on ecological receptors;

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

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

2.7 Environmental Policy

The implementation of the Environmental Management Plan (EMP) of Samicor Diamond Mining (Pty) Ltd is guided by the Environmental Policy. This updated EIA and EMP report will be integrated within the Samicor Diamond Mining (Pty) Ltd Environmental Policy requirements.

2.8 Terms of Reference for this Report

2.8.1 Overview

Risk-Based Solution CC, was contracted by Samicor Diamond Mining (Pty) Ltd to apply for the renewal of the ECC as well as update the current EIA and EMP Report and prepare Environmental Monitoring Report for the period 2011 - 2018 under review. The Terms of Reference (ToR) were prepared in line with the provisions of the Environmental Management Act, 2007, Act No. 7 of 2007 and EIA Regulation 2012.

2.8.2 Summary of the Terms of Reference

The following is the summary of the Terms of Reference (ToR) that have been used in the preparation of this updated revised EIA and EMP report in line with the provisions of the Environmental Management Act, 2007, Act No. 7 of 2007 and EIA Regulation 2012:

(i) Preparation of all the key documents to support the application for the renewal of the Environmental Clearance Certificate (ECC) for the ML No. 164:

(ii) Completion of the application for Environmental Clearance Certificate with appropriate required Revenue Stamps;

(iii) Preparation of the updated Environmental Management Plan (EMP) report;

(iv) Preparation of the Environmental Monitoring report for the period 2011-2018 under review, and;

(v) Provide other supporting activities including: Logistics, printing, binding and project management and actual lodgement of the application for Environmental Clearance Certificate to the Environmental Commissioner in the Ministry of Environment and Tourism (MET) (the Environmental Regulator) through the Mining Commissioner in the Ministry of Mines and Energy (MME) (the Competent Authority).

3. DESCRIPTION OF EXPLORATION AND MINING

3.1 Exploration and Mining Vessels

Marine diamonds exploration and mining operations requires the use of specially designed vessel to be used in such operations. Future exploration activities will be conducted by deploying the sampling and exploration vessel m/v the Explorer (length overall 114.85 metres) (Plate 3.1). The Explorer is equipped with a DP 2 dynamic positioning system enabling the vessel to accurately maintain position (to within one metre) and then to move timeously to the next sampling location.

The vessel possesses a fully integrated subsea drill tool with a 5 m-square footprint (designed and developed in-house), capable of drilling up to 12 m into the seabed in water depths of up to 180 m below sea level; 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.

The forthcoming mining activities will be conducted by deploying the mining vessel m/v Ya Toivo (length overall 149.50 metres) (Plate 3.2). The mining vessel m/v Ya Toivo is equipped with a 4 point-mooring-system, integrated anchor-assist and a DP 2 dynamic positioning system which combine to safeguard the vessel in remaining on station in all weather conditions.

The vessel is further equipped with a Remotely Operated Subsea Tractor (ROST) launch and recovery system for subsea mining tool handling consisting of a large, fixed A-frame over the stern of the vessel and as well as a hoist winch and heave compensator. The mined material is slurry pumped from the seabed through a special riser system into the fully integrated 150 ton/hour diamond DMS processing plant.

Plate 3.1: The m/v Explorer, the exploration vessel that will be used for the proposed exploration activities in support of the mining operations in the ML No. 164.

Plate 3.2: The m/v Ya Toivo, a mining vessel to be used for the proposed mining operation in the ML No. 164.

3.2 Exploration Summary

Various non-destructive Geophysical survey (Geosurveys) techniques are often used as the 1st step of the exploration process and applied over a wider area in order to delineate potential trapesites in form of diamond bearing unconsolidated sediment (Annex 2). Once potential targets have been delineated, they are often validated by undertaking primary exploration and subsequent sampling. As part of the sampling campaigns, geotechnical assessment is also undertaken in order to determine the geotechnical properties of the sediments and its suitability for possible mining with respect to the existing mining techniques and technology.

Geosurvey techniques involve non-destructive remote sensing methods, which do not utilise explosives as an energy source. Data are collected over a grid of regularly spaced lines whose separation varies according to the resolution of the survey required. Surveying techniques commonly include:

- Multibeam echo-sounder and high resolution sidescan sonar surveys are conducted using Autonomous Underwater Vehicle (AUV) 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 - 500 kHz is used to produce textural maps of the seafloor. The data are recorded and mosaiced digitally onboard the surveying vessel;

- High-frequency, low energy (<12 kHz) seismic are used during sub-bottom acoustic profiling surveys to map the uppermost 10 - 15 m of unconsolidated sediment. Acoustic pulses (chirps) are emitted from the AUV at constant height above the seafloor at specified line, and the reflected signals are recorded digitally. Medium-penetration seismic surveys, using a surface-towed airgun array provide data for the first 100 - 150 m of sediment beneath the seafloor. Such surveys are used to determine bedrock morphology, the types of sediments lying upon the consolidated footwall, particularly the

position and thickness of the diamond-bearing gravel ore body, and the thickness and composition of overlying sediments, and;

- Direct visual observations using underwater video systems mounted on Remotely Operated Vehicles (ROVs), or occasionally using manned submersibles.

3.3 Mining and Minerals Processing Operations

3.3.1 Mining Operations Overview

Mining involves the removal of only the unconsolidated superficial sediments with no penetration of bedrock (Annex 2). Mining takes place according to a mine plan in which identified blocks within the resource feature are excavated sequentially (Annex 2). Once the mining vessel is on position using the DP over predetermined positions and the mining tool deployed in the moon pool.

Material pumped through the riser to the processing plant on board the vessel will consist of an unsorted slurry containing various sediment fractions and water and will be delivered at an average rate of ~ 2500 m^3/hour in sediments of two meters thickness.

3.3.2 Onboard Processing and Diamond Recovery

The ship mounted process plant design proposed for the project is typical for marine diamond mining operations and includes the following unit processes (Fig. 3.1):

- Primary scalping and screening, removal of oversize and undersize and dewatering;
- Secondary screening and fines removal;
- Attrition milling and shell reduction multi-stage DMS concentration, and;
- X-ray recovery and glove box sorting of X-ray concentrate.

The process is completely non-chemical utilising ferrosilicon (FeSi), an inert silica sand, as a density modifying agent. The bulk of the FeSi is recycled in the process. The mined sediment is pumped to the surface as a slurry and discharged over a series of sizing screens to separate the oversize (>22mm) and undersize (<1.25mm) reject fractions from the economically important middling fraction (Fig. 3.1).

Reject fractions will immediately be discarded overboard. The fine material forms turbid “plume” and is carried away down current from the mining vessel, gradually dispersing through dilution and settling. The coarse material will fall directly to the sea floor beneath the outfall point. Onboard processing continues to sequentially treat the middling fraction (22mm > 1.25mm) by attrition and dense media and X-ray separation, producing a final concentrate that in mass is less than 0.1% of that originally delivered on board as sediment in slurry.

The balance of the middling fraction is discarded as fine (0.01 - 1.25mm) and coarse (12mm – 22mm) tailings, behaving as under and oversize fractions described above. Diamonds are recovered from the final concentrate on-board the vessel by glove box sorting in a high security area. The mine plan sequence is designed to deposit tailings material (everything that is not collected as a diamondiferous concentrate) in previously mined areas. This is done to prevent re-mining of tailings and to begin the rehabilitation process of the mined areas.

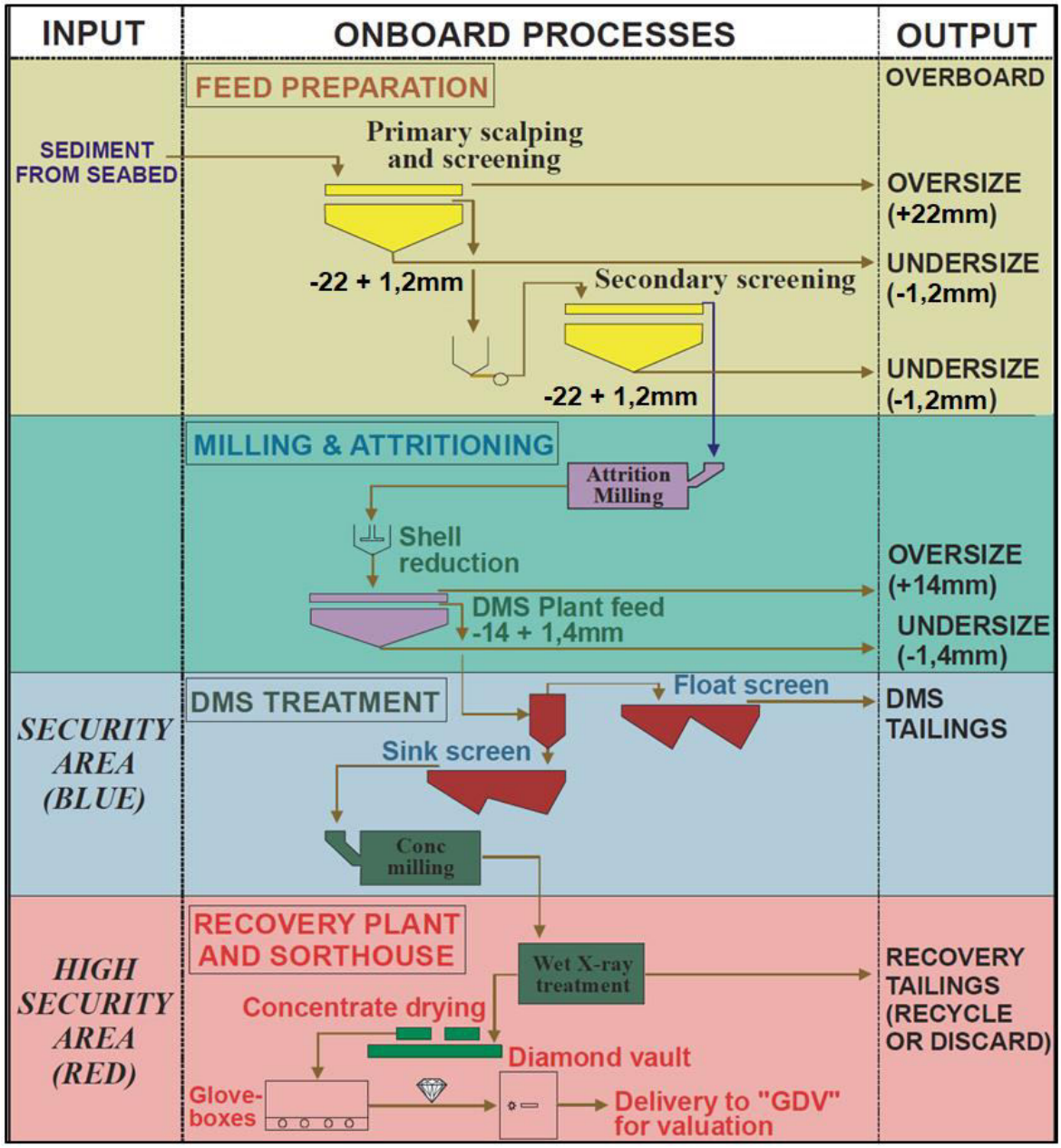

Figure 3.1: Flowchart diagram of the stages and processes during shipboard processing of marine diamond gravels.

3.4 Logistic Arrangements and Support

3.4.1 Fuel Supply, Transfer, Storage and Usage

The fuel used by marine diamond exploration and mining vessels is Marine Gas Oil (MGO), a rapidly evaporating light diesel engine fuel. The fuel is also used for the onboard generators which supply electricity for operating all mining equipment. Fuel is supplied to the vessels by refuelling from a tanker in Namibian waters at distances in excess of 12 nautical miles from shore to reduce the risks in the event of spillage. The fuel remains the risk of the supplier until the vessels are connected to transfer fuel. While the vessels are connected, however, liability for oil pollution falls to the receiving vessel. Fuel is supplied about once every three months per vessel. The transfer of fuel is achieved whereby the receiving vessel anchors on a single anchor and connects up with the tanker by means of mooring ropes and the bunker hose.

3.4.2 Water Supply and Usage

Vessels will carry stocks of potable water, which are occasionally topped up by the supply from Lüderitz Port. Additional water is purified using evaporative desalination (flash evaporation) units onboard each vessel and using waste heat generated from the engines to cause the evaporative process, thereby not requiring specific energy usage.

3.4.3 Waste and Discharges Management

Waste oils will be discharged in Lüderitz or Cape Town using certified waste collection / services provider. On onboard waste and discharge management is shown in Fig. 3.2.

3.4.4 Security

All persons entering and embarking the vessels require a Restricted Area Permit (RAP) in terms of the Diamond Act 13 of 1999 (and the Regulations) from the Ministry of Mines and Energy. Before employment, all prospective employees, temporary staff and contractors are screened by the Police Services of their country of origin. A Certificate of Conduct or Police Clearance certificate is required to verify the individual's identity and risk profile.

Short listed incumbents undergo a polygraph test, performed by the Samicor Diamond Mining (Pty) Ltd Security Investigations Unit. All new employees are given a security induction course in their first working week. All employees and visitors to the vessels are searched before boarding the vessel.

Security personnel search their luggage for illegal substances and alcohol and on disembarking; the luggage is searched for diamonds and any property of the Company, using a Scannex full body low dosage x-ray search facility. There is also random frisking of persons leaving the vessels. An electronic card system is in place to control and track access to the vessels and at the Samicor Diamond Mining (Pty) Ltd offices.

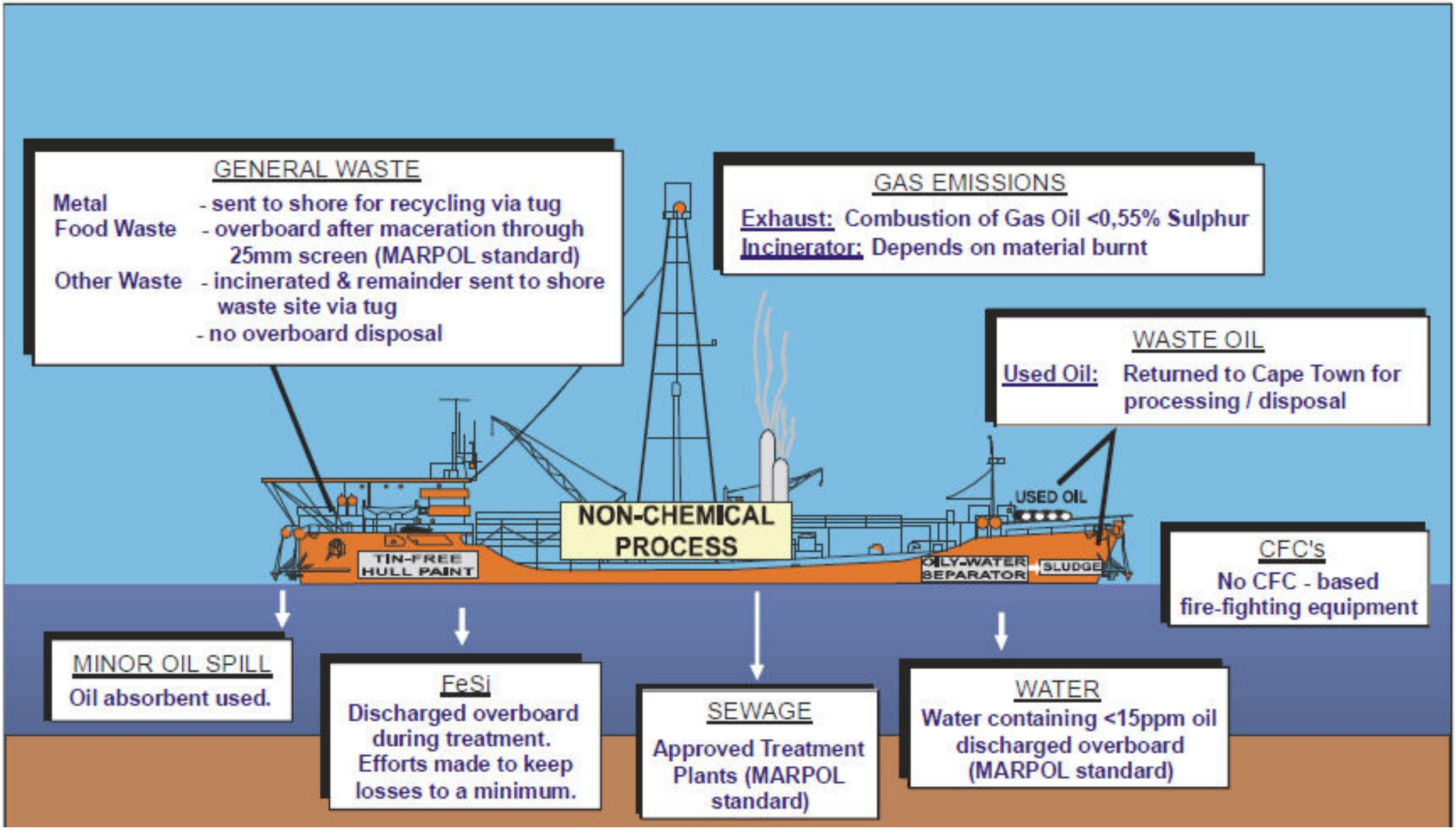

Figure 3.2: Illustration of the waste and discharges management procedures on-board a typical mining vessel.

4. REGULATORY FRAMEWORK

4.1 Exploration and Mining Operations

The Ministry of Mines and Energy (MME) is the competent authority for minerals prospecting and mining activities in Namibia. The Minerals (Prospecting and Mining) Act, 1992, (Act No. 33 of 1992) is the most important legal instrument governing minerals prospecting / exploration and mining activities. Several explicit references to the environment and its protection are contained in the Minerals Act, which provides for environmental impact assessments, rehabilitation of prospecting and mining areas and minimising or preventing pollution.

4.2 Environmental Regulations

Environmental Assessment (EA) process in Namibia is governed by the Environmental Impact Assessment (EIA) Regulations No. 30 of 2012 gazetted under the Environmental Management Act, (EMA), 2007, (Act No. 7 of 2007). The proposed exploration and mining activities falls within the categories of listed activities that cannot be undertaken without an Environmental Clearance Certificate.

4.3 Regulatory Agencies

The environmental regulatory authorities responsible for environmental protection and management in relation to the current and future mining and exploration operations in the Mining License Area including their role in regulating environmental protection are listed in Table 4.1.

Table 4.2 shows a summary of the regulating authorities with the relevant permits / licenses required for the proposed exploration and mining programme covering geophysical surveys (seismic) and sampling operations as well as the mining operations and diamond recovery process. Regional Standards for industrial effluent in line with the Government Gazette No 217 dated 5 April 1962 are summarised in Table 4.3.

Table 4.1: Government agencies regulating environmental protection in Namibia.

AGENCY	ROLE IN REGULATING ENVIRONMENTAL PROTECTION
Ministry of Environment and Tourism	Issues Environmental Clearance Certificates in line with the provisions of the Environmental Management Act (2007) and the Environmental Impact Assessment Regulations, 2012
Ministry of Mines and Energy	The competent authority for minerals prospecting / exploration and mining activities in Namibia.
Ministry of Health and Social Services	Issue authorisation in accordance with the provisions of the Atomic Energy and Radiation Protection Act (Act No. 5 of 2005) for the use or industrial application of radiation sources. This included the use of radiation sources and X-Ray machines in the diamond sorting and recovery process.
Ministry of Works, Transport and Communication	The Directorate of Maritime Affairs (DMA) in the Ministry of Works and Transport (MWT) is the government's lead agency responsible for National Marine Pollution Contingency Planning (NMPCP), organisation and response. It therefore plays a significant role with respect to prevention and management of pollution of the maritime environment arising from shipping activities.
Ministry of Fisheries and Marine Resources	The MFMR has jurisdiction over all living marine resources management in Namibia. The Ministry forms part of the review panel for EIAs which bear relevance to the marine environment

Table 4.2: Permit requirements for the proposed exploration and mining project.

