DEBMARINE NAMIBIA

A NAMIBIA DE BEERS PARTNERSHIP

Final 2024 Updated Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) Report to Support the Application for Renewal of Environmental Clearance Certificate (ECC) for Marine Diamond Exploration, Recovery and Production Operations in the Mining License (ML) No. 47 (Licensed Area), Shallow Marine Environment, //**Karas Region Southern Namibia**

JUNE 2024

De Beers Marine Namibia (Pty) Ltd
Namdeb Centre, 10 Dr. Frans Indongo Street
P.O. Box 23016
WINDHOEK, NAMIBIA

PROJECT INFORMATION SUMMARY

MEFT ECC No. 01611 Renewal Application Reference No.
APP-002694

Competent Authority
Ministry of Mines and Energy (MME)

License Type / Name / No.
Mining License (ML) No. 47 (Licensed Area)

License Validity
Granted 23rd November 1995 and Expire 22nd November 2035

Reference Project Location
Shallow Marine Environment, //Karas Region, Southern Namibia
(Latitude: -23.362500, Longitude: 18.534444)

Type of Listed Activities
Marine Diamond Exploration and Recovery

Name of the Proponent
De Beers Marine Namibia (Pty) Ltd

Address of the Proponent and Contacts
4th Floor, Namdeb Centre, 10 Dr Frans Indongo Street
P. O. Box 23016, **Windhoek Namibia**

RESPONSIBLE PERSON: **Chief Executive Officer**
Tel No.: +264 61 297 8000, Fax No.: +264 61 297 8100

CONTACT PERSON: Environmental Manager
Tel No.: + 264 61 297 8215, Fax No.: + 264 61 297 8120

ENVIRONMENTAL / PERMITTING DE-RISKING CONSULTANTS

Risk-Based Solutions (RBS) CC
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Windhoek Central Business District (CBD), P. O. Box 1839, WINDHOEK, NAMIBIA
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ENVIRONMENTAL ASSESSMENT PRACTITIONER (EAP)

Dr Sindila Mwiya
PhD, PG Cert, MPhil, BEng (Hons), Pr Eng

CITATION: *Risk-Based Solutions (RBS), 2024. De Beers Marine Namibia (DBMN) Final Updated Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) Report to support the Application for Renewal of Environmental Clearance Certificate (ECC) for Marine Diamond Exploration, Recovery and Production Operations in the Mining License (ML) No. 47 (Licensed Area), Shallow Marine Environment, //Karas Region Southern Namibia.*

DR SINDILA MWIYA EAP DECLARATION

I, Dr Sindila Mwiya, the Environmental Assessment Practitioner (EAP) for this updated Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) Report prepared to support the application for the renewal of the Environmental Clearance Certificate (ECC) No. 01611 granted by the Environmental Commissioner (EC) in the Ministry of Environment, Forestry and Tourism (MEFT) for the ongoing diamond exploration, recovery, and production operations in the Mining License (ML) No. 47 (Licensed Area) being operated by De Beers Marine Namibia ("DBMN") (Pty) Ltd, the (Proponent), on behalf of the license holder Namdeb Holdings (Pty) Ltd, hereby declares that:

1. This Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) Report has been prepared in accordance with the provisions of the Minerals (Prospecting and Mining) Act, 1992, (Act No. 33 of 1992), the Environmental Management Act, 2007, (Act No. 7 of 2007) and all other applicable national laws and regulations.

2. As an EAP for the ECC No. 01611 renewal application, I am qualified and experienced Engineering and Environmental Geologist and hold a PhD with research interests, academic training and technical knowledge in Engineering Geology / Geotechnical / Geoenvironmental / Environmental Engineering, Artificial Intelligence and Knowledge-Based Systems with special focus on Environmental Impact Assessments (EIAs), Environmental Management Plans (EMPs), Environmental Management Systems (EMSs), Strategic Environmental Assessments (SEAs) and Strategic Environmental Management Plans (SEMPs) utilisation for subsurface resources (minerals, petroleum, water) and energy utilisation covering the onshore and offshore environments.

3. I have knowledge and experience in conducting environmental assessments, management, and monitoring, and have undertaken more than 300 projects since 2004, including more than 200 minerals exploration, recovery, and production related environmental assessments, management, and monitoring projects.

4. I have performed the work relating to the renewal of the ECC No. 01611 application in an objective manner, even if the outcomes will result in views or Record of Decision (RoD) that may not be favourable to the stakeholders, Interested and Affected Parties (I&APs) or the Proponent.

5. I am an independent consultant not related to the Proponent, I co-own and operate an independent company (Risk-Based Solutions CC) not related to the Proponent and I have no shares, interests, or involvement in the license, financial or other affairs or business or operational decisions of either the Proponent, license holder or the decision-making structures of the relevant Government Institutions.

.....

Dr Sindila MWIYA
Environmental Assessment Practitioner (EAP)
RISK-BASED SOLUTIONS (RBS) CC

DEBMARINE

ENVIRONMENT POLICY

Debmarine Namibia is a joint venture marine diamond prospecting and recovery Company, owned in equal shares by the Government of the Republic of Namibia and De Beers.

The Company embraces the concept of sustainable development and pursues the highest standards of environmental management in all aspects of its offshore and onshore operations.

The employees, contractors and business partners, management and staff of Debmarine Namibia are committed to the protection of the environment by:

- Complying with applicable legal and other requirements related to the Company's environmental aspects;
- Allocating adequate resources to establish, implement, maintain and continually improve the Environmental Management System to enhance environmental performance;
- Setting environmental objectives and indicators within the framework of the ISO 14001 Environmental Management System;
- Minimising and mitigating potential environmental impacts associated with its activities, products and services;
- Conserving the use of water, energy and other natural resources by employing principles of reduction, recovery, re-use and recycling;
- Preventing pollution from wastes, emissions, effluents and harmful substances to the environment;
- Protecting the natural world by creating a positive legacy through our Building Forever 2030 goals on climate change, water and biodiversity;
- Supporting responsible planning and stewardship of biodiversity and advancing biodiversity knowledge in areas within which we operate from exploration through to closure of operations;
- Respecting legally designated Protected Areas and key biodiversity areas and not operating within World Heritage sites;
- Communicating the environmental policy and significant environmental aspects to all employees, contractors and stakeholders; and ensure integration in the business processes;
- Reporting and providing assurance on environmental risks and performance.

Willy Mertens
CHIEF EXECUTIVE OFFICER

March 2024 (2002, Rev 1)
DATE

DEBMARINE

SUSTAINABILITY POLICY

Environment, Community, Health, Employment Equity & Diversity, Safety, Social & Ethical Performance and Security

In conducting its business, Debmarine Namibia will have the highest regard for the achievement of Sustainability set standards and best practices. Debmarine Namibia is committed to maintaining and improving Sustainability performance in all its operations by:

- Ensuring Sustainability management systems are managed as an integral part of the Company's Business Plan through setting clear and attainable annual objectives and targets;
- Allocating resources to develop and implement appropriate Sustainability programmes to achieve set objectives and targets;
- Complying with relevant legislation, as well as other applicable requirements and global best practices;
- Continuously review risk assessments and the effectiveness of the applied controls focusing on the effectiveness of the critical controls to minimize these risks;
- Maintaining a healthy and safe working environment that is conducive to the prevention of any work related incidents through active hazard and opportunity identification and risk assessments;
- Reporting and investigating all incidents that may affect the Company, its employees, visitors, service providers, environment and the community and sharing any lessons learned with interested affected parties;
- Ensuring that impact assessments and good management processes are applied to all projects and operations and that the required steps are taken to minimize the impacts;
- Meeting our moral and statutory obligations through the process of joint consultation at all levels of the Company, worker's representatives and work place committees, and other interested affected parties;
- Enhancing employees participation and involvement through various mediums and continuous communication on Sustainability performance;
- Fostering openness and dialogue with stakeholders to address the Sustainability concerns of interested affected parties;
- Ensuring service providers comply with the Company's Sustainability management systems procedures and processes;
- Support regular audits to evaluate the effectiveness of the Sustainability management systems and take appropriate corrective measures to manage non conformances;
- Reviewing of the Sustainability management systems regularly to ensure these remains relevant and appropriate to the Company's purpose, ambition, values and strategy;

SUSTAINABILITY OBJECTIVES AND TARGETS/LIMITS

Improve performance through:
- Risk Management
- Assurance Audits
- Regular Emergency Exercises
- Training of employees and relevant service providers
- Stakeholder engagement and awareness programmes
- Reviewing effectiveness of systems and critical controls
- Employee participation and engagements

Maintain certification for:
- Affirmative Action Compliance Certificate
- ISM Code: Document of Compliance
- ISPS Code: Ship Security Compliance
- ISO 14001: Certificate
- ISO 45001: Certificate

Achieve:
- A Fatality Rate of Zero (0) (2023: 0)
- A Loss Time Injury Frequency Rate (LTIFR) limit of 0.69 (2023: 1.36)
- A Total Recordable Case Frequency Rate (TRCFR) limit of 0.95 (2023: 1.59)
- Delta Commander engagements minimum of 14 (2023: 18)
- An External Occupational Health audit score of not less than 90% (2023: 96%)
- Occupational Health (level 3 5) diseases of Zero (0) (2023: 0)
- High and major environmental (level 3 5) incidents of Zero (0) (2023: 0)
- Onboard fresh water generation of 96% (2023: 95%)
- Maintain security proactiveness of not less than 91% (2023: 91%)
- H IV 95/95/90 (2023: 96/100/79)

Willy Mertens
CHIEF EXECUTIVE OFFICER

PUT SAFETY FIRST TEAMWORK INTEGRITY EXCELLENCE RESPECT

March 2024 (2002, Rev 1)
DATE

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Non-Technical Summary

De Beers Marine Namibia ("**DBMN**") (Pty) Ltd, "**the Proponent**", holds exclusive contract for marine diamond exploration, recovery, and production operations over the licensed area Mining License (ML) No. 47 also called the Atlantic 1 Mining Licenses Area (MLA). The licensed area belongs to Namdeb Holdings (Pty) Ltd which owns a 100% share in De Beers Marine Namibia (DBMN). Namdeb Holdings is jointly and equally owned by the Government of the Republic of Namibia and De Beers Centenary. The ongoing diamond exploration, recovery, and production operations in the licensed area falls under the activities that are listed in the Environmental Management Act, 2007, (Act No. 7 of 2007) and cannot be undertaken without a valid Environmental Clearance Certificate (ECC).

To obtain an ECC, DBMN is required to have undertaken environmental assessment process comprising the preparation of Scoping/ Background Information Document (BID), updated Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) reports and environmental monitoring reports. The current ECC No. 01611 was granted to DBMN on the 9th September 2021 and will expire on the 9th September 2024 and need to be renewed. The current ECC No. 01611 was granted by the Environmental Commissioner in the Ministry of Environment, Forestry and Tourism (MEFT) with respect to the ongoing marine diamond exploration, recovery, and production operations in the ML No. 47.

This updated EIA and EMP report has been prepared based on the Terms of Reference (ToR) as provided in Scoping/ Background Information Document (BID) to support the application for the renewal of the current ECC No. 01611 for DBMN expiring on the 9th September 2024. The report has been prepared by Risk-Based Solution (RBS) CC, an independent technical specialist consultant, permitting and de-risking advisors in natural resources company led by Dr Sindila Mwiya as the Environmental Assessment Practitioner (EAP). The report has been prepared in accordance with the provisions of the Environmental Management Act, 2007, Environmental Impact Assessment (EIA) Regulations 2012, the Minerals Act, 1992, DBMN Environmental and Sustainability Policies as well as all other related operational and contractual obligations.

DBMN operations involves a robust logistical arrangement in the search (exploration) and recovery and production of marine diamonds. Exploration activities involves the use of 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 sampling process is used to validate the geophysical survey and collects key data sets that is used in the final resource evaluation, geotechnical engineering assessment and determination of the correct recovery and production techniques to be used. The mv SS Nujoma is the only exploration and sampling vessel in the DBMN Namibia fleet.

Marine diamonds recovery operations involve the extraction of seabed materials, on-board processing and diamond capturing process. The following is the summary of the two types of seafloor diamond recovery techniques that are used depending on the geotechnical engineering determination:

- The airlift-drill technology, which uses a 6.8 meter in diameter drill bit working in overlapping circles on the sea floor, and.

- The crawler technology, which uses a 280-tonne truck-mounted crawler dredging on the sea floor.

Within its own fleet, DBMN currently owns six (6) production vessels, the mv AMV3, the mv. Mafuta, the mv. Grand Banks, the mv. Debmar Atlantic, the mv. Debmar Pacific and the mv. !Gariep. Additionally, the Coral Sea has been chaptered and bringing the total number of recovery and production vessels to seven (7). Five (5) of the production vessels use the airlift-drill technology, whilst only two (2) vessels (mv Mafuta and the mv. AMV3) uses the crawler technology. Seafloor diamonds recovery process takes place in the licensed area and in water depths of between 94 – 154 m. The production vessels are self-contained units, with onboard diamond processing facilities, and operate 24-hours a day for 12 months of the year, with a dry-docking scheduled every third year.

The receiving environment of 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.

Sediment distribution on the continental shelf is strongly influenced by the Orange River, and consequently river-related sediments are found overlying the bedrock both north and south of the river mouth, attaining a maximum thickness of 60 m. The dominant role of wave action along the coastline is reflected in a subtle but definite fining of the sediments seaward. 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.

The Tsau //Khaeb (Sperrgebiet) National Park coastline is an important habitat for breeding and migrant seabirds as well as for wetland birds, which occur along the coastline and near shore areas adjacent to the licensed area. A number of these bird species are listed as Endangered and Near Threatened by the International Union for Conservation of Nature (IUCN). The proclamation of the Orange River Mouth area in 1991 as a "Wetland of International Importance" in terms of the Ramsar Convention gives official recognition to its vital importance to migrant and resident bird species. Within the marine environment, DBMN operations falls within the larger Benguela upwelling ecosystem. Diamond exploration, recovery, and production operations are undertaken outside the Namibian Islands' Marine Protected Area (NIMPA) which was proclaimed in 2009 covering 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.

Hake utilises inshore (100-300 m deep) and offshore (400-1000m deep) areas for spawning on the western Agulhas Bank (Augustyn et al. 2018) with a nursery area known as the "Orange Banks", located offshore (along the 200 m depth contour) (Mbatha et al. 2019) beyond the outer limits of Atlantic 1 MLA. Two separate stocks of sardine occur on the west coast of Namibia; a southern and northern stock separated by the Lüderitz upwelling cell (Coetzee et al. 2019). The southern stock is of relevance to DBMN operations and is known to spawn on the western Agulhas Bank with the west coast of South Africa serving as a nursery area (Miller et al. 2006, Coetzee et al. 2019). Horse mackerel also consist of a northern and southern stock with the latter occurring southward of Lüderitz and spawning on the Agulhas bank (Barange et al. 1998).

In addition, kingklip that are present south of Lüderitz are considered part of the same stock that spawn on the eastern part of the Agulhas Bank (Punt and Japp 1994). Atlantic 1 MLA does, however, overlap with the Orange Cone Area, which has recently (2013) been advocated as an Ecologically or Biologically Significant Area (EBSA) in terms of the Convention on Biodiversity and has been earmarked for some level of protection in future.

Although 40% of Namibian demersal catches are from the southern region, the overall fishing grounds off the licensed area are seldom visited by the commercial fleets due to the extended distances from the major fishing harbours of Lüderitz and Walvis Bay. The commercial rock lobster fishery in Namibia is centred on Lüderitz and forms an important part of the socioeconomic environments of southern Namibia.

DBMN has a significant positive socioeconomic impact on Namibia and its people. The Company has 964 and 6 permanent and Temporary employees, of which one quarter is based at its head office in Windhoek, and three quarters are sea-going employees. The crew members operate on twenty-eight (28) days on, twenty-eight (28) days off shift system. The Company puts significant emphasis on skills development through a wide range of programmes including: Bursaries, technical training, long-term trainee, self-study assistance, leadership development and safety awareness. Annual expenditure on human resource development in excess of N$20 million. The DBMN's Social Responsibility Fund continues to make donations to various worthy causes, with a focus on education (science and technology), sustainable enterprise development and health.

Tables 1 and 2 summarises the key negative impacts of high and medium significances respectively and the associated management intervention measures that DBMN continues to implement and monitor and audit internally and externally. The impacts of offshore diamond recovery are considered to be of

low significance given that the area of the shelf that has been affected by mining to date remains low (less than 1% of the total shelf area in the Southern Benguela Outer Shelf bioregion) and the benthic fauna are characterised by generalist species with a wide distribution. The areas affected past and current and likely to be affected by future exploration, recovery and production operations are also not considered to be especially important as a spawning and nursery area for commercially important species.

Table 1: Summary of likely negative impacts of high significance.

Impacts of High Significance	**Management Intervention Measures**
❖ Recovery 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 recovery subregions P,O,N,X,W and V.
❖ 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.
❖ Operational Closure	It is essential that DBMN embark upon the development of a Operational Closure Plan, which includes social and labour issues, to manage the risks associated with the closure of operations.

Table 2: Summary of likely negative impacts of medium significance.

Impacts of Medium Significance	**Management Measures and Mitigation**
❖ Sediment removal during seabed sampling ❖ Benthic community impacts of recovery and production ❖ Tailings disposal (smothering of benthic communities) ❖ 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 recovery and production area that will not be directly or indirectly impacted by the operations in the foreseeable future. Such areas could also serve as pristine reference sites in long-term monitoring studies assessing recovery and production impacts.
❖ Habitat alteration	The alternative of no recovery and production operations, and the option of not disposing tailings overboard while conducting recovery and production operations.
❖ Release of H_2S from muds	For safety reasons it is essential that on-board air quality is monitored during recovery and production operations in the licensed 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 recovery and production	Optional measures include no repeated recovery and production areas.
❖ Archaeological, paleontological and historical aspects	It is essential that the relevant managers and specialists be informed on finding of historical material and that artefacts are retained and recovery and production 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.

Environmental performance monitoring activities shall be undertaken before, during and after exploration, recovery, and production operations because this approach will make it possible to identify unpredicted effects and take the necessary precautions to eliminate the likely negative impacts before

the effects become significant. Environmental performance monitoring activities including the EMP and internal and external EMP and EMS monitoring and auditing respectively, shall be implemented.

The Environmental Performance Monitoring activities that have been undertaken for both exploration, recovery, and production operations for the period under review, 2021-2024 shall continue to be implemented, monitored and externally audited annually.

Overall, DBMN has implemented all the applicable mitigation measures and monitoring, thereof with respect to the Company's Strategic Business (exploration, recovery, and production operations) undertaken for the period under review (2021-2024) ECC validity period.

The monitoring activities shall be undertaken in accordance with the provisions of the Environmental Clearance Certificate (ECC), the Environmental Management Plan (EMP) and DBMN Environmental Policy and International Organization for Standardisation (ISO) 14001 Environmental Management System (EMS) standard.

Based on the results of the overall environmental performance monitoring undertaken for the period under review, 2021-2024 and this updated EIA and EMP report, it is hereby recommended that the Proponent (DBMN) be issued with a new ECC for the ongoing and future marine diamonds exploration (geophysical survey and sampling), recovery and production operations in the ML No. 47 and all the associated logistical arrangements.

1. BACKGROUND

1.1 Overview

De Beers Marine Namibia ("**DBMN**") (Pty) Ltd, "**the Proponent**", holds an exclusive contract for marine diamonds exploration, recovery and production operations over the licenced area, Mining License (ML) No. 47 also known as the Atlantic Mining License Area (MLA) (Figs. 1.1-1.3). The 598318.4748 Ha ML No. 47 area was granted to Namdeb Holdings (Pty) Ltd by the Competent Authority, the Ministry of Mines and Energy (MME) for base and rare metals and precious metals on the 22nd November 2020 and will expire on the 22nd November 2035.

The ongoing marine diamond exploration, recovery and production operations being undertaken by DBMN in the licensed area are listed in the Environmental Management Act, 2007, (Act No. 7 of 2007) and cannot be undertaken without a valid Environmental Clearance Certificate (ECC) issued by the Environmental Commissioner (EC) in the Ministry of Environment, Forestry and Tourism (MEFT). The current DBMN ECC No. 01611 was issued on the 9th September 2021 and is valid for a period of three (3) years and will be expire on the 9th September 2024 (Fig. 1.4). The ECC was issued following the approval of the updated Environmental Impact Assessment (EIA), Environmental Management Plan (EMP) and Environmental Monitoring Reports submitted by DBMN to the Environmental Commissioner (EC). This updated EIA and EMP report has been prepared to support the application for the renewal of the current ECC No. 01611 expiring on the 9th September 2024 (Fig. 1.4). This report has been prepared by Risk-Based Solution (RBS) CC, an independent technical specialist consultant, permitting and de-risking advisors in natural resources company led by Dr Sindila Mwiya as the Environmental Assessment Practitioner (EAP). The report has been prepared in accordance with the provisions of the Environmental Management Act, 2007, Environmental Impact Assessment (EIA) Regulations 2012, the Minerals Act, 1992, DBMN Environmental and Sustainability Policies as well as all other related operational and contractual obligations.

1.2 Structure and Profile of DBMN (Proponent)

Namdeb and De Beers Marine Namibia (Pty) Ltd (DBMN) are wholly owned subsidiaries of Namdeb Holdings (Pty) Ltd (Fig. 1.5). Namdeb Holdings (Pty) Ltd holds all land-based and marine licensed areas, and Namdeb and DBMN perform land-based and marine exploration, recovery, and production operations respectively on behalf of Namdeb Holdings. Namdeb Holdings is equally owned by De Beers Holdings (Pty) Ltd and the Namibian Government (GRN). The representation by the ultimate shareholders (De Beers and GRN) on the board of DBMN is in proportion to their respective equity stakes (50% from De Beers and 50% from GRN). De Beers S.A. owns 100% of the share in De Beers UK Limited. De Beers UK Limited in turn owns 100% of the shares in De Beers Namibia Holdings (Pty) Ltd DBNH owns 50% of the shares in Namdeb Holdings (Pty) Ltd while the Government of the Republic of Namibia owns the other 50%. Namdeb Holdings (Pty) Ltd owns 100% of the shares in both Namdeb Diamond Corporation (NDC) (Pty) Ltd and De Beers Marine Namibia (DBMN) (Pty) Ltd. These two entities are therefore wholly owned subsidiaries of Namdeb Holdings (Pty) Ltd. DBMN operates under the provisions of the marine exploration, recovery, and production services agreement entered between Namdeb Holdings (Pty) Ltd and De Beers Marine Namibia (Pty) Ltd. This is so in some instances but nowhere has Anglo or De Beers been appointed as technical partner.

As one of two operating companies wholly owned by Namdeb Holdings (Pty) Ltd, the Management of De Beers Marine Namibia (the Proponent) through the Chief Executive Officer (CEO) is accountable to the Board of Directors for the operational, legal, and financial control of its affairs. DBMN therefore has no Management Committee (only an Executive Committee). Within the Company, the Chief Executive Officer (CEO) directs company activities by direct communication with an Executive Committee (EXCO) comprising an Operations Manager, Financial Manager, Mineral Resources Manager, Senior Human Resources Manager, Security Manager, Strategic Projects and Engineering Manager and Information Technology manager. These managers in turn form the organisational structure of the Company and lead activities within their respective departments that inter-relate in the combined set of activities of the Company. Although all the diamonds recovered are indirectly the property of the state, the revenue derived from sale of the diamonds (less taxes and royalties) are credited to De Beers Marine Namibia via Namdeb Holdings.

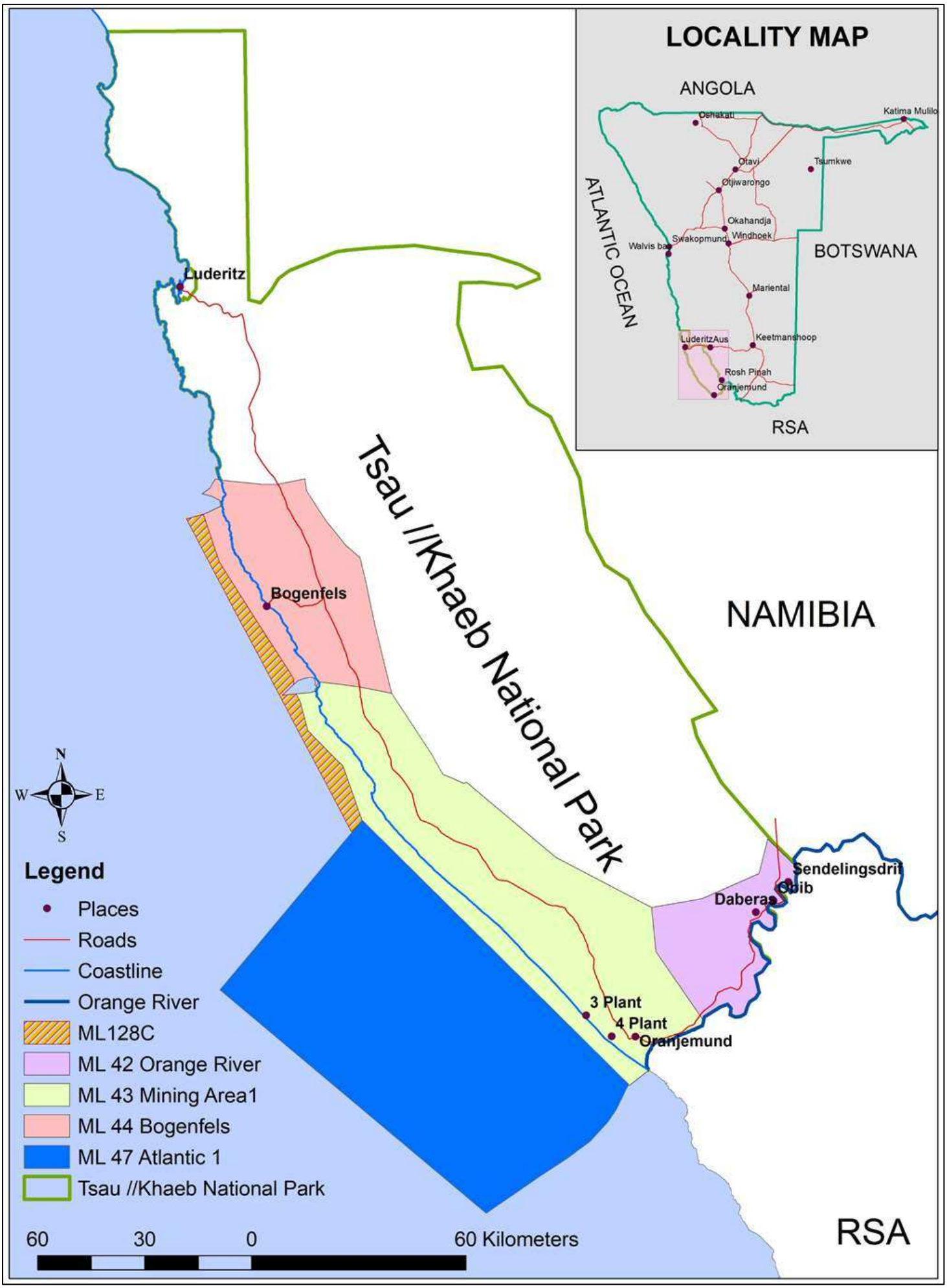

Figure 1.1: Location of licensed areas of Namdeb Holdings in Namibia (Source: DBMN, 2024).

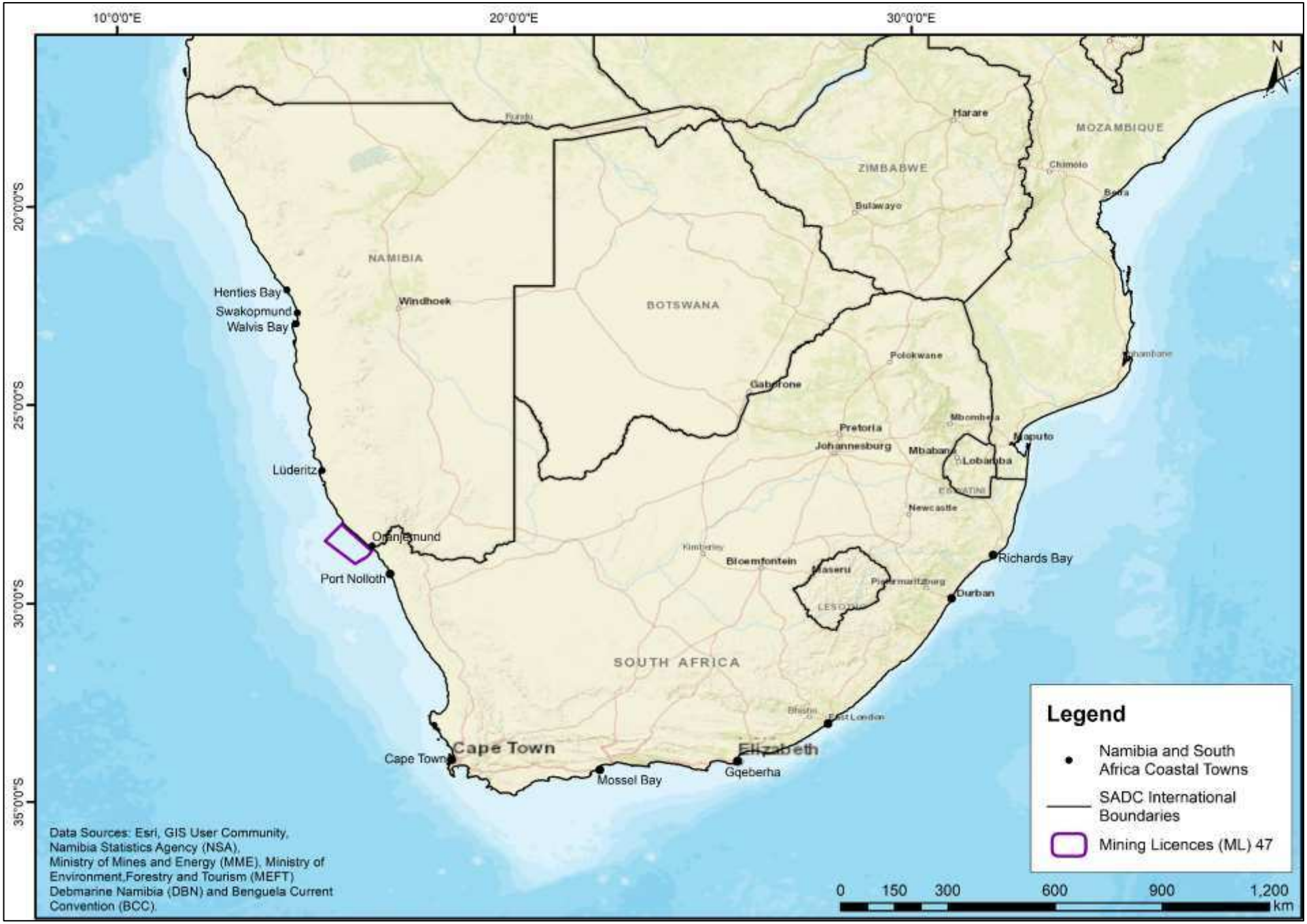

Figure 1.2: Regional location of the ML No. 47 and the associated logistical centres of Oranjemund (nearest to the ML area), Lüderitz, 160 km direct plan distance to the north, Cape Town (South Africa) 600 km to the south, and Walvis Bay 700 km to the north.