Activity	Applicable Legislation	Permitting Authority	Current Status
Exploration License Mining Licence	Minerals (Prospecting and Mining) Act, 1992	Ministry of Mines and Energy (MME)	Pending
EIA Clearance	Environmental Impact Assessment Regulations, 2012 and Environmental Management Act (2007)	Ministry of Environment and Tourism (MET)	Granted 30th March 2011
Radiation Authorisations for Transport, Storage and Use,	Atomic Energy and Radiation Protection Act (Act No. 5 of 2005)	Radiation Authority, Ministry of Health and Social Services	To Apply Once Actual Mining Operations Starts and Radiation Sources Procured
Pollution Safety Certificate	❖ Prevention and Combating of Pollution of the Sea by Oil Act, (Act 6 of 1981) (as amended by Act 24 of 1991); ❖ Marine Traffic Act, (Act 2 of 1981) (As amended by Act 15 of 1991); ❖ Dumping at Sea Control Act 73 of 1980	Department of Maritime Affairs, Ministry of Works and Transport (MWT	Exists and to renew or apply as maybe required

Table 4.3: R553 Regional Standards for Industrial Effluent, in Government Gazette No 217 dated 5 April 1962.

Colour, odour and taste	The effluent shall contain no substance in concentrations capable of producing colour, odour or taste	
pH	Between 5.5 and 9.5	
Dissolved oxygen	At least 75% saturation	
Typical faecal coli	No typical faecal coli per 100 ml	
Temperature	Not to exceed 35 °C	
Chemical demand oxygen	Not to exceed 75 mg/l after applying a correction for chloride in the method	
Oxygen absorbed	Not to exceed 10 mg/l	
Total dissolved solids (TDS)	The TDS shall not have been increased by more than 500 mg/l above that of the intake water	
Suspended solids	Not to exceed 25 mg/l	
Sodium (Na)	The Na level shall not have been increased by more than 50 mg/l above that of the intake water	
Soap, oil and grease	Not to exceed 2.5 mg/l	
Other constituents	Residual chlorine	0,1 mg/l as Cl
	Free & saline ammonia	10 mg/l as N
	Arsenic	0,5 mg/l as As
	Boron	1,0 mg/l as B
	Hexavalent Cr	0,05 mg/l as Cr
	Total chromium	0,5 mg/l as Cr
	Copper	1,0 mg/l as Cu
	Phenolic compounds	0,1 mg/l as phenol
	Lead	1,0 mg/l as Pb
	Cyanide and related compounds	0,5 mg/l as CN
	Sulphides	1,0 mg/l as S
	Fluorine	1,0 mg/l as F
	Zinc	5,0 mg/l as Zn

4.4 Key Relevant International Obligations

4.4.1 UNCLOS 1982

The United Nations Law of the Sea Convention (UNCLOS) of 1982 requires member states to adopt legislation to reduce marine pollution from sea-bed activities in the Exclusive Economic Zone (EEZ) and on the continental shelf (Articles 208 and 214), and from land based sources (Articles 194 and 207). It also contains provisions relating to marine pollution resulting from dumping of waste at sea (Articles 210 and 216).

Overall, the convention deals with the prevention of marine pollution and the compensation for damage caused by this pollution. It contains provisions relating to the prescription and enforcement of pollution standards; in addition, it emphasises on unilateral action by states with regard to pollution control, and provides for contingency plans against pollution.

4.4.2 MARPOL 73/78

The International Convention for the Prevention of Pollution from Ships, 1973 was adopted in 1973 (MARPOL 73). This convention was subsequently modified by the Protocol of 1978 (MARPOL 78) and hence abbreviated MARPOL 73 / 78. It provides regulations covering the various sources of ship-generated pollution (IMO, 1992). Namibia is a party to Annexes I, II, III, IV and V of MARPOL 73/78. The various Annexes are highly applicable to the activities associated with the proposed survey operations. Guidance on the various provisions of the MARPOL 73/78 with respect to the proposed exploration and mining activities are summarised as follows:

- Management of Oil: MARPOL Annex 1: Regulations for the Prevention of Pollution by Oil, Regulation 9 (1) (b) Control of discharge of oil. Any discharge into the sea of oil or oily mixtures from ships to which this Annex applies shall be prohibited except when all the following conditions are satisfied;

- Sewage: MARPOL Annex IV: Regulations for the Prevention of Pollution by Sewage from ships, Regulation 8 Discharge of sewage. Refer to the Recommendation on International Performance and Test Specifications for Oily-Water Separating Equipment and Oil Content Meters adopted by the Organization by resolution A.393 (X);

- Galley Wastes: MARPOL Annex V: Regulations for the Prevention of Pollution by Garbage from Ships, Regulation 3(1)(b), (1)(b)(ii) and (1)(c) Disposal of garbage outside special areas;

- Solid waste: MARPOL Annex V: Regulation 3(1) (a) and (1) (b), and;

- Atmospheric Emissions: MARPOL Annex VI: Regulations for the Prevention of Air Pollution from Ships Regulation 12: Ozone Depleting Substances.

4.5 Summary of All Applicable Legal and Other Requirements

A summary of the regulatory register for all applicable current and likely future legal and other requirements as provided in the EMP.

5. RECEIVING ENVIRONMENT

5.1 Climatic Components

The southern Namibian coastline is characterised by the frequent occurrence of fog, which occurs on average more than 100 days per year at Oranjemund, being most frequent during the months of February through May (Fig. 5.1). Average precipitation per annum ranges from 16.4 mm at Lüderitz to 51.5 mm at Oranjemund. Due to the combination of wind and cool ocean water, temperatures are mild throughout the year. Coastal temperatures average around 16°C, gradually increasing inland (Barnard 1998).

During autumn and winter, the south Atlantic anticyclone weakens and migrates north-westwards causing catabatic, or north-easterly 'berg' winds. These powerful offshore winds can exceed 50 km/h, producing sandstorms that considerably reduce visibility at sea and on land. Although they occur only 8-22% of the time, they have a strong effect on the coastal temperatures, which often exceed 30°C during 'berg' wind periods (Zoutendyk 1992; Shannon & O'Toole 1998; CSIR 1998; Lane & Carter 1999).

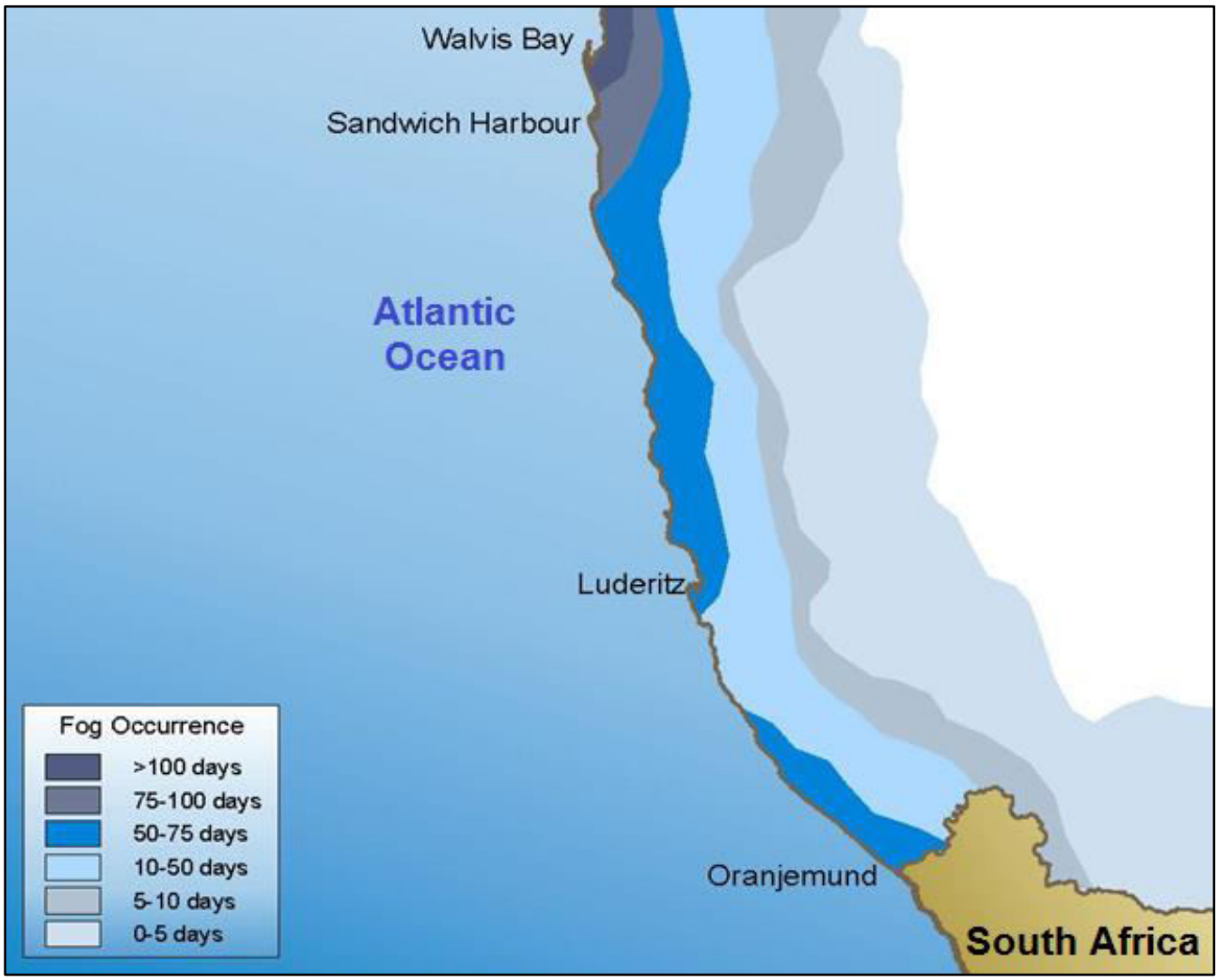

Figure 5.1: Fog day frequency for 1984 using Meteosat Images (Adapted from Olivier 1992, 1995).

5.2 Oceanographic Setting

5.2.1 Upwelling and Thermoclines

Due to the vigorous winds, large waves and the upwelling process the water column on the inner continental shelf adjacent to Lüderitz is generally well mixed and thermocline development is weak. Consequently currents are mostly barotropic although some baroclinicity may develop during periods of slack winds when weak thermoclines develop through surface heating. Deep mixing limits the development of large/dense phytoplankton populations. Therefore, compared to conditions downstream from the upwelling cell, there are no large pelagic fish stocks and little organic supply to the sediments.

5.2.2 Temperatures

Long-term mean sea surface temperatures off Lüderitz fall in the narrow range of 14°C - 16°C, the weak minima occurring in July/August (Annexes 2 and 3). Surface salinity ranges between 34.9 and 35.2psu. Vertical gradients in temperature are also generally weak ranging from ~11°C near the seabed (~100m = inner continental shelf) to 13-15°C at the surface. Turbulent mixing can reduce this gradient further, sometimes resulting in more or less isothermal conditions at ~12°C. Temperature-salinity distribution analysis shows that the upwelling water is derived from ~300m depth on the edge of the continental shelf and is comprised of Atlantic Central Water.

Dissolved oxygen concentrations in the region are generally low (2 – 4 mlO2/ℓ), especially in upwelled water. This low oxygen water invades the area from the continental shelf north of Hottentots Point, the southern limit of the area of formation of oxygen deficient continental shelf water of the Northern Benguela system. The water is carried into the Lüderitz area by poleward flow in bottom waters. Dissolved oxygen concentrations reach a minimum of < 2ml O2/ℓ) in summer. Within ML164, oxygen concentrations have been measured at 1.34 ml O2/ℓ on the seafloor and 5.49 ml O2/ℓ at the surface (Midgley, 2008).

5.2.3 Currents

Oceanographically the Benguela Current, the eastern boundary current of the South Atlantic, dominates the region. Surface flow on the continental shelf is mainly wind driven and equatorward (NW) at velocities that may reach 20 - 25cm/sec. Subsurface flow compensates this and is mainly poleward (S-SE). Subsurface current velocities on the inner shelf are low at ~5cm/sec, but increase with depth reaching greatest magnitudes at and immediately offshore of the shelf break (>300m water depth).

5.2.4 Winds

Equatorward wind stress off Lüderitz is strong throughout the year with a seasonal maximum in spring and a minimum in autumn/winter. These strong and persistent winds coupled with the narrow continental shelf combine to result in favourable conditions for the establishment of a semi-permanent upwelling cell immediately offshore of Lüderitz. This is the largest upwelling cell in the Benguela Current and effectively divides the Benguela Current system into northern and southern halves.

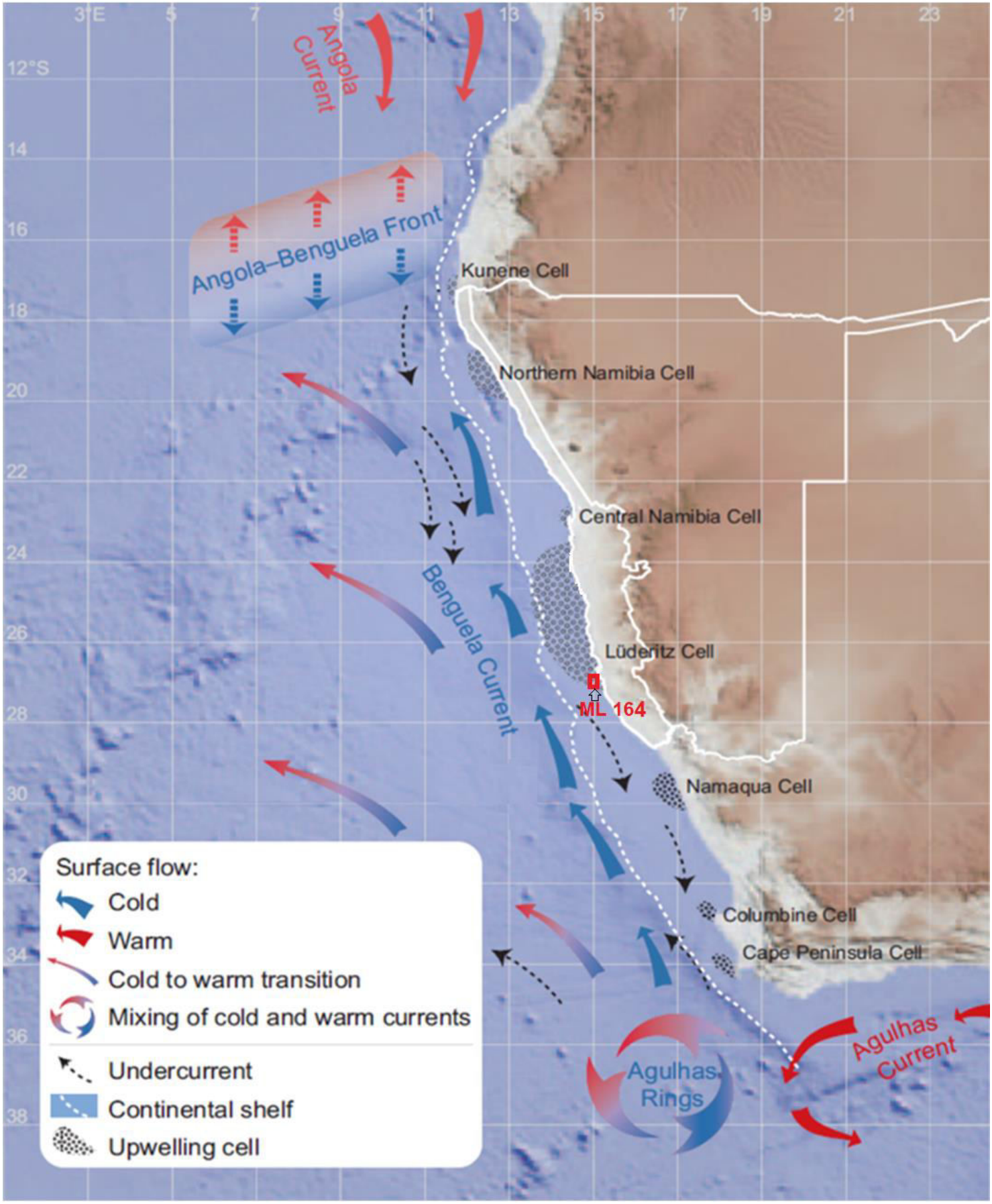

Figure 5.2: Main features of the Benguela System within the BCLME (Source: Ministry of Environment and Tourism, 2012).

5.3 Marine Protected Area (MPA)

The ML No. 164 falls within the 30 km demarcation of the Marine Protected Area (MPA) (Fig. 5.3). A Marine Protected Area (MPA) has been declared along a 400 km stretch of the southern Namibian coast from Meob Bay to Chamais Bay. Additionally, the southern islands have been granted protection status under the Namibia Islands Marine Protected Area (NIMPA). The islands are the breeding grounds for 11 of Namibia's 14 seabird species, including the endangered African penguins and 90% of the world's *Endangered* Bank cormorants (Annex 2).

Lüderitz Bay and its Islands have unique and abundant birdlife as a consequence of high productivity of sea life and plankton, due to the nutrient-rich Benguela current, as well as the effluents from the fish processing plants. The Islands are Important Bird Area (IBA) and hosts a couple vulnerable, threatened, and endangered species. These are breeding and nesting areas for birds (Annex 2). Most of the seabirds that breed on Namibian shores have an inshore/near-shore foraging range of between 10 and 30 km, falling within the MPA boundaries. Exceptions include the African penguin, which has been seen up to 60 km offshore and the Cape gannet, which is known to travel 140 km offshore in search of food. The most significant impact on the sustainability of Namibia's seabirds is the lack of high-energy food sources and competition with commercial pelagic fisheries (Kemper, 2007).

Sea traffic and industrial development threatens the habitat and breeding success of these birds. Crawford *et al*. (2006) observed that breeding populations of both the African penguin and the Cape gannet have shown severe decline over the past half century. Conversely, the breeding population of the Cape cormorant has increased by over 15%. The crash and subsequent northwards and eastwards migration of primary food sources for the birds breeding on the southern Namibian islands (particularly anchovy and sardine) is cited as the major contributor to population declines.

An Environmental Management Programme (EMP) has been compiled for Samicor Diamond Mining (Pty) Ltd, detailing ways in which negative effects on the biophysical and social environment will be avoided or minimised and how benefits can be optimised. Samicor Diamond Mining (Pty) Ltd will ensure that appropriate marine and coastal fauna, seawater and marine sediment quality monitoring are undertaken and management actions are put in place to minimise negative environmental effects, in accordance with the EMP and in compliance with local, national and international regulations (Annexes 2 and 3).

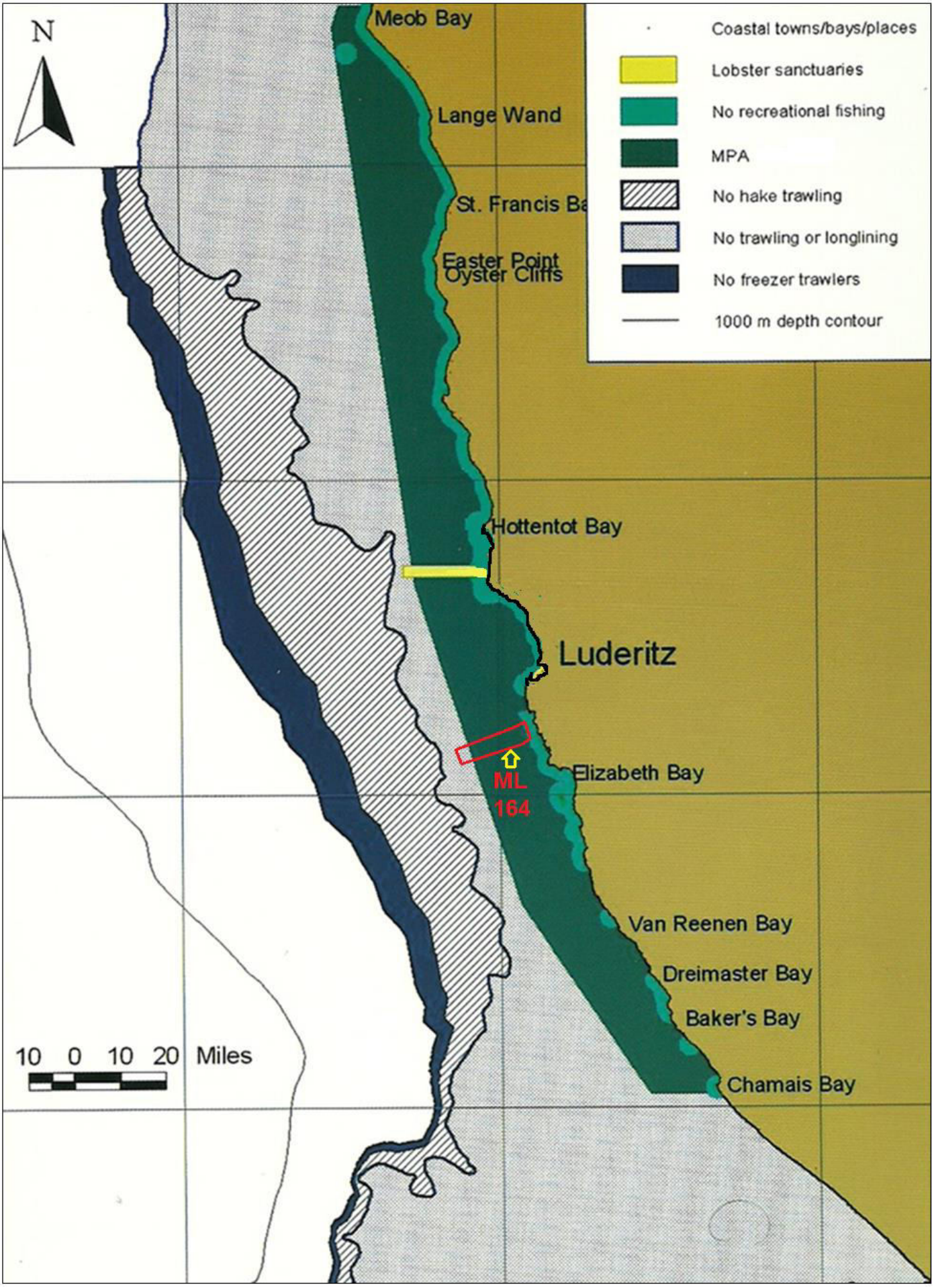

Figure 5.3: Map showing the Marine Protected Area (MPA) in southern Namibia (source: MFMR, 2009).

5.4 Biological Environment

5.4.1 Benthic Fauna

Faunal distributions in the sands and muds comprising the soft substrates on the inner and middle continental shelf are strongly related to particle size distributions. Important taxonomic groups in this environment are polychaetes, gastropods, nemerteans, amphipods, bivalves and cumaceans (Annexes 2 and 3). The analyses carried out and the overall data sets available for these environments do not allow classification of any of the organisms in terms of rarity or population status. Observations on the fauna inhabiting the rock reef areas are even sparser and are limited to the records obtained by submersible (Annexes 2 and 3). These have shown that at least some of the reefs support dense populations of the colonial brachiopod Discinisca along with whelks Nassarius sp, and cushion stars. Mobile fauna such as mantis shrimp Squilla (?) sp and bearded gobies Sufflogobius bibarbatus also occur on the reefs but probably forage in the upper water column (Annexes 2 and 3).

5.4.2 Marine Mammals and Seabirds

5.4.2.1 CETACEANS

According to Bianchi *et al*, (1999); Currie *et al*., (2009); Enigma, (2012); Elwen, (2014); Elwen and Leeney, (2011); Elwen *et al*, (2010); ICUN, (2015); Maloney and Shannon, (2008); Midgley, (2008); NACOMA, (2015); Namibia Dolphin Project, (2014), thirty seven (37) species of whales and dolphins are found in the oceans around southern Africa, of which 31 have been seen in Namibian waters. The cetacean species seen regularly within the inshore waters, particularly within the MPA, are Humpback, Mincke and Southern Right whales, as well as Benguela/Heaviside's, Bottlenose, Dusky and Southern Right Whale dolphins and the Orca or Killer whale (Fig. 5.3 and Annexes 2 and 3). The first two whales are migrants through Namibian coastal waters, but the Southern Right whale has been increasingly making use of inshore bays in southern Namibia for breeding. The Heaviside's dolphin is endemic to Namibia and frequents the Lüderitz lagoon and harbour area (Annexes 2 and 3).

5.4.2.2 Seabirds

The islands are the breeding grounds for 11 of Namibia's 14 seabird species, including the endangered African penguins and 90% of the world's Endangered Bank cormorants. The African penguin and Cape gannet have been classified as globally Vulnerable Species and Endangered and Critically Endangered on a regional scale, owing to significant decreases in population numbers. African penguins, Cape gannets, Bank cormorants, African Black oystercatchers and Damara terns are listed as Specially Protected birds (Annexes 2 and 3).

Lüderitz area is characterised by large fish stocks there are associated large populations of piscivorous (fish-eating) birds (Annexes 2 and 3). Cape Gannets, three species of cormorants and Jackass Penguins are dominant components of the resident seabird community. Gulls and terns also contribute. Gannets, cormorants and penguins are colonial breeders and utilise the islands as breeding areas. These birds generally form dense colonies and thereby prohibit access to the islands by other breeding seabirds. Key seabird areas near the mining area are Ichaboe Island, Marshall Rocks, Seal, Penguin and Halifax Islands, and the Lüderitz Lagoon. Penguins and cormorants forage in the Lüderitz Bay area (Fig. 5.3 and Annexes 2 and 3)). Gannets generally feed outside of the region as shoals of pelagic fish (e.g. pilchards) are rare. As pointed out above this is due to the effects of turbulence associated with the Lüderitz upwelling cell. Primary prey for cormorants and penguins appear to be the bearded goby Sufflogobius bibarbatus.

5.4.3 Fisheries

5.4.3.1 Fish Communities

The Benguela Current system supports an extensive commercial fishery focused on the major resource groups of hake Merluccius spp, horse mackerel Trachurus spp, the epipelagic pilchard Sardinops ocellata, and anchovy Engraulis japonicus. Other important but smaller components of the overall fishery are inter alia chub, mackerel and snoek, two species of sole, kingklip, monkfish and rock lobster Jasus lalandii. The only fishery that is directly dependent on the Lüderitz region is that for rock lobster which thrive in the rocky seabed in the vicinity of Lüderitz between Easter Point in the north, and Kerbehuk in the south. Whitefish (hake) is landed and processed in Lüderitz along with tuna, the latter mainly being directly exported (Annex 2). Neither of these are caught locally (Annex 2).

Falling within the MPA, the ML Area covers important rock lobster fishing grounds and sanctuary as well as commercial mariculture and Lüderitz Port area in the Lüderitz Bay (Fig. 5.4). Rock lobsters (*Janus lalandii)* are commercially exploited in Namibian waters from the Orange River border in the south to Easter Cliffs/Sylvia Hill, near Meob Bay (Fig. 5.3). South of Lüderitz, Rock lobster are commercially targeted outside of the southern sanctuary between Affenrücken and Mittag (28°20’55.7’’S), south of Chamais Bay. However, north of Lüderitz, all the commercial lobster grounds fall within the MPA buffer zone (Currie *et al*., 2009).

The sector operates in water depths of up to -80 m, but from December to April the Rock lobsters are generally concentrated on rocky substrates in waters shallower than -20 m, owing to the seasonal incursion of low oxygen bottom waters (Annexes 2 and 3). Commercial fisheries operate inshore during spring and summer, mainly using baited traps consisting of rectangular metal frames covered by netting that are deployed from small dinghies. Traps are set at dusk and retrieved during the early morning using a powerful winch for hauling. Recovered traps are taken to larger refrigerated vessels called *catcher reefers* which take the lobsters to shore for processing (Japp, 2011). The entire catch is landed at Lüderitz Harbour. The peak fishing season is January and February with up to 25 vessels active per day. Activity and vessel numbers decline towards the end of the season in May (Japp, 2011).

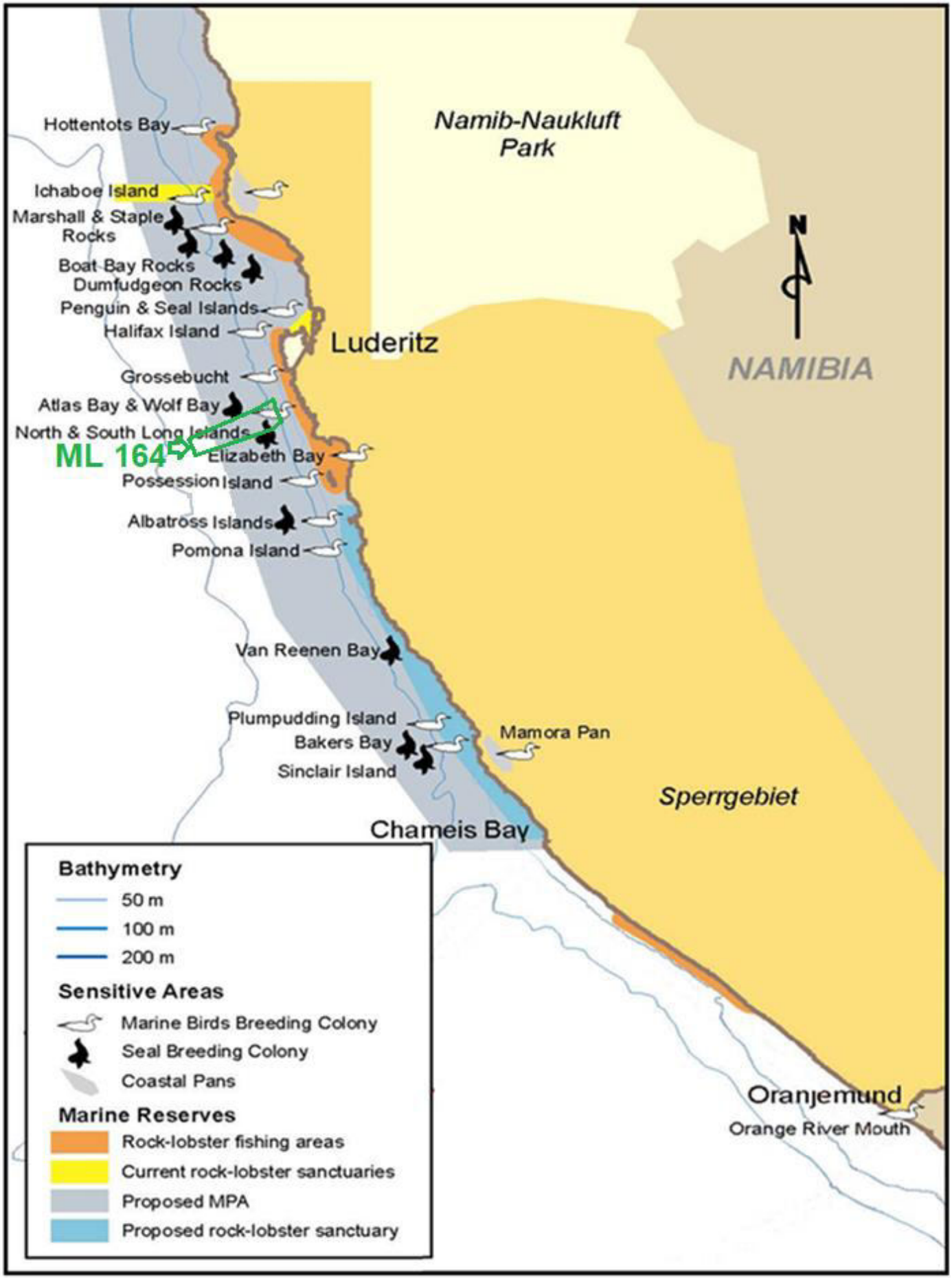

Figure 5.4: ML No. 164 in relationship to commercial rock lobster fishing areas, seabird and seal breeding areas and Marine Protected Areas (MPAs).

5.5 Socioeconomic Setting

5.5.1 National Overview

Namibia's heavy industry is totally dominated by mining, which is also the major export earning sector. The country's mining sector generated N$11.3 billion during 2013 contributing 9.3% towards the Gross Domestic Product (GDP) (Annex 4). The diamond mining industry alone delivered 7.2% towards GDP and N$ 8.23 billion of the total GDP, while other mining and quarrying contributed N$ 3.07 billion to the GDP (CoM, 2015). Exports from the mining sector reached N$ 25.2 billion in 2013. Mineral exports accounted 53% percent of total merchandise exports. At the end of 2013, the formal mining sector directly employed 7,582 permanent employees, 909 temporary employees and 8,218 contractors (CoM, 2015).

5.5.2 //Karas Regional Summary

The //Karas Region is a predominantly small stock farming area, consisting mostly of animals such as sheep or goats. Game farming and irrigation farming along the Naute Dam and the Orange River have gained significantly in importance. A further characteristic of the region is the harbour town of Lüderitz with key industries covering fishing, the diamond areas along the coast, both on and off shore, with Oranjemund as the main centre, mining enterprises in the southern part of Namibia (Klein Karas area, Rosh Pinah), the Kudu Gas field in the Atlantic Ocean near Lüderitz and small-scale industries outside Lüderitz town boundary and Keetmanshoop.

Tourism is one of the key important industries in the //Karas Region. Tourist attractions in the region include the: Hot Water Springs at Ai-Ais, and in future probably also the Hot Water Springs in Warmbad, the Kokerboom forest near Keetmanshoop, the Fish River Canyon which is the second largest in the world, the Brukaros Mountain near Berseba, the coastal town Lüderitz and several guest and game farms. The tourism industry has the potential for further expansion. The main railway line and two main roads network give access to South Africa. Keetmanshoop is the capital of the //Karas Region and has direct air, railway and road links with Windhoek. Its airport is of international standard and suitable for international air traffic. Well-developed landing facilities also exist at Lüderitz and Oranjemund. The region comprises six constituencies: Keetmanshoop Urban, Berseba, Lüderitz, Oranjemund, Karasburg, and Keetmanshoop Rural.

5.5.3 Lüderitz Socioeconomic Setting

Lüderitz is a centre for diamond mining and fishing, including crayfish, white fish, and pilchards. The town, formerly a German possession, was named after a German merchant who acquired land in 1883. The Port of Lüderitz is an important fishing, mining/energy supply and minor import/export port. The local economy is centred on the utilization of the clean sheltered waters for aquaculture purposes and tourism development such as sailing, kiting, fishing and whale watching. With increasing traffic in the port it may be considered appropriate to develop MARPOL Reception facilities within the Lüderitz port for waste and sewage. In strengthening tourism potential of the town, angling areas around Lüderitz, tour boat operation, whale watching, rock lobster catching and other recreational activities are being developed. According to the Namibian Coast Conservation and Management (NACOMA) Project, (2009), the modelling of the suitability for ecotourism shows large potentials east and north of Lüderitz

Despite the mining, fisheries and tourism industries, it's imperative that the local economy diversifies and expand the already existing industries in order to provide more employment

opportunities to relieve the ever growing unemployment situation (Annex 4). Lüderitz is a harbour town with urban population of 12, 537 people (Republic of Namibia, 2014b). The population size for Lüderitz Constituency amounts to 13, 859 with close to equal gender ratios – 49.7% females and 50.3% males. The estimated labour requirements for the Development are 53 employees which are needed to operate the mining systems of exploration and mining vessels. The service contractor responsible to the job arrangement is Nutam Operations (Pty). At the time of the review, there was no further data or information available on labour arrangement and employment figures (Annex 4).

The company is committed to maximum employment of suitably qualified Namibian nationals. Educational and training programmes for Namibians is instituted, directly by Diamond Fields and indirectly through its contractors. Preference in providing supplies and services to Diamond Fields and its contractors will be given to Namibian suppliers and service providers (Annex 4).

5.6 Geological Setting

5.6.1 Regional Geology

The inner shelf is underlain by Precambrian bedrock (also referred to as Pre-Mesozoic basement), whilst the middle and outer shelf areas are composed of Cretaceous and Tertiary sediments (Dingle 1973; Birch *et al.* 1976; Rogers 1977; Rogers & Bremner 1991). The bedrock of the inner shelf between Lüderitz and the Orange River displays an irregular, erosion surface with relief of up to 15 m, generally with a thin cover of unconsolidated Quaternary sediments of Orange River origin.

5.6.2 Surficial Local Geology

In southern Namibia and Namaqualand in northern South Africa, the distribution of sediments on the continental shelf is strongly influenced by currents and wave action (Annexes 2 and 3). Channel fill sediment varies in composition with depth decreasing in thickness from the deep water, 5m thick sediment package characteristic of the southern reaches of the feature to a thin (1m or less) lag gravel horizon overlying bedrock above the 65 m isobath Where sediments are thickest the stratigraphy comprises of a sediment package of Holocene mud and fossil mussel shell with or without an underlying early Pleistocene aged marine clay or later Pleistocene aged beachrock layer, overlying diamondiferous gravel and pebbles on the bedrock (Fig. 5.5). In these areas the gravel may be 1-1.5m thick and the non-gravel component 1-2m.

The Holocene aged muds may contain hydrogen sulphide (H2S) as a product of the breakdown of planktonic and diatomaceous sediments. This fine grained sediment package contrasts sharply with the 0.5 m-1m thick diamondiferous pebble to boulder layer at the base of the stratigraphy, overlying bedrock. As water depth decreases northward along the channel, the low energy, fine-grained sediments thin until only a lag gravel remains overlying bedrock above the 65 m isobath. Here the gravel and pebble layer is generally <1m thick.