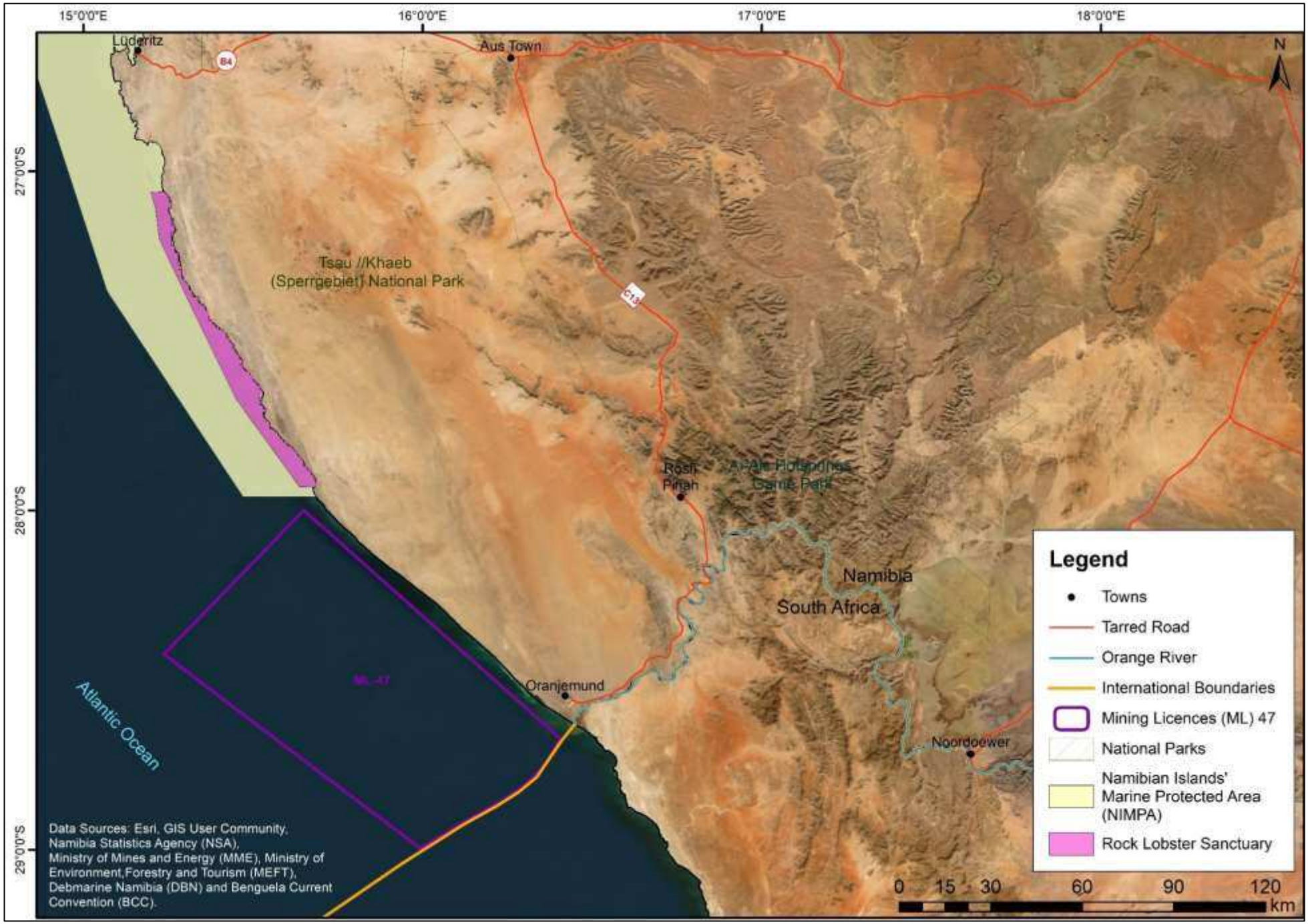

Figure 1.3: Detailed regional location of the ML No. 47 showing the bathometry of the licensed and surrounding areas.

ECC – 01611 Serial: MYHkTa1611

REPUBLIC OF NAMIBIA

MINISTRY OF ENVIRONMENT, FORESTRY AND TOURISM

OFFICE OF THE ENVIRONMENTAL COMMISSIONER

ENVIRONMENTAL CLEARANCE CERTIFICATE

ISSUED

In accordance with Section 37(2) of the Environmental Management Act (Act No. 7 of 2007)

TO

De Beers Marine Namibia (DBMN) (Pty) Ltd
P. O. Box 23016, Windhoek

TO UNDERTAKE THE FOLLOWING LISTED ACTIVITY

Marine diamond exploration, recovery and production operations in Atlantic 1 Mining License (ML), Mining License No. 47 offshore, Southwest Namibia

13 SEP 2021

ENVIRONMENTAL COMMISSIONER

Issued on the date: **2021-09-09**

Expires on this date: **2024-09-09**

(See conditions printed over leaf)

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NAMIBIA TRASH BIN

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Figure 1.4: Copy of the ECC No. 01611 for the ongoing diamond exploration, recovery, and production operations in the Mining License (ML) No. 47 (Licensed Area) ranted by the EC in the MEFT on the 9th September 2021 and expiring on 9th September 2024.

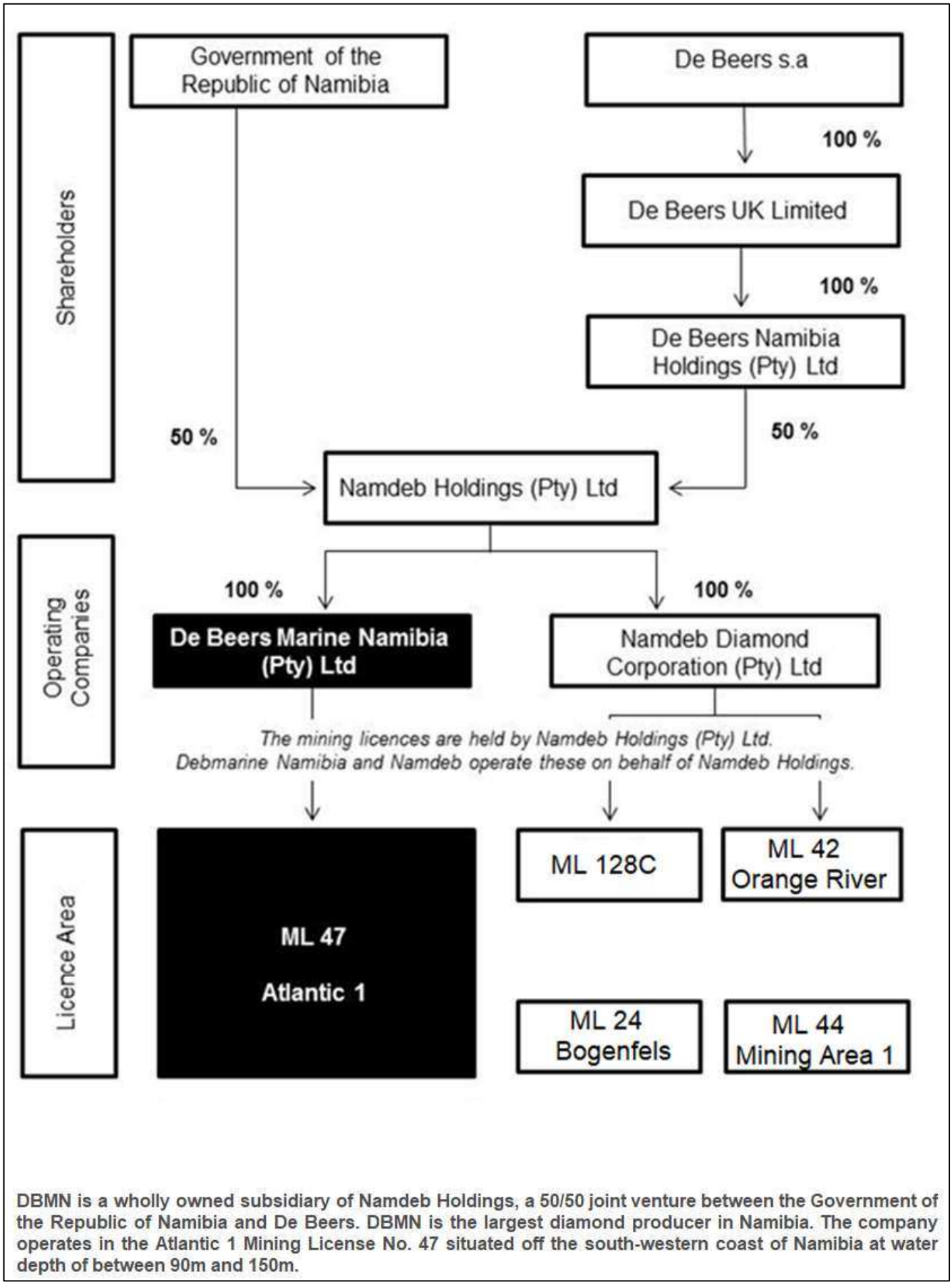


Figure 1.5: Shareholding structure, operational companies, and license areas (Source: DBMN, 2024).

1.3 Detailed Location and History of licensed area

1.3.1 Detailed Location and Description of the Atlantic MLA

The licensed area is situated in the south-eastern corner of the Namibian Exclusive Economic Zone (EEZ) (Figs. 1.1- 1.3). The total license area is about 5,987 km^2 with varying water depths from 20 m to 180 m (Figs. 1.6 and 1.7). The nearest town is Oranjemund which is used for helicopter and all the associated logistic services. The nearest Namibian port is that of Lüderitz, some 160 km (direct plan distance) to the north. The closest ports of international standing are those of Cape Town (South Africa) some 600 km to the south, and Walvis Bay (Namibia) 700 km to the north (Figs. 1.2 and 1.3).

The current mineable resource is located close to the Orange River Mouth between approximately 94 - 154 m water depths (Figs. 1.7-1.9). The most prospective portion of the entire licensed area has been divided into regional recovery and production blocks numbered A – Y, and recently extended to cover the entire leasehold in line with the adopted exploration, recovery, and production operational survey system (Fig. 1.7). The south-eastern limit is the international boundary between the EEZs of the Republics of Namibia and South Africa. The area, which extends ~110 km to the northwest and is about 60 km wide, is separated from the coastline by a 5 km wide coast-parallel strip forming part of Namdeb's onshore ML 43 (Figs. 1.6-1.9).

1.3.2 History of the ML No. 47

Previously known as Consolidated Diamond Mines (CDM) (Proprietary) Ltd, Namdeb Diamond Corporation (Proprietary) Ltd (Namdeb) has held licences in the areas known as Diamond Area 1 (Sperrgebiet) and Diamond Area 2 since 1919. In 1961 an American entrepreneur, Sammy Collins, established a company known as Marine Diamond Corporation (Pty) Limited, (MDC), to explore and exploit diamond deposits in the sea adjacent to the coastal mines operated by Consolidated Diamond Mines (CDM) (Pty) Ltd on land. He discovered viable deposits in the sea, close inshore immediately to the north of Chameis Bay, and commenced production utilising specially constructed barges and a converted tank-landing craft. To secure additional financial backing, Collins approached De Beers Consolidated Mines (DBCM), of which CDM was a subsidiary.

An independent contractor, Ocean Science and Engineering (Pty) Limited (OSE) in collaboration with CDM carried out an evaluation exercise. De Beers later took over effective control of MDC and resumed the exploration tasks as CDM Marine (Pty) Limited. Active recovery and production, evaluation sampling and seabed mapping continued until early in 1971, when the known marine reserves were exhausted and marine recovery and production operations consequently ceased.

The CDM Marine was downgraded to a purely marine exploration arm, whose activities were directed to the deeper water areas, which had previously largely been ignored due to the physical challenges it presented. As the problems associated with recovery and production in increasing water depths were overcome, a widespread but low-grade diamondiferous deposit was detected, and in the early 1980s De Beers Marine (Pty) Ltd (DBM) was established. DBM proceeded to develop the groundwork for innovative operations in the deeper waters of the inner continental shelf.

Following Namibian independence, CDM became Namdeb Diamond Corporation (Pty) Ltd in 1994 and the single large marine concession area was consolidated into the ML 47 with the South African-based DBM formally appointed as a contractor to Namdeb. As a newly formed Windhoek-based Company, in 2001 and 2002 DBMN subsequently took over prospecting and diamonds recovery operations in Namdeb's offshore concessions on exclusive contract.

Today, DBMN provides the full spectrum of mineral resource management activities within the licensed area, including initial exploration, follow-up sampling, resource evaluation and active diamond recovery operations and environmental management and monitoring.

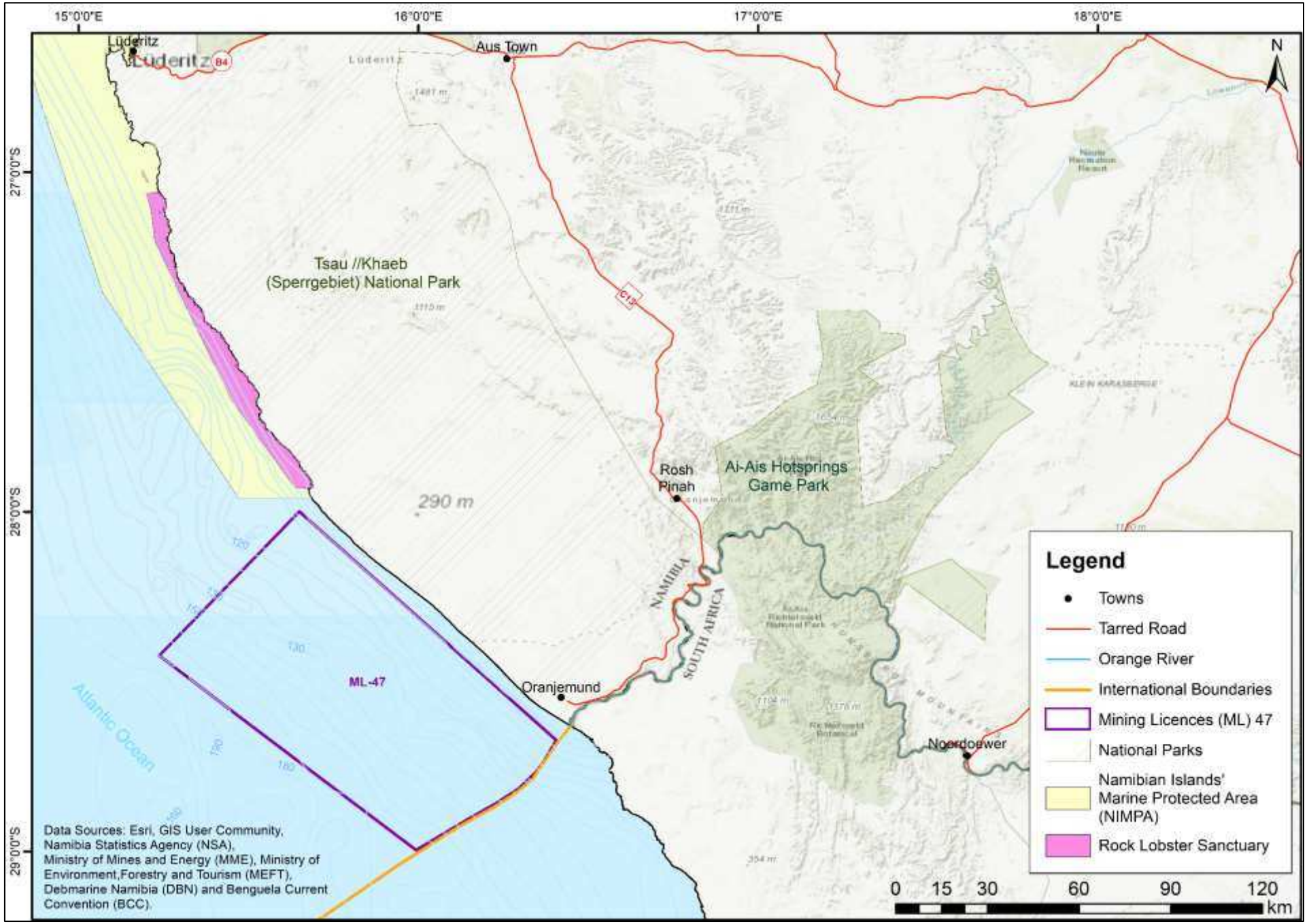


Figure 1.6: Detailed regional location of the ML No. 47 showing the bathometry of the licensed and surrounding areas.

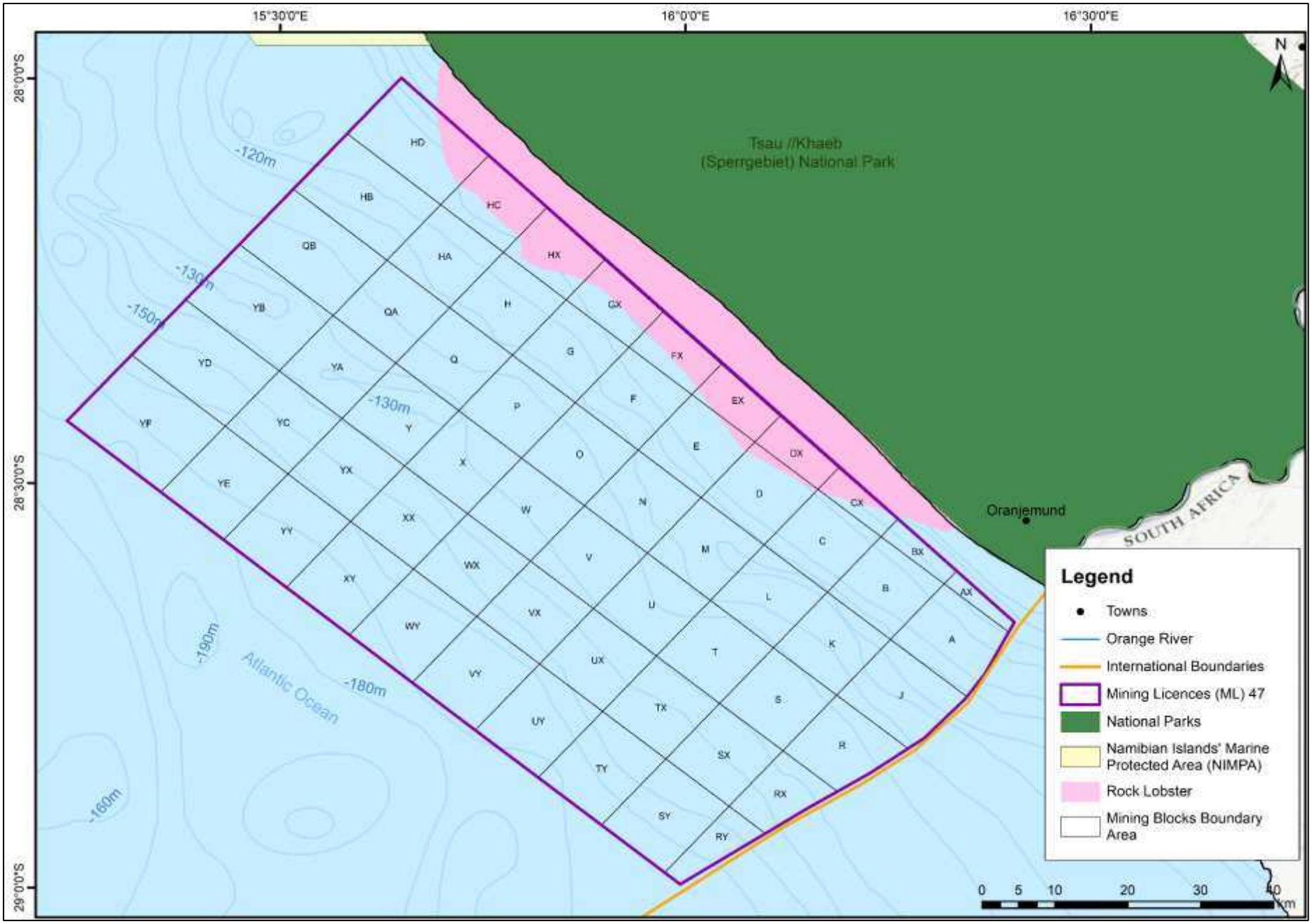


Figure 1.7: Detailed location of the ML No. 47 area showing the bathometry and exploration and recovery DBMN regional blocks survey system (Datta Source: DBMN 2024).

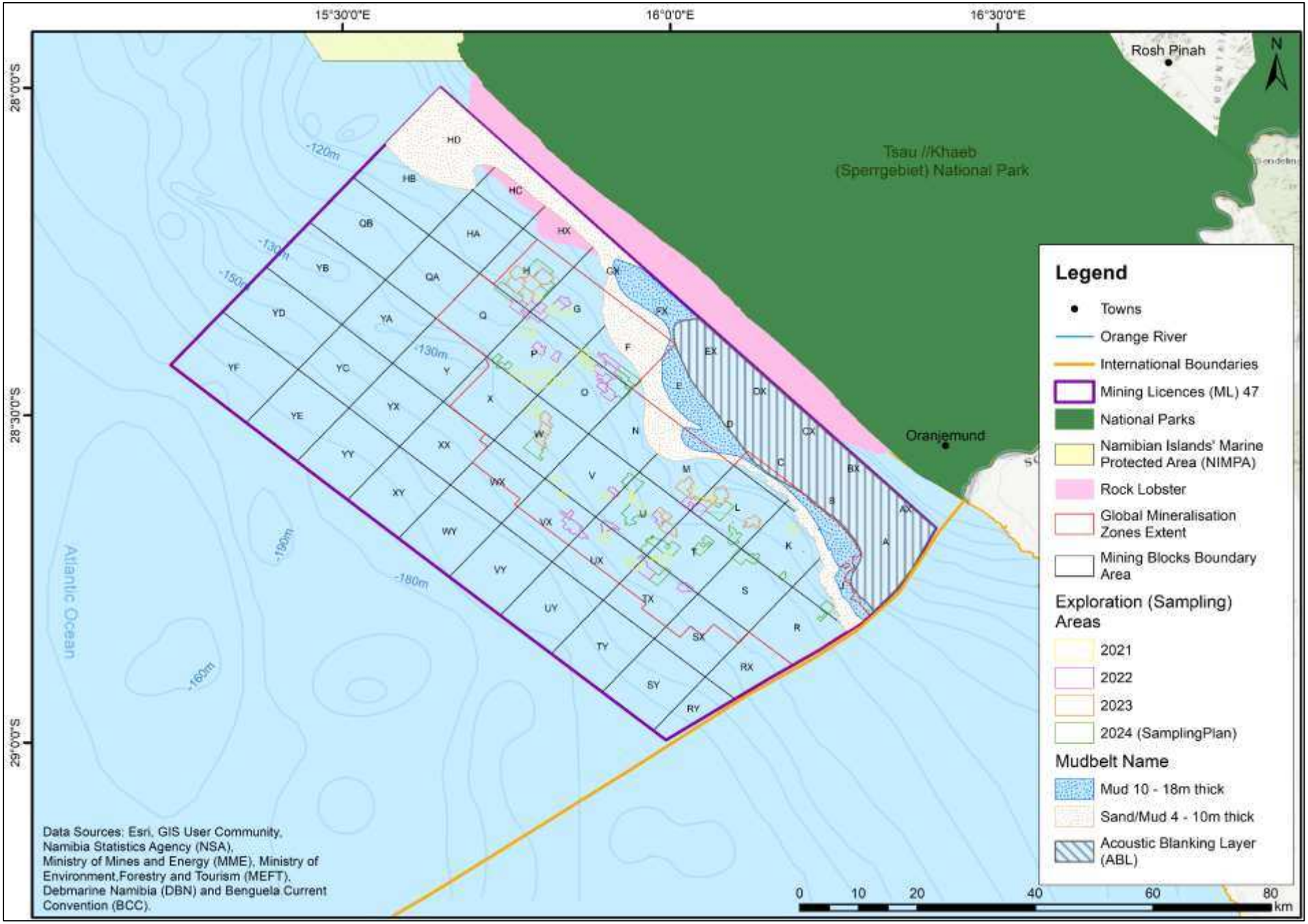


Figure 1.8: ML No. 47 area showing the bathometry and exploration areas with respect to the DBMN regional blocks survey system.

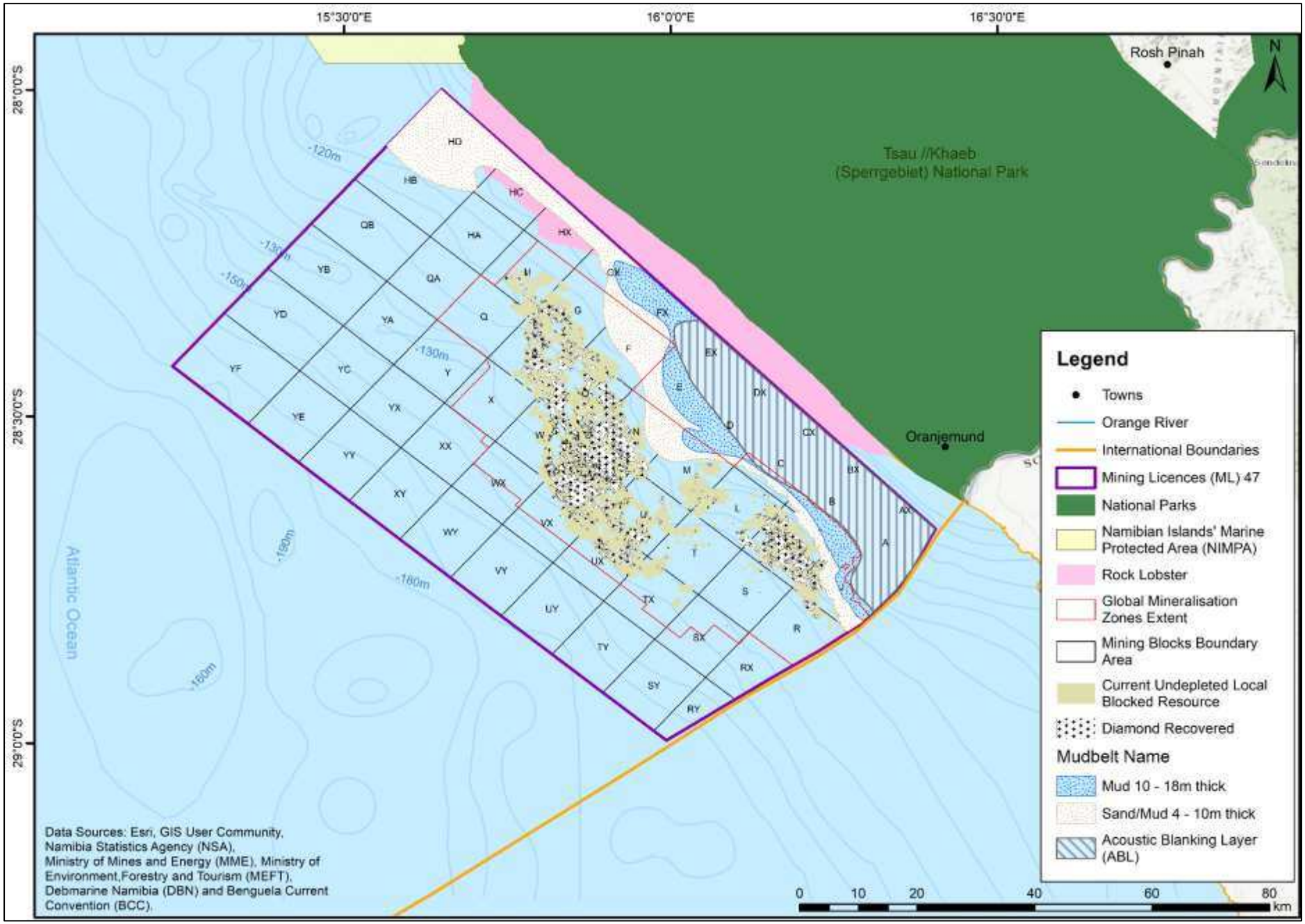


Figure 1.9: ML No. 47 area showing the bathometry and recovery, and production operational areas with respect to the DBMN regional blocks survey system.

1.4 Purpose of this Updated EIA and EMP Report

This report has been prepared to support the application for the renewal of the Environmental Clearance Certificate (ECC) for DBMN expiring on the 9th September 2024. This updated EIA and EMP Report with all the annexes has been prepared based on the ongoing exploration and recovery activities, results of the previous updated Environmental Assessment report prepared by Risk-Based Solutions in 2021 and the environmental monitoring activities undertaken for the period under review (2021-2024 ECC validity period). The preparation of the report took into consideration the provisions of the following key documents:

- Environmental Management Act, 2007, (Act No. 7 of 2007).
- Environmental Impact Assessment (EIA) Regulations, 2012.
- Environmental Clearance Certificate (ECC) issued on the 9th September 2024 and expiring on the 9th September 2024.
- Minerals (Prospecting and Mining) Act, 1992, (Act 33 of 1992),
- DBMN Environmental and Sustainability Policies as well as all other related operational and contractual obligations), and.
- Other applicable legalisations.

1.5 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 the exploration, recovery, and production operations** covering the summary of the ongoing exploration, recovery, and production operations.
- **Section 4: Regulatory Framework** covering the ongoing exploration, recovery, and production operations.
- **Section 5: Receiving Environment** covering summaries of the physical, biological, and socioeconomic environments of the ongoing exploration, recovery, and production 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 as well as performance monitoring and reporting requirements.
- **Section 8: Conclusions and Recommendations** - Summary of the findings and way forward.
- **ANNEXES**.

2. TERMS OF REFERENCE AND METHODOLOGY

2.1 Overview

The environmental assessment review process adopted for this project took into considerations the provisions the Environmental Management Act, 2007, (Act No. 7 of 2007) and all other applicable national laws and Regulations. The proposed activities, alternatives and key issues have all been considered during the Environmental Assessment (EA) review process. The first step in the environmental assessment review process was the project screening with respect to the requirements for the renewal of the expiring ECC followed by the preparation of the Scoping / Background Information Document (BID) used for the project registration process with the Environmental Commissioner and this updated EIA and EMP and Environmental Monitoring Reports to support the application for the renewal of the ECC No. 01611.

The preparation of this updated EIA and EMP Report has been performed objectively and independently, with reasonable skill, care and diligence in accordance with professional standards and practices existing at the date of performance of the assessment and that the guidelines, methods and techniques used and applied in this study conformed to the national regulatory requirements, process and specifications in Namibia and in particular as required by Ministry of Mines and Energy (MME), Ministry of Environment, Forestry, and Tourism (MEFT) and the client (Proponent).

The preparation of the Scoping\ BID, updated EIA and EMP and monitoring reports have all been undertaken in line with the January 2015 MEFT Environmental Assessment Reporting Guideline.

2.2 Terms of Reference (ToR)

2.2.1 Overview

Risk-Based Solution (RBS) CC, was contracted by DBMN to provide environmental support services with respect to the ongoing marine diamonds exploration, recovery, and production operations in the licensed area. The overall objective of the scope of work was to prepare updated EIA and EMP and Environmental Monitoring Reports for the period 2021 – 2024 under review to support the application for the renewal of the current ECC that will expire on the 9th September 2024.

2.2.2 Summary of the Terms of Reference

The following is the summary of the Terms of Reference (ToR) for the environmental support services with respect to the ongoing marine diamonds exploration, recovery, and production operations in the licensed area:

- Review of the current EIA and EMP Report in the light of the ongoing exploration, recovery, and production operations prepared in 2021.
- Updating of the thematic maps (Decision Support Tools (DSTs) maps covering Environmental, Sensitivity, Constraint and Opportunity layers linked to the EMP.
- Prepare the updated EIA and EMP to support the application for the renewal of the ECC that will expire on the 9th September 2024.
- Undertake a gap analysis and preparation of a summary report with the respect to the current level of Environmental Monitoring being undertaken and propose alternative interventions for management review and for future implementation.
- Prepare an overall Environmental Compliance / Performance Monitoring Report for the period 2024 under review.
- Preparation of the Environmental Clearance Certificate (ECC) renewal application and lodgement via the Ministry of Ministry of Mines and Energy (Competent Authority) as per the

new requirements instead of submitting directing to the Environmental Commissioner in the Ministry of Environment, Forestry and Tourism (MEFT), and.

- Submit the application for ECC Renewal and the supporting final environmental reports to MEFT via MME and follow-up until the Record of Decision (RD) has been issued by the Environmental Commissioner.

2.2.3 Assumptions and Limitations

The following assumptions and limitations underpin the approach adopted, overall outcomes and recommendations of the environmental assessment process:

- The proposed activities as well as all the plans, maps, coordinates of the ML area, and appropriate data sets received from the Proponent, project partners, regulators, Competent Authorities, and specialist consultants are assumed to be current and valid at the time of conducting the studies and preparation of this report.

- The impact assessment outcomes, mitigation measures and recommendations provided in this updated EIA and EMP Report are valid for the lifecycle of the proposed activities.

- A precautionary approach has been adopted in instances where project information, baseline data and impact assessment guidelines were insufficient or unavailable at the time of preparing this report, and.

- Mandatory timeframes as provided for in the EIA Regulations No. 30 of 2012 and the EMA, 2007, (Act No. 7 of 2007) have been observed.

2.2.4 Summary of the Steps

The environmental assessment steps that have been undertaken are summarised as follows (Fig. 2.1):

(i) Project screening process (**Undertaken in May 2024**).

(ii) Preparation of the Scoping Report / Background Information Document (BID) (**Undertaken in March 2021**).

(iii) Preparation of the updated Draft EIA and EMP, and Environmental Monitoring Reports for client review and inputs (**Undertaken in May-June 2024**).

(iv) Comments and inputs from the client used to finalise the updated Draft EIA and EMP, Environmental Monitoring and BID Reports (**Undertaken in June 2024**).

(v) Project registration / notification through the completion of the online formal registration / notification form on the MEFT online Portal (Junewww.eia.meft.gov.na) (**Undertaken in 2024**).