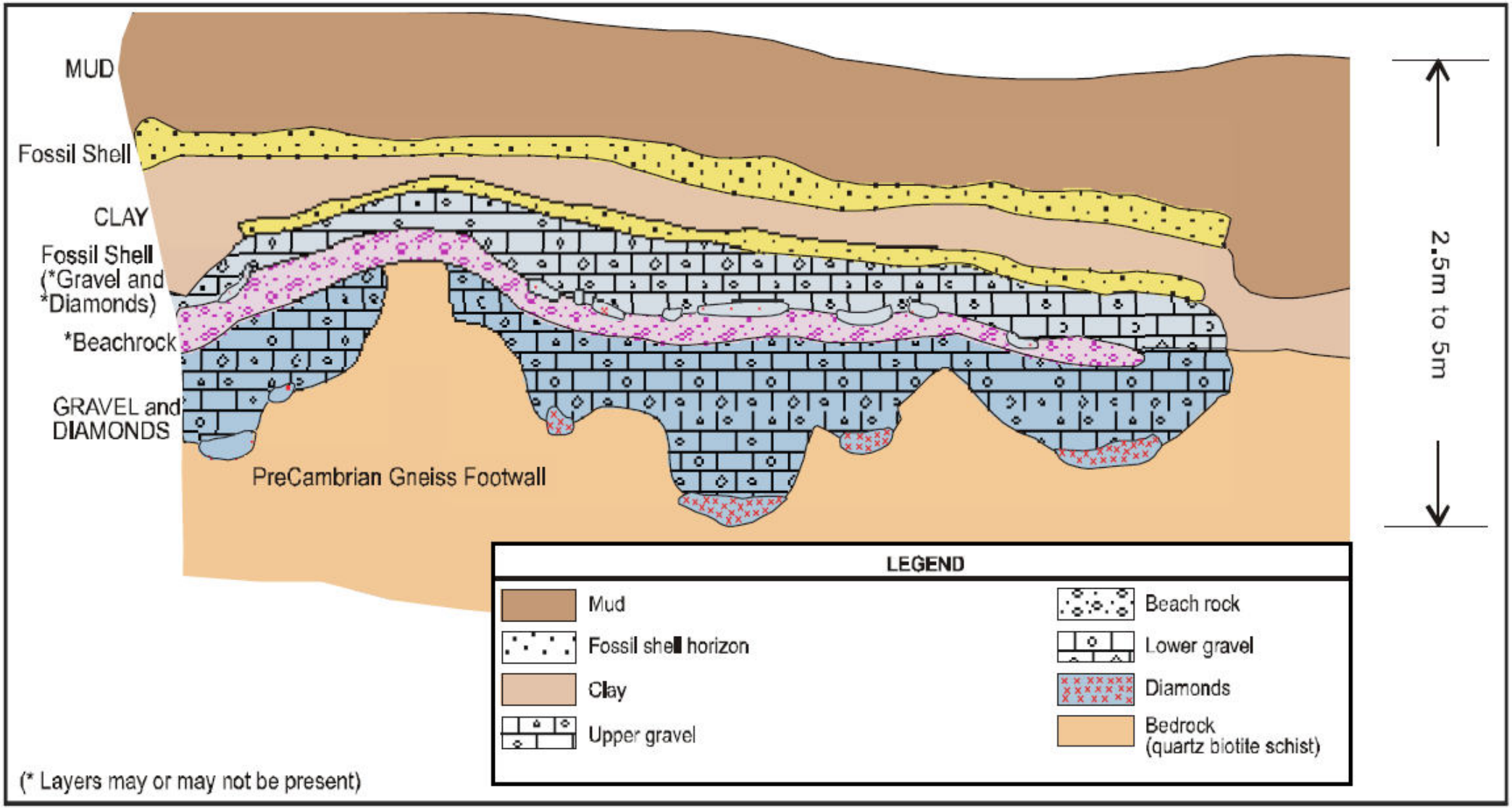

Figure 5.6: Typical Cross Section of Mid Water Target Gravels.

6. IMPACT AND RISK ASSESSMENT

6.1 Overview

The **'environment'** is the surroundings in which an organisation operates, including air, water, land, natural resources, flora, fauna, humans, and their interrelation. An **'environmental aspect**' is defined as an element/part of an organisation's activities, products or services that can interact with the environment – i.e. the source of the impact. An **'environmental impact'** is any change to the environment whether adverse or beneficial wholly or partially resulting from an organisation's environmental aspect. An **'environmental objective'** is an overall environmental goal, consistent with the environmental policy that an organisation sets to achieve. **'Environmental performance'** is the measurable results of an organisation's management of its environmental aspects. Results can be measured against the organisation's environmental policy, environmental objectives, environmental targets and other environmental performance requirements.

6.2 Likely Sources Positive Impacts

Not all activities of Samicor Diamond Mining (Pty) Ltd operations have negative impacts on the receiving environment. The following is summary of the positive socioeconomic impacts identified during the original 2008 EIA and EMP (Annex 4):

- The contribution of taxes, royalties and dividends- These will contribute to the national economy. Namibian Government will benefit in the form of taxes, royalties and dividends. This also includes property and company income taxes to the Namibian Government;

- Employment – provision of work provides an income, with boosting the quality of life for employees and their families; which will also reduce unemployment and sustain the Namibian economy;

- Transfer of knowledge, skills and technology associated with different aspects of the Development – the use of new technologies will call for a new skills base;

- Investments in community development –The Company is committed in community development in most regions of the country with major investments made in the field of education (particularly in the area of science and technology), health, welfare and supporting sustainable income-generating community projects, and;

- Secondary economic boost – the development will aid in sustaining secondary industries in Lüderitz, //Karas Region and elsewhere in Namibia.

6.3 Likely Sources of Negative Impacts

The following is the summary of the key sources of likely negative and positive impacts associated with the ongoing exploration (geophysical survey and sampling) and mining operations:

(i) Prospecting and mining equipment and methods in use;

(ii) Mining vessels operational at sea for extended periods;

(iii) Support and supply services for the exploration and mining vessels at sea;

(iv) Pollution resulting from possible accidents or emergencies at sea;

(v) Possible effects of environmental research and monitoring;

(vi) Possible cumulative impacts, and;

(vii) Socioeconomic impacts.

6.4 Evaluation of Impacts

6.4.1 Overview

In line with Samicor Diamond Mining (Pty) Ltd objective of focusing attention specifically on exploration and mining related impacts of potentially significant risk and how best to mitigate for these, the following approach is taken regarding the concept of whether issues in the EIA table need to be actively addressed in the EMP:

- If environmental aspects are evaluated to be of low significance, they do not require specific management plans, and need not be actively addressed in the EMP (although they may still be listed and reported on);
- A decision on the need to actively address any issue with a "Medium" significance ranking will require consideration of other relevant factors, such as the nature of the impact, risks associated with possible cumulative aspects, and the degree of concern of stakeholders, and;
- If environmental aspects receive a "High" significance ranking, they must be addressed by means of active management, mitigation or rehabilitation measures.

For each negative impact of high or medium significance, mitigation objectives are set (i.e. ways of reducing negative impacts), and attainable management actions are subsequently addressed in the amended EMP for mining and prospecting in the ML 164 Area. Without management, these impacts would either breach statutory limits or be unacceptable to statutory authorities or to stakeholders, as they would result in a significant deterioration of one or more environmental resources.

6.4.2 Environmental Impact Assessment Rankings

To ensure consistency in the evaluation of environmental impacts associated with Samicor Diamond Mining (Pty) Ltd activities for all of their operations, the rating criteria for the impact assessment have been standardised to include set definitions applied in the risk assessment (Table 6.1). To the extent possible, allocation to rank categories is based on quantifiable criteria which can be measured as detailed in Table 6.1. Furthermore, when evaluating impacts, the allocated ranks refer to the resultant *impact* (e.g. area of seabed affected, or time that the result of the impact will last), and not of the *cause* thereof (e.g. area of seabed actually mined, or time of active impact). Each activity has been assessed with respect to the type of effect that the aspect will have on the relevant component of the environment and includes “what will be affected and how?” The criteria used to determine the significance rating of the impact(s) is detailed in Table 6.2.

Table 6.1: The criteria used in the evaluation of environmental impacts.

Rating	Definition of Rating
Status of the Impact – in terms of meeting the objective of maintaining a healthy environment.	
Positive	The impact benefits the environment
Negative	The impact results in a cost to the environment
Neutral	The impact has no effect
Probability – the likelihood of the impact occurring	
Negligible	Possibility negligible
Improbable	Possibility very low
Probable	Distinct possibility
Highly Probable	Most likely
Definite	Impact will occur regardless of preventive measures
Degree of confidence in predictions – in terms of basing the assessment on available information	
Low	Assessment based on extrapolated data
Medium	Information base available but lacking
High	Information base comparatively reliable
Extent – the area over which the impact will be experienced	
Site specific	Confined to within < 1 km of the project
Local	Confined to the study area or within 5 km of the project
Regional	Confined to the region, i.e. > 5 km but < National
National	Nationally
International	Beyond the borders of Namibia
Duration – the time frame for which the impact will be experienced	
Very short	Less than 2 years
Short-term	2 to 5 years
Medium-term	6 to 15 years
Long-term	More than 15 years
Permanent	Generations
Intensity – the magnitude of the impact in relation to the sensitivity of the receiving environment	
Negligible	Natural functions and processes are negligibly altered due to adaptation by the receptor(s) to high natural environmental variability
Mild	Natural functions and processes continue albeit in a modified way that **does not** appear to have a significant disruptive effect (i.e. changes are temporary)
Moderate	Natural functions and processes continue albeit in a modified way that **does** appear to have a noticeable disruptive effect (i.e. changes are permanent)
Severe	Natural functions or processes are altered to the extent that they temporarily cease resulting in severe deterioration of the impacted environment
Very Severe	Natural functions or processes permanently cease or are completely disrupted

Table 6.2: The criteria used to determine the significance rating of the impact(s).

Low:	Where the impact will have a negligible influence on the environment and no modifications or mitigations are necessary for the given project description. This would be allocated to impacts of any severity/ magnitude, if at a local scale/ extent and of temporary duration/time.
Medium:	Where the impact could have an influence on the environment, which will require modification of the project design and/or alternative mitigation. This would be allocated to impacts of moderate severity, locally to regionally, and in the short term.
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 without substantial mitigation and management, and pro-active rehabilitation commitments (i.e. there could be a 'no-go' implication for the project). This would be allocated to impacts of severe magnitude, locally over the medium-term, and/or of severe magnitude regionally and beyond.

6.5 Results of the Environmental Impact Assessment

6.5.1 Exploration Activities

Tables 6.3 - 6.5 summarizes the impact assessment results associated with exploration activities with respect to noise, light disturbances and seabed sampling operation.

Table 6.3: Noise disturbance.

Vibration or noise disturbance of marine mammals, particularly during times of whale migration or aggregation caused by the acoustic pulses from seismic transducers in the survey towfish, or exploding bubbles from airguns	*Status*	Negative
	Probability	Highly probable
	Confidence	High
	Extent	Local; limited to the study area
	Duration	Very Short; limited to the duration of the geophysical survey
	Intensity	Mild; considering the low sound levels of equipment currently in use
	Significance	Low

Table 6.4: Light disturbance

Disturbance of marine mammals and fish through vibration from propeller action and light projection from underwater spotlights associated with underwater videoing and submersible use	*Status*	Negative
	Probability	Probable (distinct possibility)
	Confidence	High
	Extent	Site specific (<1 km)
	Duration	Very Short; limited to the duration of the geophysical survey
	Intensity	Mild; considering the low frequency of use of submersibles and ROVs
	Significance	Low

Table 6.5 Seabed sampling.

Disturbance of benthic communities & habitat due to seabed sediment sample removal and vibrations on seabed from vibracoring, rock drilling, geological and environmental grab sampling activities	*Status*	Negative	
	Probability	Definite (impact will occur regardless of prevention measures)	
	Confidence	High	
	Extent	Local (<5 km) for vibrations; Site specific (<1 km) for sediment removal	
	Duration	Very Short (vibrations) to Medium-term (sediment removal)	
	Intensity	Mild (vibrations) and Very Severe (sediment removal)	
	Significance	Low (vibrations)	Medium (sediment removal)

6.5.2 Mining Activities

Tables 6.6 - 6.21 summarizes the impact assessment results associated with mining operations activities with respect to removal of sediments, destruction of macrofauna, habitat alteration, removal of mud belt sediments: biochemical processes, Removal of mud belt sediments: Release of H_2S, mining excavations: water quality, mining excavations: Hydrographical changes, tailings disposal during mining: suspended sediment plumes, tailings disposal during mining: smothering, tailings disposal onto rocky outcrops, tailings disposal: re-mobilisation of contaminants, tailings disposal: Bacterial decomposition, tailings disposal: organic loading, repeat mining, archaeological, paleontological and historical aspects and exclusion of other users.

Table 6.6: Removal of sediments.

Direct mortality of infaunal and epifaunal organisms, alteration of benthic community composition and potential reduction in benthic biodiversity due to the removal of benthic organisms during the mining process	*Status*	Negative
	Probability	Definite (impact will occur regardless of prevention measures)
	Confidence	High
	Extent	Site Specific (<1 km)
	Duration	Medium-term (<15 years) although infill rates are site specific, they are expected to be extremely slow (3-5 mm per year) and consequently recovery of communities to functional similarity is predicted to take decades
	Intensity	Very Severe; all epifaunal and infaunal benthic organisms in the mining target area are severely disturbed or eliminated, and environmental functions and processes in the mined and adjacent area may temporarily and/or permanently cease.
	Significance	Medium

Table 6.7: Destruction of macrofauna.

The loss of macrofauna in the mined areas reduces the amount of food available, both directly to demersal fishes as well as to their prey utilising these resources	*Status*	Negative
	Probability	Highly probable (impact will most likely occur)
	Confidence	Medium
	Extent	Local (confined to the study area)
	Duration	Medium-term (<15 years) although infill rates are site specific, they are expected to be extremely slow (3-5 mm per year) and consequently recovery of communities to functional similarity is predicted to take decades
	Intensity	Negligible; being mobile, fish can leave mined areas and move to adjacent undisturbed areas.
	Significance	Low

Table 6.8: Habitat alteration.

Alteration of sediment structure / seabed habitat due to the excavation of mined sediments and resultant effects on benthic community structure	*Status*	Negative
	Probability	Definite (impact will occur regardless of prevention measures)
	Confidence	Low
	Extent	Site Specific (<1 km)
	Duration	Permanent; infill rates by naturally depositing sediments are slow and changes in seabed geomorphology will persist in the long-term, possibly over decades/ generations
	Intensity	Moderate; Being dependent on the infill rate, recovery through natural recolonisation and establishment of succession communities is slow and although ecological processes will ultimately be re-established, community structure may be different
	Significance	Medium

Table 6.9: Removal of mud belt sediments: Biochemical processes.

Disruption of biogeochemical processes due to the excavation of mud belt sediments	*Status*	Negative
	Probability	Probable (distinct possibility of impact occurring)
	Confidence	High
	Extent	Regional
	Duration	Short-term; settling rates of the resuspended sediments will depend on the proportions of silt and clay fractions in the muds
	Intensity	Mild (at current mining rates) to Moderate (at proposed future increased mining rates)
	Significance	Low

Table 6.10: Removal of mud belt sediments: Release of H_2S.

Release of hydrogen sulphide when mining in the mud belt and the effects on marine organisms and health and safety of personnel	*Status*	Negative
	Probability	Unknown; information on the extent of H_2S under the acoustic blanking layer is lacking
	Confidence	High
	Extent	Local to Regional; the impact at each mining site is site-specific, however multiple vessels are operating simultaneously in the license area
	Duration	Long-term to Permanent; although hydrogen sulphide has a half-life of a few hours, if it results in the death of organisms its effects are permanent. However, depending on the length of exposure of marine organisms to H_2S, recovery over the short-term is possible.
	Intensity	Very Severe; hydrogen sulphide is highly toxic in nanomolar concentrations.
	Significance	Medium

Table 6.11: Mining excavations: Water quality.

Potential trapping of organic matter in excavations and subsequent pooling of low oxygen water	*Status*	Negative
	Probability	Probable
	Confidence	High
	Extent	Site specific (within the excavation)
	Duration	Very Short; flushing is likely to occur periodically during storms when the wave base reaches the seabed.
	Intensity	Moderate; different community structure may develop but ecological processes will probably be maintained
	Significance	Low

Table 6.12: Mining excavations: Hydrographical changes.

Mining excavations may affect patterns in the wave regime on a regional scale, which may in turn affect nearshore sediment transport. This may ultimately result in corresponding changes to the beach morphodynamics.	*Status*	Negative
	Probability	Unknown but improbable, as target panels are far offshore and any changes in wave patterns are likely to have dissipated by the time they reach the coastline
	Confidence	High
	Extent	Local: changes may occur in areas around the site being excavated
	Duration	Long to Permanent; changes in hydrographical conditions and corresponding shoreline changes may persist over the long term, or may even be permanent.
	Intensity	Negligible; changes in beach morphodynamics on the exposed coastline as a result of shoreline changes are unlikely to severely change the communities associated with this habitat
	Significance	Low

Table 6.13: Tailings disposal during mining: Suspended sediment plumes.

Visible sediment plumes caused by fine tailings particles suspended near the water surface causing both a visual impact, decrease in light penetration thereby affecting primary production and lethal or sub-lethal effects on marine organisms	*Status*	Negative
	Probability	Improbable; although elevated suspended sediment concentrations are a typical by-product of mining activities, effects on marine organisms are unlikely
	Confidence	High
	Extent	Local; the extent and area over which plumes disperse will depend on the strength and direction of the prevailing currents and winds, and the particle size of the material in question
	Duration	Very Short; plumes will be rapidly dispersed and drift away from the vessels, however, potential effects will extend over the duration of the mining activity in the licence area (Medium-term)
	Intensity	Mild; adverse effects are experienced generally at suspended sediment concentrations higher (>100 mg/l) than those expected during mining operations, or to longer exposure periods (>2 days) than typical life times of suspended sediment plumes.
	Significance	Low

Table 6.14: Tailings disposal during mining: Smothering.

Smothering of benthic invertebrates resulting in mortality and alteration of benthic community composition and potential reduction in benthic biodiversity, caused by discarding of over and undersized tailings into mined areas and onto adjacent unmined areas	*Status*	Negative
	Probability	Highly probable (most likely)
	Confidence	Medium; depends on the duration of tailings discharge in a specific area, and the nature of the sediments
	Extent	Local (<5 km); the extent and area over which discharged sediments settle will depend on the strength and direction of the prevailing currents and winds, the depth of the discharge area, and the particle size of the material in question
	Duration	Short-term; recovery may take from <1 year to as long as 3 years depending on the nature of the sediments and the sediment layer thickness
	Intensity	Moderate to Severe; depending on the sediment layer thickness many organisms may be able to burrow to the surface through the deposited sediment. Many filter-feeders are also highly adaptable to increased sediment loads.
	Significance	Medium

Table 6.15 Tailings disposal onto rocky outcrops.

Smothering of vulnerable deepwater benthic reef communities resulting in mortality and potential reduction in benthic biodiversity, caused by discarding of over and undersized tailings onto reefs adjacent to the mining areas	Status	Negative
	Probability	Highly probable (most likely)
	Confidence	High (based on a generic mine plan which assumes mining activities near reef structures)
	Extent	Regional; No emergent reefs in the form of cemented platforms occur adjacent to mining targets
	Duration	Medium- to Long-term; depending on the depth of the reef and the extent of smothering, recovery may take decades
	Intensity	Severe to Very Severe; some reefs and their associated organisms may be smothered and die, although most adverse effects appear only under high sediment rates and long-term deposition.
	Significance	High

Table 6.16: Tailings disposal: Re-mobilisation of contaminants.

Re-mobilisation of trace metals and pesticides present in the tailings spoil thereby exceeding established water quality guidelines for contaminants outside the 500 m mixing zone around the vessel	*Status*	Negative
	Probability	Improbable; low contaminant concentrations expected in the sediments
	Confidence	Low; as a sound information base is lacking
	Extent	Local; the extent and area over which discharged sediments settle will depend on the strength and direction of the prevailing currents and winds, and the nature of the sediments
	Duration	Long-term to Permanent ; exposure to contaminants can result in permanent damage (lifespan of the organism) or death
	Intensity	Negligible; contaminants concentrations in the sediments are expected to be low and any dissolved contaminants should be quickly diluted to background levels
	Significance	Low

Table 6.17 Tailings disposal: Bacterial decomposition.

Depletion of water column and near-bottom oxygen concentration through bacterial decomposition of organic matter deposited with the tailings spoil	*Status*	Negative
	Probability	Improbable (low likelihood)
	Confidence	High
	Extent	Site-specific to Local; 'hotspots' of organic matter remineralisation in the mined pits may result in localised hypoxia
	Duration	Very Short; depending on the amount of organic matter in the sediments and the accumulation of organic matter due to cumulative effects, potential effects will persist for the duration of mining activities in a target area and for some time thereafter
	Intensity	Moderate; although most of the marine biota of the Benguela inner shelf is well adapted to cope with large fluctuations in dissolved oxygen concentrations, tolerance levels will be species specific. Persistent hypoxia in localised 'hotspots' may, however, play a role in structuring macrofaunal abundances.
	Significance	Low

Table 6.18: Tailings disposal: Organic loading.

Eutrophication through introductions to the water column of nutrients (in the form of damaged organisms that inhabited the mined sediments) due to discard of tailings spoils	*Status*	Negative
	Probability	Improbable (low likelihood)
	Confidence	High
	Extent	Local; the extent and area over which discharged sediments settle will depend on the strength and direction of the prevailing currents and winds, the depth of the discharge area, and the particle size of the material in question
	Duration	Very Short; potential effects extend over the duration of the tailings discharge and for some time thereafter
	Intensity	Mild to Moderate; will depend on the amount of organic matter in the sediments
	Significance	Low

Table 6.19: Repeat Mining.

Re-mining / re-excavation of sediments in previously mined areas results in further impact on sediment composition, benthic community composition and biodiversity, before these aspects can recover to functional integrity	*Status*	Negative
	Probability	Probable (distinct possibility)
	Confidence	Medium
	Extent	Site specific (<1 km) to Local (within project area)
	Duration	Medium- to Long-term; recovery rates are slow and return to functional similarity will be retarded through repeated disturbance
	Intensity	Very Severe; developing successional communities will be severely disturbed or eliminated, and environmental functions and processes in the mined and adjacent area may temporarily or permanently cease
	Significance	Medium

Table 6.20: Archaeological, paleontological and historical aspects.

Destruction of wrecks / damage of sites of archaeological and/or palaeo-environmental value during prospecting / sampling / mining activities	*Status*	Negative
	Probability	Unknown, but improbable
	Confidence	Low; with regard to the value of the archaeological resource as a sound information base is lacking
	Extent	Site Specific
	Duration	Permanent
	Intensity	Very Severe; if ship wreck or archaeological artefacts or historical sites are destroyed
	Significance	Medium

Table 6.21: Exclusion of other users.

Potential exclusion of alternative resource users (e.g. fisheries, petroleum exploration /exploitation, shipping) and potential hazard if vessels are not adequately visible, due to the physical presence of vessels in an area	*Status*	Negative
	Probability	probable (high likelihood); mariculture and rock lobster operations and well as other recreational activities and port operations
	Confidence	High
	Extent	Local - Regional
	Duration	Long-term; until mining lease expires
	Intensity	Severe as it may affect mariculture and rock lobster operations and well as other recreational activities and port operations
	Significance	High

6.5.3 Vessel Operations

Tables 6.21 - 6.28 summarizes the impact assessment results associated with the vessel operations covering disturbance of marine life, loss of ferrosilicon, air pollution, re-fuelling spillages, loss of equipment and resource use.

Table 6.22: Vessel noise.

Disturbance of fish and marine mammals by noise emission from stationary vessels and crawler positioning systems	*Status*	Negative
	Probability	Improbable to Probable (crawler positioning)
	Confidence	High
	Extent	Local (confined to study area)
	Duration	Medium-term: the noise contribution is ongoing as long as the mining vessels are at sea.
	Intensity	Mild; most of the noise generated by mining operations is at a frequency that does not interfere with marine mammals.
	Significance	Low

Table 6.23: Disturbance of marine life.

Loss of fish and lobsters by sucking them up with the sediments during mining, loss of habitat, food sources and recruitment areas, loss of commercial fishing grounds, collisions with marine mammals and disruption of migration routes	*Status*	Negative
	Probability	Probable (distinct possibility)
	Confidence	High
	Extent	Local (limited to ML 164 Area)
	Duration	Medium-term: the potential disturbance is ongoing as long as the mining vessels are at sea
	Intensity	Mild
	Significance	Low

Table 6.24: Loss of Ferrosilicon.

Exceeding established water quality guidelines by other heavy metal constituents of the ferrosilicon (FeSi) used in the treatment process, or increased primary productivity with subsequent alterations in the phytoplankton community structure	*Status*	Negative
	Probability	Improbable (low likelihood) due to strict quality specifications for FeSi used, and high natural productivity in the area
	Confidence	Medium
	Extent	Local (within project area)
	Duration	Very Short; dilution of FeSi lost overboard will be rapid, and phytoplankton communities have quick turn-over rates
	Intensity	Negligible
	Significance	Low

Table 6.25: Air pollution.

Exceeding international standards for exhaust emissions of NOx, SOx, CO_2, Volatile Organic Carbons (VOCs) from ships	*Status*	Negative
	Probability	Improbable; due to the use of gas oil and the low sulphur content of the fuel on Samicor Diamond Mining (Pty) Ltd vessels.
	Confidence	Medium
	Extent	Local (within project area)
	Duration	Very Short; dilution of emissions will be rapid
	Intensity	Negligible
	Significance	Low

Table 6.26: Re-fuelling spillages.

Marine pollution from small spills during connection and disconnection of transfer of refuelling hoses while re-fuelling at sea or oil bunkering in port	*Status*	Negative
	Probability	Improbable; due to strict control and procedures implemented
	Confidence	Medium
	Extent	Site specific; limited to immediate area around the mining and supply vessel during transfer
	Duration	Very Short; the gas oil used by the vessels is a rapidly evaporating light diesel engine fuel. Short- to Medium-term; bunker fuels are more persistent and more likely to have physical impacts on wildlife
	Intensity	Mild to Moderate; re-fuelling takes place beyond 12 nautical miles from the coast; oil bunkering under controlled conditions in port only.
	Significance	Low

Table 6.27: Loss of equipment.

Irretrievable loss of sampling / mining equipment, resulting in the creation of seabed hazards, potential interference with demersal trawling, and/or potential entanglement of marine mammals and fishing vessels in anchor lines and/or buoy lines marking lost equipment.	*Status*	Negative
	Probability	Improbable (low likelihood); deepwater mining equipment is expensive, and most are successfully retrieved within weeks of the loss occurring. Irretrievable equipment is unlikely to cause a hazard for other marine users due to the operating water depths and the very limited activity by other users in the area of operation.
	Confidence	High
	Extent	Site specific
	Duration	Long-term to permanent
	Intensity	Negligible
	Significance	Low

Table 6.28: Resource use.

Depletion of natural and non-renewable resources through engine machinery operation, electricity generation, fresh water consumption, paper consumption etc.	*Status*	Negative
	Probability	Definite (impact will occur regardless of prevention measures)
	Confidence	High
	Extent	Site specific
	Duration	Long-term
	Intensity	Mild
	Significance	Low

6.5.4 Waste Management and Materials Management

Tables 6.29 – 6.33 summarizes the impact assessment results associated with waste disposal, organic waste disposal, transfer of wastes, discharge of bilge and ballast water.

Table 6.29: Waste disposal.

Exceeding MARPOL international air pollution guidelines/requirements for shipboard waste incineration - SO_2, CO_2, Volatile Organic Carbons (VOCs), metals, particulates, ash emissions	*Status*	Negative
	Probability	Improbable; only IMO-approved shipboard incinerators are installed and only general waste is incinerated
	Confidence	Medium
	Extent	Local (<5 km)
	Duration	Very Short; dilution of emissions will be rapid
	Intensity	Negligible
	Significance	Low

Table 6.30: Organic waste disposal.

Violating MARPOL standards for disposal of organic wastes (food waste) at sea	*Status*	Negative
	Probability	Improbable; due to procedures implemented to ensure that food waste is macerated before disposal to sea as well as adherence to MARPOL requirements with regards disposal in relation to distance from shore
	Confidence	High
	Extent	Site specific (<1 km)
	Duration	Very Short; dilution of macerated food waste will be rapid
	Intensity	Negligible
	Significance	Low

Table 6.31: Sewage disposal.

Violating MARPOL standards for disposal of organic wastes (sewage) at sea	*Status*	Negative
	Probability	Improbable; due to adherence to MARPOL requirements with regards disposal in relation to distance from shore and the installation of sewage plants onboard all operational vessels
	Confidence	High
	Extent	Site specific (<1 km)
	Duration	Very Short; dilution of treated sewage will be rapid
	Intensity	Negligible
	Significance	Low

Table 6.32: Transfer of wastes.

Pollution event resulting in a significant impact on the environment caused by the accidental spill or leak during handling, storage, transfer to shore and disposal of hazardous waste (oils, paints, paint cans, chemicals, etc.), or supplies	*Status*	Negative
	Probability	Improbable; due to strict control over lifting, transfer, packaging, storage and disposal procedures, and the limited use of hazardous materials
	Confidence	High
	Extent	Local
	Duration	Very Short
	Intensity	Negligible
	Significance	Low

Table 6.33: Discharge of bilge and ballast water.

Discharge of pollutants in bilge water and introduction of alien species through discharge of ballast water	*Status*	Negative
	Probability	Improbable; due to adherence to MARPOL requirements with regards discharge of oily water and ballast water, and Samicor Diamond Mining (Pty) Ltd vessels operating only offshore of the southern African west coast
	Confidence	High
	Extent	Local
	Duration	Very Short; dispersal and dilution of contaminants in discharged water will be rapid (water passes through oily water separator and water of <15ppm of oil is released)
	Intensity	Negligible
	Significance	Low

6.5.5 Onshore Logistical Support

Table 6.34 summarizes the impact assessment results associated with air support to the exploration and mining vessels.

Table 6.34: Air support to exploration and mining vessels.

Disturbance of estuarine birds at the Orange River Mouth RAMSAR site by noise caused by the use of helicopters for transfer of crew	*Status*	Negative
	Probability	Improbable; if required, flight paths adjusted to avoid most sensitive areas around Lüderitz
	Confidence	Medium
	Extent	Local (within 5 km of project area)
	Duration	Very Short; for duration of flight only
	Intensity	Mild
	Significance	Low

6.5.6 Accidents & Emergencies

Tables 6.35 – 6.39 summarizes the impact assessment results associated with fire, hydraulic fluid spills, re-fuelling accidents, grounding / sinking of vessel or helicopter ditching and radioactive sources.

Table 6.35: Fire.

Air pollution and pollution from firefighting residues resulting from a fire in any area	*Status*	Negative
	Probability	Improbable; based on standards and procedures implemented and long track record
	Confidence	Medium
	Extent	Site specific (<1 km)
	Duration	Very Short; fires likely to be rapidly extinguished
	Intensity	Mild
	Significance	Low

Table 6.36: Hydraulic fluid spills.

Marine pollution in the event of a hydraulic fluid spill due to rupture of pipes /failure of hydraulic sampling / mining equipment which cannot be contained on the vessel	*Status*	Negative
	Probability	Improbable; based on standards and procedures implemented and long track record
	Confidence	High
	Extent	Site specific (<1 km)
	Duration	Very Short; dispersal of low volume spills will be rapid
	Intensity	Mild
	Significance	Low

Table 6.37: Re-fuelling accidents.

Marine pollution in the event of accidental spillage of fuel during at-sea refuelling operations due to rupture of pipes or valve failure	*Status*	Negative
	Probability	Improbable; based on standards and procedures implemented and long track record.
	Confidence	Medium
	Extent	Local
	Duration	Very Short to Short-term; the gas oil used by the vessels is a rapidly evaporating light diesel engine fuel. Persistence will be determined by the volumes spilled.
	Intensity	Mild
	Significance	Low

Table 6.38: Grounding / sinking of vessel or helicopter ditching.

Marine pollution caused by uncontrolled spills of hazardous substances resulting from the grounding or sinking of a prospecting / mining vessel, a vessel collision, or ditching of a helicopter	*Status*	Negative
	Probability	Improbable, based on strict adherence to international maritime and aviation standards and long track record
	Confidence	High
	Extent	Local to International; slicks may be dispersed alongshore and into neighbouring South African territorial waters
	Duration	Very Short; gas oil is light and would be broken up in a matter of days
	Intensity	Moderate to Severe; if the affected marine biota die, or their breeding success is reduced
	Significance	High

Table 6.39: Radioactive sources.

Detrimental effects on the health of personnel as a result of damage to x-ray equipment resulting in the accidental release of ionising radiation	*Status*	Negative
	Probability	Improbable; strict controls implemented in line with Radiation Management Plan (RMP)
	Confidence	High
	Extent	Site specific; limited to the vessel
	Duration	Medium-term
	Intensity	Moderate to Severe
	Significance	Medium

6.5.7 Socioeconomic Issues

Tables 6.40 - 6.48 summarizes the impact assessment results associated with socioeconomic issues covering payment of taxes / royalties, employment, improved social services, training and skills transfer, boost to local economies, development of technology and technological

advancement, use of non-renewable resources and closure of Samicor Diamond Mining (Pty) Ltd operations.

Table 6.40: Payment of Taxes / royalties.

Contribution to national economy through payment of taxes and royalties	*Status*	Positive
	Probability	Definite
	Confidence	High
	Extent	International; Samicor Diamond Mining (Pty) Ltd also uses South African contactors and vendors, the airborne services are provided by a Canadian Company
	Duration	Medium-term
	Intensity	Moderate
	Significance	High; Samicor Diamond Mining (Pty) Ltd makes a marked contribution to the Namibian economy through payment of taxes and royalties

Table 6.41: Employment.

Provision of work boosts Namibian economy	*Status*	Positive
	Probability	Definite
	Confidence	High
	Extent	International; Employees are mostly from Namibia, with fewer from South Africa and other countries.
	Duration	Medium-term
	Intensity	High
	Significance	High; a significant number of especially Namibian families are being supported financially over a long period.

Table 6.42: Improved social services.

Provision of wellness and environmental awareness programmes	*Status*	Positive
	Probability	Definite
	Confidence	High
	Extent	International
	Duration	Medium-term
	Intensity	Moderate
	Significance	Medium

Table 6.43: Training and skills transfer

Provision of employee training and development of skills	*Status*	Positive
	Probability	Definite
	Confidence	High
	Extent	International
	Duration	Long-term
	Intensity	High (=Severe)
	Significance	High

Table 6.44: Boost to local economies.

Use of Lüderitz as the logistics base and facilities, Purchasing of local goods & services, Use of local vendors, Local employment and local economic boost.	*Status*	Positive
	Probability	Definite
	Confidence	High
	Extent	Local to Regional
	Duration	Long-term
	Intensity	High (=Severe)
	Significance	High

Table 6.45: Development of technology and technological advancement.

Research & design of prospecting, mining & metallurgical systems	*Status*	Positive
	Probability	Definite
	Confidence	High
	Extent	International
	Duration	Permanent
	Intensity	Moderate
	Significance	High

Table 6.46: Use of non-renewable resources, closure of Samicor Diamond Mining (Pty) Ltd Operations.

Recycling of materials and collection & removal of used oil Prevention of oil pollution through improved waste management practices	*Status*	Positive
	Probability	Definite
	Confidence	High
	Extent	Regional
	Duration	Long-term
	Intensity	Moderate
	Significance	Medium

Table 6.47: Sponsorships of research, education and community projects.

Creation of opportunities for research & education Improved environmental knowledge/awareness of the region	*Status*	Positive
	Probability	Definite
	Confidence	High
	Extent	Regional
	Duration	Medium-term
	Intensity	Moderate
	Significance	Medium

Table 6.48: Closure of Samicor Diamond Mining (Pty) Ltd operations.

Termination of all contributions to the economy including taxes, employment, support to secondary industries. Abandonment of infrastructure, buildings and equipment.	*Status*	Negative
	Probability	Definite
	Confidence	High
	Extent	International
	Duration	Permanent
	Intensity	Very High (=Very Severe)
	Significance	High

6.6Impacts Following Management Intervention

Management intervention measures to reduce negative impacts of medium and high significance are identified and described in Tables 6.49 and 6.50. Management intervention measures are described as either essential (must be implemented and are non-negotiable) or optional (must be shown to have been considered and sound reasons provided if not implemented.

Table 6.49: Summary of impacts of high significance.

IMPACTS OF HIGH SIGNIFICANCE	MANAGEMENT INTERVENTION MEASURES
• Mining in gullies and disposal of tailings onto adjacent reefs	Targeted monitoring/ research needs to be conducted to assess the biological significance and/or ecological sensitivity of benthic habitat and communities across the different types of rocky outcrops, especially in mining sub-regions
• Grounding / sinking of vessel or helicopter ditching (marine pollution from spills)	Strict enforcement of vessel and aircraft safety measures and stringent oil spill management systems are essential during all operations.
• Mine Closure	It is essential that Samicor Diamond Mining (Pty) Ltd embark upon the development of a Mine Closure Plan, which includes social and labour issues, to manage the risks associated with the closure of operations.

Table 6.50: Summary of impacts of medium significance.

IMPACTS OF MEDIUM SIGNIFICANCE	MANAGEMENT MEASURES AND MITIGATION
• Sediment removal during seabed sampling • Benthic community impacts of mining • Tailings disposal (smothering of benthic communities) • Benthic community and higher order impacts through tailings disposal • Rock lobster resources around Lüderitz	No direct intervention possible other than the no-project alternative. Optional measures to reduce the risk include setting aside an appropriate (i.e. size and seabed composition) portion of the Mining Licence Area that will not be directly or indirectly impacted by mining operations in the foreseeable future Such areas could also serve as unmined reference sites in long-term monitoring studies assessing mining impacts.
• Habitat alteration	The alternative of no mining operations, and the option of not disposing tailings overboard while mining.
• Release of H_2S from muds	For safety reasons it is essential that on-board air quality is monitored during mining operations in the ML 164 Area, if operating in muds. Prior to operations in areas of thick mud overburden it essential that a coring survey to determine the presence of H_2S pockets is conducted.
• Repeat mining	Optional measures include no re-mining of areas.
• Archaeological, paleontological and historical aspects	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.
• Radioactive sources	Strict implementation of controls in line with Government requirements is essential.