(vi) Final hardcopies of the updated EIA and EMP, Environmental Monitoring and Scoping /BID Reports submitted to the Environmental Commissioner in MEFT through the MME (Competent Authority) and the digital copies upload on the MEFT online Portal (www.eia.meft.gov.na) in fulfilment of all the requirements of the Environmental Impact Assessment (EIA) Regulations No. 30 of 2012 and the Environmental Management Act, (EMA), 2007, (Act No. 7 of 2007) for application of the Environmental Clearance Certificate (ECC) for the proposed project (**Undertaken in June 2024**).

(vii) Following the submission of the application for ECC to the Environmental Commissioner, the public and stakeholders who are interested or affected by the proposed project will have **fourteen (14) days** to submit comments / inputs about the proposed project activities direct to the Environmental Commissioner when the application will be made available for

additional comments / inputs by the Environmental Commissioner on the MEFT digital Portal www.eia.meft.gov.na, and.

(viii) Wait for the Record or Decision (RD) from the Environmental Commissioner (**From end of June 2024 – Early September 2024**).

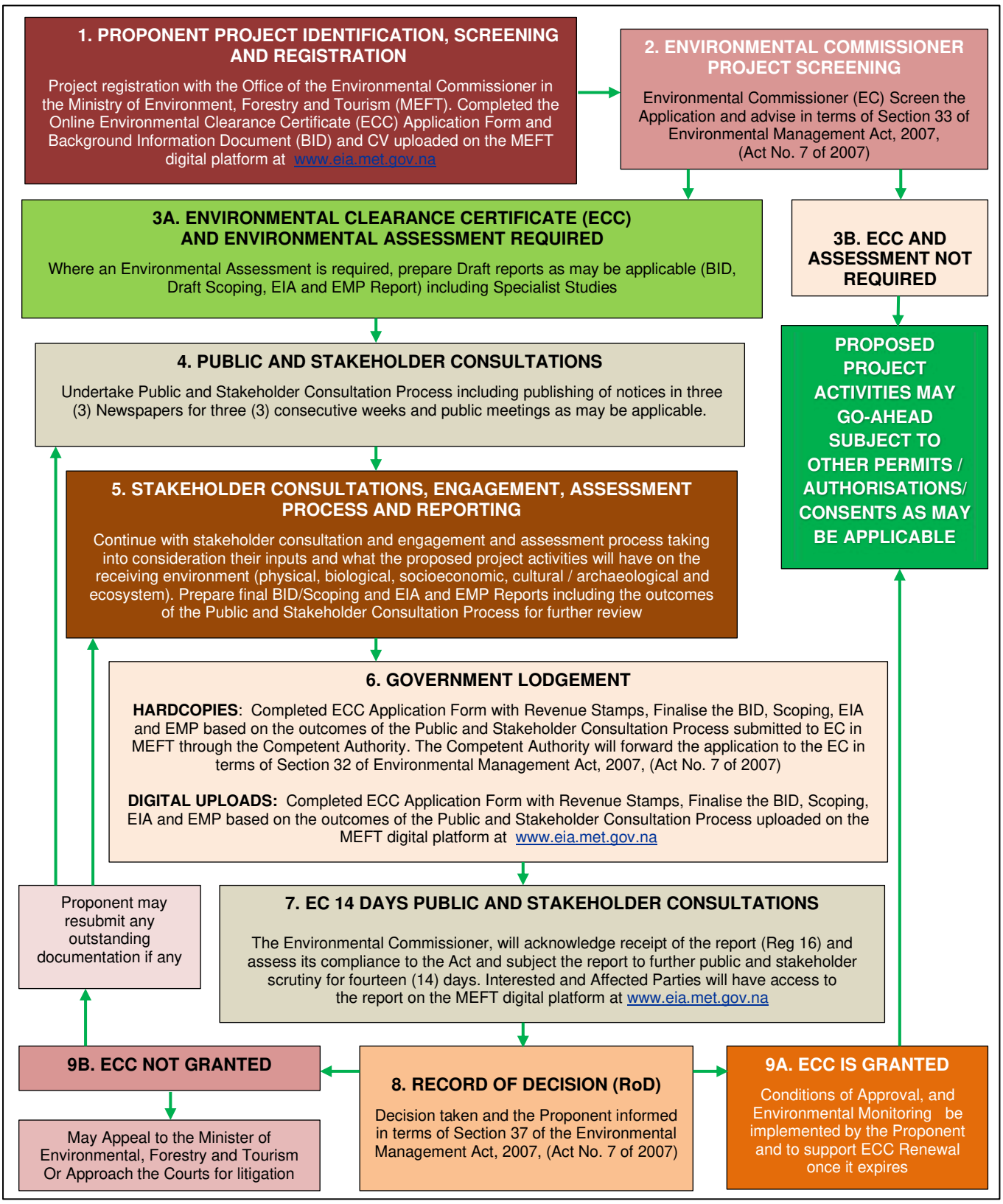


Figure 2.1: RBS illustrative schematic presentation of Namibia's Environmental Assessment Procedure.

2.3 Review of all Key Documents and Processes

The following documents related to the environmental assessment and monitoring process undertaken for the period 2021-2024 under review, shall be reviewed and updated as part of the preparation of updated EIA and EMP and monitoring reports to support the applications for the renewal of the current ECC expiring on the 9th September 2024:

(i) EIA and EMP Reports.

(ii) Monitoring Reports.

(iii) Specialist studies undertaken.

(iv) Stakeholders and public consultation.

(v) DBMN Environmental Management System (EMS) reviews and audits.

(vi) Risk assessment and Gap analysis, and.

(vii) DBMN Terms of Reference for the renewal of the current ECC.

2.4 Environmental Assessment Process Adopted

The environmental assessment as described in the methodology of the previous environmental assessment reports have been reviewed. The environmental assessment process undertaken for this updated EIA and EMP report is in line with the prevailing requirements for environmental assessment process in Namibia at the time of preparation (Fig. 2.1). No stakeholder consultation was conducted as part of the updating of this report. An updated stakeholder register initially compiled for this project is attached in Annex 2.

2.5 Review of Specialist Studies, Monitoring and Audit Results Undertaken

A number of research, specialist studies, monitoring and audit activities have been undertaken by DBMN in the licensed area for the period under review.

For the period under review, oil spill modelling specialist study and the preparation of the Oil Spill Contingency Plan were undertaken and key findings and recommendations are included in this report.

2.6 Environmental Management Plan (EMP)

In all the previous environmental assessment reports, all the environmental aspects have been identified for both the exploration, recovery, and production operations in the licensed area. However, environmental management plans have only been developed to ameliorate aspects / risks of medium to high significance identified through the impact assessment.

As adopted from the previous reports, the updated management plans included in this report are divided into two (2) categories and these are:

(i) Strategic management plans which form part of the EIA and EMP report and range from two (2) years up to the end of the life of operations, and.

(ii) Short term plans concerned with day-to-day operations, which include areas such as codes of practice, specific responsibilities and monitoring which are integrated separately into the Environmental Management System.

2.7 Environmental Monitoring

The following is summary of the environmental performance monitoring covered in this report for the period under review:

- **Monitoring Plan:** Environmental monitoring is partly in-house (data collection during exploration and recovery processes) and outsource (employ a consultant) to undertake the assessment and recommend measures to be implemented. Key aspects that are monitored include: Water quality, marine fauna and bathetic compositions and variability. The monitoring programme is supported by an external laboratory and technical facilities on water quality monitoring and benthic communities with respect to the ongoing exploration and recovery processes.

- **Implementation of the EMP**: The implementation of the EMP monitoring plan by DBMN is focused on collecting and analysing 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 EMP implementation is undertaken as an in-house activity.

- **EMP Auditing**: Compliance auditing of the EMP implementation and monitoring thereof is a key component of the environmental performance monitoring. The EMP auditing is an internal activity that is often supported by an external consultant and linked to the EMS monitoring and auditing requirements, and.

- **EMS Auditing**: Personnel within DBMN are responsible for the management of these impacts through regular environmental audits to evaluate compliance and effectiveness of the company's EMS to the ISO 14001 standard, as well as compliance with statutory requirements. This includes both internal audits and external surveillance audits.

2.8 DBMN Environmental Management System (EMS)

The implementation of Environmental Management System (EMS) of DBMN if guided by the following policies (Annex 1):

- DBMN's Environmental Policy.

- DBMN’s Sustainability Statement Policy.

- De Beers Group Environmental Policy.

- De Beers Group Occupational Health Policy.

- De Beers Group Safety Policy.

- The Namibian Environmental Assessment Policy.

- Existing and anticipated environmental legislation, and.

- Requirements in terms of the ISO 14001 Environmental Management System.

This 2024 updated EIA and EMP report shall be integrated in the DBMN’s ISO 14001 Environmental Management Systems (EMSs). Fig. 2.2 shows the EMP as part of the overall ISO 14001 EMS.

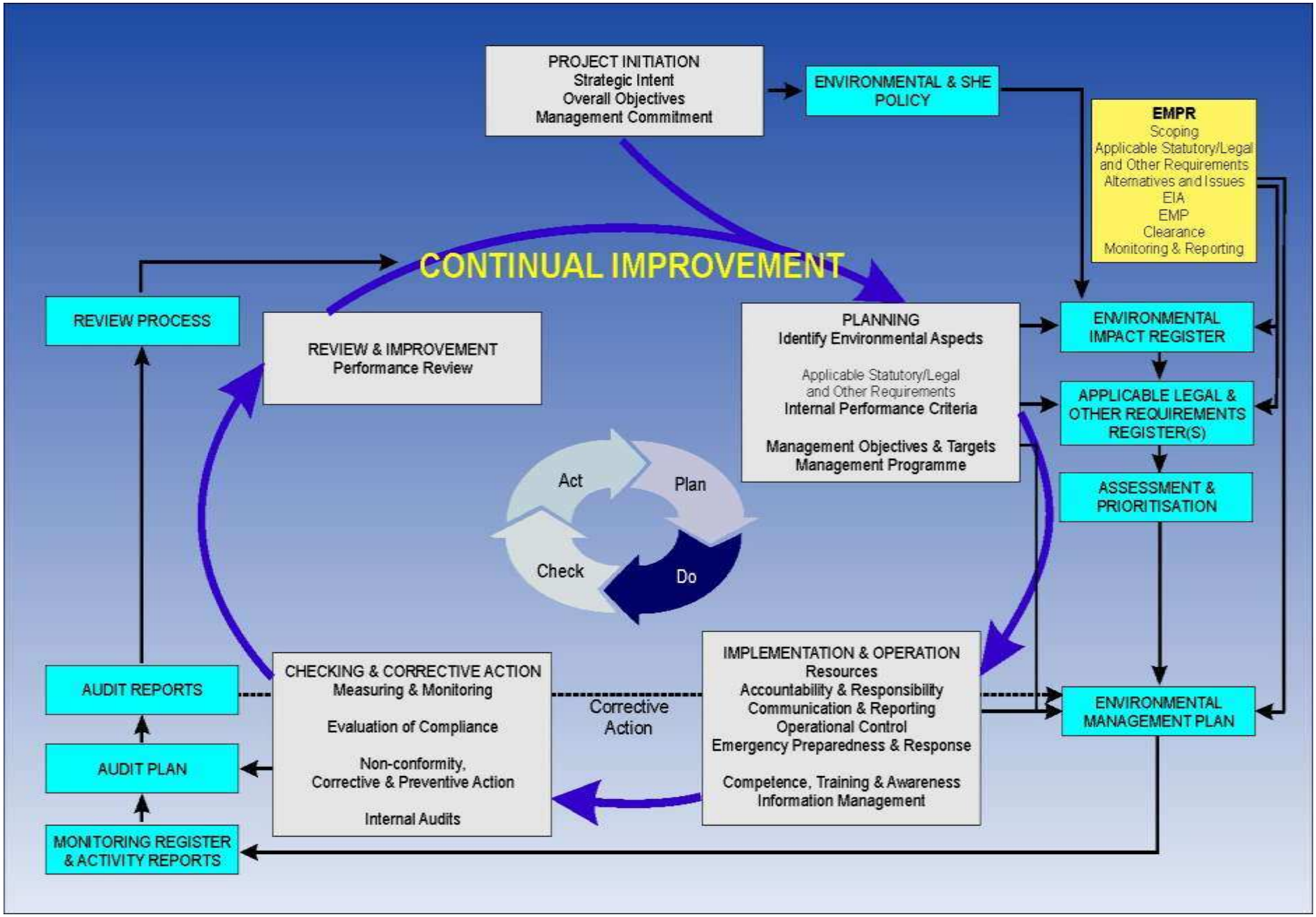


Figure 2.2: Illustration of environmental assessment, management, and monitoring as part of the overall ISO 14001 Environmental Management System adopted by DBMN.

2.9 Risk assessment and Gap analysis

As part of its Long-term Plan (Strategic Business Plan), DBMN has integrated environmental management into the lifecycle of its exploration, recovery and production operations being undertaken in the ML 47. The objective is to develop a set of environmental risks, and align all activities to work towards a more results-driven research and monitoring approach, which focuses specifically on potentially significant risks associated with the current and future exploration, recovery and production operations, and develop appropriate mitigation and monitoring measures. These risks are to be monitored and regularly reviewed and, where necessary, updated.

During the revision and update of this EIA and EMP report one of the principal objectives has been to review and assess the potential risks associated with current and future exploration, recovery, and production operations, including any new activities since the previous updates were undertaken to the current EMP, as well as reviewing potential cumulative and synergistic impacts, in the licensed area. One such new consideration that has been reviewed in this updated EIA and EMP report has been the introduction of new recovery and production vessel, the m.v. AMV3.

Using information available from the previous updated EIA and EMP reports covering the same licensed area, many specialist and research studies have been conducted on marine diamonds exploration, recovery and production impacts over the past 20 years. An update of the previous risk assessment was undertaken as part of the preparation of this updated EIA and EMP Report.

Extrapolation of results, allowed for *a priori* identification of high-risk impacts associated with strategic long-term exploration recovery and production plans in the licensed area that may be environmentally unacceptable.

In addition, a gap analysis was conducted to identify shortfalls in the current state of knowledge on marine diamonds exploration, recovery and production impacts in the licensed area, particularly those of potentially high risk to the receiving environment.

The results of the risk assessment were used to identify activities of high significance and/or medium to high risk that require management plans and mitigation measures, and those environments for which monitoring is necessary. The revised EMP, which forms part of this report, was subsequently amended where applicable and accordingly.

Identified gabs with respect to the specialist studies, environmental monitoring and auditing activities undertaken for the period under review have also been highlighted in this report with the appropriate recommendations provided as may be applicable.

3. DESCRIPTION THE ONGOING EXPLORATION AND RECOVERY

3.1 Exploration and Recovery Opportunities for ML 47

Although DBMN has the right to extract and utilise the mineral resources of all the 5,987km^2 of the licensed area (ML 47), but only a small proportion (~25%) is of commercial interest and has been designated as the area of focus within which recovery and production operations are currently concentrated (Fig. 3.1).

However, due to the thickness of the mud belt located in the inshore north regions, marine diamonds in large portions of the licensed area cannot be recovered and produced using the current technologies. Consequently, the potential resource under the mud belt area has also not as yet been fully investigated.

Beyond the designated target area, further areas have been partly explored and shown to be mineralised in some places (Fig. 3.1). Nonetheless, half of the license area remains unsampled, although it could reasonably be expected to contain some mineralised patches.

3.2 Neighbouring License Holders (Cumulative Impacts)

The marine areas within Namibia's jurisdiction and bordering the licensed area on its north-western and south-western edges consist of a number of Exclusive Prospecting Licence (EPL) and Petroleum Exploration (PELs) areas held by various companies (Figs. 3.1 and 3.2).

Possible development of the Kudu Gas Field could result in a pipeline passing through the licensed area, and may therefore influence exploration, recovery, and production operations. The ML 47 area overlaps with Block 2815, Petroleum Exploration License (PEL) No. 79 belonging to NAMCOR (Fig. 3.2).

Current known oil and gas discoveries offshore Namibia inclusive of the Kudu Gas Field, Total Energies, Shell Upstream Namibia BV and Galp oil and gas discoveries made between 2022-2024 are situated in the deepwater further offshore and outside the ML 47 (Fig. 3.2).

3.3 Current and Future Uses for Licensed Area

Although alternative uses for the licensed area include fishing, the area has not been used for any other purpose than marine diamond exploration, recovery, and production operations (Fig. 3.1). While demersal fish species targeted elsewhere by the commercial trawl-fishery do occur in the concession area, trawling and longlining is prohibited in Namibia in waters shallower than 200 m, typical of the water depth of between 40 m – 180 m within the licensed area.
There are further conditions applicable to hake trawling vessels fishing south of 25° latitude, where the fishing exclusion has been extended to a depth of 300 m. Freezer trawlers fishing in this area are confined to fishing in water depths of 350 m or more (Currie *et al.* 2007). As the licensed area lies well inshore of less than 200 m isobath, no interaction with commercial fisheries is therefore expected.

No extensive archaeological assessments have been undertaken to date in this area, but indications are that there are no likely shipwrecks in licensed area. There are no major shipping routes through the licenced area.

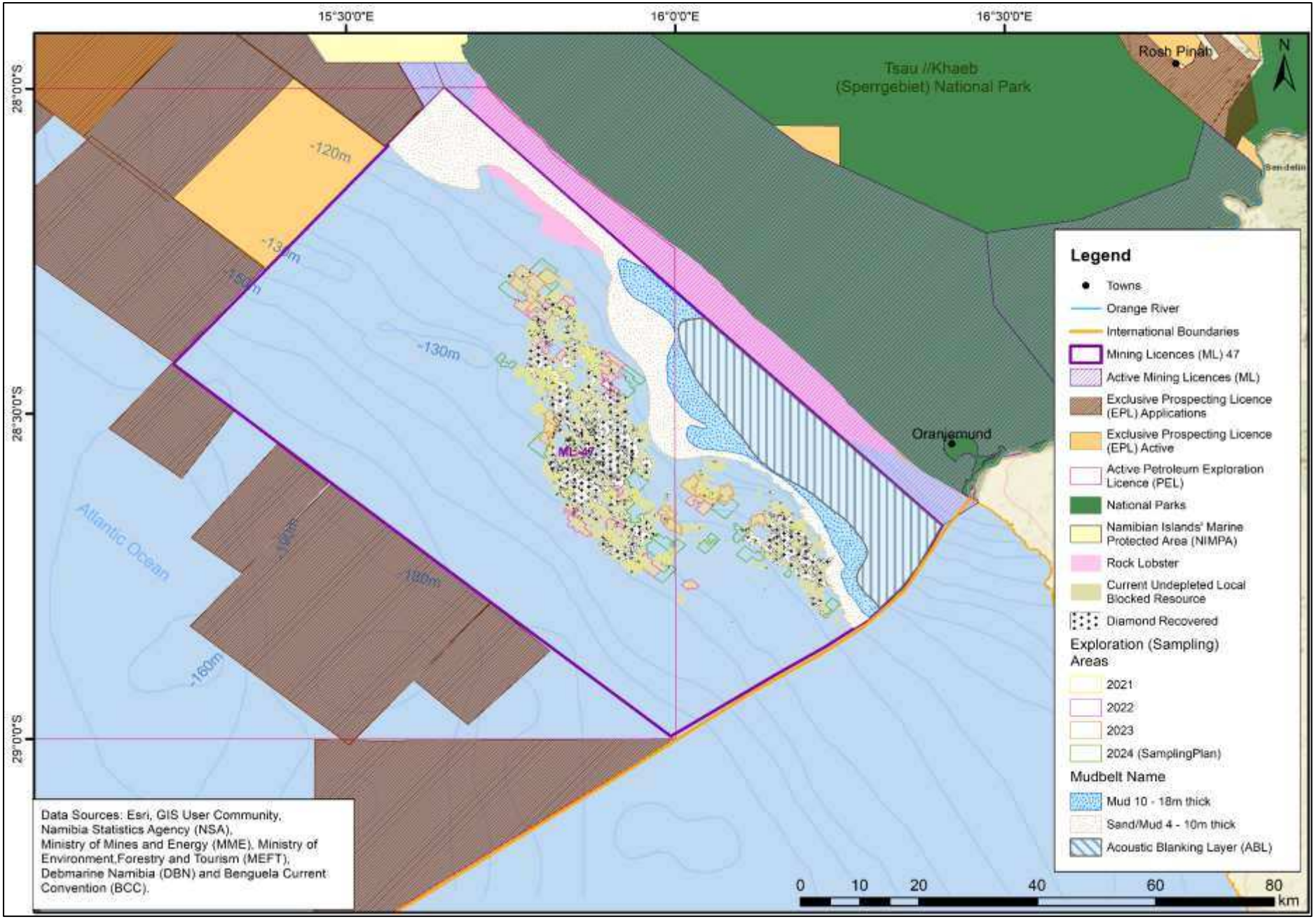


Figure 3.1: ML No. 47 combined exploration, recovery, and production areas layer with respect to other subsurface resources (minerals and petroleum) licenses.

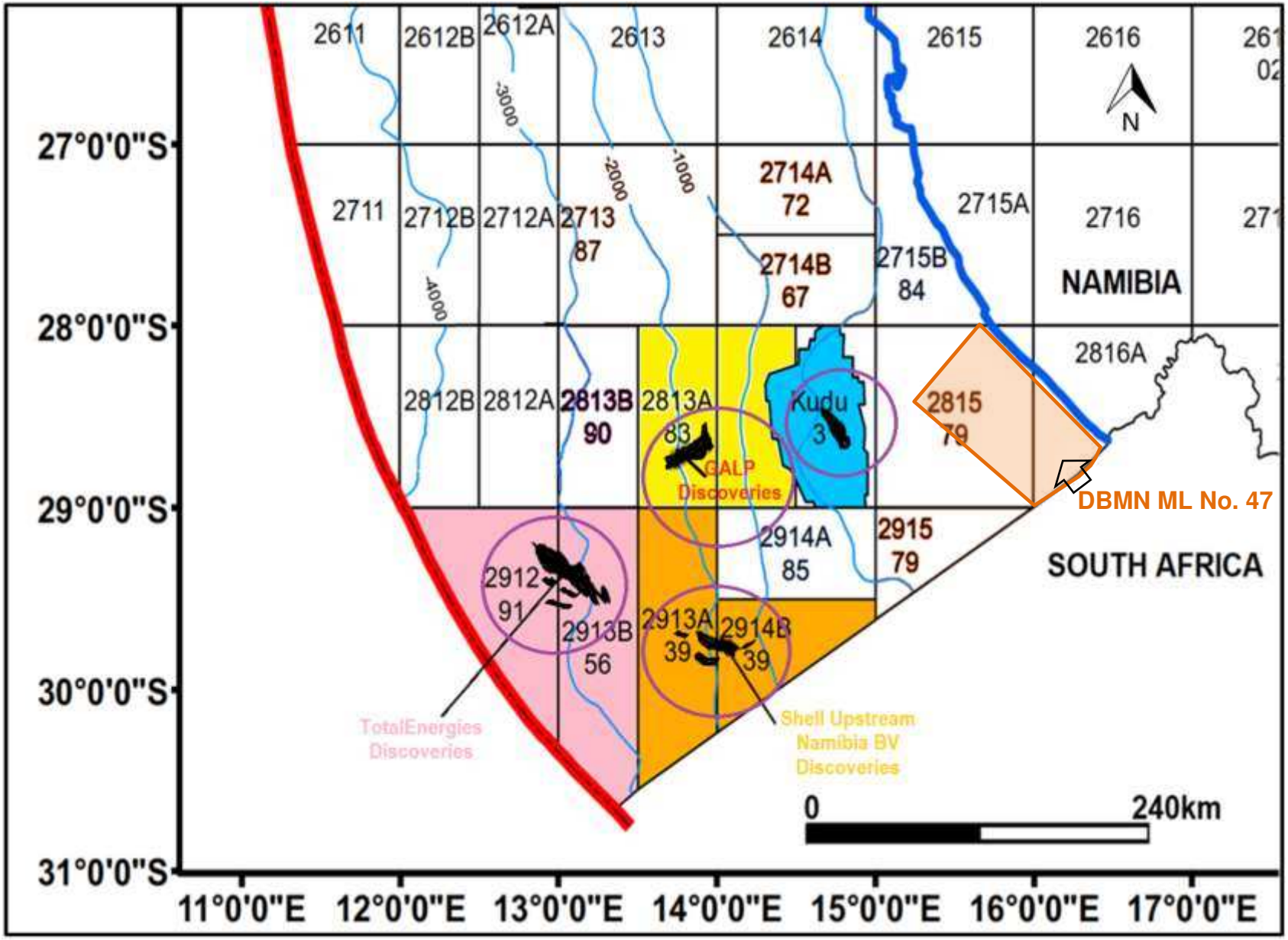


Figure 3.2: Location of the ML 47 overlapping with Block 2815, Petroleum Exploration License (PEL) No. 79 belonging to NAMCOR and the of the known oil and gas discoveries offshore Namibia showing the Kudu Gas Field, Total Energies, Shell Upstream Namibia BV and Galp oil and gas discoveries made between 2022-2024, situated in the deepwater offshore Orange Basin (Base map Source: www.mme.gov.na).

3.4 Description of the Exploration Activities

3.4.1 Exploration Overview

Exploration or prospecting activities undertaken by DBMN involves the search for potential occurrence of economic diamond bearing unconsolidated sediment with average thickness of about 0.5 m using specially adapted exploration vessels. Various non-destructive Geophysical survey (Geosurveys) techniques are often used as the 1st step of the exploration process and applied over a wider area to delineate potential targets in form of diamond bearing unconsolidated sediment.

Once potential targets have been delineated, they are often validated by undertaking sampling campaigns and geotechnical assessments as part of the Pre-Production Development (PPD) to determine the grade and economic feasibility of recovering and producing the delineated targets (Fig. 3.1).

3.4.2 Exploration Vessel

The m.v. SS Nujoma is the only exploration and sampling vessel in the DBMN Namibia fleet (Plate 3.1).

Plate 3.1: The m.v. SSN, the only exploration and sampling vessel in the DBMN Namibia fleet (Source: www.debeersgroup.com).

3.4.3 Geophysical Survey

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 surveys 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 (Fig. 3.3).

These surveying activities are undertaken continuously to develop and improve seabed maps and geological grade models. Once a mineable ore reserve has been identified, geotechnical surveys, using penetrating tools for collection of seabed sediment samples, are conducted in various sampling grids (Fig. 3.3).

3.4.4 Geotechnical Assessment and Sampling

Wide-area, low intensity prospecting is undertaken in a wider grid pattern using varying sampling tool sizes to assess broad mineralisation potential as delineated from the geophysical survey process. The sampling tool is deployed through a vessel moon pool attached through a series of rigid “500mm” pipes (for A-frame type vessel).

Alternatively, for vessel equipped with launch and recovery system (LARS), a flexible riser pipe is used to deploy a seabed tool. The tool interface has a grizzly opening generally large enough to pass large material such as cobbles, boulders and "slabs". The geological samples are transported by means of airlift system, and gravity fed onto double deck screens prior to final concentrate being treated into the recovery area.

The oversize (+19mm) and undersize (-1.47mm) material is returned overboard by means of an overboard conveyor. Concentrated prospecting is undertaken using much tighter sampling grids aimed at generating resources for recovery and production. Historically, sampling was done using the megadrill which consisted of a steel pipe with a hard facing on the cutting edge of the barrel, and high-pressure jet water-nozzles (Fig. 3.3).

Two drills were mounted in tandem, each capable of cutting a cluster of three holes of 0.72 m^2, in sediments up to 8 m depth, using percussion action. Recently, the decadrills, in contrast have rotating drill-heads lowered to the seabed on an extendable pipe ‘drill string’, and are capable of sampling an area of 10 m^2.

The spacing of samples is determined by the level of confidence required of the resource. The sediments encountered are airlifted to the surface and treated on-board the sampling vessel to recover diamonds.

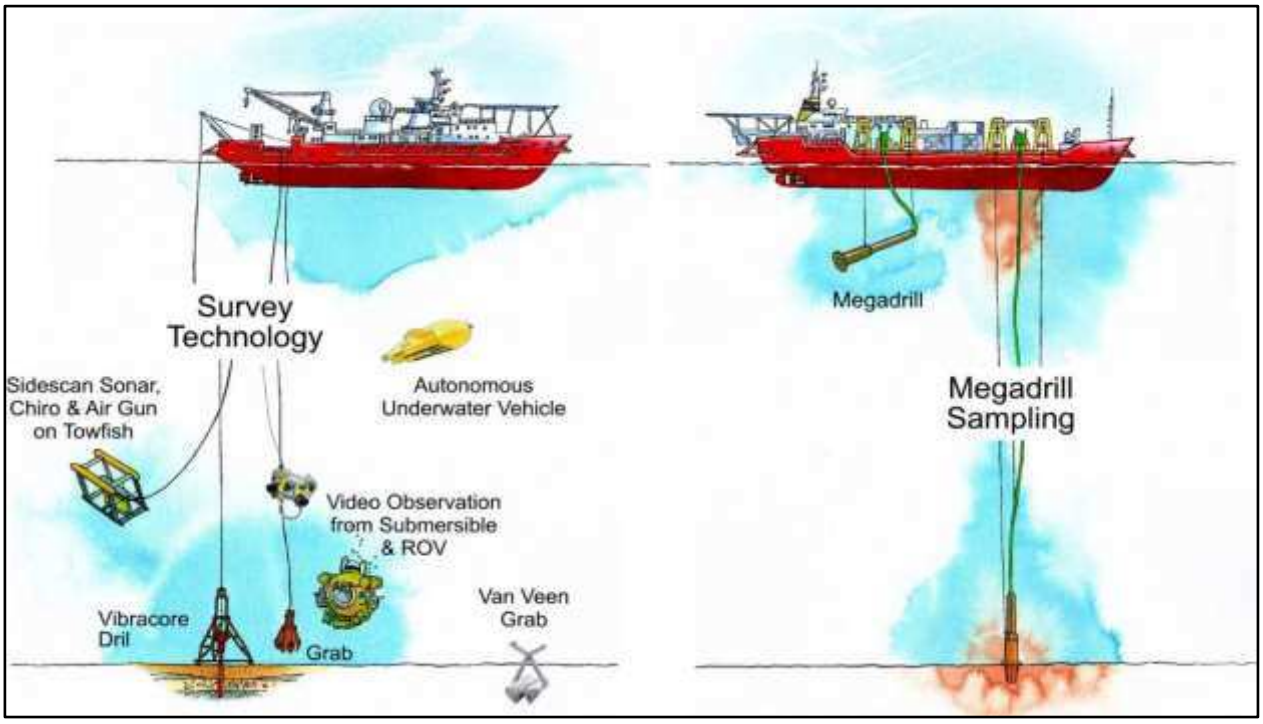


Figure 3.3: Illustration of exploration techniques covering Geophysical survey and sampling techniques used to map the distribution, and evaluate the viability, of diamond-bearing gravels (Source: DBMN 2015).

3.5 Description of the Marine Diamond Recovery Operations

3.5.1 Overview of Marine Diamond Recovery Operations

Current, marine diamond recovery and production operations are of the order of 10.6 km² per year with the current fleet. In December 2020, the estimate of total area recovered in the licensed area since operations commenced in 1991, amounted to 135.4 km², including the trial suction hopper dredger operations conducted in 2006/07 (this no longer operates). This now amounts to 2.3% of the total 5,987 km² concession area.

Marine diamond recovery and production involves the targeting of individual 100 x 100 m blocks, which are operated in contiguous groups that vary in length. some groups may be only 300 m long and 300 m wide. Depending on the nature of the sediments, each 10,000 m² block requires approximately 3 days to operate. Some circumstances require a block to be revisited. All gravel processing on the recovery and production vessels occurs on board, with 99% of the sediments being returned to the sea on site. It is estimated that in total, over 135.4 km² of the licensed area have been disturbed to date by tool action and plume settlement. This area must be viewed in the context of the 5,987 km² covered by the licence area, and the approximately 30,000 km² of continental shelf area between the Orange River and Lüderitz.

3.5.2 Marine Diamond Recovery and Production Vessels Fleet

Within its own fleet, De Beers Marine Namibia currently owns six (6) recovery and production vessels, the m.v. Mafuta (Plate 3.2), m.v. Debmar Pacific (Plate 3.3), m.v. Debmar Atlantic (Plate 3.4), m.v. Grand Banks, lay up until Q4 2022 (Plate 3.5), m.v. !Gariep (Plate 3.6) and the recently newly commissioned m.v AMV3 (Plate 3.7). Additionally, the Coral Sea has been chartered bringing the total number of marine diamond recovery and production vessels to seven (7).