7. EMP AND MONITORING FRAMEWORKS

7.1 Objective of the EMP

The Environmental Management Plan (EMP) presented in this section demonstrates how Samicor Diamond Mining (Pty) Ltd intends to manage all the exploration, mining and processing operations within the ML area that will significantly impact on the receiving environment, or that may potentially be of high risk in the long-term. By implementing this management programme, Samicor Diamond Mining (Pty) Ltd will minimise the likely negative effects and maximise the positive effects of its operations in the ML Area.

In line with the company's Environmental Policy and the implementation of the EMP, Samicor Diamond Mining (Pty) Ltd commitments to responsible and sound environmental management of all its exploration, mining and processing activities within the ML Area. The updated Environmental Management Plan discussed in this section of this report will be integrated in the overall Environmental Management Systems (EMS) of the company in line with the international best practices in marine diamond exploration and mining. The EMP and the EMS will be internally and externally audited annually.

7.2 EMP for Samicor Diamond Mining (Pty) Ltd

In accordance with the results of the impact and risk assessment for the revaluated exploration and mining activities as detailed in Chapter 6, Tables 6.3 - 6.52, detailed Environmental Management Plan (EMP) have been prepared covering the following components as presented in Table 7.1 – 7.8:

(i) Environmental performance monitoring and procedures (Table 7.1);

(ii) Environmental and safety management systems (Table 7.2);

(iii) Exploration and mining (Table 7.3);

(iv) Vessels at sea (including contracted vessels) (Table 7.4);

(v) Waste management and pollution control (Table 7.5);

(vi) Ecosystem services / values, biological diversity conservation and resource use. (Table 7.6);

(vii) Socio-economic issues (Table 7.7);

(viii) Mine closure (Table 7.8);

Each of the EMP Table 7.1 – 7.8 framework covers aspect, impact description, risk / gain ranking, action plans and control measures, responsible person(s), timing, management objectives and applicable regulations.

Table 7.1: Environmental performance monitoring and procedures.

No.	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
1	Implementation of the environmental management policy and procedure	Improved Environmental Management and Awareness	High	❖ Define the roles and authorities of staff members (and any specialist consultants) responsible for implementation of the various facets of this EMP. ❖ Address training needs of staff required to implement specialised aspects of the EMP. ❖ Maintain records of plans, decisions, data collected, communications made, emergency responses, etc., which document the implementation of the EMP.	❖ The EMP process is employed, so that operations are conducted in an environmentally responsible manner ❖ All action plans outlined in this EMP are achieved, including continued consultation with all stakeholders and compilation of Performance Monitoring ❖ Understanding about potential impacts of mining operations and environmental management is increased ❖ An ethic of environmental responsibility is instilled in all staff and contract workers ❖ Ensure that exploration, mining and processing operations does not impact significantly on existing water quality. Maintain the integrity and ecological functions	Environmental Manager	Ongoing
2	Internal communication about the EMP	Improved Environmental Management and Awareness	High	❖ All personnel will be made aware of the contents Environmental Policy Statement, EMP and EMS requirements. ❖ All personnel who are in a position to make decisions or take actions that will influence environmental protection and management will be made aware of the contents, and their respective responsibilities for implementation, of the Environmental Policy Statement, EMP and EMS requirements.		Environmental Manager	Ongoing
3	Instructions to all staff, including contractors	Improved Environmental Management and Awareness	High	❖ Provide instructions and appropriate training to all staff about aspects of the EMP that affect their specific work, including hydrocarbon pollution prevention and clean-up, general waste management, protection of natural resources, and rehabilitation. ❖ Conduct an environmental awareness programme for the marine and terrestrial environments. ❖ Prior to working in the ML area all contractors must undergo an environmental and safety awareness induction and such awareness must form part of the debriefing before workers take-up their respective work stations. ❖ Incorporate environmental aspects and management interventions applicable to particular outsourced tasks into contracts and performance appraisals to improve environmental awareness and performance, and specify penalties for non-compliance.		Environmental Manager	Ongoing

No.	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
				❖ Report all environmental incidents as specified in the Company Procedures.	of the seabed, the bay, islands and coast. ❖ Maintenance of ecosystem integrity – the Bay and Islands within and near the ML area ❖ Sound environmental integrity for the Bay and Islands maintained. ❖ Maintain the seawater and marine sediment quality standards to its natural state in order to minimize direct loss of abalone and rock lobster by smothering effects due to sediment resuspension.		
4	EMP Monitoring and Performance Assessments	Improved Environmental Management and Awareness	High	❖ Undertake a detailed currents circulation modelling followed by a continuous (on the monthly basis) ❖ Analyses of the water quality realised at source before discharge to the marine environment and around the mining area using the Benguela Current Large Marine Ecosystem (BCLME) guideline values for concentration of metals in seawater ❖ Analyses of the sediment quality realised at source before discharge to the marine environment and around the mining area using the Benguela Current Large Marine Ecosystem (BCLME) guideline values for concentration of metals in marine sediments ❖ The EMP monitoring process will carefully examine all monitoring results and combine them with current circulation models to mitigate any harmful impact to the Mariculture industry around Lüderitz. ❖ Undertake formal EMP performance assessments every 12 months to check progress in meeting the objectives and targets of this EMP ❖ Compile and submit EMP Performance Assessment Reports to the Environmental Commissioner containing as a minimum the following information: ▪ Information regarding the period applicable to the assessment ▪ Scope of the assessment ▪ Procedure used for the assessment ▪ Interpreted information gained from monitoring		Environmental Manager	First due 12 months after EMP approval date

No.	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
				▪ Evaluation criteria used ▪ Results of the assessment ▪ Recommendations on how and when non-compliances or deficiencies will be rectified.			
5	EMP Amendments	Improved Environmental Management and Awareness	High	❖ On an ongoing basis, assess the applicability of actions and activities required by the EMP, identify and address all new environmental issues arising from changed operations and/or communications with interested parties, through amendments to the EMP if/where necessary. ❖ Communicate and consult with I&APs through appropriate fora to inform them of proposed changes and address any concerns. ❖ Amend and revise this EMP, if required and submit to the Environmental Commissioner for approval.		Environmental Manager	Ongoing
6	Communications with stakeholders	Improved stakeholder relationships	High	❖ Maintain an up-to-date I&AP database. ❖ Maintain open communication with the relevant stakeholders listed in Samicor Diamond Mining (Pty) Ltd database by sharing the results of the monitoring and informing them of proposed changes to the EMP, addressing any issues of concerns that may arise, maintain records of communications, and where relevant, address their needs. ❖ Participate actively in appropriate fora to share information and co-operate with other stakeholders and resource managers in the marine environment.		Environmental Manager	Ongoing
7	Pecuniary provision/ Allocation of environmental Management Funding	Improved Environmental Management	High	❖ Allocate operational costs to maintain the EMP objectives, including all associated requirements, such as. funding of research and monitoring to understand, and where possible, mitigate impacts.		Environmental Manager	Ongoing
				❖ Maintain Protection and Indemnity (P&I) Insurance Cover of US$ 100 million to allow for clean-ups in the event of oil spills, and unlimited (P&I) Insurance Cover for other eventualities.		Mine Secretary	Ongoing

Table 7.2: Environmental and safety management systems.

No.	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
1	Maintain Environmental Management System (EMS)	Improved Environmental Management	High	❖ Ensure that all requirements of Environmental Management System are met, including compliance with the national legislation, environmental awareness training, environmental monitoring, waste management and pollution control including the following requirements: ▪ employ “good housekeeping” onboard; ▪ awareness for waste reduction through re-use and recycling maintained; ▪ only water containing <15 ppm oil discharged overboard (MARPOL standard); ▪ no overboard disposal of waste (MARPOL standard); ▪ food waste overboard only after maceration through a 25 mm screen (MARPOL standard); ▪ No discharge allowed in the ML area. Sewage processed in approved treatment plants before discharge beyond 4 nautical miles offshore (MARPOL standard); ▪ all scrap metal, cans, paper and cardboard, laser and ink cartridges separated and sent for recycling ashore; ▪ all vessels fitted with desalination units to purify seawater for use onboard; ▪ all vessels painted with TBT-free anti-fouling hull paint; ▪ other waste incinerated in IMO-approved shipboard incinerators, and remainder sent by sea to waste sites meeting legal requirements; ▪ use of gas oil containing less than 0.55% sulphur; ▪ regular service and repair of all equipment to reduce consumption of fuels and other petrochemical materials, and to minimise the release of greenhouse gases; ▪ used oil returned to supplier for recycling / disposal; ▪ no CFC-based fire-fighting equipment used; ▪ phasing out of ozone-depleting products and equipment (refrigerators, engines etc.) with alternatives (Montreal Protocol on Ozone Depleting Substances as well as United Nations (UN) Framework Convention on Climate Change 1992 and Kyoto Protocol to the UN Framework Convention on Climate Change 1997); ▪ monitoring and recording of the following from the vessels: – wind speed and direction (4-hourly in vessel’s bridge	❖ In order to build-up an accurate database of discharge characteristics / composition, levels and distribution of potential toxic elements that could be associated /mobilised / released through the exploration, mining and processing operations around the ML area ❖ Maintain compliance with the standards in the Labour Act, Environmental regulations and mining regulations ❖ Maintain compliance with operational and national and international occupational standards ❖ Internally and externally audited Environmental Management	Environmental Manager	Ongoing

No.	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
				log) – Official Garbage Record Book for all discharges of waste / incinerations – electronic logging and data-basing of separated waste forms with quantities, storage type etc ❖ Ensure that the EMP is annually internally and externally audited and submit copies of audit reports with Environmental Performance Reports	System (EMS) for exploration, mining and processing are maintained for all certified areas of activities and all identified vessels and shore-based areas have NOSA grading		
2	Integration of Environmental Management	Improved Environmental Management	High	❖ Quantify natural variability in the ecosystem by integrating data-collection requirements with other research and monitoring initiatives (to be addressed through the Samicor Diamond Mining (Pty) Ltd long term monitoring programme). ❖ Incorporate sediment plume modelling with ongoing overall monitoring for exploration and mining ❖ Modelling of potential oil spill scenarios and development of appropriate contingency plans. ❖ Integration of future mine plans with existing mariculture, lobsters operations and sanctuary areas, other user's interests and overall Marine Protected Areas as well as proposed MPA's in the future.		Environmental Manager	Ongoing
3	Establishment and review of Environmental Risks and Improved Environmental Performance	Improved Environmental Management	High	❖ Update and develop new sets of environmental risks based on the results of the ongoing monitoring. ❖ Adopt a monitoring results-based approach in managing environmental impacts by focusing on the potentially medium and high risk impacts. ❖ Improve on performance reporting by determining key indicator species by which recovery rates of impacted areas can be determined more effectively.		Environmental Manager Environmental Scientist	Ongoing
4	Maintain Safety Management System (SMS)	Improved Health and Safety	High	❖ Maintain high safety standards onboard each vessel and arrange annual audits by the National Occupational Safety Association (NOSA) to ensure ratings are maintained.		Loss Control Coordinator	Ongoing
5	International Safety Management (ISM) Code Prevention	Improved Health and Safety	High	❖ Ensure compliance with the International Maritime Organisation's International Safety Management (ISM) Code developed and implemented. ❖ Ensure that the required external assessments of compliance to the ISM Code are conducted. ❖ Submit certificates of compliance with Environmental Performance Reports to the Environmental Commissioner.		Operations Manager	Ongoing

Table 7.3: Exploration and mining.

No.	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
1	Seismic surveying (airgun, towfish)	Vibration or noise disturbance of marine fish and mammals	Medium	❖ Maintain the Marine Life Sightings Programme (including turtles and jellyfish etc.) from vessels, to record the presence, proximity to and behaviour patterns of marine mammals and seabirds near the exploration vessel. ❖ Consider providing specialised marine mammals observer training for the relevant monitors. ❖ Depending on the results of the bridge log, further studies on the impact of sonar on marine mammals	❖ Improved understanding and develop appropriate mitigation measures with respect to the direct impacts of prospecting/mining on the environment ❖ Exploration and mining-related impacts on the marine environment are managed, to avoid compromising current and future utilisation of renewable marine resources ❖ The information base that will provide improved insight into the cumulative impacts of exploration and mining on marine environment ❖ Recovery rates of marine habitats impacted or destroyed during prospecting/mining are established, recolonisation of areas within a	Environmental Manager and onboard Environmental Monitors	Ongoing
2	Sampling programme	Disturbance of benthic communities and habitat	High	❖ Undertake to develop a programme whereby data-collection requirements to quantify natural variability in the ecosystem and facilitate habitat/sensitivity mapping are integrated with proposed exploration and mining.		Environment Manager / Environmental Scientist	Ongoing
				❖ Conduct high resolution geophysical surveys (SSS, bathymetry and seismic profiling) prior to mining, and of the target areas ~2-3 years post-mining to determine the depth, wall steepness and infilling rates of mining 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 device: ▪ Grab sampling or box-coring surveys. ▪ Video footage collected from a Remotely Operated Vehicle. ▪ Geophysical (e.g. high resolution AUV) surveys. ▪ Submersible video footage (when submersible is available).		Environmental Manager / Environmental Scientist	Prior to mining (ongoing)
						Environmental Manager / Environmental Scientist	Ongoing
						Geological Manager / Environmental Manager	Ongoing
						Environmental Manager	Annually
3	Mining excavations	Destruction of geological record, and reorganisation of sediment structures	Medium			Geological Manager	Ongoing
4	Exploration and Mining in the mudbelt	Hydrogen sulphide eruptions	Medium	❖ Consider conducting a coring survey to determine the presence of H_2S pockets before mining is conducted in thick mud overburden areas. ❖ Monitor on-board air quality during exploration and mining operations in the ML 164 Area.		Onboard Environmental Monitors Geological Manager	Ongoing When targeting of

No.	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
				❖ Consider training of Health and Safety personnel in handling of personal safety issues in the event of H_2S eruptions during exploration and mining	reasonable period of time is allowed ❖ Key habitats of high ecological sensitivity and importance (e.g. mariculture, lobster sanctuary and kelp beds) are protected ❖ Conflict between the fishing industry and diamond mining is minimised by maintaining open and frequent communications ❖ Archaeological and historic sites are protected, thereby preventing the loss of information and research material ❖ Information exchange with all relevant stakeholders is promoted		mudbelt planned
						Environmental Scientist	Prior to mining
5	Disposal of all tailings overboard during mining	Suspended sediment plumes	Low	❖ If the levels recorded in the sacrificial mixing zone exceed set water quality criteria, conduct an ecological hazard assessment on the suspended sediment plumes and report the results to the DEA and MAWF who should decide on further action.		Environmental Scientist	Prior to mining During mining
				❖ Ensure that the water sample analyses are carried out by a laboratory certified to conduct the analyses. ❖ Have the monitoring results scientifically evaluated by an appropriate expert. ❖ Submit the monitoring results together with the evaluation to the Environmental Commissioner		Environmental Scientist	Prior to mining
				During mining operations: ❖ Record wind speed and direction in vessel's bridge log. ❖ Conduct visual observations of the plumes. ❖ Monitor the proportion of clay (<63 µm) in the overspill.		Environmental Scientist	Ongoing
						Onboard Environmental Monitors Environmental Manager	During mining
6	Disposal of mine tailings overboard	Smothering of benthic invertebrates	High	❖ Through modelling, asses the effects of the tailings plume on the marine and coastal environments. ❖ Based on results of bottom-oxygen levels, consider undertaking further field/laboratory studies regarding the physiological oxygen tolerance for some large benthic species, considered characteristic of mined and unmined areas.		Environmental Manager Environmental Scientist	Ongoing Ongoing
7	Archaeological Sites	Destruction of wrecks	Medium	❖ While no wrecks have been identified from surveys in ML 164, the following actions will be undertaken if shipwreck material is encountered in the course of sampling/mining:		Vessel Master / Marine Superintendent /	If shipwreck

No.	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
				▪ Immediately inform the Marine Superintendent or Environment Manager who will inform the National Monuments Council; ▪ Retain artefacts recovered and, where possible, maintain a photographic record. Note the date, time, location and types of artefacts found in the logbook; ▪ Contract a marine archaeologist in consultation with Government to survey the site; ▪ Avoid mining or prospecting within 500 m from the centre of the site once the area has been surveyed to obtain baseline data (approximately 2-3 years baseline required		Environment Manager	material is found
8	Use of ferrosilicon in onboard treatment process	Increased primary productivity	Low	❖ Monitor use of ferrosilicon on an ongoing basis. ❖ Continue initiatives to use shell crushing equipment to maximise retrieval of ferrosilicon where operating in shelly substrates as this compound accumulates in shells.		Plant Superintendent	Ongoing

Table 7.4: Vessels at sea (including contracted vessels).

No.	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
1	Presence of vessels	Potential exclusion of alternative resource use (e.g. aquaculture, fishing, tourism / recreational, shipping and township development along the coast bordering the ML area)	High	At least 14 days in advance of commencement of mining activities: ❖ Notify the Permanent Secretary: MME in writing providing particulars regarding the location, nature and extent of such operations. ❖ Notify other potential user groups (maritime authorities, fishing / aquaculture industry, NamPort and Lüderitz Town Council) in the area in writing, providing particulars regarding the location, nature and extent of such operations. ❖ Notify Walvis Bay Radio of intended vessel activities, light buoys and exclusion zones.	❖ Disruption to other legitimate users of the sea is minimised by respecting their rights ❖ Conflict between the fishing industry and diamond mining is minimised by maintaining open and frequent communications ❖ Pollution of marine and coastal habitats and resources is prevented ❖ Manage waste streams to reduce wastage and promote reuse/recycling of resources are in	Vessel Manager	Prior to commencement of activities
				❖ On cessation of activities inform Walvis Bay radio on completion of operations.		Vessel Masters	On cessation of activities
				❖ In the vessel logbook, record sightings of and interactions with other vessels to note potential conflicts over rights of passage and access to resources.		Vessel Masters	Ongoing
2	Presence of vessels	Vibration or noise disturbance of marine mammals and seabirds	Low	❖ Maintain the Marine Life Sightings Programme (including turtles, jellyfish, rock lobsters and anything else of interest) from vessels, to record the presence, proximity to and behaviour patterns of marine mammals and seabirds near the mining vessels, particularly during mining operations. ❖ Consider providing specialised marine mammals observer training for the relevant monitors.		Environmental Manager and onboard Environmental Monitors	Ongoing

No.	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
				❖ To avoid disturbance of whales, vessels should not approach within 300 m of a whale whilst underway ❖ If a whale surfaces within this distance of the vessel when at anchor, or during discharging of tailings sediments, the vessel should remain stationary until the whale has moved to a distance 300 m away.	an effective manner ❖ Natural resources are used conservatively	Environmental Manager and onboard Environmental Monitors	Ongoing
3	Oil-spill Contingency Plans	Pollution of the sea by diesel and heavy fuel	Medium	❖ 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: ▪ Follow the Shipboard Oil Spill Emergency Response Manual procedure. This Manual must be approved by the Namibian Directorate of Maritime Affairs. ▪ In terms of the Emergency Plan the Superintendent will inform the following Namibian authorities (as deemed applicable): Marine Division of the Ministry of Works and Transport; MFMR; MME, MET and the Lüderitz and Walvis Bay Harbour Masters		Marine Manager	Prior to refuelling at sea
4	Release of ballast water	Marine pollution and introduction of alien species	Low	❖ Ballast water may only be released when the vessel is more than 12 miles from land and in water depths greater than 25 m.		Vessel Master	Ongoing
5	Acoustic positioning for seabed crawlers	Seabed hazards	Medium	❖ Maintain the Hazards Database of the locations of concrete blocks used in the acoustic positioning systems for the crawlers. ❖ If requested, report these data to the relevant authority		Marine Manager	Ongoing
6	Incidental loss of equipment	Seabed hazards	Low	❖ Maintain hazards database listing the type of gear left on the seabed and/or in the mine/prospecting area with the dates of loss and locations and where applicable, the dates of retrieval.		Vessel Masters / Surveyor	Ongoing
7	Waste Management	Marine Pollution	Low	❖ Ensure that waste management practices in place and enforced		Vessel Manager	Ongoing

Table 7.5: Waste management and pollution control.

No.	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
1	Waste generation – general	Pollution of terrestrial, aquatic and marine habitats	Low	❖ Comply with all legal requirements for waste management and pollution control, and employ "good housekeeping" and monitoring practices. ❖ Follow stringent 'cradle to grave' waste management practices. ❖ Conduct environmental awareness programmes for waste management. ❖ Ensure safe inshore waste disposal practices ❖ Maintain records on the types and amounts of waste disposed.	❖ Pollution of terrestrial, marine and fresh water habitats and resources is prevented ❖ Waste streams are effectively managed to minimise pollution using a cradle-to-grave philosophy ❖ Reuse / recycling and being conservative in use of natural resources is promoted	Environmental Manager	Ongoing

Table 7.6: Ecosystem services / values, biological diversity conservation and resource use.

No.	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
1	Ecosystem services / values	Impact on the coastal and marine ecosystem function, services, value and non-use	Medium	❖ Maintain the coastal and marine ecosystem function (What the Ecosystem Does): Wildlife habitat, carbon cycling or the trapping of nutrients and characterized by the physical, chemical, and biological processes or attributes that contribute to the self-maintenance of an ecosystem in this zone; ❖ Maintain the coastal and marine ecosystem services: Food chain, harvesting of animals or plants, and the provision of clean water or scenic views; ❖ Maintain the coastal and marine ecosystem services use values: Direct use for fishing and indirect include watching a television show about the area and its wildlife, food chain linkages that sustains the complex life within this zone and bequest value for future generations to enjoy; ❖ Maintain the coastal and marine ecosystem non-use, or passive use: Preserve what exists (Existence Value) with no consideration for direct use / benefits.	❖ Promote the integration of coastal and marine ecosystem function, services, value and non-use in the EMP and EMS	Environmental Manager	At all times Ongoing
2	Illegal hunting, fishing and plant collection	Destruction and loss of flora and fauna (note that mining is only limited to the marine and coastal environment	Low	❖ Samicor Diamond Mining (Pty) Ltd personnel and contractors will not: ▪ Disturb, catch, remove, injure, kill or feed, any wild animal or bird which occurs in the area without a permit. ▪ Intentionally remove, injure or kill any sea-life. ▪ Pick, uproot, fell or damage any plant growing in the coastal area without a permit - other than according to the approved EMP which will provide necessary mitigation measures. ❖ Conduct environmental awareness program for wildlife ethics. ❖ Disciplinary action will be undertaken, and strict penalties imposed in case of transgressions.	❖ Disturbance of wildlife is minimised ❖ Key habitats important for wildlife are protected, thereby conserving biological diversity		
3	Freshwater Consumption	Sustainability of water supply and depletion of natural resources	Low	❖ Ensure relevant water permits are in place. ❖ Minimise the use and wastage of clean purified water. ❖ Keep records of quantities of fresh water used. ❖ Conduct water conservation awareness programmes and water saving campaigns.	❖ Wastage is reduced and fuel use is minimised	Environmental Manager	Ongoing Monthly Ongoing
4	Recourses usage during Samicor Diamond Mining (Pty) Ltd staff and contractors during periods of crew change	Use of natural resources	Low	❖ Keep records of fuel consumption, set targets and put action plans in place when targets are exceeded.		Environmental Manager	Monthly

Table 7.7: Socioeconomic issues.

No.	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
1	Environmental Communication	Improved Environmental Awareness	High	❖ During compilation of the EIA and EMP consult with the following to identify their rights and/or other legitimate interests: ▪ Government departments with jurisdiction over resources or activities in the Mining Licence Area and/or in adjoining areas (MET, MFMR and Lüderitz Town Council). ▪ Representatives of any other interest group (e.g. fishing / Aquaculture industry).	❖ Economic benefits to people of Namibia optimised, where feasible ❖ A balance between economic, social and environmental responsibilities is struck ❖ Opportunities provided for local business, industrial relations promoted, and contribution to socio-economic stability ❖ Training and development opportunities provided for all staff ❖ Relevant stakeholders consulted on a regular basis ❖ Good working and living conditions all employees promoted and maintained	Environmental Manager(s) and Contracted Consultants	Done as part of Public Scoping
				❖ Improve stakeholder relationships by maintaining open communication with relevant I&APs on issues that may arise, and where relevant, address their needs. ❖ Keep a record of all communications with I&APs, the points raised, and how these points have been addressed.		Environmental Manager(s)	Ongoing
				❖ Report to the relevant stakeholder on new activities with potential environmental impacts.		Environmental Manager(s)	Ongoing
				❖ Publicise and make available information on environmental monitoring programmes and environmental performance.		Environmental Manager(s)	Ongoing
2	Employment	Boosts Namibian economy and development of skills	High	❖ Continue to increase number of Namibians employed and to provide them with training to develop skills. ❖ Outsource services to Namibian where possible. ❖ Include local Small and Micro enterprise service providers in the tendering process for supplies and services		Human Resources Manager	Ongoing
3	Local, regional and national and support / social responsible	Contribution to Lüderitz communities and //Karas region and overall Namibian citizen support	Medium to High	❖ Minimise net loss of employment opportunities ❖ Give hiring priority to suitably qualified or experienced local Namibian citizens		Human Resources Manager	Ongoing
				❖ Within the resources available, support appropriate initiatives to improve community welfare, particularly in Lüderitz and //Karas Region. ❖ Ensure that wellness programme covers all workers ❖ Consider expanding some wellness programme interventions to sub-contractors.		Financial Manager Human Resources Manager	Ongoing
4	Taxes / royalties	Contribution to national economy	High	❖ Pay all applicable taxes and royalties to the government as required. ❖ Pursue operational targets as set out in the Business Plan by maintaining and continual increasing of the current level of production. ❖ Internally track the efficiency to ensure maintenance of profits.		Financial Manager	Ongoing

No.	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
5	Use of harbours	Financial contribution to harbours	Medium	❖ Pay all applicable fees at harbours. ❖ Use Lüderitz/Walvis Bay harbour infrastructure and services where possible.		Materials Manager	Ongoing
6	Training and Skills Transfer	Contribution to Namibian training, education and research	High	❖ Continue to provide employees with training to develop skills by: ▪ Addressing training needs of the work force. ▪ Continuously, conduct environmental awareness and health and safety awareness programmes. ❖ Incorporate environmental aspects and management interventions applicable to particular outsourced tasks into contracts and performance appraisals to improve environmental awareness and performance. ❖ Emergency preparedness and response teams/contractors are to train employees and contractors on appropriate skills.		Human Resources Manager Environmental Manager	Ongoing
7	Research and development	Technological advancements in mining systems	High	❖ Continue conducting research and development in prospecting, mining and metallurgical technologies for marine diamond mining as well as management associated likely environmental impacts and monitoring		Technical Manager	Ongoing
8	Sponsorships of research, education and community projects	Contribute to Namibia's knowledge-base in building a knowledge based economy	High	❖ Where possible supply research/exploration data to the marine science and fisheries communities ❖ Where possible, sponsor Namibian research and education to contribute to public understanding of relevant environmental issues and environmental management practices e.g. invite scientists to participate in environmental surveys and share knowledge on findings including contributions to biodiversity conservation and ecosystem value and functions. ❖ Continue with identification of important social corporate responsibility initiatives / programme at local (Lüderitz), regional (//Karas Region) and national (Namibia) levels ❖ Provide social contributions at local (Lüderitz), regional (//Karas Region) and national (Namibia) levels		Environmental Scientist Environmental Manager	Ongoing

Table 7.8: Mine closure.

No.	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
1	Closure Plan	Termination of all contributions to the economy including taxes, employment, support to secondary industries	High	❖ As an interdisciplinary initiative for all involved undertake to develop Closure Plan, which gives attention to: ▪ approximate dates of progressive or partial closure applications, ▪ objectives of closure planning, ▪ relevant decommissioning and rehabilitation monitoring programmes, ▪ financial provisioning for mine closure, ▪ provisioning for the development of a social and labour plan for closure, ▪ rehabilitation actions required to obtain closure, ▪ human resources and community plan of action, ▪ communication strategy, and ▪ actions required for sustainability.	❖ Address a range of issues from the very first stages of mine development. ❖ Prioritise key financial, social, health, safety, as well as traditional environmental and economic considerations in the development and implementation of mine closure and reclamation plans. ❖ Ensure that regulatory requirements in terms of financial provision for mine Closure, Rehabilitation and Aftercare are met	Environmental Manager	**Ongoing**
2	Closure Planning	Improved management of closure and rehabilitation	High	❖ Ensure that closure planning continues throughout the life of the operation. ❖ Gather relevant information throughout the life of mine to ensure that environmental risks are quantified and managed proactively. ❖ Make provision as part of ongoing environmental management for post-mining surveys of selected areas to demonstrate recovery (3-5 year intervals). ❖ Ensure that Safety and Health requirements are complied with.		Environmental Manager	Ongoing
3	Closure Certificate	Improved management of closure and rehabilitation	High	❖ A final EMP performance assessment should be conducted to ensure that: ▪ the requirements of the relevant legislation have been complied with; ▪ the research and monitoring that has been conducted (including the total area disturbed) is summarised;		Environmental Manager	On Closure

No.	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
				▪ the closure objectives as described in the Closure Plan have been met; and ▪ all residual and latent environmental impacts and the risks thereof occurring have been identified, quantified and arrangements for the management thereof have been finalised. ❖ When applying for closure, submit the following documentation to both the Mining and Environmental Commissioners: ▪ The Closure Plan ▪ The Final Performance Assessment Report ❖ An application form to transfer environmental responsibilities and liabilities beyond mine closure into the aftercare stage and for the as the Environmental Commissioner may prescribe			
4	Financial Provisioning for Mine Closure, Rehabilitation and Aftercare	Improved management of Closure, Rehabilitation and Aftercare stages	High	❖ Allocate operational costs to maintain to meet the EMP objectives, ensuring that potential environmental impacts are integrally managed or monitored in such a way as to prevent or minimise them. ❖ Maintain adequate Protection and Indemnity (P&I) Insurance Cover to allow for Closure, Rehabilitation and Aftercare liabilities. ❖ Allocate operational costs to monitor and demonstrate natural recovery of the seabed through pre- and post-mining benthic faunal and seabed surveys. ❖ Provide sufficient funds for a post-closure environmental survey (seabed and/or benthic faunal survey) in the event that on closure or premature closure, the benthic monitoring programme has not been completed or has not been able to demonstrate sufficiently that natural recovery processes are occurring.		Financial Manager	Ongoing

7.2 Environmental Performance Monitoring

7.2.1 Overview

The monitoring programme developed for the proposed mineral exploration (geophysical survey and sampling operations) and mining operations outlines further data collection and analyses to ensure safe operations and the protection of the marine environment during the exploration and mining process. By undertaking monitoring before, during and after operations it may be possible to identify unpredicted effects and take the necessary precautions to eliminate the likely impacts before the effects become significant. The main objectives of the Environmental Performance Monitoring programme are to:

- Check the overall effectiveness of design and operational procedures in protecting the environment;
- Comply with regulations, standards and license conditions;
- Detect sudden or long term environmental changes;
- Measure physical disturbance and subsequent recovery;
- Study impact and recovery following an accident (e.g. oil spill), and;
- Compare actual impacts with those predicted in the EIA and thereby aim to improve the EIA process as well as engineering design process for the mining phase.

7.5.2 Monitoring Implementation

The implementation of the monitoring programme will require resources to collect, analyse the required datasets and propose recommendations on what need to be done. The implementation could be done as an in-house activity or partly in-house (data collection during exploration process) and outsource (employ a consultant) to undertake the assessment and recommend measures to be implemented. There will be a need for a full range of laboratory and technical facilities to support the monitoring programme of sediment and water quality monitoring with respect to the exploration (sediment sampling) and mining operations.

7.5.3 Monitoring Strategy

The monitoring programme has been developed to allow maximum flexibility in both the timing and monitoring locations to allow adaptation to the conditions encountered and to allow decisions to be made in the field, based on all available data. As a basis for this, a two level scheme is proposed so that monitoring effort can be increased if dictated by the results. As many of the analyses as possible will be carried out on site to allow immediate feedback to the monitoring programme. Control sites outside the area of predicted impacts should also be included during the determination of the monitoring points to account for variations due to factors other than the proposed exploration and mining activities.

8. CONCLUSIONS AND RECOMMENDATIONS

8.1 Conclusions

Despite the fact that no exploration or mining have been taking place since 2011, the environmental performance monitoring and research undertaken prior to 2011 provides a great source of valuable resources on the state of environmental around the ML 164 Area. Previous environmental assessments as well as ongoing environmental monitoring programmes have all been reviewed in this report. The implementation of the EMP as provided in this report will minimise the negative effects and maximise the positive effects thereby enhance the overall ecosystem services / value of the area being explored or mined within the ML 164 Area.

8.3 Recommendations for Environmental Clearance Certificate

Based on the results of this updated Environmental Impact Assessment (EIA) and Environmental Management Plan report, it's hereby recommended that the proponent (Samicor Diamond Mining (Pty) Ltd) be issued with the new Environmental Clearance Certificate for marine diamond exploration (geophysical survey and sampling) and mining operations in the ML No. 164.

9. BIBLIOGRAPHY AND FURTHER READING

AIROLDI, L., 2003. The effects of sedimentation on rocky coast assemblages. *Oceanogr. Mar. Biol. Ann. Rev.,* 41: 161–236.

BAILEY, G.W., BEYERS, C.J. DE B. & S.R. LIPSCHITZ, 1985. Seasonal variation of oxygen deficiency in waters off southern South West Africa in 1975 and 1976 and its relation to catchability and distribution of the Cape rock-lobster *Jasus lalandii*. *S. Afr. J. Mar. Sci.*, **3**: 197-214.

BAILEY G.W. & P. CHAPMAN, 1991. Chemical and physical oceanography. In: Short-term variability during an Anchor Station Study in the southern Benguela Upwelling system. *Prog. Oceanogr.*, **28**: 9-37.

BANK OF NAMIBIA, 2007. Bank of Namibia Annual Report 2007, www.bon.com.na.

BARKAI, A. & M.O. BERGH, 1990. *Final report of the Zone 'A' 30 MT Diving Experiment.* Unpublished report. 75pp.

BERG, J.A. & R.I.E. NEWELL, 1986. Temporal and spatial variations in the composition of seston available to the suspension-feeder *Crassostrea virginic*a. *Estuar. Coast. Shelf. Sci.*, **23**: 375–386.

BEYERS, C.J. DE B., C.G. WILKE & P.C. GOOSEN, 1994. The effects of oxygen deficiency on growth, intermoult period, mortality and ingestion rates of aquarium-held juvenile rock lobster *Jasus lalandii*. *S. Afr. J. Mar. Sci.*, **14**: 79-88.

BIRCH G.F., ROGERS J., BREMNER J.M. & G.J. MOIR, 1976. Sedimentation controls on the continental margin of Southern Africa. *First Interdisciplinary Conf. Mar. Freshwater Res. S. Afr.*, Fiche 20A: C1-D12.

BIRDLIFE SOUTH AFRICA, 2015. Orange River Mouth Wetlands fact sheet. Available: http://www.birdlife.org.za/support-us/leave-a-legacy/item/171-sa030-orange-river-mouth-wetlands. Accessed: 28/04/2015.

BOYD, A..J. & G.P.J. OBERHOLSTER, 1994. Currents off the west and south coasts of South Africa. *S. Afr. Shipping News and Fish. Ind. Rev.*, **49**: 26-28.

BOYD, A.J., TAUNTON-CLARK, J. & G.P.J. OBERHOLSTER, 1992. Spatial features of the near-surface and midwater circulation patterns off western and southern South Africa and their role in the life histories of various commercially fished species. *S. Afr. J. Mar. Sci.*, **12**: 189-206.

BRANCH, G.M., EEKHOUT, S. & A.L. BOSMAN, 1990. Short-term effects of the 1988 Orange River floods on the inter-tidal rocky-shore communities of the open coast. *Trans. Roy. Soc. S. Afr.,* **47**: 331-354.

BREMNER, J.M., ROGERS, J. & J.P. WILLIS, 1990. Sedimentological aspects of the 1988 Orange River floods. *Trans. Roy. Soc. S. Afr.*, **47**: 247-294.

BRICELJ, V.M. & R.E. MALOUF, 1984. Influence of algal and suspended sediment concentrations on the feeding physiology of the hard clam *Mercenaria mercenari*a. *Mar. Biol.*, **84**: 155–165.

BROWN, R.S. & N. CAPUTI, 1983. Factors affecting the recapture of undersize western rock lobster *Panulirus cygnus* George returned by fishermen to the sea. *Fishery Bull., Wash.*, **2**: 103-128.

BROWN, R.S. & N. CAPUTI, 1985. Factors affecting the growth of undersize western rock lobster *Panulirus cygnus* George returned by fishermen to the sea. *Fishery Bull., Wash.*, **84(3)**: 567-574.

CENTRAL BUREAU OF STATISTICS, 2006. 2003/2004 Namibia Household Income and Expenditure Survey. National Planning Commission. Windhoek. 15-20.

CENTRAL BUREAU OF STATISTICS, 2003. 2001 Population and Housing Census. National Report. Basic Analysis and Highlights. National Planning Commission. Windhoek. 94pp and appendices.

CHAMBER OF MINES. Chamber of Mines Annual Review 2005-2006. Mining and the Economy. 79pp. Windhoek.

CHAMBER OF MINES, 2015. Mining industry overview. Available: http://www.chamberofmines.org.na/. Accessed: 28/04/2015.

CHAPMAN, P. & L.V. SHANNON, 1985. The Benguela Ecosystem. Part II. Chemistry and related processes. *Oceanogr. Mar. Biol. Ann. Rev.*, **23**: 183-251.

CHITTLEBOROUGH, R.G., 1975. Environmental factors affecting growth and survival of juvenile western rock lobster, *Paulirus longipes* (Milne-Edwards). *Aust. J. mar. Freshwat. Res.*, **26(2)**: 177-196.

CHRISTIE, N.D. 1974. Distribution patterns of the benthic fauna along a transect across the continental shelf off Lamberts Bay, South Africa. Ph.D. Thesis, University of Cape Town, 110 pp & Appendices.

CHRISTIE N.D. & A.G. MOLDAN. 1977. Effects of fish factory effluent on the benthic macro-fauna of Saldanha Bay. *Mar. Pollution Bull.*, **8**: 41-45.

CRAWFORD R.J.M., SHANNON L.V. & D.E. POLLOCK, 1987. The Benguela Ecosystem. Part IV. The major fish and invertebrate resources. *Oceanogr. Mar. Biol. Ann. Rev.* **25**: 353-505.