Five (5) of the recovery and production use the airlift-drill technology, whilst only two (2) vessel (mv Mafuta and the mv AMV3) uses the crawler technology. Recovery and production operations take place in the licensed area on the seafloor at water depths of between 94 – 154 m. The recovery and production vessels are self-contained units, with a processing facility on board, and operate 24-hours a day for 12 months of the year, with a dry-docking scheduled every third year.

Plate 3.2: The m.v. Mafuta, DBMN marine diamond recovery vessel (Source: https://debmarinenamibia.com/).

Plate 3.3: The mv Debmar Atlantic, DBMN marine diamond recovery vessel (Source: https://debmarinenamibia.com).

Plate 3.4: The mv Debmar Pacific, DBMN marine diamond recovery vessel (Source: https://debmarinenamibia.com).

Plate 3.5: The mv Grand Banks, DBMN marine diamond recovery vessel. This vessel is currently on lay up in the Port of Walvis bay from 20th December 2020 until around Q4 of 2022. (Source: https://debmarinenamibia.com).

Plate 3.6: The mv !Gariep, DBMN marine diamond recovery vessel (Source: https://debmarinenamibia.com).

Plate 3.7: The mv Additional Mining Vessel 3 (AMV3), new vessel DBMN marine diamond recovery and production vessle to start operations in 2022 (Source: www.damen.com).

3.5.3 Marine Diamond Recovery Technology

3.5.3.1 Overview

Marine diamond recovery operations in the licensed area are undertaken using the following two (2) innovative and advance seafloor recovery methods as illustrated in Fig. 3.4 and Plates 3.8 and 3.9:

- Vertical recovery using the rotating Wirth Drill (Plate 3.8), and.
- Horizontal recovery using tracked vehicles or seabed crawlers (Plate 3.9).

3.5.3.2 Wirth Drill Marine Diamond Recovery

The Wirth Drill is a vertically mounted, large diameter drill-head (current drill heads range from 7.0 – 7.2 m in diameter) used to excavate diamond-bearing gravel in a systematic pattern of overlapping circles in the recovery area (Plate 3.8).

The drill-head consists of a large-diameter circular disc fitted with wheel-cutters and hardened steel scrapers, and is lowered to the seabed on an extendable pipe 'drill string'. The drill string is suspended in a state of constant tension by means of a compensation system, which enables the bit to remain in contact with the seabed while the vertical motion of the ship is absorbed. Loosened rocks and sediment are fed along a semi-circular channel across the lower surface of the plate, extracted through a central aperture and airlifted to the surface through the drill string for on-board processing.

The sediment-water mixture discharges into a slotted circular tower, which in turn drops the mixture onto screens below. The drill is capable of penetrating about 2-3 m of sediment and partially consolidated conglomerate or calcareous sandstone in water depths down to 150 m. The drill head can be accurately positioned on the seabed under the recovery vessel using the dynamic winch positioning system, and acoustic seabed imaging systems can provide the operator with real-time visualisation of the operations area.

Repeated recovery operations of an area seldom occur, and only when the initial coverage of a block by the recovery tool was substantially incomplete. The recovery rates are dependent on drill string diameter and for the current drill vessels range from 100 m^2/hr (~0.7 km^2/yr) to 380 m^2/hr (~2 km^2/yr).

Due to lateral movement of the drill string in response to swells, patches of gravel are sometimes missed when recovery using Wirth drills, particularly in deeper water. The drill head must also be moved by moving the entire vessel between each drilling operation, and the position of the vessel directly above the drilling operation can, depending on currents, result in discarded sediments being returned directly back into the operations area, potentially resulting in these waste sediments being inadvertently re-operated.

3.5.3.3 Seabed Crawler Marine Diamond Recovery Method

Crawler systems consist of an underwater vehicle mounted on twin caterpillar tracks, and equipped with an anterior suction head (Plate 3.9). The crawler is lowered to the seabed on a hoist rope, with power and signal umbilical cables and a suction hose, and is controlled remotely from the surface support vessel.

The machine operator uses a joystick to manoeuvre the machine and its suction arm on the seabed to remove all diamond-bearing material, and the crawler is fitted with highly accurate acoustic seabed navigation and imaging systems, which provide the operator with real-time visualisation of the operations area. Seabed crawlers usually recover the orebody by systematically advancing along a 'lane', thereby achieving precise and complete coverage of the area of operations.

The vessel does not need to be anchored directly over the crawler, and can instead advance behind the crawler, effectively depositing discarded sediments back into the recovered areas as the operations continue to advance forward.

The crawler's anterior suction system is powered by its own variable speed dredge pump, which provides high suction power at the recovery face. The suction head is also usually equipped with water jets to loosen seabed sediments, while cutters break up harder material and assist in excavation, and sorting bars filter out oversize boulders.

The anterior suction arms operate by either a vertical radial (digging) motion, or are designed to excavate material through a horizontal sweeping action in a swathe of up to 22 m width. In this way, these crawlers can achieve higher recovery rates and more complete coverage of the area to be recovered, avoiding the need for repeated recovery operations. Current recovery ates for crawlers are averaging ~1000 m^2/hr, or 6.0 km^2/yr, although future recovery rates of >1200m^2/hr.

Crawlers are particularly suitable for marine diamond recovery on flatter areas, and are capable of operating in sediment thicknesses of up to 7 m, in water depths of up to 150 m. A powerful 2.4 MW submersible motor drives a dredge pump capable of transporting the slurry to the vessel with an average velocity of 6.8 m/s. A 500 kw submersible motor drives a 500 cc hydraulic pump delivering an average 180 bar and maximum 240 bar to the crawler's hydraulic system.

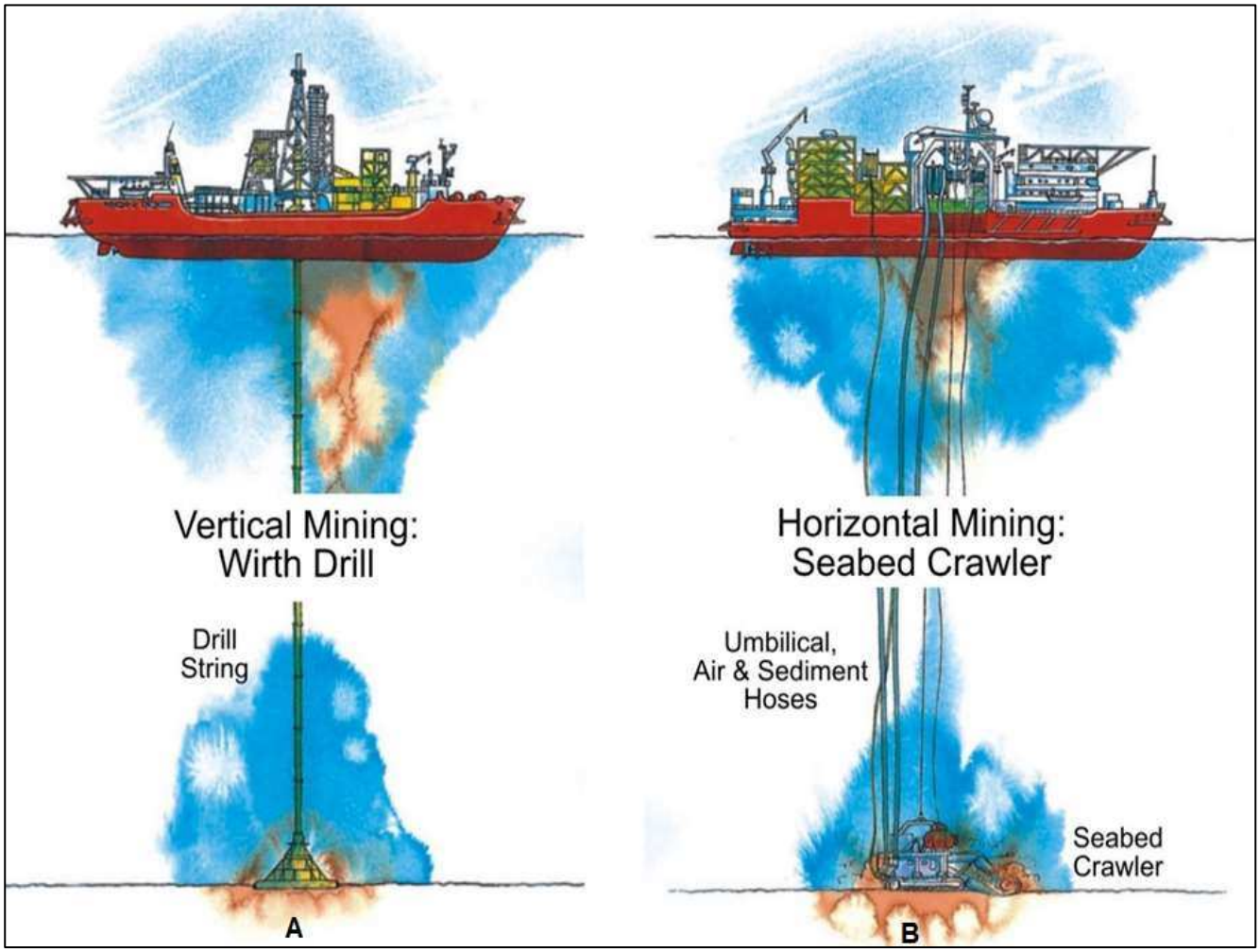


Figure 3.4: Illustration of the current marine diamond recovery and production methods. a) Vertical Wirth drills, and b) horizontal seabed crawlers (Source: DBMN, 2021).

Plate 3.8: Overhead view of the cutting face of the Wirth Drill (note the individual wheel-cutters embedded in the circular disc (Source: DBMN, 2021).

Plate 3.9: Typical seabed crawlers with different recovery head configurations (Source: DBMN, 2021).

3.5.4 Onboard Processing and Diamond Recovery

Diamondiferous alluvial gravels are sucked from the sea-floor by means of crawler or drill technology (Fig. 3.6 and Plates 3.8 and 3.9). The seafloor recovered orebody is brought onboard the production vessels for further processing and diamond recovery as illustrated in Fig. 3.7. The gravel gravitates from the recovery and production system onto a series of vibrating screens on which oversize (+19mm) and slimes (-2mm) is screened off and returned to the sea-floor.

The 'plantfeed' fraction (-19mm+2mm) is fed to a comminution circuit that employs preferential milling to crush the shell and disagglomerate the clay present in the plant feed (Fig. 3.7). The comminution product is then mixed with a high-density ferrosilicon (FeSi) slurry and pumped under pressure into a Dense Medium Separation (DMS) plant. As a result of the carefully controlled density of the FeSi slurry, low density materials (floats) are separated from the heavier, diamond-bearing '' concentrate, and the lighter material is discarded overboard.

Most of the ferrosilicon is drained from the solids as it passes over the drain and rinse screens. The remaining FeSi which is washed from solids is magnetically recovered and re-circulated in the processing plant for re-use. The heavier DMS concentrate fraction is dried and fed to a set of x-ray sorting machines which by exploiting the luminescence characteristics of diamonds, separates the diamonds from tailings, where-after it is sealed in a tin before export to the land-based sort house. The tailings from the x-ray sorting process is discarded and deposited back onto the sea floor. Final hand sorting is done on land to separate the diamonds from the gangue.

Most of the sediment discarded overboard during the recovery and production process settles back to the sea floor in and around the area being operated, depending on the position of the vessel in relation to the seafloor recovery tool. To prevent re-recovery of tailings, effort is made to prevent deposition onto pristine areas ground. This is achieved quite easily with crawler systems, where the vessel position can be offset from the crawler position, compared with a mega drill, where the vessel is always positioned directly above the drill.

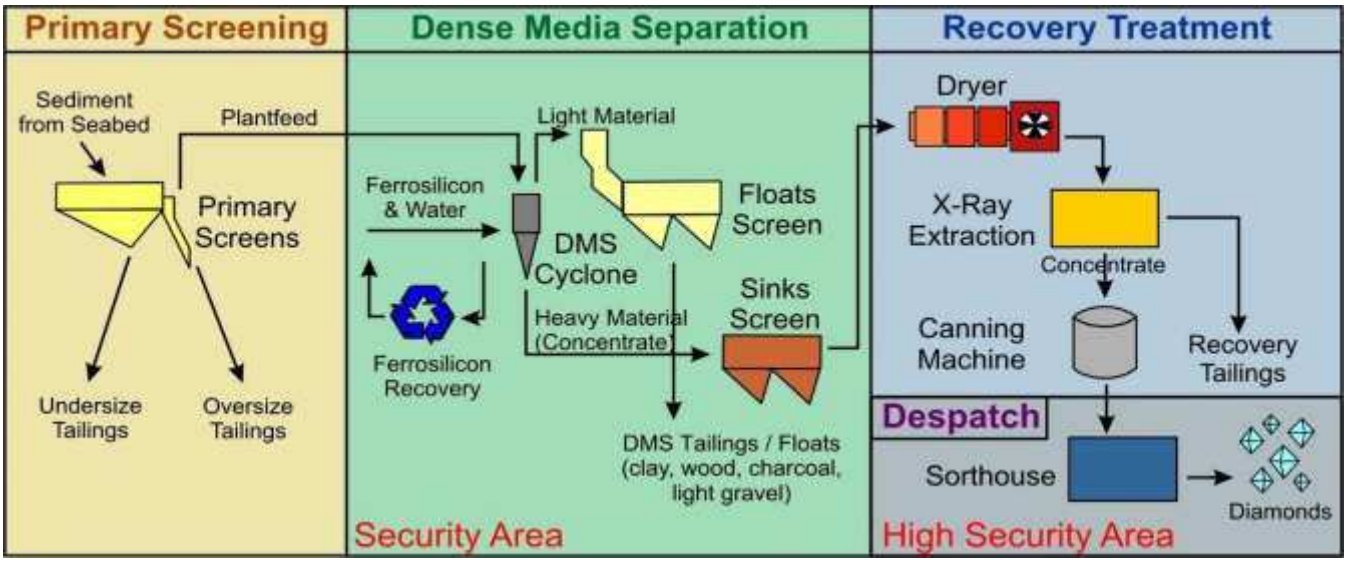


Figure 3.5: Flowchart diagram of the stages and processes during shipboard processing of marine diamond gravels (Source: DBMN, 2024).

3.6 Logistic Arrangements and Support

3.6.1 Fleet Overview

The specifications of the DBMN fleet are provided in Annex 3. The vessels undergo all required marine statutory and class surveys, and are issued with the necessary certificates from the American Bureau of Shipping for ISM certification. During these surveys, class items, navigation, safety and pollution

prevention gear and competency certificates for crew are checked. The facilities available to employees onboard the vessels include a library, mess, gym, laundry, canteen, recreational lounges with board games, darts, satellite television and videos.

3.6.2 Fuel Supply, Transfer, Storage and Usage

The fuel used by the drill and crawler 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 the recovery and production equipment. Fuel is supplied to the vessels by refuelling from a tanker in Namibian waters at distances more than 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 with the tanker by means of mooring ropes and the bunker hose. An alternative option is to have the receiving vessel on a 4-anchor spread (instead of the single anchor) and a tug is used to static tow the tanker.

3.6.3 Water supply and usage

Each vessel is equipped with one or two desalination plants. On average, the fleet generates 66,000 litres of water per day, which meet the fresh water needs on board the vessels. Approximately 95% of fresh water needed on board the vessel is supplied by desalination plants. Currently very little supplementary water is supplied from Port Nolloth in South Africa or Lüderitz in the event of breakdowns or equipment failures of the desalination units.

3.6.4 Waste management

The types of wastes from exploration, recovery, and production vessels are summarised in Table 3.1. Waste is removed from the vessels and transported to Port Nolloth and Lüderitz by means of a service/supply vessel for disposal at approved dumping/recycling sites in Lüderitz and Walvis Bay.

3.6.5 Discharges to Sea

3.6.5.1 Overview

As legally required, an Oil Record Book is maintained to record discharges passed through the oily water separator from onboard as well as other oil movements and an Official Garbage Record Book is completed as required by legislation.

Table 3.1: Types of waste generated in all the DBMN operations.

Non-hazardous waste	
Food waste	Macerated and disposed of at sea in accordance with the MARPOL requirements.
Domestic waste (e.g., food and packaging materials)	Incinerated on board to reduce the quantities /volumes of waste to be stored onboard and transported ashore in 209 litre yellow hazardous drums. Where no incineration plants are present onboard, all wastes are stored in garbage/waste skips and returned to port for disposal at recognised / registered waste disposal facilities. Domestic waste generated at the Windhoek Office is recycled and/or disposed of *via* the City of Windhoek's waste removal services. At the Logistics Base in Oranjemund, domestic waste is disposed of *via* Oranjemund' s waste removal services.
Sewage	Sewage onboard the vessels is treated in accordance with MARPOL Annex IV. Exploration, recovery, and production vessels are equipped with sewage treatment plants that release inert sludge and chlorinated water. Sewage generated at the Windhoek Office is disposed of *via* the City of Windhoek's sewage treatment works. At the Logistics Base in Oranjemund, sewage is disposed of *via* Oranjemund' s sewage treatment works.
Non-combustibles (e.g., glass (crushed), plastics, metals and crushed cans))	They are accumulated onboard, stored in waste skips and removed by a service / supply vessel, and off-loaded in port, to approved disposal / recycling facilities.
Scrap metals	They are accumulated onboard, stored in waste skips and removed by a service / supply vessel, or off-loaded in port, to approved recycling facilities or scrap metal dealer(s).
Empty/Dirty oil **drums**	They are kept intact and transferred *via* launch for resale to a drum refurbishing company or scrap metal recycling facilities.
Non-usable (rusted) **ferrosilicon** (FeSi)	Transferred ashore and disposed of at a recognised / registered waste disposal facility
Hazardous waste	
Medical waste	Transferred ashore, incinerated and disposed of at a recognised / registered waste disposal facility. Expired medicines that cannot be incinerated are transferred to Oranjemund pharmacy.
Contaminated rags (saturated by hydrocarbons)	Transferred ashore in yellow 209 litre hazardous drums via a service/supply vessel and disposed of at a recognised / registered waste disposal facility.
Paint / paint remover or **chemicals** (semi-full containers)	Transferred ashore in yellow 209 litre hazardous drums via a service/supply vessel and disposed of at a recognised / registered waste disposal facility.
Fluorescent light ballasts / tubes	On board the vessels these are stored in a fluorescent tube crusher drum (yellow 209 litre drum) and transferred via a service/supply vessel to Windhoek via Lüderitz Port for final disposal at a recognised / registered hazardous waste disposal facility, and those generated at the Windhoek Office are disposed of at the City of Windhoek hazardous waste disposal facility.
Batteries (lead-acid and dry cell batteries)	Sent off the vessel to battery manufacturers in orange plastic containers for recycling and final disposal at recognised / registered hazardous waste disposal facilities.
Toner and ink cartridges	Transferred from the vessel via Lüderitz to Windhoek for recycling or final disposal at a recognised / registered waste disposal facility, and those generated at the Windhoek Office are recycled and/or disposed of at the City of Windhoek hazardous waste disposal facility.
Hydrocarbon substances (e.g., fuel, oils and hydraulic fluid)	Stored in the ships' bilges and are recovered using oily-water separators. In accordance with MARPOL standards, only water with <15 ppm of hydrocarbons is discharged from the bilges. The remaining sludge is stored in drums and off-loaded during in-port maintenance, or transferred to a service/supply vessel for transport via Lüderitz to Walvis Bay, where it is re-processed/ recycled or disposed of at a recognised / registered waste disposal facility.
Radiation sources (e.g., sealed source used for density measuring and X-Rays for product separation)	Disposed in South Africa, according to the Namibian Hazardous Substances Ordinance 14 of 1974 and the South African Hazardous Substances Act 15 of 1973 and the Group IV Hazardous Substance Regulations (247/1993).
Pyrotechnics (e.g., flares)	Transferred ashore via a service/supply vessel to port and destroyed by the Namibian Police.

3.6.5.2 Hydrocarbons

Various hydrocarbon substances (including marine gas oil, hydraulic oil, lubricating oil and solvents) from the machinery spaces from inside the confines of the vessel are collected into the bilges and are passed through an oily water separator. Water containing <15 ppm of oil, in accordance with MARPOL standards is then discharged regularly from bilges into drums/flow bins. The remaining sludge amounts to a monthly quantity of approximately 5-10 tonnes per recovery and production vessel and 2-3 tonnes per prospecting vessel which are discharged when the vessels are in port. Alternatively, it is pumped to the supply tug at intervals of approximately 3 months, or stored in drums and removed by the service/supply vessel to Lüderitz, from where it is transported to Walvis Bay for proper disposal at a recognised/registered waste disposal facility.

For oil spillages on deck, a natural sphagnum peat moss product is used, which is an oil absorbent that encapsulates the oil so that the hydrocarbons do not leach out once put into a landfill site. Hydraulic oil is used in the drilling equipment and in the event of a burst pipe, a minimum of 1,000 litres and a maximum of 2,000 litres of hydraulic oil would be lost. If equipment is damaged, lubricating oil may be spilled in small quantities. Any spillage of solvents, such as turpentine and paraffin used during painting, would be in very small quantities and will be contained onboard.

Excluding disasters, it is only during refuelling at sea that there is any likelihood of a marine gas oil spill. Refuelling at sea occurs at distances in excess of 12 nautical miles offshore. In the event of a spill during refuelling, it is anticipated that at most 5,000 litres would be spilled. Should a spill occur, the procedure would be to follow the Shipboard Oil Pollution Emergency Plan (SOPEP). This Manual is approved by the Namibian Directorate of Maritime Affairs (DMA). In terms of the Emergency Plan DBMN's Marine Superintendent (DPA) will inform the following Namibian authorities (as deemed applicable): Maritime Division of the Ministry of Works, Transport and Communication. Ministry of Fisheries and Marine Resources. Ministry of Environment, Forestry and Tourism and the Lüderitz and Walvis Bay Harbour Masters. and, if applicable, the South African Departments of Transport, and Department of Environmental Affairs.

In the event of a major disaster, such as a vessel breaking up at sea, the quantities of marine gas oil that could be spilled per vessel (taken as 95% capacity) in the worst-case scenario are:

1. m.v. Mafuta – 4,275 kl.
2. m.v. Debmar Atlantic – 2,290 kl.
3. m.v. Debmar Pacific - 2,290 kl.
4. m.v. !Gariep – 2,449 kl.
5. m.v. Grand Banks – 2,375 kl.
6. m.v. Coral Sea – 2,006 kl.
7. m.v. AMV3 – 4, 574 kl, and.
8. m.v. SS Nujoma – 1,476 kl.

Marine gas oil is very light and would be broken up in a matter of days. Quantities of other oils (lubricating, hydraulic, used oils and sludge) and hazardous substances that could be spilled vary for each vessel, with a total of approximately 10,000 litres being the worst-case scenario.

The Australian Maritime Safety Authority has highlighted the differences between heavy fuels and refined products and the difficulty in quantifying the consequences of spills. In general, however, refined petroleum products tend to be more toxic to organisms but less persistent in the environment. On the other hand, crude oils and heavy fuel oils like bunker fuels tend to be less toxic but are more persistent and more likely to have physical impacts on wildlife (e.g., coating feathers, fur and skin). Additionally, the chemistry of the crude oils and refined petroleum products varies significantly. For each occasion,

spilt oil or fuel will behave differently and it is therefore difficult to predict accurately the impacts of such hydrocarbon spills on wildlife. The DBMN Safety Management System (SMS) strives to achieve the objectives of the International Safety Management System (ISM) Code through the safe operation/management of its vessels and the prevention of pollution of the marine environment.

3.6.5.3 Ferrosilicon

Although every effort is made to recover FeSi used in the onboard DMS Plant, some is lost with the tailings that are discharged overboard. Losses are highly variable, depending on the substrate being operated. Losses increase in areas where the sediments have high shell content, because FeSi accumulates in shells and is lost as the shells are discharged overboard. To reduce FeSi loss, some DMS plants have been fitted with ball-mills to fragment shell- and clay-material during sediment processing to improve the recovery of FeSi.

3.6.5.4 Deck and Other Drainage

Save-alls have been constructed around machinery that may leak oil / grease. These collect leaks and the oil/grease can then be cleaned out of the contained area.

3.6.5.5 Sewage

Treatment plants have been fitted to all vessels, and the effluent is discharged to sea following onboard treatment, thereby complying with the MARPOL international standards.

3.6.5.6 Processed Water

Grey water (i.e., drainage from dishwater, shower, laundry, bath and washbasin drains) is discharged directly into the sea in accordance with MARPOL V guidelines for implementation.

3.6.5.7 Garbage

Except for food wastes, all garbage generated on the recovery and production vessels such as wood, paper, plastic, cans, glass, metal etc. is retained onboard. Metal waste such cans are crushed and all waste which will not produce a toxic smoke is incinerated. Glass and the incinerated materials are stored in 210ltr drums onboard the vessels. Scrap metal and crushed cans are retained separately for recycling.

The full skips are periodically transported to Port Nolloth and Lüderitz by the supply vessel where they are sent to an approved dumping/recycling site ashore. Macerators and grinders have been fitted in the galleys of all vessels to reduce food waste such that it will pass through a 25 mm screen in order to comply with the MARPOL Annex V requirement.

3.6.5.8 Hazardous Chemicals

No hazardous chemicals are used in the diamond extraction process. The only chemicals kept onboard are normal domestic cleaning materials.

3.6.5.9 Lost Equipment

Occasionally, equipment such as anchors, anchor chains or anchor wires, drill bits etc. may be lost at sea from the recovery and production vessels. For financial reasons, every effort is made to retrieve such items. Lost equipment is recorded in a Geographical Information System (GIS) Hazards Database with details of the date lost, position and possible reason for loss.

3.6.5.10 Ballast Water

The vessels will not be doing any foreign voyages (i.e., beyond southern Africa) and ballast water may therefore be released. The International Convention for the Control and Management of Ships' Ballast

Water and Sediments (BWM Convention) was adopted by consensus at a Diplomatic Conference held at the International Maritime Organization (IMO) Headquarters in London on 13 February 2004. The Convention will enter into force 12 months after ratification by 30 States, representing 35 per cent of world merchant shipping tonnage. South Africa has acceded to the BWM Convention (as at 31st August 2004), but not Namibia or Belgium (see www.imo.org).

3.6.6 Discharges to Air

3.6.6.1 Gas emissions

On all vessels gas emissions result from engine/generator exhausts utilising marine gas oil and from the incineration of wastes. Based on average fuel consumption of 45 tonnes/day for the current fleet and the average environmental conditions in the recovery and production areas, daily engine emissions are estimated at 81,000 m^3 carbon dioxide, 3,150 m^3 carbon monoxide, 6,300 m^3 nitrous oxide and 180 sulphur m^3. No estimates of incinerator gases have been made as this varies depending on the material incinerated.

3.6.6.2 CFCs

In compliance with the Vienna Convention of 1985 and the Montreal Protocol of 1987 to which Namibia became a party in 1993, DBMN is reducing CFCs. All Halon fire-fighting systems onboard have been replaced by carbon dioxide systems.

Hydro-Chlorofluorocarbons (HCFCs), which are interim refrigerants with a lower ozone depletion factor than that of CFCs are, however, still used in the refrigeration and air-conditioning plants onboard.

3.6.7 Maintenance and Related Activities

3.6.7.1 Shutdown Maintenance and Related Activities Waste Flows

During the shutdown maintenance period and related activities such as scheduled conversions to vessels, contractors will be required to comply with De Beers Marine's Environmental Policy with regards compliance with environmental legislation and management of waste to prevent pollution.

De Beers Marine will manage the maintenance and conversion/construction works conducted in the Cape Town harbour and waste will be managed in accordance with the ISO14001 compliant Waste Management Procedures developed for Shut down maintenance and conversion activities (Fig. 3.6 and Table 3.2).

An environmentally-friendly anti-fouling paint, which is tin-free and has cuprous oxide and organic biocides as active ingredients, is the current specification for all DBMN vessel hulls. All vessels in the fleet have been painted with the specified paint. Redundant assets are sent for re-use whenever possible.

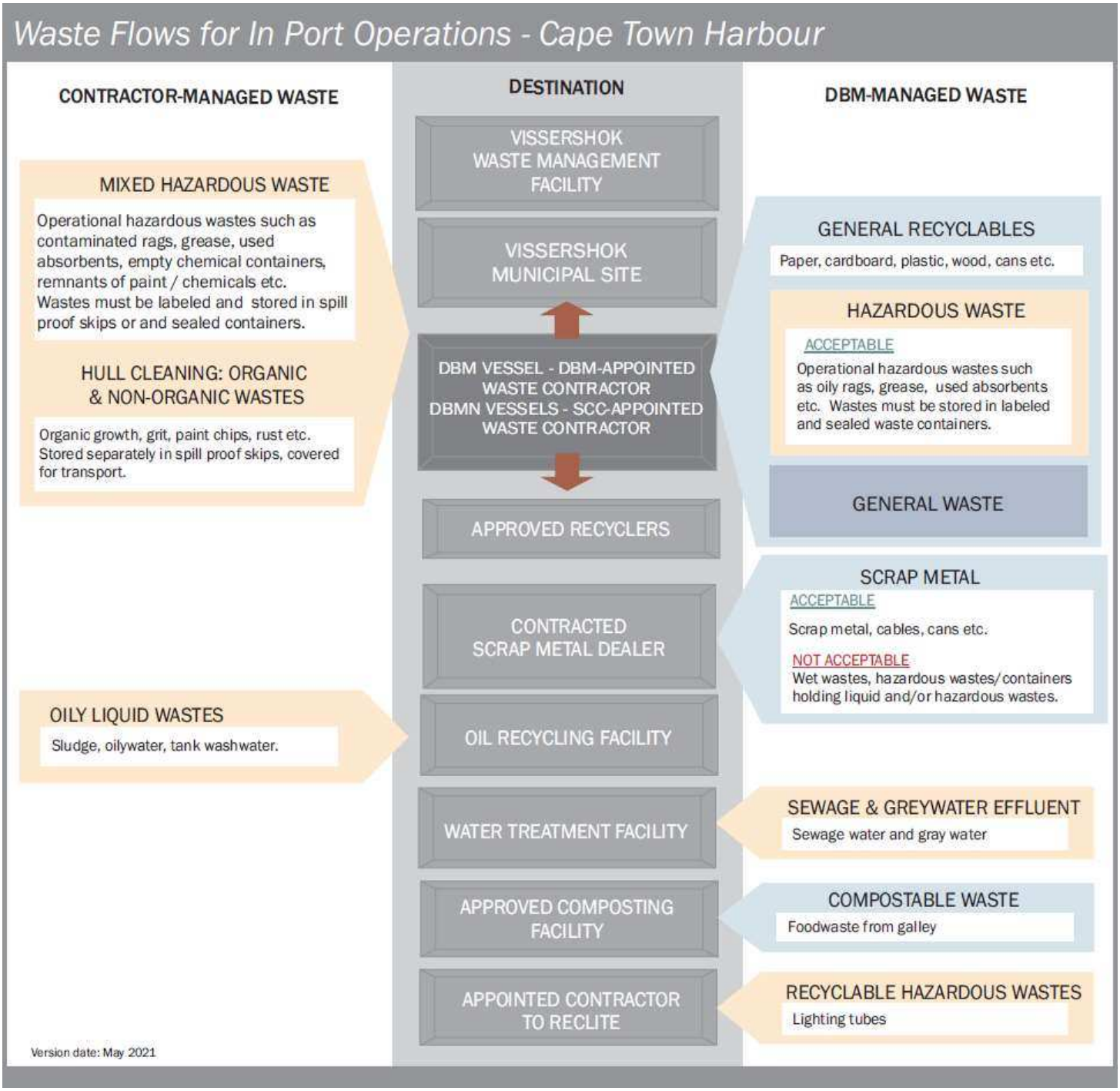


Figure 3.6: Summary of DBMN shutdown waste management flows.

Table 3.2: Summary of the key shutdown activities and waste flows.

Site establishment /maintenance / decommissioning	**In Port team site establishment, maintenance, and removal**	**General waste from clearing site**
	Flooding of the dry-dock	General waste from clearing dock
	Galley	Galley waste & wash water
	Pollution prevention	Used absorbents, contaminated water/oil, oily rags
	Housekeeping	General waste, sweepings
Repair, maintenance and construction activities	General repair, maintenance and construction activities	General waste, scrap metal
	Mechanical hotwork, cutting and grinding	Cutting discs, waste welding rods, scrap metal, sweepings
	Stripping - Asbestos insulation / lagging waste handling, storage and disposal	Asbestos containing wastes
	Use of solvent-based coatings (spray or brush painting)	Solvents, waste paints, brushes, tins
	Replacement of fluorescent lights and ballasts	Hazardous waste - fluorescent lights and ballasts
Engines	Hydrocarbon management during engine repair, maintenance and replacement activities	Waste oil, filters, oil containers
Hull	High-pressure washing to remove fouling/organic growth	Organic growth removed from hull, waste water
	Dry Abrasive Blasting - Hull and equipment in dry-dock	Organic growth removed from hull, grit, waste water
Tanks	Ballast tank cleaning	Waste water
	Bilge and fuel tank cleaning	Waste water, waste oil, oil rags, containers from degreasers
	Tank maintenance: ballast, freshwater, wash water (freshwater wash, chemically de-rust and paint)	Chemical / paint containers, rags, painting materials
Hydraulics	Hydraulic equipment repair, maintenance and replacement	Hydraulic oil, oily rags
Refrigeration & air conditioning	Refrigeration /air conditioner repair, maintenance and replacement activities	Refrigerant
Sewage systems	Sewage system maintenance, repair and replacement	Sewage effluent
Radiation control	X-ray equipment maintenance, repair and installation and removal and installation of nuclear sources	Nuclear sources, x-ray tubes

3.6.7.2 Planned Maintenance System

De Beers Marine Namibia runs a Planned Maintenance System as an integrated part of the Company's business management system. The system provides planning, control, and processing of scheduled maintenance, inspections, and service management to ensure safe and reliable operational systems.

A maintenance strategy for all equipment is developed, taking cognisance of the original equipment supplier maintenance recommendation and the consequences of equipment failure in respect to Safety, Health and Environment together with the impact on business.

3.6.8 Logistic Support Services

3.6.8.1 Port Support

The following ports were used and will still be used in the next 3 years:

- Port of Lüderitz.
- Port Nolloth.
- Port of Walvis Bay, and.
- Port of Cape Town.

3.6.8.2 Airborne Services

The Debmarine Namibia vessels remain at sea for extended periods, making it necessary to rotate and relieve the crew members. The normal crew cycle/voyage is 28 days service at sea, followed by 28 days' shore leave.

Crew members joining vessels are transported by fixed-wing charter aircrafts, one (1) 50-seater, Embraer ERJ145. flying between Windhoek and Oranjemund owned by Westair Aviation, and one (1) 11-seater Beechcraft B1900 flying between Cape Town and Oranjemund owned by Westair Aviation. The Embraer ERJ145 also carry out one return flight from Cape Town to Oranjemund per month. There are on average 11 crew change flights per month, which include Security/Maintenance crew change flights.

At the Logistics Base in Oranjemund, crew members are transported by helicopters to or from their vessels on crew change days and on-crew days. There are three helicopters on the contract, namely, one (2) Augusta Westland 139 (AW139) and one (1) Sirkorsky 76 C+ (S76C+). The three helicopters are operated by Court Helicopters Namibia, a subsidiary of Titan Offshore Helicopters Group PTY Ltd. Equipment and supplies of modest mass and dimensions also accompany these flights.

On average some 125 helicopter flying hours are undertaken per month to the vessels, which include crew change and assistant crew change flights, consignment, production and medical emergency flights, compassionate, medivac and VIP flights. Court Helicopters Namibia is the current contractor to provide rotary wing services to provide these airborne helicopter services.

Debmarine Namibia is also the operator of the Oranjemund Airport (Farm no 166, Karas Region), that provides services to the companies' aviation activities, as well as those required by Namdeb and the greater community of Oranjemund.

The airport consists of a 1600m runway, terminal buildings, fire station, refueling facilities and hangars associated with the activities of Westair Aviation and Court Helicopter Namibia.

3.6.8.3 Seaborne Services

A supply vessel is chartered regularly to transport heavy and bulky items to the vessels at sea, such as drill pipes, drums of ferrosilicon and engine components. The transfer at sea is conducted by cranes while the vessels are moored together or are in close proximity (Plate 3.10). A substantial materials handling department covers the purchase and reception of items required, and sees to the effective delivery to their required destinations.

3.6.8.4 Oranjemund Services

Oranjemund is used as a base for DBMN personnel and they have access to the facilities provided in Oranjemund for DBMN employees, including a pre-primary and primary school, sports facilities, shops,

hospital with medical facilities including social services, dispensary, physiotherapy and dental care. For seagoing personnel, emergency medical and rescue facilities are provided by Namdeb. DBMN utilises one third of the Namdeb-owned airport at Oranjemund as a logistics base. DBMN employees are accommodated in the Namdeb or private Guest Houses in Oranjemund when required.

Plate 3.10 Typical supply vessel bringing equipment and supplies to DBMN vessel and removing general waste and other empty containers (Source: DBMN, 2015).

3.6.8.5 Offices

DBMN's head-office is located in the Namdeb Centre, 10 Dr Frans Indongo Street, Windhoek, Namibia.

3.6.9 Safety, Health, Environment and Security (SHES)

3.6.9.1 Overview

Health and safety issues comply with the De Beers Group policy on Occupational Health Safety and Environment (Annex 1). A health and safety agreement between DBMN management and the Mine Workers Union of Namibia has been signed.

3.6.9.2 SHES Auditing

De Beers Marine Namibia runs a Safety, Health and Environmental Management System (SHEMS) supported by an electronic data management system called ISOMETRIX. The SHEMS covers both international and national legislation in the fields of maritime and international safety. This is in line with the requirements of the IMO International Safety Management (ISM) Code, and the Occupational health and safety management systems (ISO 45001:2018) certification. All ships' statutory and classification required documents are in place. All ships are classed, either with Lloyd's Register or the American Bureau of Shipping (ABS).

De Beers Marine Namibia certification body for ISO 45001 is the American Bureau of Shipping (ABS).

3.6.9.3 Medical Facilities and Emergency Procedures

Advanced medical facilities are found onboard the vessels, where designated ships officers are trained in comprehensive First Aid. DBMN has an Emergency Response Plan that covers all of the following situations: collision, grounding, fire, helicopter ditching, serious injury/illness, oil pollution, man overboard, irreparable propulsion or steering failure, contagious diseases, notifiable conditions, piracy,

terrorist activity, severe weather, natural disaster, aeroplane accident, flooding, injury or broken mooring in port and unforeseen events. The plan details the responsibilities, procedure etc. for any of the above emergencies. Helicopters are on permanent standby to evacuate emergency medical cases. Injured persons will be taken to the hospital at Oranjemund for initial treatment after which, in serious cases, they will be transferred to Windhoek or Cape Town.

3.6.9.4 Onboard Noise

There are various sources of noise on each vessel. Onboard noise measurements have been taken on all vessels and specific areas were identified as high noise zones. Noise levels have been reduced where possible by introducing sound proofing. Hearing protection devices have been made compulsory in these areas for people exposed to the noise. DBMN has a hearing ability programme in place in terms of which noise levels are re-evaluated on an annual basis. All on-board staff is sent for audiometry tests as part of their annual medical check-ups.

3.6.10 Security Detail

All persons entering Oranjemund and embarking the vessels require a Restricted Area Permit (RAP) in terms of the Diamond Act, 1999 (Act No. 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 DBMN 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 at the airport logistics base. 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 DBMN offices.

3.7 Sustainability and Rehabilitation and Closure Plan

3.7.1 Future Operational Plan

The minerals licence will expire in 2035, while the current life of mine plan (2023 LoM) extends to 2057. The mine plan is based on the profitable parts of a combination of the higher confidence Local Block Estimate (LBE) resource, and the lower confidence Global Resource Estimate (GRE) blocks.

The GRE portion scheduled for mining requires resource development of at least one year ahead of mining. This resource development is done using the dedicated sampling vessel, the m.v. Sam Shafishuna Nujoma (SSN). As part of strategic business planning process, Debmarine Namibia reviews the LoM annually to update the plans with the latest assumptions reflecting current realities.

3.7.2 Rehabilitation and Closure Plan

An update of the 2011 Preliminary Rehabilitation and Closure Plan for Debmarine Namibia is currently in progress, with the 2024 Mine Closure Plan scheduled for completion around mid-2024.

The proposed overarching objective of the Closure Plan is to ensure that the biophysical, physical and social closure issues are addressed in the early stages of operational planning, thereby managing the risks that may arise due to either premature or planned closure of operations.

The recommended closure objectives have been developed based on the risk assessments undertaken to date. Furthermore, closure requirements are accounted for to ensure the financial viability of the operation incorporates provisioning for closure costs.

4. REGULATORY FRAMEWORK

4.1 Exploration, Recovery, and Production Operations

The Ministry of Mines and Energy (MME) is the competent authority for minerals exploration, recovery, and production activities in Namibia. The Minerals (Prospecting and Mining) Act, 1992, (No 33 of 1992) is the most important legal instrument governing minerals prospecting / exploration and recovery activities. Several explicit references to the environment and its protection are contained in the Minerals Act, which provides for environmental impact assessments, rehabilitation of exploration, recovery, and production areas and minimising or preventing pollution. A detailed regulatory register is provided in Annex 4.

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 current ongoing exploration and recovery activities falls within the categories of listed activities that cannot be undertaken without an Environmental Clearance Certificate. DBMN has an Environmental Clearance Certificate for the ongoing exploration, recovery, and production operations that will expire on the 9th September 2024 and this report has been prepared to support the newel application.

Locally, Namibia might have State of Health Emergency on top of the current escalating health restrictions under the Public and Environmental Health Act, 2015 (Act No. 1 of 2015) that may also affect not only equipment and specialist workforce mobilisation but also the actual exploration, recovery, and production operations.

4.3 Regulatory Agencies

The environmental regulatory authorities responsible for environmental protection and management in relation to the current and future exploration and recovery, and production operations 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 ongoing exploration programme covering geophysical surveys (seismic) and sampling operations as well as the recovery and production operations.

Table 4.1: Government agencies regulating environmental protection in Namibia.

AGENCY	ROLE IN REGULATING ENVIRONMENTAL PROTECTION
Ministry of Environment, Forestry 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 recovery 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. Public and Environmental Health Act, 2015 (Act No. 1 of 2015) provides for Public Health Management.
Ministry of Works, Transport and Communication	The Directorate of Maritime Affairs (DMA) in the MWTC is the government's lead agency responsible for National Oil Spill Contingency Planning (NOSCP), 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 ongoing marine diamonds exploration and recovery activities (Annex 4).

Type of Permit / Approval	Current Status	Authorising / Institution	Legal Framework
1. **Mining License**	Granted 23rd November 1995 Expire 22nd November 2035	Ministry of Mines and Energy (MME)	Minerals (Prospecting and Mining) Act, 1992, (No. 33 of 1992)
2. **Environmental Clearance Certificate (ECC)**	Currently ECC granted on the 9th September 2021 and will expire on the 9th September 2024	Office of the Environmental Commissioner, Ministry of Environment and Tourism (MET)	Environmental Impact Assessment (EIA) Regulations No. 30 of 2012 gazetted under the Environmental Management Act, (EMA), 2007, (Act No. 7 of 2007)
3. **Oil Spill Contingency Plan (OSCP)**	Oil Spill Contingency Plan (OSCP) Document based on the Dispersion Modelling – Oil Spill Modelling Results Prepared and Formal Endorsement Shall be Obtained	Marine Pollution Control and SAR, Directorate of Maritime Affairs | Ministry of Works and Transport (MWT)	Prevention and Combating of Pollution of the Sea by Oil Act, (Act 6 of 1981) (as amended by Act 24 of 1991)
4. **Diamonds Security Permits**	All necessary permits are in Place	Ministry of Mines and Energy (MME)	Diamond Act, 1999 (Act No. 13 of 1999 (and the Regulations 1 April 2000 and Amendment of the Diamond Regulations 2003).
5. **Emergency Response Plan (ERP)**	Emergency Response Plan (ERP) Report Prepared and Formal Endorsement Shall be Obtained	Ministry of Mines and Energy – Office of the Mining Commissioner	Minerals (Prospecting and Mining) Act, 1992, (No 33 of 1992)
6. **Radioactive Authorisation (Import and Export Permits) for the use of radioactive sources**	Authorisations are in Place	National Radiation Protection Authority (NRPA), Ministry of Health and Social Services (MHSS)	Atomic Energy & Radiation Protection Act (Act No 5 of 2005) and Radiation Protection & Waste Disposal Regulations (No 221 of 2011)
7. **Pollution Safety Certificate for the Vessels**	Certification to Operate in Namibia Marine Environment Obtained	Marine Pollution Control and SAR, Directorate of Maritime Affairs, Ministry of Works and Transport (MWT)	Prevention and Combating of Pollution of the Sea by Oil Act, (Act 6 of 1981) (as amended by Act 24 of 1991)
8. **Preapproval for the Used of Dispersant in line with the Oil Spill Contingency Plan (OSCP) in an Event of an Accidental Oil Spill**	Pre-approval Shall be Obtained	Ministry of Fisheries and Marine Resources.	Marine Resources Act, (Act 27 of 2000)
		Ministry of Works and Transport	Prevention and Combating of Pollution of the Sea by Oil Act, (Act 6 of 1981) (as amended by Act 24 of 1991)

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 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

The following is the summary of the regulatory register for all applicable current and likely future legal and other requirements as reference in the EMP Tables 7.1 -7.10 (Annex 4):

1. Minerals (Prospecting and Mining) Act, 1992, (Act No 33 of 1992).

2. The Diamond Act 13 of 1999 (and the Regulations 1 April 2000 and Amendment of the Diamond Regulations 2003).

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

4. Water Resources Management Act, 2013 (Act No. 11 of 2013), and Water Resources Management Regulations, 2023.

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

6. Public Health Act 36 of 1919 (as last amended by Act 21 of 1988).

7. Merchant Shipping Act 57 of 1951.

8. Sea Shore Ordinance 37 of 1958.

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

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

11. Soil Conservation Act 76 of 1969 (as amended in South Africa (SA) to March 1978. section 13 is amended by the Forest Act 12 of 2001).

12. Hazardous Substance Ordinance 14 of 1974.

13. Atmospheric Pollution Prevention Ordinance 11 of 1976.

14. Dumping at Sea Control Act 73 of 1980.

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

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

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

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

19. Foreign Investment Act 27 of 1990.

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

21. Nature Conservation Amendment Act 5 of 1996.

22. Arms and Ammunition Act 7 of 1996 (and the Regulations 1998).

23. Road Traffic and Transport Act 22 of 1999 (as amended by the Road Traffic and Transport Amendment Act 6 of 2008).

24. Electricity Act 2 of 2000 and Electricity Act 4 of 2007 (and the Electricity Regulations: Administrative Electricity Act 2 of 2000 and the Electricity Control Board: Namibian Electricity Safety Code, 2009: Electricity Act, 2007).

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

26. Environment Investment Fund of Namibia Act 13 of 2001.

27. Wreck and Salvage Act 5 of 2004.

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

29. Atomic Energy and Radiation Protection Act 5 of 2005 (and the Radiation Protection and Waste Disposal Regulations 2011).

30. Labour Act 11 of 2007 (and the Labour Amendment Act 2 of 2012).

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

32. Disaster Risk Management Act 10 of 2012.

33. International Conventions and Protocols:

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

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

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

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

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

f) International Convention for the Prevention of Pollution from Ships (MARPOL) 1973 (as modified by the Protocol of 1978 adopted by the Inter-Governmental Maritime Consultative Organization ("IMCO") in London on 3 November 1973).

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

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

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

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

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

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

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

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

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

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

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

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

34. Regional Agreements:

a) Southern African Development Community (SADC) Protocol on Mining 1997.

b) Southern African Development Community (SADC) Protocol on Energy 1998.

5. RECEIVING ENVIRONMENT

5.1 Climatic Components Overview

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). Oranjemund experiences an average low temperature range in July of 9-17°C, and average high temperature ranges in January of 16-20°C (Wijnberg 1995). Highest temperatures (>30°C) tend to occur in winter during 'berg' wind conditions.

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 (Fig. 5.2). 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).

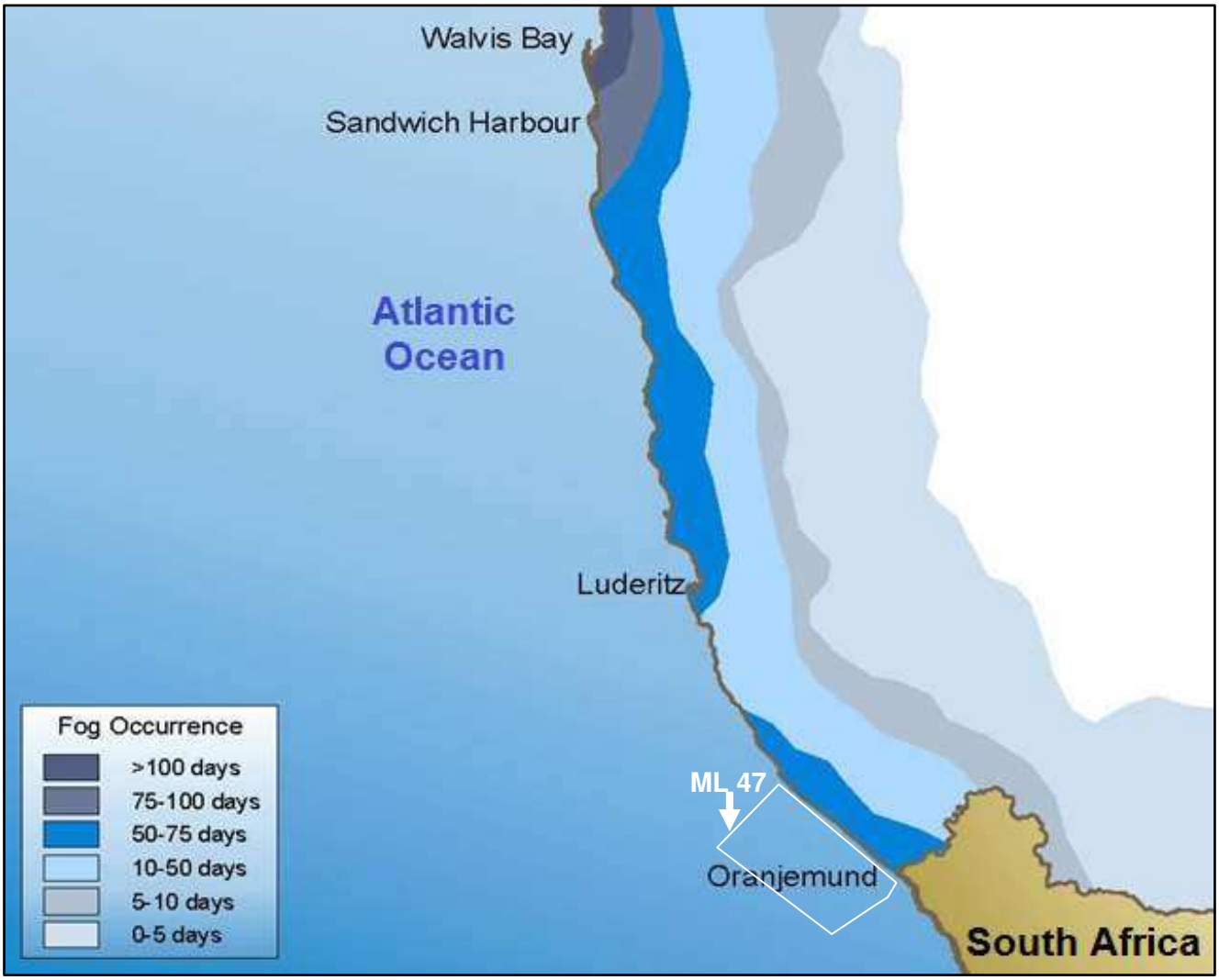


Figure 5.1: Fog day frequency for 1984 using Meteosat Images (Adapted from Olivier 1992, 1995).

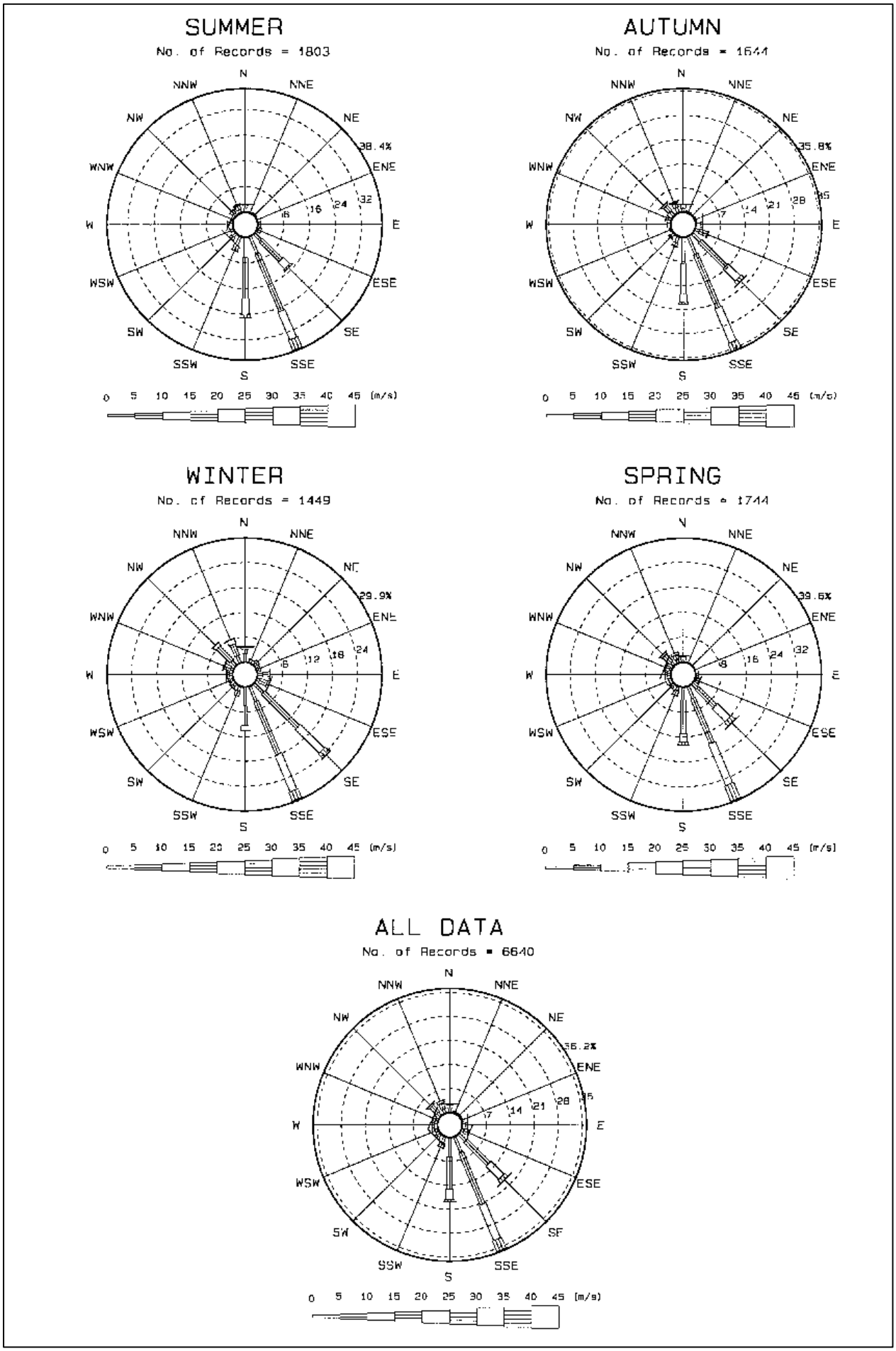


Figure 5.2: Seasonal wind roses for the offshore area 28°-29°S. 15°-16°E (Oranjemund) (Source: Voluntary Observing Ship (VOS) data from the Southern Africa Data Centre for Oceanography (SADCO))

5.2 Oceanographic Setting

5.2.1 Wind

The licensed area is in an area of strong south-easterly winds which blow approximately parallel to the coastline (Fig. 5.3). Data indicating a predominantly south and south-easterly wind direction and generally stronger in spring and summer than in autumn and winter (Figs. 5.3 and 5.4).

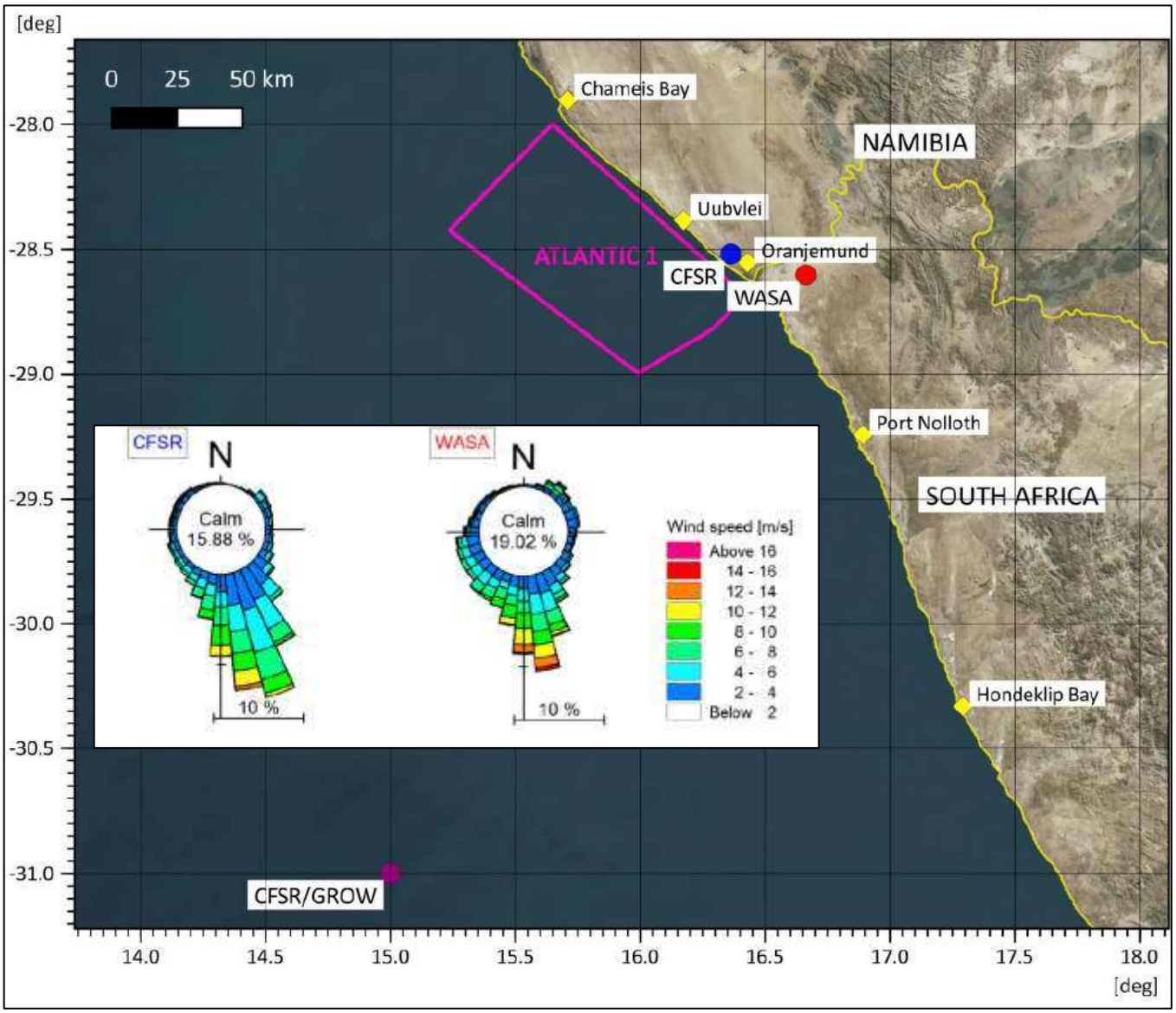


Figure 5.3: Prevailing wind directions derived from the locations of the measured Weather Atlas of South Africa (WASA) and modelled Climate Forecast System Reanalysis (CFSR) wind extraction points (Source: PRDW, 2020a).

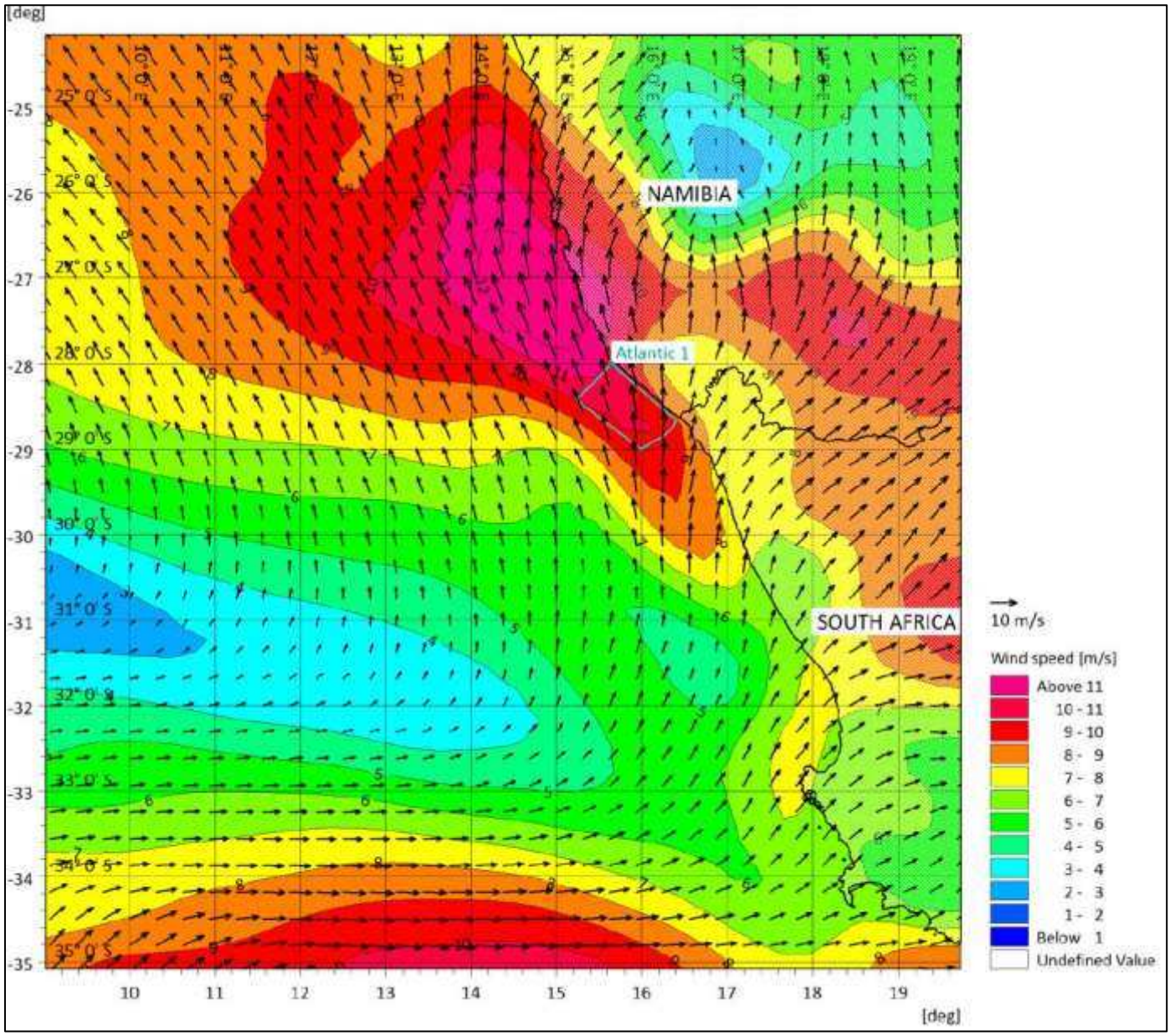


Figure 5.4: Example of a CFSR hindcast wind field, highlighting the potential for spatial variation of winds at an instance in time (Source: PRDW, 2020a).

5.2.2 Currents

According to PRDW, (2020a) and (2020b), there is some evidence of wind-induced currents and Ekman transport at the 10 m depth, resulting in north-westerly to westerly current directions, although the current speeds and directions are highly variable over the considered area.

The spatial variation in the hindcast currents highlights the importance of modelling space and time varying current fields, rather than seasonally averaged currents (Figs. 5.5 and 5.6).