CSIR, 1998. Coastal Evolution as a result of the disposal of dredger tailings in the G68-G90 region. *CSIR Report EMV/S-C 98034.*

CURRIE, H., GROBLER, K. & J. KEMPER (NACOMA), 2007. *Concept note, background document and management proposal for the declaration of Marine Protected Areas on and around the Namibian offshore islands and adjacent coastal areas*. Compiled by Feike for the Ministry of Fisheries and Marine Resources, Namibian Coast Conservation & Management Project and World Wildlife Fund for Nature. Draft: September 2007, pp156.

DAVIS, G.E., 1981. Effects of injuries on spiny lobster, *Panulirus argus*, and implications for fisheries management. *Fishery Bull., Wash.*, **78(4)**: 979-984.

DE DECKER, A.H., 1970. Notes on an oxygen-depleted subsurface current off the west coast of South Africa. *Invest. Rep. Div. Sea Fish. South Africa*, **84**, 24 pp.

DE DECKER R.H., 1987. The geological setting of diamondiferous deposits on the inner shelf between the Orange River and Wreck Point. *Bull. Geol. Surv. S. Afr.* **86**, 99 pp.

DESPREZ, M., 2000. Physical and biological impact of marine aggregate extraction along the French coast of the Eastern English Channel: short-and long-term post-dredging restoration. *ICES J. Mar. Sci.,* **57**: 1428–1438.

DINGLE, R.V., 1973. The Geology of the Continental Shelf between Lüderitz (South West Africa) and Cape Town with special reference to Tertiary Strata. *J. Geol. Soc. Lond.*, **129**: 337-263.

DRAKE, D.E., CACCHIONE, D.A. & H.A. KARL, 1985. Bottom currents and sediment transport on San Pedro Shelf, California. *J. Sed. Petr.*, **55**: 15-28.

DUNCOMBE RAE, C.M., 2005. A demonstration of the hydrographic partition of the Benguela upwelling ecosystem at 26°40'S. *Afr. J. mar. Sci.*, **27(3)**: 617–628.

EKAU, W. & H. M. VERHEYE, 2005. Influence of oceanographic fronts and low oxygen on the distribution of ichthyoplankton in the Benguela and southern Angola currents. *Afr. J. mar. Sci.*, **27(3)**: 629–639.

EMANUEL, B.P., BUSTAMANTE, R.H., BRANCH, G.M., EEKHOUT, S. & F.J. ODENDAAL, 1992. A zoogeographic and functional approach to the selection of marine reserves on the west coast of South Africa. *S. Afr. J. Mar. Sci.*, **12**: 341-354.

FEGLEY, S.R., MACDONALD, B.A. & T.R. JACOBSEN, 1992. Short-term variation in the quantity and quality of seston available to benthic suspension feeders. *Estuar. Coast. Shelf Sci.*, **34**: 393–412.

GOOSEN, A.J.J., GIBBONS, M.J., MCMILLAN, I.K., DALE, D.C. & P.A. WICKENS, 2000. Benthic biological study of the Marshall Fork and Elephant Basin areas off Lüderitz. Prepared by De Beers Marine (Pty) Ltd. for Samicor Diamond Mining, January 2000. 62 pp.

GORDON, A.L., WEISS, R.F., SMETHIE, W.M. & M.J. WARNER, 1995. Thermocline and intermediate water communication between the South Atlantic and Indian Oceans. *J. Geophys. Res.*, **97(C5)**: 7223-7240.

HAMPTON, I., BOYER, D.C., PENNEY, A.J., PEREIRA, A.F. & M. SARDINHA, 1999. BCLME Thematic Report 1: Integrated Overview of Fisheries of the Benguela Current Region. *Unpublished Report*, 89pp.

HUNT, J.H., LYONS, W.G. & F.S. KENNEDY, 1986. Effects of exposure and confinement on spiny lobster *Panulirus argus*, used as attractants in the Florida trap fishery. *Fishery Bull., Wash.*, **84(1)**: 69-76.

JACKSON, L.F. & S. MCGIBBON, 1991. Human activities and factors affecting the distribution of macro-benthic fauna in Saldanha Bay. *S. Afr. J. Aquat. Sci.*, **17**: 89-102.

KAMSTRA, F., 1985. Environmental features of the southern Benguela with special reference to the wind stress. In: *South African Ocean Colour and Upwelling Experiment*. Shannon L.V. (ed.). Cape Town. Sea Fisheries Research Institute: 13-27.

KENDALL, M.A. & S. WIDDICOMBE, 1999. Small scale patterns in the structure of macrofaunal assemblages of shallow soft sediments. *J.Exp.Mar.Biol.Ecol.*, 237:127-140.

KENNY, A. J., REES, H. L., GREENING, J., & S. CAMPBELL, 1998. The effects of marine gravel extraction on the macrobenthos at an experimental dredge site off north Norfolk, U.K. (Results 3 years post-dredging). *ICES CM 1998/V*:14, pp. 1-8.

LANE, S.B. & R.A. CARTER, 1999. *Generic Environmental Management Programme for Marine Diamond MIning off the West Coast of South Africa*. Marine Diamond Mines Association, Cape Town, South Africa. 6 Volumes.

LONGHURST, A.R., 2006. *Ecological geography of the sea*. 2nd Edition. Academic Press, San Diego, 542 pp., ISBN: 0124555217.

MAARTENS, L., 2003 - Biodiversity. In: Molloy, F. & T. Reinikainen (Eds). *Namibia's Marine Environment*. Directorate of Environmental Affairs, Ministry of Environment and Tourism, Namibia: 103-135.

MARTIN A P., 1997. African Black Oystercatcher. *In: The Atlas of Southern African Birds. Volume 1: Non-passerines*. Harrison J A, Allan D G, Underhill L G, Herremans M, Tree A J,

Parker V and Brown C J (eds.). BirdLife South Africa. Johannesburg, South Africa. pp 374-375.

MATTHEWS, S.G. & G.C. PITCHER, 1996. Worst recorded marine mortality on the South African coast. In: *Harmful and Toxic Algal Blooms*. Eds. Yasumoto, T, Oshima, Y., Fukuyo, Y. Intergovernmental Oceanographic Commission of UNESCO, pp 89-92.

MATTHEWS, J.P. & N.L. SMIT, 1979. Trends in the size composition, availability, egg-bearing and sex ratio of the rock lobster *Jasus lalandii* in its main fishing area off South West Africa, 1958-1969. *Investl. Rep. Div. Sea Fish. S. Afr.*, **103**: 1-38

McLACHLAN, A., 1980. The definition of sandy beaches in relation to exposure: a simple rating system. *S. Afr. J. Sci.*, **76**: 137-164.

MIDGLEY, D.C. & W.V. PITMAN, 1969. Surface water resources of South Africa: *Rep. No. 2/69*, *Hydrol. Res. Unit*, Univ. Witwatersrand, Johannesburg.

MINISTRY OF ENVIRONMENT AND TOURISM. Republic of Namibia. 2012. Namibia's Coast; Ocean Riches and Desert Treasures, Windhoek, 192 pp.

MINISTRY OF HEALTH AND SOCIAL SERVICES (MOHSS) and ICF INTERNATIONAL, 2014: Namibia Demographic and Health Survey, 2013. Windhoek, Namibia and Rockville Maryland, USA, pp 530.

MOLDAN, A.G.S., 1978. A study of the effects of dredging on the benthic macrofauna in Saldanha Bay. *S.Afr. J. Sci.*, **74**: 106-108.

MONTEIRO, P.M.S. & A.K. VAN DER PLAS, 2006. Low Oxygen Water (LOW) variability in the Benguela System: Key processes and forcing scales relevant to forecasting. In:

SHANNON, V., HEMPEL, G., MALANOTTE-RIZZOLI, P., MOLONEY, C. & J. WOODS (Eds). *Large Marine Ecosystems*, Vol. 15, pp 91-109.

NAMIBIAN COAST CONSERVATION MANAGEMENT PROJECT (NACOMA), 2015. Marine Protected Area's (MPA's): Namibian Islands MPA. Available: http://www.nacoma.org.na/Key_Activities/MarineProtectedAreas.htm. Accessed: 28/04/2015.

NAMIBIAN STATISTICS AGENCY, 2012. Namibia Household Incoem & Expenditure Survey (NHIES) 2009/2010. Windhoek, pp 20.

NELSON, G., 1989. Poleward motion in the Benguela area. In: Poleward Flows along Eastern Ocean Boundaries. NESHYBA *et al*. (eds) New York; Springer: 110-130 (Coastal and Estuarine Studies 34).

NELSON G. & L. HUTCHINGS, 1983. The Benguela upwelling area. *Prog. Oceanogr.*, 12: 333-356.

NEPRU. 2007. Economic Indicator Tables. Available: http:/www.nepru.org.na. Accessed: 5/12/2007.

NEWMAN, G.G. & D.E. POLLOCK, 1971. Biology and migration of rock lobster *Jasus lalandii* and their effect on availability at Elands Bay, South Africa. *Investl. Rep. Div. Sea Fish. S. Afr.*, **94**: 1-24.

NEXUS, 2015. Commonwealth Network, Namibia. Industry and Manufacturing overview. Available: http://www.commonwealthofnations.org/sectors-namibia/business/industry_and_manufacturing/. Accessed: 28/04/2015.

OLIVIER, J., 1992. Aspects of the climatology of fog in the Namib. *SA geographer* **19(2)**: 107-125.

OLIVIER, J., 1995. Spatial fog distribution pattern in the Namib using Meteosat images. *J. Arid Environments* **29**: 129-164.

OOSTHUIZEN W.H., 1991. General movements of South African (Cape) fur seals *Arctocephalus pusillus pusillus* from analysis of recoveries of tagged animals. *S. Afr. J. Mar. Sci.,* **11**: 21-30.

O'TOOLE, M.J. & D. BOYER, 1998. An overview of fisheries and some marine environmental issues in Namibian waters. First Regional Workshop on the BCLME: July 22-24, 1998, Cape Town, South Africa.

PARRY, D.M., KENDALL, M.A., PILGRIM, D.A. AND M.B. JONES, 2003. Identification of patch structure within marine benthic landscapes using a remotely operated vehicle. *J.Exp.Mar.Biol.Ecol.,* 285– 286: 497–511.

PAYNE A.I.L., 1985. The sole fishery off the Orange River, Southern Africa. *Int. Symp. Upw. W. Afr. Inst. Pesq*., *Barcelona* vii: 1063-1079.

PAYNE A.I.L. & A. BADENHORST, 1989. Other Groundfish resources. *In*: PAYNE A.I.L. & R.J.M. CRAWFORD (Eds), *Oceans of Life off Southern Africa*, Vlaeberg, Cape Town, pp. 148-156.

PENNEY, A.J., PULFRICH, A., ROGERS, J., STEFFANI, N. & V. MABILLE, 2008. *Project: BEHP/CEA/03/02: Data Gathering and Gap Analysis for Assessment of Cumulative Effects of Marine Diamond Mining Activities on the BCLME Region.* Final Report to the BCLME mining and petroleum activities task group. December 2007. xxpp.

PITCHER, G.C., 1998. *Harmful algal blooms of the Benguela Current.* IOC, World Bank and Sea Fisheries Research Institute Publication. 20 pp.

POLLOCK, D.E., 1986. Review of the fishery for and biology of the the Cape rock lobster, *Jasus lalandii* with notes on larval recruitment. *Can. J. Fish. Aquat. Sci*., **42**: 2107-2117.

POLLOCK, D.E. & L.V. SHANNON, 1987. Response of rock-lobster populations in the Benguela ecosystem to environmental change – a hypothesis. *S. Afr. J. Mar. Sci*., 5: 887-899.

ROGERS, J., 1979. Dispersal of sediment from the Orange River along the Namib Desert coast. *S. Afr. J. Sci*., 75: 567 (abstract).

ROGERS, J. & J.M. BREMNER, 1991. The Benguela Ecosystem. Part VII. Marine-geological aspects. *Oceanogr. Mar. Biol. Ann. Rev*., 29: 1-85.

SAKKO, A., 1998. *Biodiversity of marine habitats*. In: BARNARD, P. (Ed.) Biological diversity in Namibia: a country study. Windhoek, Namibian National Biodiversity Task Force. pp 189-226.

SCHOEMAN, D.S., COCKCROFT, A.C., VAN ZYL, D.L. & P.C. GOOSEN, 2002a. Trap selectivity and the effects of altering gear design in the South African rock lobster *Jasus lalandii* commercial fishery. *S. Afr. J. mar. Sci*., **24**: 37-48.

SCHOEMAN, D.S., COCKCROFT, A.C., VAN ZYL, D.L. & P.C. GOOSEN, 2002b. Changes to regulations and the gear used in the South African commercial fishery for *Jasus lalandii*. *S. Afr. J. mar. Sci*., **24**: 365-369.

SEIDERER, L.J. & R.C. NEWELL, 1999. Analysis of the relationship between sediment composition and benthic community structure in coastal deposits: Implications for marine aggregate dredging. *ICES J. Mar. Sci.,* **56**: 757–765.

SHANNON, L.V., 1985. The Benguela Ecosystem. Part 1. Evolution of the Benguela, physical features and processes. *Oceanogr. Mar. Biol. Ann. Rev.*, **23**: 105-182.

SHANNON, L.V. & F.P. ANDERSON, 1982. Application of Satellite Ocean colour imagery in the study of the Benguela Current system. *S. Afr. J. Photogrammetry, Remote Sensing and Cartography*, **13(3)**: 153-169.

SHANNON, L.V. & G. NELSON, 1996. The Benguela: Large scale features and processes and system variability. In: *The South Atlantic: Present and Past Circulation*. WEFER, G., BERGER, W. H., SIEDLER, G. & D. J. WELLS (eds.). Berlin; Springer: 164-210.

SHANNON, L.V. & M.J. O'TOOLE, 1998. BCLME Thematic Report 2: Integrated overview of the oceanography and environmental variability of the Benguela Current region. *Unpublished Report*, 58pp

SHANNON, L.J., C.L. MOLONEY, A. JARRE and J.G. FIELD, 2003. Trophic flows in the southern Benguela during the 1980s and 1990s. *Journal of Marine Systems*, **39**: 83 - 116.

SHAUGHNESSY P.D., 1979. Cape (South African) fur seal. In: Mammals in the Seas. *F.A.O. Fish. Ser. 5*, **2**: 37-40.

SHILLINGTON, F. A., PETERSON, W. T., HUTCHINGS, L., PROBYN, T. A., WALDRON, H. N. & J. J. AGENBAG, 1990. A cool upwelling filament off Namibia, South West Africa: Preliminary measurements of physical and biological properties. *Deep-Sea Res.*, **37 (11A)**: 1753-1772.

SIAPAC, 2004. Social Impact Assessment Specialist Report: Marine Dredging Project Environmental Impact Assessment. 30pp.

SIMMONS, R.E., CORDES, I. & R. BRABY, 1998. Latitudinal trends, population size and habitat preferences of Damara Terns *Sterna balaenarum* on Namibia's desert coast. *Ibis* **140**: 439-445.

SMITH, H., 2007. *Uranium in Namibia. Opportunities for the new Alchemists*. The Chamber of Mines. Windhoek. Namibia.

SMITH, G.G., MOCKE, G.P. & C. SOLTAU, 1999. Coastal process modelling in support of mining operations on the southern Namibian coastline. In: MOCKE, G.P. (ed.), *Fifth International Conference on Coastal and Port Engineering in Developing Countries.* Cape Town, South Africa, pp 824-836.

SMITH, G.G & G.P. MOCKE, 2002. Interaction between breaking/broken waves and infragravity-scale phenomena to control sediment suspension and transport in the surf zone. *Marine Geology*, **187**: 1640-345.

SNELGROVE, P.V.R. & C.A. BUTMAN, 1994. Animal–sediment relationships revisited: cause versus effect. *Oceanogr. Mar. Biol. Ann. Rev.,* **164**: 164–177.

TOMALIN, B.J., 1996. Specialist study on impacts of diamond mining on rock-lobster populations and the fishery. *In*: Environmental Impact Assessment of Marine Diamond Mining in the Namibian Islands Concession, *CSIR Report EMAS-C96023*, 33 pp.

VAN DALFSEN, J.A., ESSINK, K., TOXVIG MADSEN, H., BIRKLUND, J., ROMERO, J. & M. MANZANERA, 2000. Differential response of macrozoobenthos to marine sand extraction in the North Sea and the Western Mediterranean. *ICES J.Mar.Sci.* 57: 1439–1445.

VAN DER MERWE, J.H., 1983. *National Atlas of South West Africa*. National Bookprinters, Goodwood, Cape, 92 pp.

VERMEER, G.K., 1987. Effects of air exposure on desiccation rate, haemolymph chemistry, and escape behaviour of the spiny lobster *Panulirus argus*. *Fishery Bull., Wash.*, **85(1)**: 45-51.

VISSER G.A., 1969. Analysis of Atlantic waters off the coast of southern Africa. *Invest. Rep. Div. Sea Fish. S. Afr.*, **75**: 26 pp.

WALDRON, F.W., 1901. On the appearance and disappearance of a mud island at Walfish Bay. *Trans. S. Afr. Phil. Soc.*, **11(1)**: 185-194.

WARD, L.G., 1985. The influence of wind waves and tidal currents on sediment resuspension in Middle Chesapeake Bay. *Geo-Marine Letters*, **5**: 1-75.

WARWICK, R.M., GOSS-CUSTARD, J.D., KIRBY, R., GEORGE, C.L., POPE, N.D. & A.A. ROWDEN, 1991. Static and dynamic environmental factors determining the community structure of estuarine macrobenthos in SW Britain: why is the Severn estuary different? *J.Appl.Ecol.* 28: 1649–345.

WEEKS, S., CURRIE, B. & A. BAKUN, 2002. Massive emissions of toxic gas in the Atlantic. *Nature*, **415**: 493-494.

WORLD BANK GROUP, 2015: Economic Indicator Tables for Namibia. Available: http://databank.worldbank.org/data/views/reports/tableview.aspx. Accessed 28/04/2015

YATES, M.G., GOSS-CUSTARD, J.D., MCGRORTY, S.M., LAKHANI, DIT DURRELL, S.E.A., LEVIT, CLARKE, R.T., RISPIN, W.E., MOY, I., YATES, T., PLANT, R.A. & A.J. FROST, 1993. Sediment characteristics, invertebrate densities and shorebird densities on the inner banks of the Wash. *J. Appl. Ecol.,* **30**: 599– 614.

ZAJAC, R.N., LEWIS, R.S., POPPE, L.J., TWICHELL, D.C., VOZARIK, J., & M.L. DIGIACOMO-COHEN, 2000. Relationships among sea-floor structure and benthic communities in Long Island Sound at regional and benthoscape scales. *J. Coast. Res.,* **16**: 627– 640.

ZOUTENDYK, P., 1992. Turbid water in the Elizabeth Bay region: A review of the relevant literature. *CSIR Report EMAS-I 92004*.

ZOUTENDYK, P., 1995. Turbid water literature review: a supplement to the 1992 Elizabeth Bay Study. *CSIR Report EMAS-I 95008*.

10. ANNEXES

Annex 1 – Copy of the Current ECC

Annex 2 – EIA Report 2010

Annex 3 – EMP Report 2010