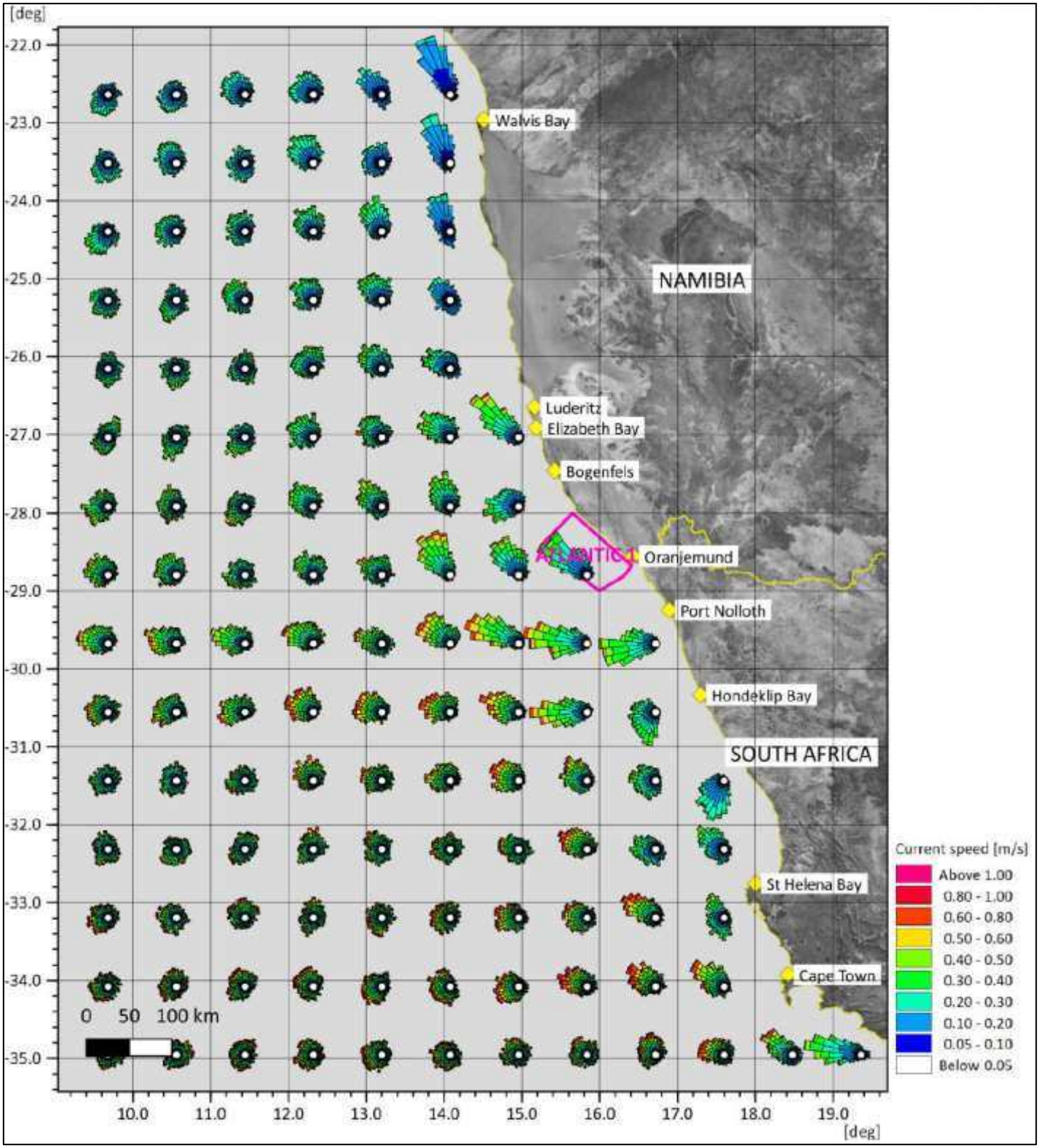


Figure 5.5: Hybrid Coordinate Ocean Model (HYCOM) current roses at 10 m water depth in the vicinity of the study area, highlighting the spatial variation for the five-year current climate (Source: PRDW, 2020a).

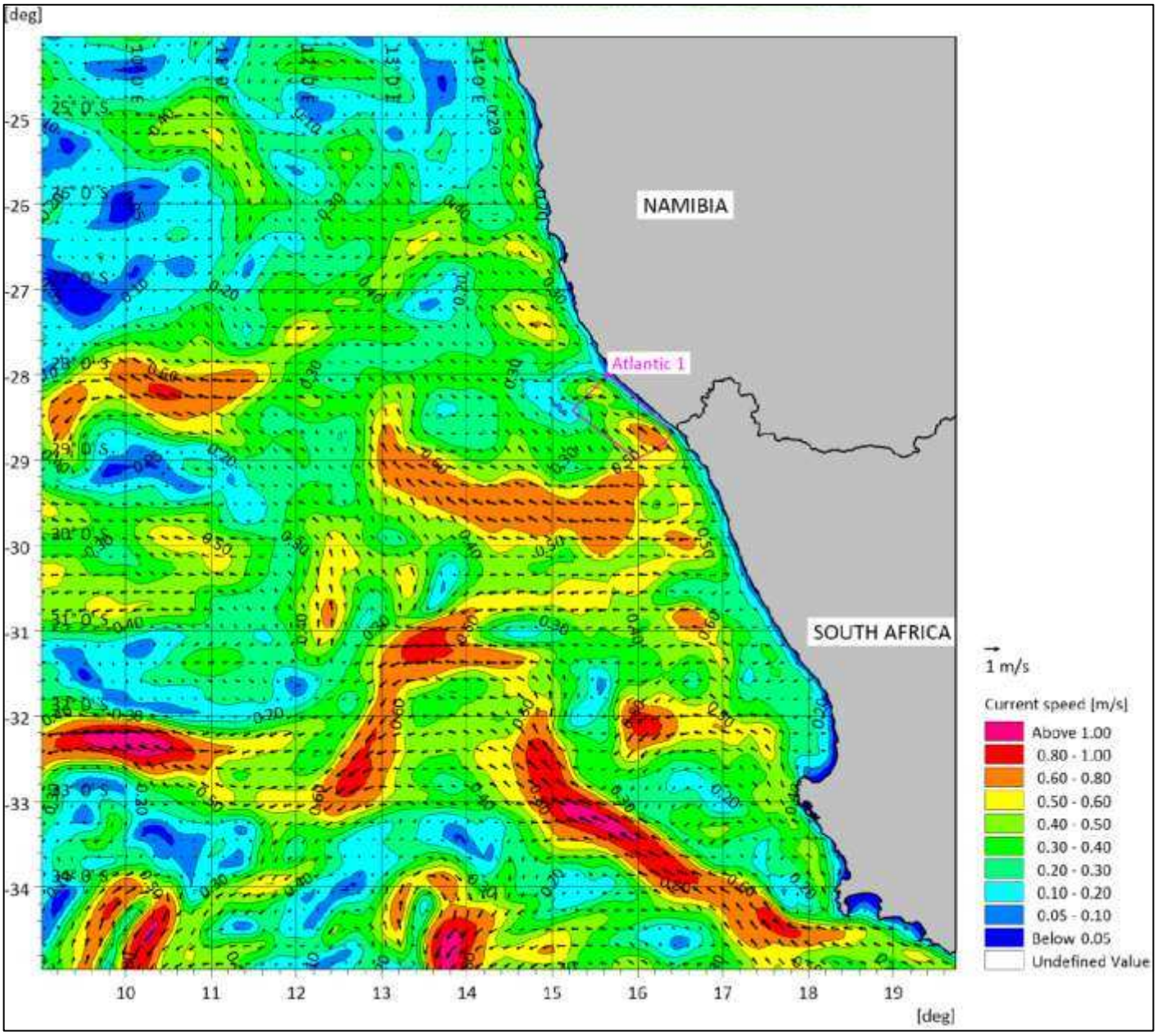


Figure 5.6: Example of a Hybrid Coordinate Ocean Model (HYCOM) current field at 10 m water depth, highlighting the potential for spatial variation of currents at an instance in time (Source: PRDW, 2020a).

5.2.3 Waves and Tides

Wind-induced waves, on the other hand, have shorter wave periods (~8 seconds), are generally steeper than swell waves, and tend to come from a more south-easterly direction (CSIR 1996). Daily wave height measurements from a wave recorder stationed off Port Nolloth indicate an 'event' scale distribution of wave heights, with large wave events persisting for a maximum of 7 days, but 2–4-day periods being more common (Lane & Carter 1999). Generally, wave heights decrease with water depth and distance longshore.

On occasion, the prevailing south-westerly winds can reach gale force velocities more than 70 km/hr, producing swells up to a maximum height of 10 m. In common with the rest of the southern African coast, tides are semi-diurnal, with a total range of some 1.5 m at spring tide (as measured at Port Nolloth), but only 0.6 m during neap tide periods (Table 5.1).

Table 5.1: Tide statistics for Port Nolloth and Lüderitz (from SA Tide Tables 2004, all levels referenced to Chart Datum).

	Port Nolloth	**Lüderitz**
Lowest Astronomical Tide (LAT)	0 m	0 m
Mean Low Water Springs (MLWS)	0.28 m	0.23 m
Mean Low Water Neaps (MLWN)	0.78 m	0.65 m
Mean (Sea) Level (ML)	1.09 m	0.94 m
Mean High Water Neaps (MHWN)	1.40 m	1.22 m
Mean High Water Springs (MHWS)	1.91 m	1.65 m
Highest Astronomical Tide (HAT)	2.41 m	1.99 m

5.2.4 Seawater Temperature

South Atlantic Central Water (SACW) comprises the bulk of the seawater in the study area, either in its pure form in the deeper regions, or mixed with previously upwelled water of the same origin on the continental shelf (Nelson & Hutchings 1983).

Temperatures range between 6°C and 16°C, and salinities between 34.5‰ and 35.5‰ (parts per thousand) (Shannon 1985).

5.2.5 Water Masses and Circulation

The major feature of the Benguela Current along the coastline is upwelling. It is seasonal in the south but is a semi-permanent feature at Lüderitz and areas to the north due to perennial southerly winds (Fig. 5.7 and Shannon 1985).

Wind stress is a persistent forcing influence that induces intense upwelling along the coast between the Orange River Mouth and Walvis Bay (Duncombe Rae 2005). In the nearshore zone along the southern Namibian coastline, strong wave activity from the south and southwest (generated by winds and waves in the South Atlantic and Southern Ocean) drives a predominantly northward long-shore current (Shillington *et al*., 1990).

Surface currents appear to be topographically steered, following the major topographic features (Nelson & Hutchings 1983). Current velocities vary accordingly (~10-35 cm/s), with increased speeds in areas of steep topography and reduced velocities in areas of regular topography.

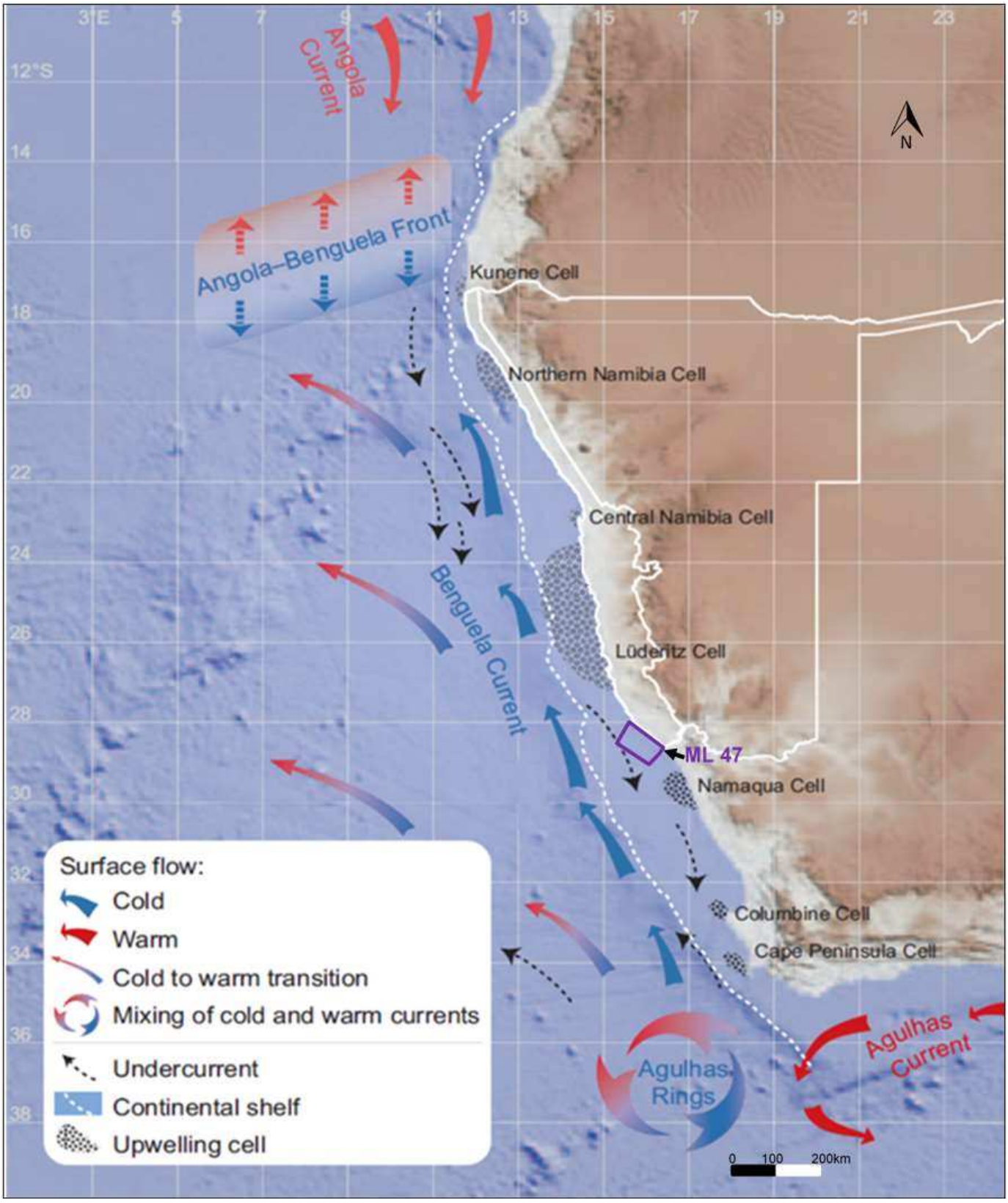


Figure 5.7: Main features of the Benguela System showing the location of ML 47 within the BCLME (Source: Ministry of Environment, Forestry and Tourism, 2012).

5.2.6 Natural Disturbances

5.2.6.1 Natural Sediment Inputs

The Orange River system, together with its principal tributaries, the Fish, Vaal, and Caledon Rivers, drains the greater part of the interior of southern Africa. The system is unique in that it receives the

majority of its water supply from the summer rainfall on the eastern side of the continent, yet discharges in the west and at the southern end of a major coastal desert.

The average annual historical (1930-1969) sediment discharge from the Orange River has been estimated at 60.4 million tonnes (Midgley & Pitman 1969. Rogers 1977. Bremner *et al.* 1990). A steady downward trend in discharges is apparent, however, from 80-90 million tonnes/year in the 1930s, 30-40 million tonnes/year in the 1960s and decreasing to <17 million tonnes/year during the 1980s (Rogers 1977. Bremner *et al.* 1990). Rogers (1979) estimated that the current annual sediment discharge varies from 8-26 million tonnes. Nonetheless, it is estimated that 97-98% of the particulate matter is captured by the many dams that impound the river's flow.

The larger, bedload fraction (sand and gravel), which contributes 10 - 20% of the sediment carried by this river, settles out first, close to the Orange River Mouth, contributing substantially to nearshore sediment transport. Silts and clays bypass the surf-zone in suspension and are dispersed northwards and southwards by a combination of wind-driven and coastal currents. The fine sediments take several years to redistribute into deeper water, and contribute to the offshore mud belt characteristic of the region (Bremner *et al.* 1990).

Periodic floods issuing from the Orange River affect coastal systems not only by causing substantial increases in turbidity by increasing the sediment load over a wide area, but by severely depressing salinities due to elevated freshwater input into the marine system. Depending on the temperature of the flood water, nearshore water temperatures may also be altered. These physical affects can act alone or in synergy to have an impact on the marine biota. While they can result in mass mortalities of marine biota, the degree of impact depends largely on the severity and duration of the flood, as well as the physiological tolerances of the organisms in question. In March 1988, the Orange River experienced its most severe flood of the 20th century, discharging some 15,400 million m^3 of water, and 35.7 million m^3 (64.2 million tonnes) of bedload and suspended sediment (Branch *et al.* 1990. Bremner *et al.* 1990). Although the most intense effects of the flood on the rocky intertidal and subtidal biota occurred within 25 km of the mouth, consequences of the flood were evident up to 140 km south of the Orange River. Evidence suggests that coastal and marine communities on the southern African west coast are sufficiently robust to recover rapidly from major episodic flood events in the relatively short term.

The powerful easterly 'berg' winds occurring along the Namibian coastline in autumn and winter also play a significant role in sediment input into the coastal marine environment, potentially contributing the same order of magnitude of sediments as the annual estimated input of sediment by the Orange River (Zoutendyk 1992. Shannon & O'Toole 1998. Lane & Carter 1999). For example, during a single berg-wind event in May 1979, it was estimated that 50 million tonnes of dust were transported into the sea during by extensive sandstorms along much of the coast from Cape Frio in the north to Kleinzee in the south (Shannon & Anderson 1982). These 'berg' wind events effectively reverse this process for short periods, and return some of these aeolian sediments to the sea. Transport up 150 km offshore has been observed for a single wind event and was particularly in the vicinity of the Orange River.

5.2.6.2 Organic Inputs

The Benguela upwelling region is an area of particularly high natural productivity, with extremely high seasonal production of phytoplankton and zooplankton. These plankton blooms in turn, serves as the basis for a rich food chain up through pelagic baitfish (anchovy, pilchard, round-herring and others), to predatory fish (snoek), mammals (primarily seals and dolphins) and seabirds (jackass penguins, cormorants, pelicans, terns and others). All of these species are subject to natural mortality, and a proportion of the annual production of all these trophic levels, particularly the plankton communities, die naturally and sink to the seabed.

Balanced multispecies ecosystem models have estimated that during the 1990s the Benguela region supported biomasses of 76.9 tonnes/km^2 of phytoplankton and 31.5 tonnes/km^2 of zooplankton alone (Shannon *et al*. 2003). Thirty six percent of the phytoplankton and 5% of the zooplankton are estimated to be lost to the seabed annually. This natural annual input of millions of tonnes of organic material onto the seabed off the southern African west coast has a substantial effect on the ecosystems of the Benguela region. It provides most of the food requirements of the particulate and filter-feeding benthic communities that inhabit the sandy-muds of this area, and results in the high organic content of the

muds in the region. As most of the organic detritus is not directly consumed, it enters the seabed decomposition cycle, resulting in subsequent depletion of oxygen in deeper waters overlying these muds and the generation of hydrogen sulphide and sulphur eruptions along the coast.

5.2.6.3 Low Oxygen Events

The continental shelf waters of the Benguela system are characterised by low oxygen concentrations, especially on the bottom. South Atlantic Central Water has depressed oxygen concentrations (~80% saturation value), but lower oxygen concentrations (<40% saturation) frequently occur (Chapman & Shannon 1985).

As the mud on the shelf is distributed in discrete patches, there are corresponding preferential areas for the formation of oxygen poor water, one of these being the Orange River Bight (Chapman & Shannon 1985). The distribution of oxygen poor water is subject to short (daily) and medium term (seasonal) variability in the volumes of oxygen depleted water that develop (De Decker 1970. Bailey & Chapman 1991). Subsequent upwelling processes can move this low-oxygen water up onto the inner shelf, and into nearshore waters, often with devastating effects on marine communities.

Oxygen deficient water can affect the marine biota at two levels. It can have sub-lethal effects, such as reduced growth and feeding, and increased intermoult period in the rock-lobster population (Beyers *et al*. 1994). The oxygen-depleted subsurface waters characteristic of the southern and central Namibian shelf is an important factor determining the distribution of rock lobster in the area. During the summer months of upwelling, lobsters show a seasonal inshore migration (Pollock & Shannon 1987), and during periods of low oxygen become concentrated in shallower, better-oxygenated nearshore waters.

On a larger scale, periodic low oxygen events in the nearshore region can have catastrophic effects on the marine communities. Low oxygen events associated with massive algal blooms can lead to large-scale stranding of rock lobsters, and mass mortalities of white mussels, rocky shore biota and fish. Such mass 'walk-outs' of rock lobsters have resulted in the death of up to 3 million lobsters per time (Newman & Pollock 1971. Matthews & Pitcher 1996, Pitcher 1998). Whilst these 'black tide' events are relatively common on the Namaqualand coast, no reports of similar large-scale mortalities have been documented from southern Namibia.

5.2.6.4 Sulphur Eruptions

Closely associated with seafloor hypoxia in the highly productive coastal regions off central Namibia, is the generation of toxic hydrogen sulphide and methane within organically rich muds. Under conditions of severe oxygen depletion, hydrogen sulphide (H_2S) gas is formed by anaerobic bacteria in anoxic seabed muds. This is periodically released from the muds as 'sulphur eruptions', causing upwelling of anoxic water, formation of surface slicks of sulphur discoloured water, and even the temporary formation of floating mud islands (Waldron 1901). These eruptions strip dissolved oxygen from the surrounding water column, resulting in mass mortalities of marine life, including dramatic mass rock lobster 'walk-outs'.

5.2.6.5 Turbidity

Total Suspended Particulate Matter (TSPM) can be divided into Particulate Organic Matter (POM) and Particulate Inorganic Matter (PIM), the ratios between them varying considerably. The POM usually consists of detritus, bacteria, phytoplankton and zooplankton, and serves as a source of food for filter-feeders. PIM, on the other hand, is primarily of geological origin consisting of fine sands, silts and clays. Off southern Namibia, the PIM loading in nearshore waters is strongly related to natural inputs from the Orange River or from 'berg' wind events, as well as tailings discharge activities from recovery operations along the coast of MA1. On the other hand, seasonal microphyte production associated with upwelling events will play an important role in determining the concentrations of POM in coastal waters.

For example, in the vicinity of the Orange River Mouth, where river outflow strongly influences the turbidity of coastal waters, concentrations ranged from 14.3 mg/l at Alexander Bay just south of the

mouth (Zoutendyk 1995) to peak values of 7,400 mg/l immediately upstream of the river mouth during the 1988 Orange River flood (Bremner *et al*. 1990). During normal discharge, Orange River water can be present more than 20 km offshore, and muddy water extends along a 1 km wide coast-parallel zone to at least 20 km north of the mouth. The distribution of marine sediments on the inner and middle shelf provides a basic insight into the origin or fate of turbid water along the southern Namibian coastline. As the mobilisation and deposition of sediments is a function of particle size, aggregation and current-induced turbulence, the deposition of terrigenous sediments in the Orange River region indicates a strong fractionation of sediments at the mouth (Bremner *et al*. 1990).

On the inner and middle continental shelf, the ambient currents are insufficient to transport coarse sediments, and resuspension and shoreward movement of these by wave-induced currents occur primarily under storm conditions (see also Drake *et al.* 1985. Ward 1985). Data from a Waverider buoy at Port Nolloth have indicated that 2 m waves are capable of resuspending medium sands (200 µm diameter) at ~10 m depth, whilst 6 m waves achieve this at ~42 m depth. Low-amplitude, long-period waves will, however, penetrate deeper. Most of the sediment distributed shallower than 90 m will therefore be subject to resuspension and transport by the ambient wave climate, although deeper sediments will be beyond the maximum depth of wave penetration (Lane & Carter 1999).

5.3 Benthic Invertebrates

5.3.1 Marine Benthos

The marine benthos comprises all organisms that live on, or in the top 20 cm, of unconsolidated sediments on the seabed. Benthic zones are defined as the bottom sediments and other surfaces of a body of water such as an ocean or a lake. Organisms living in this zone are called benthos. They live in a close relationship with the bottom of the sea, with many of them permanently attached to it, some burrowed in it, others swimming just above it. In oceanic environments, benthic habitats are zoned by depth, generally corresponding to the comparable pelagic zones: the intertidal (where sea meets land, with no pelagic equivalent), the subtidal (the continental shelves, to about 200 m), the bathyal (generally the continental slopes to 4,000 m), the abyssal (most of the deep ocean seafloor, 4,000 - 6,000 m), and the hadal (the deep trenches 6,000 to 11,000 m).

There are several types of deep benthic surfaces, each having different life forms. First, most of the deep seafloor consists of mud (very fine sediment particles) or "ooze" (defined as mud with a high percentage of organic remains) due to the accumulation of pelagic organisms that sink after they die. Unlike the shoreline, sandy habitats are rarely found in the deep sea because sand particles, created by wave action on coral and rocks at shorelines, are too heavy to be carried by currents to the deep.

Benthos is usually differentiated by size. macrobenthos consists of those organisms retained by a 1 mm mesh sieve whilst those passing through comprise the meio-and microbenthos. Within the ML 47 Several studies have been conducted over the past 40 years. DBMN has also conducted several studies as part of the benthic environmental monitoring programme conducted to date and are discussed in detailed under Section 7 of this report. Results and insights gained from the various benthic grab sampling projects are presented in a series of reports as follows:

- Impact Monitoring Study I (1994-1998): Field *et., al*. (1996), Parkins & Field (1998), Pulfrich & Penney (1999).
- Mudbelt Natural Variability Study (2002-Present): Steffani & Pulfrich (2007), Steffani (2007a, b), Steffani (2009a, 2010a, b, 2012a), Mafwila (2014).
- Marine Dredging Project (2005-present): Steffani (2007b, 2009a, 2010a, b, 2012a), Mafwila (2014).
- Impact Monitoring Study II (2007-2009): Steffani (2009a, 2010a, b).
- Impact Monitoring Study III (2011-2014): Steffani (2012a), Mafwila (2014).
- 2013 benthic sampling campaign: Biccard, A.B., and B.M. Clark., (2016).

- 2014 benthic sampling campaign: Biccard *et, al*., 2016.
- 2015 benthic sampling campaign: Biccard *et, al*., 2017.
- 2016 benthic sampling campaign: Biccard *et, al*., 2018.
- 2017 benthic sampling campaign: Biccard *et, al*., 2019.
- 2018 benthic sampling campaign: Biccard *et, al*., 2020.
- 2019 benthic sampling campaign: Biccard et, al., 2021, and.
- 2022 benthic sampling campaign: Biccard et, al., 2024.

5.4 Pelagic Resources

5.4.1 Overview

Pelagic refers to the open water in which swimming and floating organisms live. Organisms living there are called the pelagos. From the shallowest to the deepest, biologists divide the pelagic into the epipelagic (less than 200 meters, where there can be photosynthesis), the mesopelagic (200 - 1,000 m, the "twilight" zone with faint sunlight but no photosynthesis), the bathypelagic (1,000 - 4,000 m), the abyssopelagic (4,000 - 6,000 m) and the deepest, the hadopelagic (the deep trenches below 6,000 m to about 11,000 m deep).

Namibia's marine environment is among the most productive in the Atlantic Ocean. This is because of the Benguela upwelling system, which provides abundant fisheries resources. Although upwelling happens almost throughout Namibia's coastline, the major upwelling occurs for much of the year off Luderitz (Iyambo, 2001).

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

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

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

The main management measures for commercial fisheries in Namibia are:

- Limitation of effort, through access to fishing rights and vessel licensing. The purpose of the fishing rights is to limit entry to the sector specific fishery in order to protect the fisheries resources and maintain sustainability. All fishing vessels are required to obtain a license in order to fishing within the Namibian Exclusive Economic Zone (EEZ).

- ❖ The Management of commercial fisheries in Namibia consist of exploitation rights, total allowable catches (TAC), individual quotas (IQs), and quota fees, by catch fees and monitoring and control and fisheries observers' system.

- ❖ The commercial exploitation of fish stock in Namibia is managed by the MFMR, which is advised by scientific research at the MFMR' National Marine Information and Research Centre (NaTMIRC) in Swakopmund.

- ❖ Limitation of catch, through setting of TACs. The TAC for respective commercial fisheries, is determined annually and are based on scientific advice in terms of size and structure of the stocks as determined by MFMR scientists.

- ❖ In some years, there are additional trans-boundary surveys conducted on the Dr. Fridtjof Nansen research vessel, which has conducted several stock assessments of trans-boundary fisheries.

- ❖ The Total Allowable Catches (TAC) are set annually by the Minister based on recommendation by the Marine Resources Advisory Council (MRAC).

- ❖ The 200-metre depth restriction, that prohibits any fishing activities within the 200m meters isobath along the entire coastline of Namibia, this restriction aims to protect juvenile and spawning fish of all fish stocks.

- ❖ All vessels must be fitted with automatic location communicators, as part of the vessel monitoring system (VMS), and.

- ❖ In terms of fisheries management, the commercial fisheries sectors are represented at industry level by sector specific associations, such as the Namibian Hake Association, the Namibian Hake Logline Association, Namibian Monk and Sole Association, Namibian Tuna Association and the Mid-water Trawlers Association of Namibia.

The management measures are enforced by a Fisheries Observers and Fisheries Inspectors, that are employed by the Fisheries Observer Agency and the MFMR.

5.4.2 National Commercial Fisheries

5.4.2.1 Cape Hake

In terms of landed volume and revenue, the hake resource is the most important commercial demersal fishery. The fishery accounts for approximately 90% of total demersal catches (Van der Westhuizen, 2001). Hake catches increased in the early 1960s during a time of open excess to resources by foreign fleets, primarily from the Soviet Union and Spain. Around 1972, catches increased to more than 800,000 tons (Van der Westhuizen, 2001).

The International Commission for the Southeast Atlantic Fisheries (ICSEAF) was formed in 1969 to control the exploitation of marine fisheries resources in the South East Atlantic Ocean due to high landings and economic values of most species (Gordoa *et al*., 1995). The creation of ICSEAF resulted in the implementation of Total Allowable Catches (TAC) and a minimum legal mesh size (110 mm) on the hake fishery. Despite management efforts, catches fell below 400 000 tons by 1989 and have remained below 200 000 tons since independence in 1990.

The shallow-water Cape hake (*Merluccius capensis*), deep-water Cape hake (*Merluccius paradoxus*), and Benguela hake (*Merluccius polli*) are the three hake species found off Namibia. The shallow-water hake and deep-water Cape hake are the two most common species. The shallow-water Cape hake distribution covers the entire coastline off Namibia at depths ranging from 50 to over 1000 m, with higher densities between 150 and 450 m (Bianchi *et al*., 1999).

Deep-water Cape hake, on the other hand, is found in deeper water than shallow-water Cape hake, typically at depths of 200 to 1000 m (Bianchi *et al*., 1999). In addition, the deep-water Cape hake is

distributed along the entire coastline of Namibia from Cape Frio to East London, South Africa. Benguela hake is commonly found in northern part of the Namibian water at the depth of 50 to 550 m (Bianchi *et al*., 1999).

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

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

The ML No. 47 area does not overlap with the distribution of Hake fishing and spawning grounds, and the biomass survey grounds.

5.4.2.2 Cape Monk

Historically, monk have been caught as a bycatch in bottom trawls that primarily target hake (Maartens and Booth, 2001). This is due to the fact that hake and monk coexist in the benthic zones, making it nearly impossible not to capture either species in the two fisheries.

Landed monk records extend from 1973 to 1989, during the International Commission for the Southeast Atlantic Fisheries (ICSEAF), and from 1990 to the current fishing season (2022-2023), under Namibia's Ministry of Fisheries and Marine Resources.

As hake catches increased, so did monk catch in the hake fishery, peaking at around 16 000 tons in 1981 and then declining towards 1990, when the foreign fleet left Namibian waters prior to independence. As the market value of monk started to increase, landings of monk also increased post-independence prompting the opening of a monk directed fishery in the early 2000 (Maartens and Booth, 2001).

There are two species of monk found in the Namibian water, the *Lophius vomerinus* and *Lophius vaillanti*. L vomerinus is the more common of the two species, and its spatial distribution extends from Namibia's northern border to South African waters (Froese and Pauly, 2023), mostly at depths ranging from 200 to 400 meters (Bianchi *et al*., 1999). *L. vaillanti*, on the other hand, is found primarily north of the central region of Namibia, with a depth range of 200 to 800m (Bianchi *et al*., 1999). The monk is an opportunistic feeder that feeds on benthic species and occasionally on pilchard, horse mackerel, and round herring (Bianchi *et al*., 1999).

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

The ML 47 area does not overlap with the distribution monk fishing grounds, and the biomass survey grounds (Fig. 5.8). However, the western section of the ML 47 area overlaps with the known Monkfish spawning area (Fig. 5.8). The overlapping area excludes the previous and current exploration, recovery and production areas (Fig. 5.8).

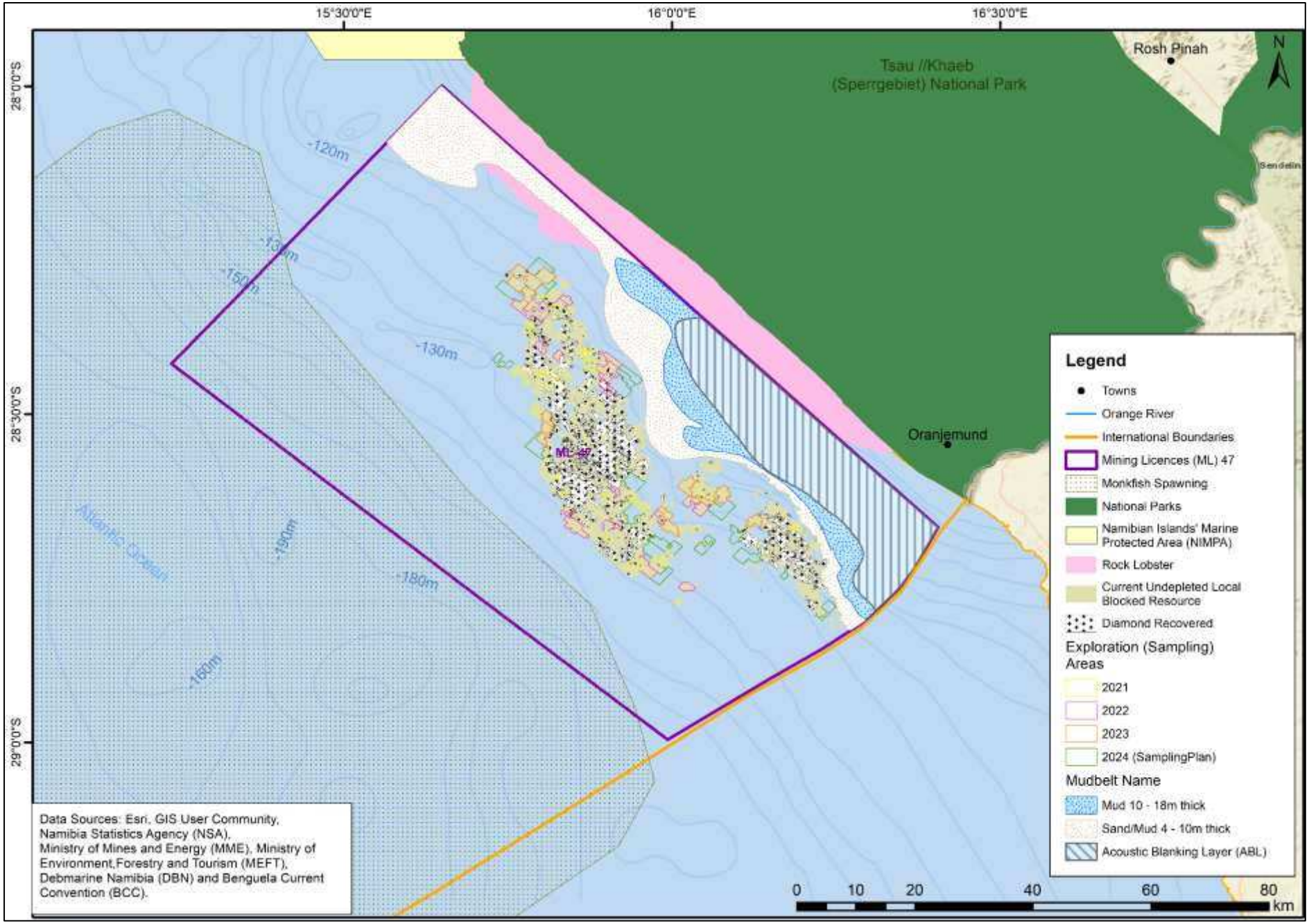


Figure 5.8: The ML 47 area with respect to the known Monkfish spawning area.

5.4.2.3 Orange Roughy

Orange roughy (*Hoplostethus atlanticus*) resource exploitation began around 1994, with a direct fishery opening in 1997. However, the fishery could only be sustained for about 11 years, resulting in the implementation of a fishing moratorium since 2009. This fish's biological characteristics, specifically its long lifespan, slow growth and maturation, and aggregating behaviour, make it vulnerable to overfishing (Boyer, et al., 2001). It is also reported that approximately 70% of the world's stock has been depleted (Boyer, et al., 2001).

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

The ML No. 47 area does not overlap with the distribution of the orange roughy fishery and the biomass survey areas.

5.4.2.4 Deep Sea Red Crab

The deep-sea red crab (*Chaceon maritae*) is the largest crustacean fishery in Namibia. Historically the fishery which was dominated by Japanese fleets, was first exploited around 1973, with volume landed peaking at 10,000 tons in 1983 (Beyers and Wilke 1980; De and Beyers, 1994). Following that, catches decreased until 1990. After 1990, landings ranged between 2000 and 3000 tons, prompting a 400-meter fishing depth restriction in 1993 to protect female crabs (Le Roux, 2001). In contrast to other demersal fisheries (Cape hake, Cape monk, and orange roughy), the deep-sea crab is captured using beehive traps on longlines. The traps are conical in shape, with a plastic collar at the top that functions as a crab entrance, and they are typically hauled after 24 hours. However, the deep-sea crab is also landed as a bycatch in the demersal fisheries.

The deep-sea red crab is shared by Namibia and Angola. The species is found off the coast of central Namibia and into Angolan waters (Melville-Smith,1989). The deep-sea red crab inhabits muddy bottoms at depths ranging from 100 to 950 meters, but is most common between 300 and 700 meters, and can grow to a carapace width of 16 cm for males and 10 cm for females (Bianchi *et al*., 1999). The deep-sea red crab is presently managed through the allocation of TAC and bycatch fees on other fisheries' catches. In terms of research, the Ministry of Fisheries and Marine Resources (MFMR) carries out an annual deep-sea red crab survey, in August to assess distribution patterns, determine biomass and stock status. Even though traps are used for commercial fishing, the survey is conducted using bottom trawls.

The ML No. 47 area does not overlap with the distribution of area of the deep-sea crab fishery that is mainly found in the deep waters of Walvis Bay.

5.4.2.5 West Coast Rock Lobster

The west-coast rock lobster (*Jasus landii*) is another important crustacean fishery in Namibia. Namibia's rock lobster catches records stretch back to the 1950s, with catches ranging between 14 000 and 13 000 tons around the 1960s (Bianchi *et al*., 1999). However, catches started decreasing in the 1970s to around 1 500 tons, and by the mid-1990s, catches had dropped even further to around 250 tons per year (Bianchi *et al*., 1999). The west coast rock lobster is found on the inshore rocky seabed at depths of up to 100 m. The species' main distribution extends from Walvis Bay in Namibia to East London in

South Africa (DAFF, 2016). It is also believed that the west coast rock lobster migrates seasonally based on water temperature and oxygen levels (Tomalin, 1993). The species can reach a carapace length of 59 mm and survive for up to 40 years (Bianchi et al., 1999). Mating occurs after male lobsters molt between September and December, and females between April and May. The west coast rock lobster harvest is regulated by a TAC that is allocated to fishermen. The TAC is primarily caught off the coast of Lüderitz at four known rock lobster hotspots between November and April while catching is prohibited between June and October (Shuuluka, et al., 2018). To establish the TAC, the Ministry of Fisheries and Marine Resources conducts research off the coast of Lüderitz. Anglers obtain permits for harvesting lobsters.

The commercial rock lobster fishery in Namibia is centred on Lüderitz and forms an important part of the socioeconomic environments of southern Namibia. The targeted exploration, recovery and production within the licensed area extends from ~30 m depth in the southeast corner to -140 m depth in the northwest corner and is located on the Orange River delta-front, which is exclusively dominated by sands and muds (Fig. 5.9). Prospecting, recovery, and production operations areas within the licensed area are therefore located at a considerable distance to the south and offshore of the nearest known rock lobster reefs (Fig. 5.9).

The ML No. 47 boundary area does not overlap with the West coast rock lobster fishery but the actual prospecting, recovery, and production operational areas within the licensed area are therefore located at a considerable distance to the south and offshore of the nearest known rock lobster reefs (Fig. 5.9).

5.4.2.6 Horse Mackerel

The Cape horse mackerel (*Trachurus capensis)* fishery is the largest contributor by volume and second highest contributor by value to the Namibian fishing industry. The stock is caught by the mid-water trawl fishery, targeting adult horse mackerel and pelagic purse-seine fishery targeting smaller quantities of juvenile horse mackerel and by the demersal trawlers as by-catch (while targeting hake and monk). The horse mackerel landed are either sold as frozen whole product or converted to fishmeal. The history of the sector in Namibian waters shows initial low catches reported in the early 1960s but increased to about 600 000 tons annual catch in the early 1980s. Since 1990 landings were on average 300 000 tons per year. The current TAC for horse mackerel is 290 000 tons for the 2023 fishing season. The fishery operates year-round with relatively constant catch and effort by month. The mid-water trawl fleet operates exclusively out of the port of Walvis Bay with fishing grounds extending north of 25ºS to the border of Angola. Juvenile Cape horse mackerel move into deeper water when mature and are fished mostly between the 200 m and 500 m isobaths towards the shelf break.

Horse mackerel (*Trachurus capensis)* from the Carangidae family is a schooling species mainly found over the continental shelf. Horse mackerel dwells from surface water down to a depth of 400 m with shoals rising to feed in surface waters at night while close to the bottom during daytime (Bianchi et al., 1999). Horse mackerel is an opportunistic feeder, feeding on mainly on euphausiids (Boyer et al., 2001), and to a lesser extent on *Sufflogobius bibarbatus*, *Diaphus hudsoni*, *Diaphus meadi*, (Bianchi et al., 1999). Horse mackerel is preyed on by Cape monkfish (Bianchi et al., 1999; Erasmus 2021), Cape fur seal *Arctocephalus pusillus* (Raja alba Lacepède, *M. capensis* (Bianchi et al., 1999). Horse mackerel generally have a protracted spawning season (up to eight months) across a wide area (Abaunza et al. 2003, Dransfeld et al. 2005), In Namibian waters, spawning of Cape horse mackerel occurs throughout the year, but with a spawning peak between December and March (Wysokinski1985)

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

The ML No. 47 area does not overlap with the distribution, fishing and biomass survey ground for horse mackerel.

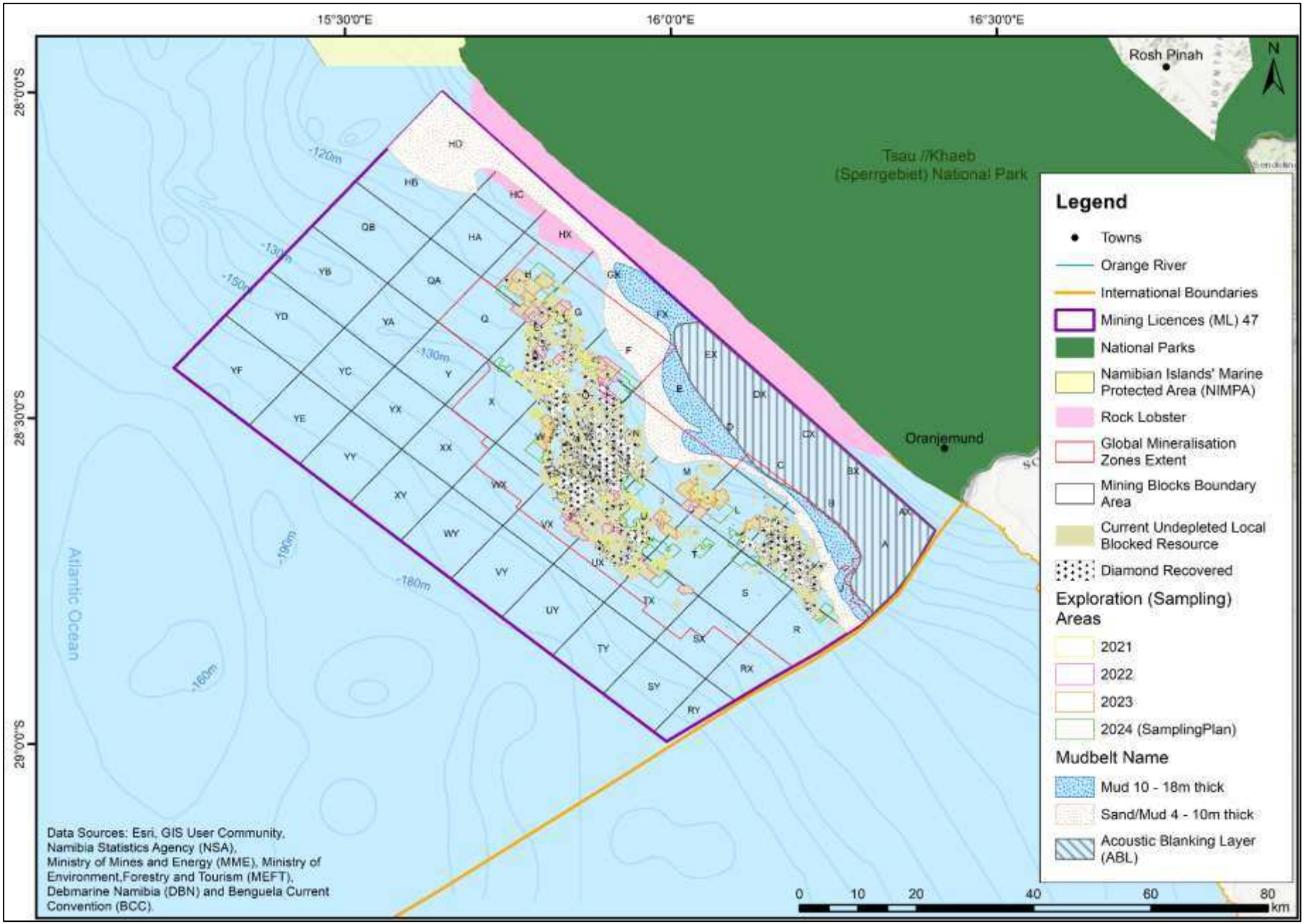


Figure 5.9: West coast rock lobster fishery area with respect to the ML No. 47 boundary area. The actual prospecting, recovery, and production operational areas within the licensed area are located at a considerable distance to the south and offshore of the nearest known rock lobster reefs.

5.4.2.7 Small Pelagic (Sardine)

Sardine, *Sardinops sagax* also known as pilchard is a small pelagic species of the Clupeidae family. In the 1950s and 1960s, European fleets spearheaded fishing activities off Namibia, beginning with an inshore pelagic fishery for sardine and Cape anchovy (Bianchi et al., 1999; Boyer et al., 2001; Kirchner et al., 2010). The sardine stock in Namibian waters was estimated to be 11 million tonnes in the late 1960s, but it had declined to less than one million tonnes by the mid-1970s (Boyer et al., 2001; Erasmus et al., 2021a). Sardine stocks continued to decline, prompting the first fishing moratorium in 2001 (Boyer et al., 2001; Roux & Shannon, 2004).

Following the lifting of the moratorium, fisheries continued with limited sardine catches, but both catches and biomass estimates continued to fall, resulting in the imposition of a second moratorium since 2018. Sardine is distributed from southern Angola to KwaZulu-Natal in South Africa (Beckley and van der Lingen 1999). However, this population is separated into two discrete stocks by the perennial Lüderitz upwelling cell, which divides the Benguela Current into northern and southern sections (Boyd and Cruickshank 1983). Off the coast off Namibia, the sardine stock ranges along the entire Namibian coast, but in recent years predominantly from 25°S northwards to southern Angola.

Historically, spawning occurred continuously from September to April with two seasonal peaks evident; the first from October to December in an inshore area between Walvis Bay and Palgrave Point and the second from February to March near the 200 m isobaths between Palgrave Point and Cape Frio (Pillar and Barange, 1998; Crawford et al., 1999.

Multiple predators including the Cape fur seals preyed on sardine at the time when it was abundant. Sardine feed predominantly on phytoplankton and zooplankton (Crawford et al., 1987). Sardine are surveyed annually during the horse mackerel and small pelagic survey conducted in March, and during the annual dedicated sardine and small pelagic survey conducted in October. The fishery is currently closed following a fishing moratorium that have been in place since2018 due to a significant reduction in the stock.

The ML No. 47 area does not overlap with the small pelagic fishing and biomass survey areas.

5.4.2.8 Line Fish

Linfish fishery consist of Snoek (*Thyristsites atun),* Dusky kob (Argyrosomus coronus) (*Argyrosomus inodorus).* Snoek is found off the Namibian coast from November to March, thereafter the stock mves southwards towards the Western Cape, of South Africa. The return migration commences between August and October. (Crowford *et al, 1990*). The movement of the snoek stock correlates with the distribution patterns of some prey species such as small pelagic species (sardine, sardinella, juvenile anchovy) in the southern Benguela system (Crowford *et al, 1990*). Dusky kob and silver kob are members of the sciaenidae family, which lives in subtropical and temperate waters around the world. Silver kob is the most important fish species caught in the line fish fishery (Kirchner 1998). Silver kob is an ideal finfish for mariculture mostly due to its robust growth, ability to spawn in captivity as well as its market value (Tjipute, 2011). Silver kob is harvested by the line fish and ski boat fishery and recreationally by shore- and ski boat-anglers.

Dusky kob is mostly caught with handlines, although in fairly low numbers (Bianchi et al., 1999). This species is the most important in southern Angola's inshore recreational fishery (Cunene Estuary to Namibe) (Potts et al., 2010). Both species are heavily exploited in Namibia by an established recreational fishery that operates in the West Coast Recreational Area (a 200km stretch of coastline between the northern boundary of the Namib Naukluft National Park and the Ugab River) and contributes significantly to the local economy (Stage & Kirchner, 2005). Dusky kob are distributed between northern Namibia (north of Cape Frio) and southern Angola (south of Lucira), although only few individuals have been observed as far south as St Helena Bay on the South African west coast (Lamberth et al. 2008). Silver kob feed primarily on euphausiids and small fish in the surf zone (Boyer and Hampton, 2001). Dusky kob is a fast growing, late maturing species (Potts et al., 2010). Silver kob is a slower growing, early maturing species while Dusky kob can grow up to 200 cm (Bianchi et al.,

1999). Silver kob spawn in summer and migrate to the south of Walvis Bay, the southern end of their distribution, returning northwards towards the end of summer (Boyer and Hampton, 2001).

The ML No. 47 area does not overlap with the distribution of the line fish fishery and the biomass survey areas.

5.4.2.9 Large Pelagic Species

The large pelagic species, including various tunas, billfish, and pelagic sharks are known to occur in the Namibian water. Many of these species are considered to be threatened by the International Union for Conservation of Nature (IUCN), due to overfishing. Tuna species are usually offshore at the shelf break, their distribution is related to the presence of shoaling pelagic fish. Thire diets include small fish, shrimps crabs, cray fish larvae and squid.

Tuna is classified to be highly migratory species and many of the stocks are a shared resource between coastal states of the South Atlantic. Tuna is managed by regional fisheries management organizations, specifically the International Commission for the Conservation of Atlantic Tunas (ICCAT).

The ML No. 47 area does not overlap with the fishing grounds of the large pelagic sector.

5.4.2.10 Albacore Tuna

Tuna is widespread and highly mobile, but there is a concentration around Tripp seamount in southern Namibia, excluded and falling outside the ML No. 47 (Table 5.2). The albacore tuna tends to follow the underwater contours of a depth between 400 and 1000 meter (219 to 547 fathoms) along the entire tuna grounds. The lowest known tuna landing area overlaps with the northwestern corner of the ML No. 47 area (Fig. 5.10). The main tuna fishing season is January to end of April, with highest landings recorded in March and April.

In past the tuna pole-fishing industry has approached MME to disallow seismic survey operations associated with petroleum exploration during their fishing season, October to April around the Trip Seamount situated far outside the ML No. 47 (Table 5.2 and Fig. 5.10).

They argued that the in the past the reduction in tuna catches coincided with significant petroleum seismic exploration activities near the fishing grounds and deduce that seismic exploration is the cause thereof (Russell, 2013).

The northwestern corner of the ML No. 47 boundary area does overlap with the lowest known Tuna landing areas but the actual prospecting, recovery, and production operational areas within the licensed area are located at a considerable distance to the east of the nearest known Tuna landing areas (Fig. 5.9).

Table 5.2: Main tuna fishing hotspot co-ordinates concentrated arround the Seamount situated far west of the ML No. 47 area.

No.	Latitude	Longitude
1. Tripp Seamount	**29° 38,0 S**	**14° 18,0 E**
2.	27° 45,0 S	14° 45,0 E
3.	26° 50,0 S	13° 45,0 E.
4.	26° 10,0 S	13° 40,0 E
5.	25° 40,0 S	13° 38,0 E

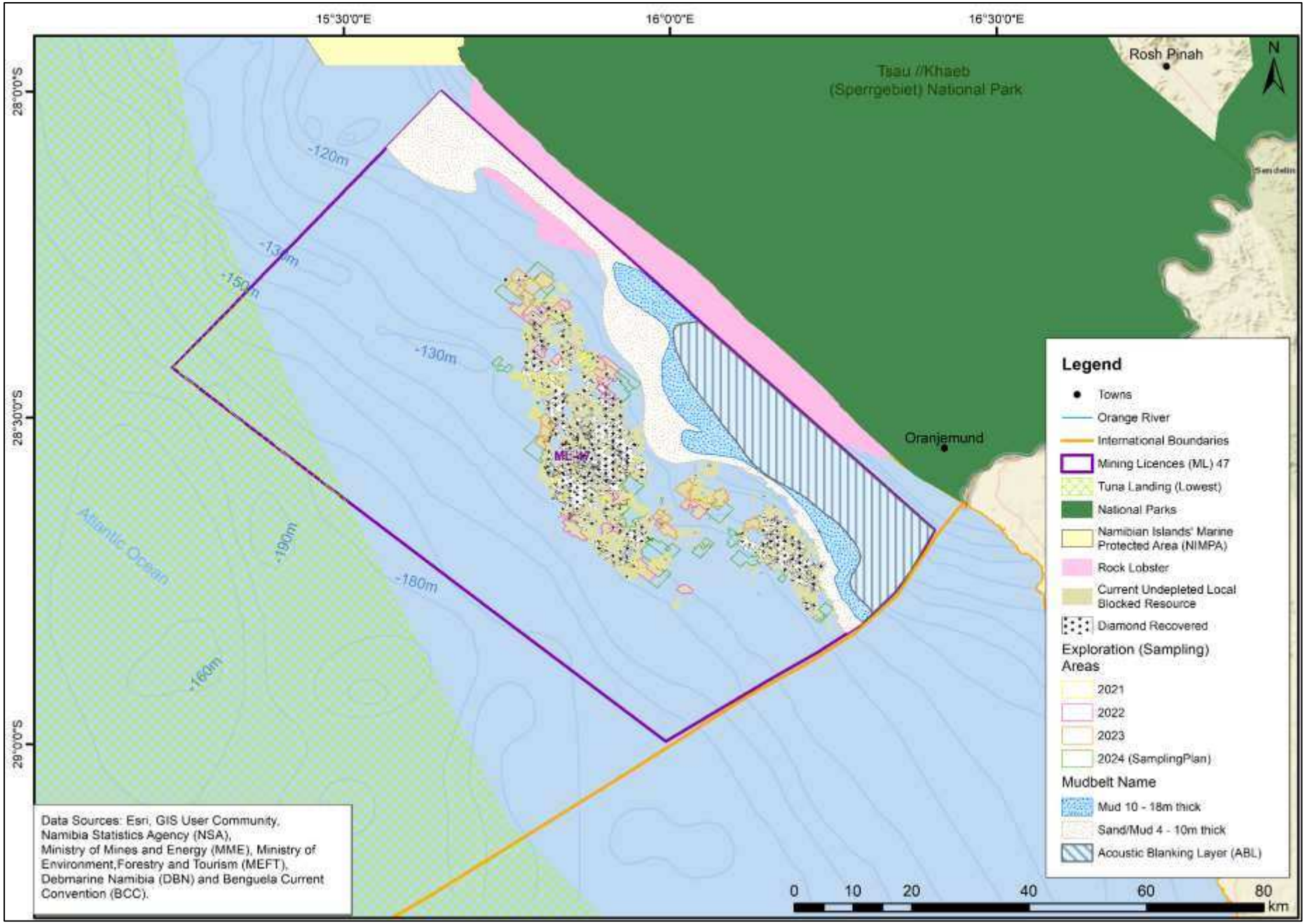


Figure 5.10: Known tuna landing areas relative to the ML No. 45 boundary and actual exploration, recovery and production areas (Extracts from RBS, 2024 Map series).

5.4.3 Sea Turtles

5.4.3.1 Overview

The northern BCLME has a high biomass of jellyfish, a potential food source for several species of marine turtles. Although the climate of coastal Namibia is too cold for successful nesting, the northern BCLME may act as a regionally important feeding area for turtles. Five of the world's seven sea turtle species (Leatherback, Olive Ridley, Green, Hawksbill and Loggerhead turtles) have been seen in Namibian offshore waters. However, they prefer the warmer waters closer to Angola, and inhabit these waters and nest on Africa's continental shores from Mauritania south to Angola on Africa's Atlantic coast, and from South Africa north to Somalia on the Indian Ocean (Sea turtle status, 2017). Inshore, turtles are seen fairly regularly in the Kunene River mouth (Elwin and Braby, 2015), but there have been only rare sightings in recent years in shallower waters closer to Walvis Bay (Elwin and Leeney, 2011). Of the eight species of turtle that are known worldwide, five species occur offshore Namibia:

- Leatherback turtles (Dermochelys coriacea).
- Green turtles (Chelonia mydas).
- Loggerhead turtles (Caretta caretta).
- Hawksbill turtles (Eretmochelys imbricata), and.
- Olive Ridley turtles (Lepidochelys olivacea).

5.4.3.2 General Threats to Sea Turtles

Apart from natural predation turtles are threatened by human action including:

- Human consumption (sea turtles are caught by artisanal fisheries for consumption in Angola).
- Direct targeting (Catches are likely to be the highest in the northern Benguela, where sea turtle abundance and fishing (longline and artisanal) activity is the highest).
- Bycatch (As many as 700 sea turtles are caught by the Namibian pelagic longline fishery targeting tuna, swordfish and sharks each year).
- Plastic pollution (turtles mistake plastic waste for jellyfish and subsequently die of starvation as the plastic blocks their gut), and.
- Poisoning by industrial and military effluents.

5.4.4 Seabirds

5.4.4.1 Important Bird and Biodiversity Areas (IBAs)

Important Bird and Biodiversity Areas (IBAs) are internationally important areas for conservation of bird populations and other biodiversity. IBAs are identified using objective internationally accepted criteria and are used to guide conservation planning, action and sustainable development. The islands off the coast of Namibia support a number of near endemic seabirds' species such as the Spheniscus demersus African Penguins, Morus capensis Cape gannets, Phalacrocorax capensis Cape Cormorant, Phalacrocorax neglectus Black Cormorant, Microcarbo coronatus Crowned Cormorant, Chroicocephalus hartlaubii Hartlaub's Gull and Sternula balaenarum Damara Tern. There are 19 sites designated as global IBAs in Namibia, and 11 marine IBAs are found along the coast of Namibia (Bird Life International, 2023, Tables 5.3 and 5.4 and Fig. 5.11). IBA sites were selected taking into consideration the existing protected area network and conservation areas in Namibia (Simmons et al., 1999).

Namibia's coastline sustains large populations of breeding and foraging sea- and shorebird species. Numerous species of seabirds breed on islands or at mainland sites along the southern Namibian coast. The African penguin, Bank cormorant, Crowned cormorant and Cape gannet have been classified as Vulnerable Species owing to significant decreases in populations. Most of the seabirds that breed on Namibian shores have a nearshore/inshore foraging range of between 10 and 30 km. 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. As the ML No. 47 is mostly within the shallow waters of less than -200 m, it is unlikely that these birds will be seen in the ML area (Fig. 5.11).

Many sea- and shorebirds over-winter in Namibia. The highest pelagic seabird densities are found offshore of the shelf-break during the winter months, when Southern Ocean species move north to temperate and subtropical regions. The highest potential impacts from this survey are likely to be on sea-going birds that forage offshore and rest on the water, and those that plunge-dive for food. Sixty-two species of seabirds have been recorded in Namibian waters. Twenty are rare visitors or vagrants. The numerous islands off Namibia's coasts and the relatively sparsely populated and inaccessible coastline sustain large populations of breeding and foraging seabird and shorebird species. Twelve bird species breed along the Namibian coast, favouring the offshore islands or manmade platforms for nesting sites (Simmons et al., 2015).

The southern islands are the breeding grounds for 11 seabird species (Kemper, 2007) and hold the predominance of the global breeding populations for the Bank cormorant, Cape cormorant, Crowned cormorant, Cape gannet, Hartlaub's gull, African Black oystercatcher and African penguin (Kemper, 2007. NACOMA, 2013. Simmons et al., 2015). Most of Namibia's islands lie just offshore of the southern coast and fall within the Namibia Islands Marine Protected Areas (NIMPA). The NIMPA lies north of the proposed survey grid. The central Namibian coastline between Lüderitz and Walvis Bay comprises predominantly sandy beaches backed by the dunes of the Namib Desert. Predators such as Black-backed Jackals and Brown Hyenas roam the strandline in search of food, making the mainland largely unsuitable for the establishment of breeding colonies. All-important seabird colonies are, thus, found on the offshore islands or on the few artificial platforms built between Walvis Bay and Cape Cross. Important migratory bird populations also find shelter in coastal lagoons and bays. Most of the seabirds that breed on Namibian shores have an inshore/ nearshore foraging range of between 10 and 30 km. 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.

As many as three quarters of a million albatrosses, petrels and shearwaters have been reported in Namibian waters, usually foraging far offshore during the winter months. Species include Black-browed, Shy and Yellow-nosed albatross, Sabine's gulls, Cape and White-chinned petrels, Arctic, Pomarine and Subantarctic Skuas, Cory's and Sooty Shearwaters, Wilson's Storm-petrels, and Caspian terns. The highest densities of pelagic seabirds are seen north of Walvis Bay, offshore of the shelfbreak. Virtually all pelagic seabirds scavenge offal and fish discarded from fishing vessels and other vessel waste, and thus may be encountered by the vessels used in this exploration activity. A number of coastal seabird plunge-dive for fish. Only five species are found in Namibia, either as breeding residents or as transient migrants: Brown booby, Red-footed booby, Australian gannet, Cape gannet and Swift tern. All seabirds are protected in Namibian waters (Tables 5.3 and 5.4). African penguins, Bank cormorants, Cape cormorants, Crowned cormorants and Cape gannets are currently the most endangered seabirds in Namibia owing to the low numbers of breeding pairs. These species, together with the African Black oystercatcher and Damara tern, are listed in the Namibian Parks & Wildlife Bill as 'Specially Protected' (Currie et al., 2009. Kirkman et al., 2007. Ludynia et al., 2012. Maloney and Shannon. 2008. NACOMA, 2013. Simmons et al, 2015).

Of interest to this report are the seabirds that are feed some distance offshore and that may be impacted by the seismic survey operations. Of highest concern are the endemic, rare and endangered species. The following sensitive bird species are coastal and near-shore species: Lesser flamingo (Phoenicoparrus minor), Damara tern (Sternula balaenarum), African Black oystercatcher (Haematopus moquini), Bank cormorant (Phalacrocorax neglectus), Cape cormorant (Phalacrocorax capensis), Crowned cormorant (Microcarbo coronatus) and African penguin (Spheniscus demersus).

Table 5.3: List of Important Bird Areas (IBAs) and their criteria listing (adopted from http://datazone.birdlife.org/country/namibia/ibas).

Site Name	Site Description
30 Kilometre Beach: Walvis - Swakopmund	The site is one of the country's four Ramsar sites located on the Kuiseb river delta. The wetlands south and west of the town make up the natural areas of the Walvis Bay lagoon, supporting a significant number of seabirds.
Cape Cross Lagoon	The Cape Cross Lagoon is characterised by coastal embayment south of Cape Cross. The inner part of the embayment are lagoons. The lagoons provide roosting and breeding areas for seabirds, and their guano is harvested from the platforms. The guano also enriches the environment benefiting the micro flora and fauna.
Ichaboe Islands	Ichaboe Islands is a small coastal island (6.5 ha) that supports a significant number of seabirds including the largest colony of African Penguin, Cape Gannet, Cape Cormorant, Black Cormorant, Crowned Cormorant and Damara Tern.
Lüderitz Bay Islands	The Lüderitz Bay Islands consist of four coastal islands, all situated one kilometre off the shore. The Flamingo Islands is joined to the mainland and supports fewer seabirds compared to the other three Islands. The Seal Islands extends over 44 hectares, the Penguin Island extends over 38 hectares, and the Halifax Island extends over 10 hectares, all supporting several thousands of diverse seabirds.
Mercury Island	Mercury Islands is 3 ha in size and one of the three very important coastal seabird islands along the south western Namibia, which supports a significant number of seabirds
Mile 4 Saltworks	Mile 4 Saltworks supports a great number of seabirds, and host a large commercial guano platform.
Namib Naukluft Park	This site host roosting, foraging and breeding areas for a variety of marine flora.
Possession Island	Possession Island is the largest of Namibia's seabird breeding Island, south of Elizabeth Bay. It supports a significant number of seabirds which forage throughout Elizabeth Bay.
Sandwich Harbour	Sandwich harbour is a natural lagoon, which lies in the Namib desert and one of Namibia's' four Ramsar sites, and the country's only marine reserve.
Sperrgebiet	The Sperrgebiet is one of the four Ramsar sites of the country. The Sperrgebiet has a diverse range of flora and fauna, due to little human intervention in the area. The site includes the Namibian side of the Orange River Mouth. The Orange River Mouth is species rich, and in the past has been the sixth important wetland in southern Africa.
Walvis Bay	This site is one of the countries four Ramsar sites, and is located in the Kuiseb Delta. The site is regarded as one of the most important coastal wetlands in southern Africa for Birdlife. The 30 km Walvis Bay coastline is therefore a designated IBA.

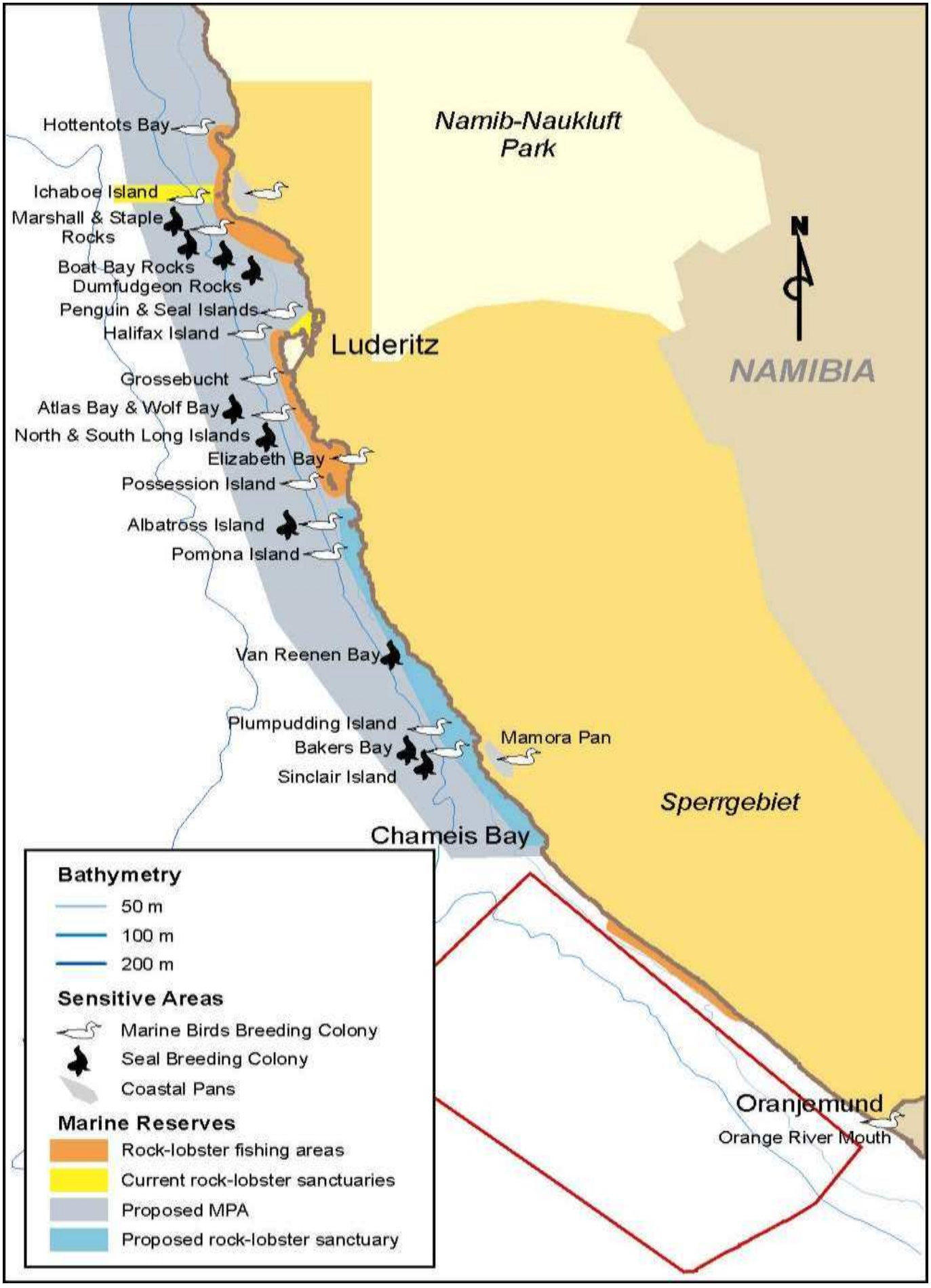


Figure 5.11: ML 47 Area in relationship to commercial rock lobster fishing areas, seabird and seal breeding areas and Marine Protected Areas (MPAs).

Table 5.4: Seabirds of southern Namibia.

SPECIES	STATUS*	RELATIVE ABUNDANCE	SEASONALITY	CONSERVATION STATUS (IUCN)
African Penguin *Spheniscus demersus*	B, inshore	Common	All year	Endangered
Black-necked Grebe *Podiceps nigricollis*	AM, inshore	Locally common	Winter, summer	Least Concern
Wandering Albatross *Diomedea exulans*	SM, offshore	Rare	Winter, summer	Vulnerable
Shy Albatross[a] *Thalassarche cauta*	SM, offshore	Uncommon	All year	Near Threatened
Black-browed Albatross *T. melanophris*	SM, offshore	Common	Winter, summer	Near Threatened
Grey-headed Albatross *T. chrysostoma*	SM, offshore	Rare	Vagrant	Endangered
Atlantic Yellow-nosed Albatross[a] *T. chlororhynchos*	SM, offshore	Common	Winter, summer	Endangered
Northern Giant Petrel *Macronectes halli*	SM, In/offshore	Common	All year	Least Concern
Southern Giant Petrel *M. giganteus*	SM, In/offshore	Uncommon	All year	Least Concern
Pintado Petrel *Daption capense*	SM, offshore	Common	Winter	Least Concern
Antarctic Fulmar *Fulmarus glacialoides*	SM, offshore	Rare	Winter	Least Concern
Antarctic Prion *Pachyptila desolata*	SM, offshore	Common	All year	Least Concern
Great-winged Petrel *Pterodroma macroptera*	SM, offshore	Uncommon	All year?	Least Concern
Atlantic Petrel *P. incerta*	SM, offshore	Rare	Summer	Endangered
Soft-plumaged Petrel *P. mollis*	SM, offshore	Uncommon	Winter, summer	Least Concern
White-chinned Petrel *Procellaria aequinoctialis*	SM, offshore	Common	Winter, summer	Vulnerable
Grey Petrel *P. cinerea*	SM, offshore	Rare	Winter	Near threatened
Spectacled Petrel *P. conspicillata*	SM, offshore	Rare	Winter, summer	Vulnerable
Manx Shearwater *Puffinus puffinus*	NM, offshore	Rare	Summer, winter	Least Concern
Great Shearwater *Ardenna gravis*	SM, offshore	Uncommon	Summer passage	Least Concern
Sooty Shearwater *A. griseus*	SM, offshore	Common	Winter, summer	Near Threatened
Cory's Shearwater *Calonectris* borealis	NM, offshore	Common	Summer	Least Concern
European Storm Petrel *Hydrobates pelagicus*	NM, offshore	Common	Summer, winter	Least Concern
Wilson's Storm Petrel *Oceanites oceanicus*	SM, offshore	Common	Winter, summer	Least Concern
Leach's Storm Petrel *Oceanodroma leucorhoa*	NM, offshore	Uncommon	Summer	Least Concern

Table 5.4: *Cont.*

Black-bellied Storm Petrel *Fregetta tropica*	SM, offshore	Rare	Winter	Least Concern
White-bellied Storm Petrel *F. grallaria*	SM, offshore	Rare	Winter	Least Concern
White-faced Storm Petrel *Pelagodroma marina*	SM, offshore	Rare	Winter	Least Concern
Great White Pelican *Pelecanus onocrotalus*	B, inshore	Rare	All year	Least Concern
Cape Gannet *Morus capensis*	B, In/offshore	Common	All year	Vulnerable
Cape Cormorant *Phalacrocorax capensis*	B, inshore	Common	All year	Endangered
Bank Cormorant *P. neglectus*	B, inshore	Rare	All year	Endangered
Crowned Cormorant Microcarbo *coronatus*	B, inshore	Uncommon	All year	Near threatened
White-breasted Cormorant *P. carbo*	B, inshore	Uncommon	All year	Least Concern
Grey Phalarope *Phalaropus fulicarius*	NM, offshore	Uncommon	Summer	Least Concern
Arctic Skua *Stercorarius parasiticus*	NM, In/offshore	Common	Summer, winter	Least Concern
Pomarine Skua *S. pomarinus*	NM, offshore	Common	Summer, winter	Least Concern
Long-tailed Skua *S. longicaudus*	NM, offshore	Common	Summer	Least Concern
Brown Skua *Catharacta antarctica*	SM, offshore	Common	Winter, summer	Least Concern
Sabine's Gull *Xema sabini*	NM, In/offshore	Common	Summer	Least Concern
Kelp Gull *Larus dominicanus*		Common	All year	Least Concern
Hartlaub's Gull *L. hartlaubii*	B, inshore	Common	All year	Least Concern
Grey-headed Gull *L. cirrocephalus*	B, inshore	Rare	All year	Least Concern
Common Tern *Sterna hirundo*	NM, inshore	Common	Summer	Least Concern
Arctic Tern *S. paradisaea*	NM, offshore	Uncommon	Summer passage	Least Concern
Sandwich Tern Thalasseus *sandvicensis*	NM, inshore	Common	Summer	Least Concern
Swift Tern *T. bergii*	B, inshore	Common	All year	Least Concern
Damara Tern *Sternula balaenarum*	B, inshore	Uncommon	All year	Near threatened
Caspian Tern Hydroprogne *caspia*	B, inshore	Rare	All year	Least Concern
Black Tern *Chlidonias niger*	NM, inshore	Rare	Summer	Least Concern

5.4.4.2 General Threats to Seabirds

Whilst all seabirds are protected in Namibia, there are hazards and vulnerabilities that jeopardise the long-term sustainability of birdlife. The main risks facing sea and shorebirds in Namibia are:

- Habitat loss and encroachment by human settlement, development and industry.
- Disturbance or alteration of nesting and brooding sites by human activities (e.g., guano scraping, off-road vehicles and recreational pursuits).
- Displacement by other breeding species (e.g., seals and other birds).

- Predation by other birds, seals and land-based predators.
- Decreased food availability (Crawford et al. 2001, 2006. Kemper, 2007).
- Pollution from increased shipping, both commercial and tourist.
- Small-scale chronic oil pollution from ships discharging waste oil and wrecks leaking oil.
- Fish oil pollution from factories and fishing fleets (mainly affecting Cape and Australasian Gannets and gulls (Kemper, 2007), and.
- Entanglement in discarded fishing tackle (commercial gear and at recreational beaches).
- Entanglement in lobster traps and in aquaculture structures (MFMR unpubl.data).
- Collisions with ship cables.
- Increased air traffic disturbance (industrial, commercial and tourist), and.
- Entanglement in fishing gear (particularly during demersal trawls or long-line fishing).

Anderson et al. (2011) estimated an annual bycatch of ca. 19,190 petrels and 606 albatrosses in the Namibia hake fisheries. A the 2024 MFMR study estimated the annual bycatch mortality in the Namibian demersal trawl fishery at around 8 088, 5010 are albatrosses (MFMR 2014b). Any of the above can have a devastating effect on a population that is already weakened by, for example, the outbreak of a virus.

5.4.5 Marine Mammals

5.4.5.1 Overview

The abundance of plankton and pelagic fish draws a variety of marine mammals to Namibian waters (Figs. 4.12-4.15). Namibia is well known for its large Cape Fur seal colonies. While there are resident dolphin pods, larger cetacean species utilising the Namibian waters as feeding and breeding grounds, or are simply transient migrants enroute between Antarctic and tropical waters. The most common dolphins in the BCLME area the Atlantic Bottlenose, Common, Dusky, Risso's, Rough-toothed and Southern Right-whale dolphins. The Heaviside's dolphin is endemic to Namibian coastal waters. There have been rare or occasional sightings of toothed whales such as Sperm, Cuvier's Beaked, False Killer and Long-finned Pilot whales. Orcas are known to feed opportunistically on migrating animals in offshore waters, mostly reported within the CBR in the vicinity of Walvis Bay. Occasionally, baleen whale species have been reported transiting through Namibian shelf waters. (Elwen and Leeney, 2010. Maloney and Shannon, 2008. NACOMA, 2017. Namibian Dolphin Project, 2017. O'Toole, 2009. Roux, J.P., 2008. Travel News Namibia, 2019).

There are two main groups of cetaceans: Mysticetes or baleen whales and Odontocetes or toothed whales and dolphins. Mysticetes are largely migratory, while odontocetes are both migratory and resident. Although as many as 33 species of cetacean have been recorded in Namibian waters, there is still only sparse data on abundance, stock structure and conservation status of most species within the region (Elwen et al., 2010), although data from marine mammal observers and passive acoustic monitoring is improving the database, particularly for deep offshore waters (>200m), where previously information was reliant on historic whaling records.

However, population sizes and trends of most cetacean species recorded in Namibian waters is sparse. Some cetaceans are semi-permanent residents within Namibian waters, others come to breed and still others are long-distance travellers, entering and leaving the Benguela almost without pause, en route to preferred destinations. Heaviside's (or Benguela) dolphin is the only odontocete endemic to the Benguela Current. There are two main distributions of cetaceans in Namibian waters: inshore species living on the continental shelf in higher density, and oceanic or pelagic species, ranging over thousands

of kilometres. Only a limited number of offshore cetacean species are likely to be encountered in and around the ML 47 and includes Southern Right Whales, Southern Right Whale Dolphin, Heaviside Dolphin and Dusky Dolphin known to occur in the eastern coastal shallow waters and overlapping with the ML 47 area but not necessary with the previous and current exploration, recovery and production areas (Fig. 5.12-5.15).

Most dolphins, including the Heaviside's dolphin, prefer shallow inshore waters and are thus likely to be encountered within the ML 47 area. There is almost no data relating to abundance, distribution, or seasonality of odontocetes in oceanic waters off the Namibian continental shelf (1 000 – 2 000 m), except for recent sightings of Sperm whales near Tripp Sea Mount (Weir, 2011. Benthic Solutions, 2019). False Killer Whales frequent open ocean waters, although they are not seen with any regularity. Orcas roam throughout the oceans, making their occurrence difficult to predict. Detailed information on the various marine mammals found in the Namibian water relative to the ML 47 area are shown in Figs. 5.12-5.15.

5.4.5.2 General Threats to Mammals in Namibian Waters

The Sea Fisheries Act (29 of 1992) grants marine mammals full protection within the 200 nautical mile Namibian Exclusive Economic Zone. To date, visual observation records by vessels operating within Namibian waters (as required by MME) suggest that dolphin numbers have been increasing in the last decade. None-the-less, these animals may be impacted by human activities both on- and offshore. The increased ship traffic in and out of Lüderitz and Walvis Bay Harbours, and the general noise in the environment, can possibly have a negative effect on whales and dolphins in a local area. There are no official reports of detrimental impacts on cetaceans resulting directly from the previous or ongoing marine diamonds exploration, recovery and production operations in the ML No. 47.

Elsewhere and away from the ML 47 activities, increasing numbers of marine tour operators in Lüderitz and Walvis Bay may be placing pressure on seals, dolphins and recovering whale populations. Impacts from aquaculture and mariculture can include pollution and the introduction of alien species. These farms also close off spaces previously accessible to wild marine life, possibly impacting habitat and feeding and breeding patterns. They can lie in the direct path of migrating whales and may trap and cause confusion to dolphins. All marine related operations including the ongoing and future marine diamonds exploration, recovery and production shall adhere to the provisions of the MARPOL regulations and national laws.

5.5 Geological Setting

5.5.1 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.

5.5.2 Surficial Local Geology

In southern Namibia and Namaqualand in northern South Africa, the distribution of sediments on the continental shelf is strongly influenced by the Orange River, and consequently river-related sediments are found overlying the bedrock both north and south of the river mouth, attaining a maximum thickness of 60 m. Firm sandy sediment occurs on the delta front around the Orange River Mouth and to Mittag about 45 km to the north. The sand, which occurs between the 40 m isobath and the coast, merges with a beach, which extends virtually continuously along the coastline pinching out altogether at Affenrücken, 95 km north of the mouth and at the northern extent of the licensed area (Rogers 1977) (Fig. 5.16). South of the Orange River Mouth, the shoreline is primarily rocky, particularly between Alexander Bay and Port Nolloth.

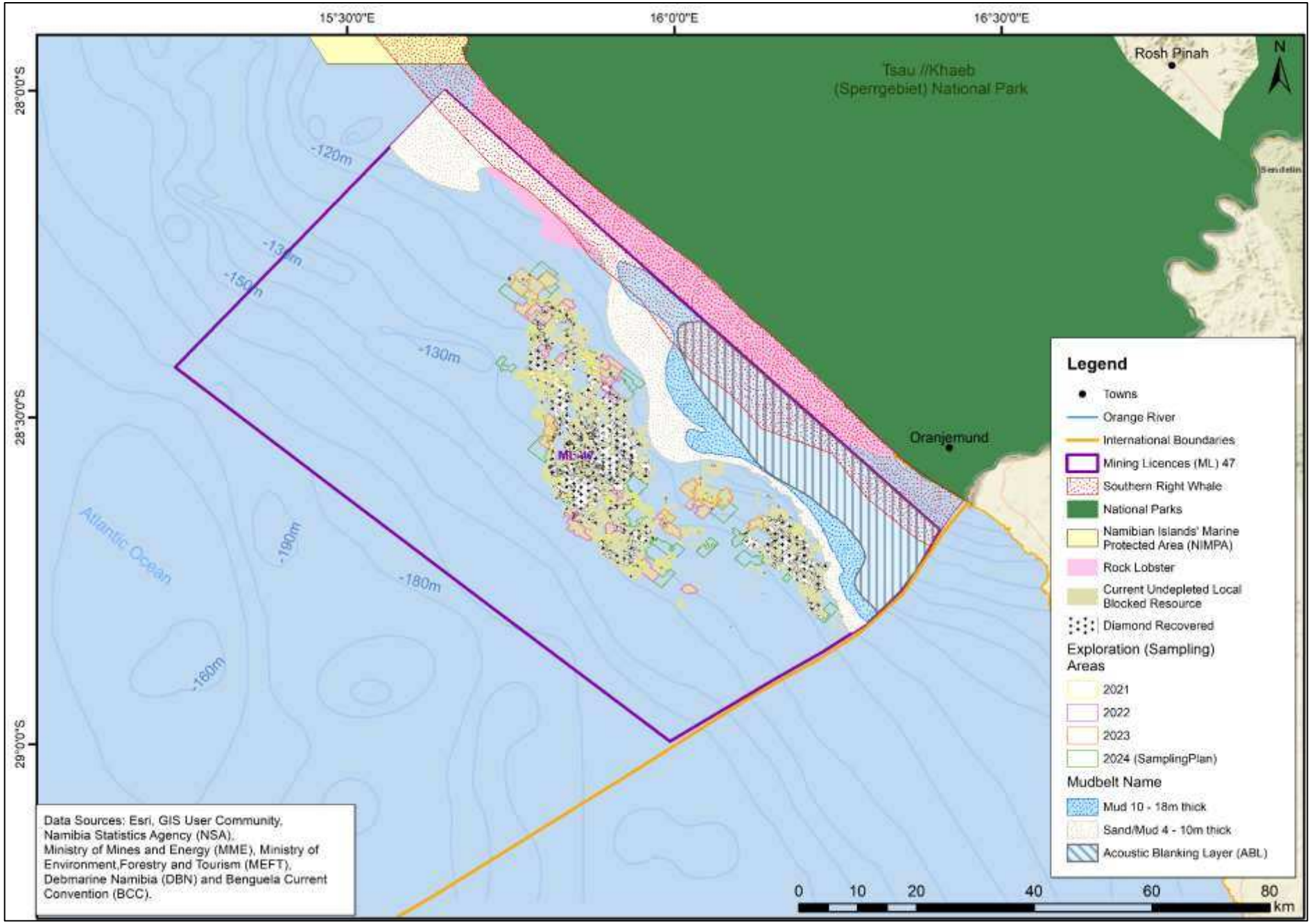


Figure 5.12: Known occurrences of Southern Right Whales in the eastern coastal shallow waters and overlapping with the ML 47 area but not necessary with the previous and current exploration, recovery and production areas.

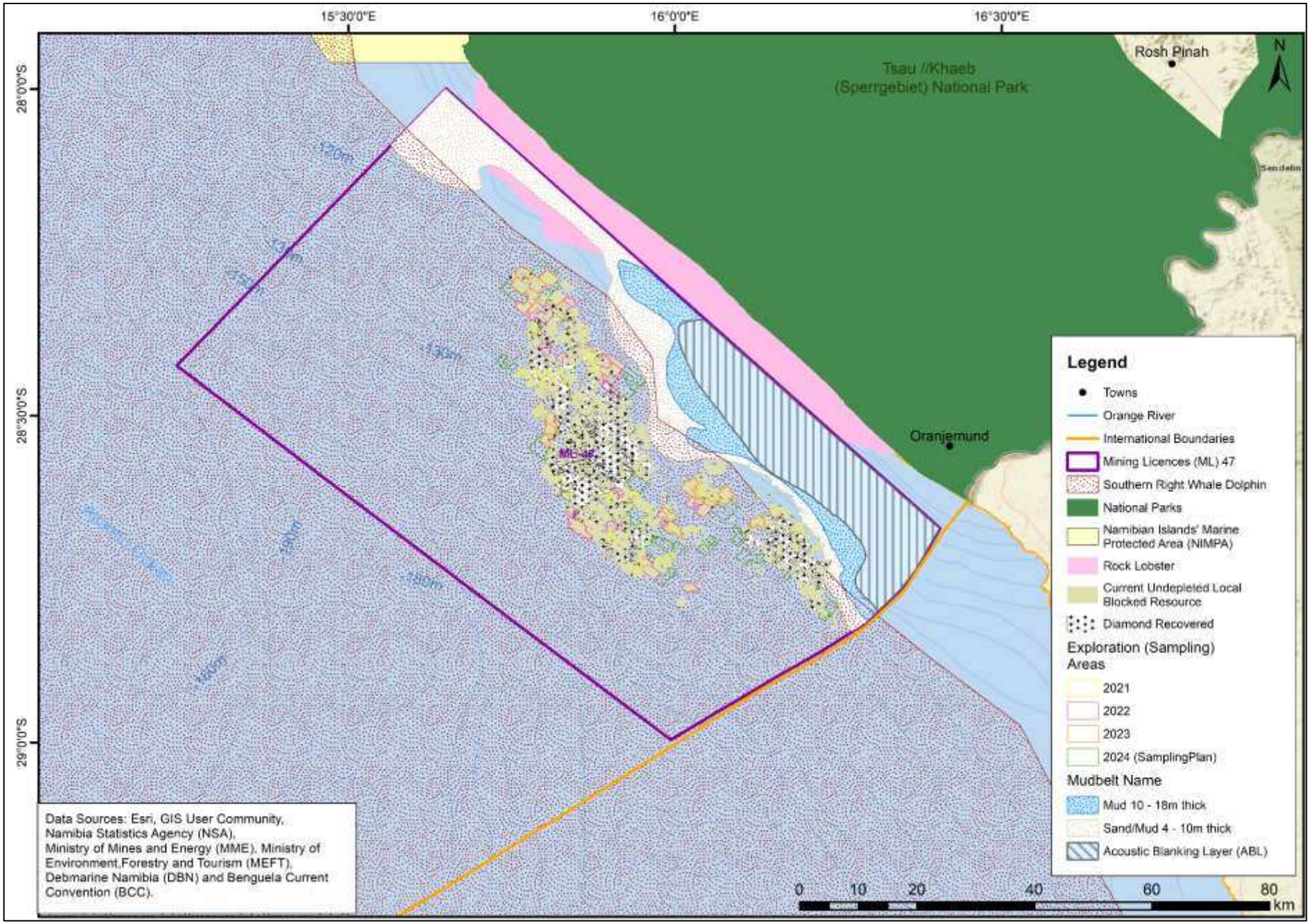


Figure 5.13: Known occurrences of Southern Right Whale Dolphin in the eastern coastal shallow waters and overlapping with the ML 47 area but not necessary with the previous and current exploration, recovery and production areas.

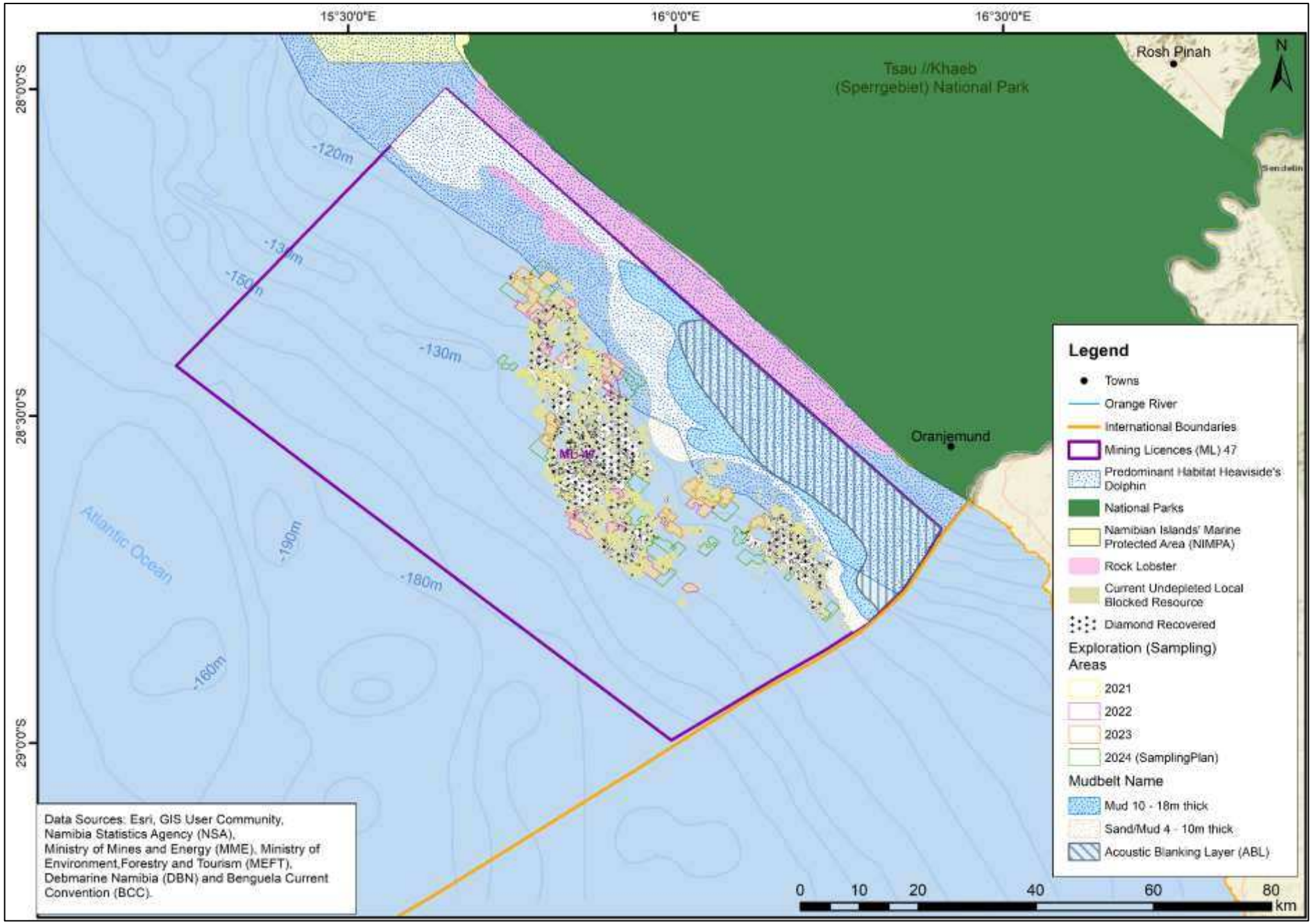


Figure 5.14: Known occurrences of Heaviside Dolphin in the eastern coastal shallow waters and overlapping with the ML 47 area but not necessary with the previous and current exploration, recovery and production areas.

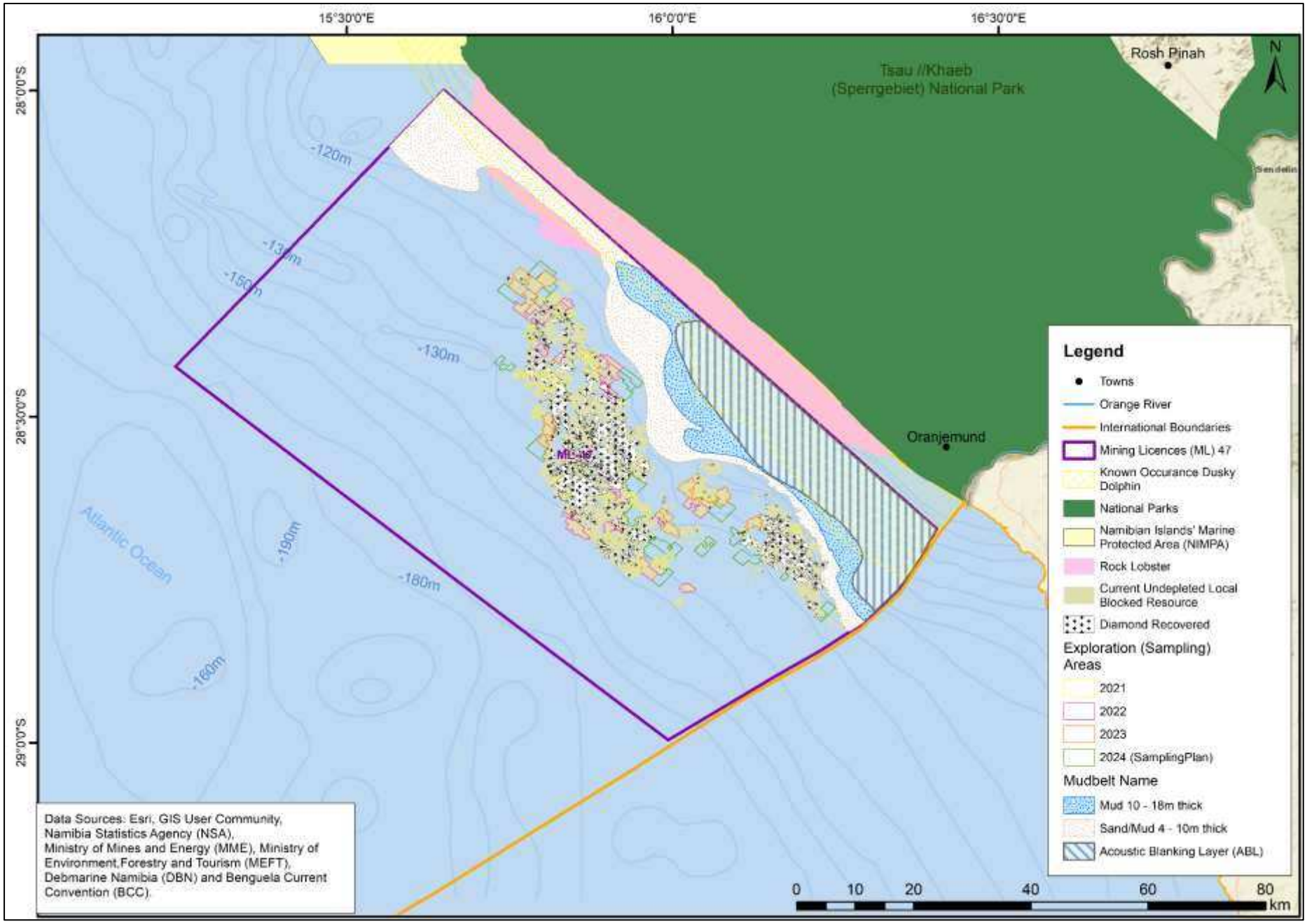


Figure 5.15: Known occurrences of Dusky Dolphin in the eastern coastal shallow waters and overlapping with the ML 47 area but not necessary with the previous and current exploration, recovery and production areas.

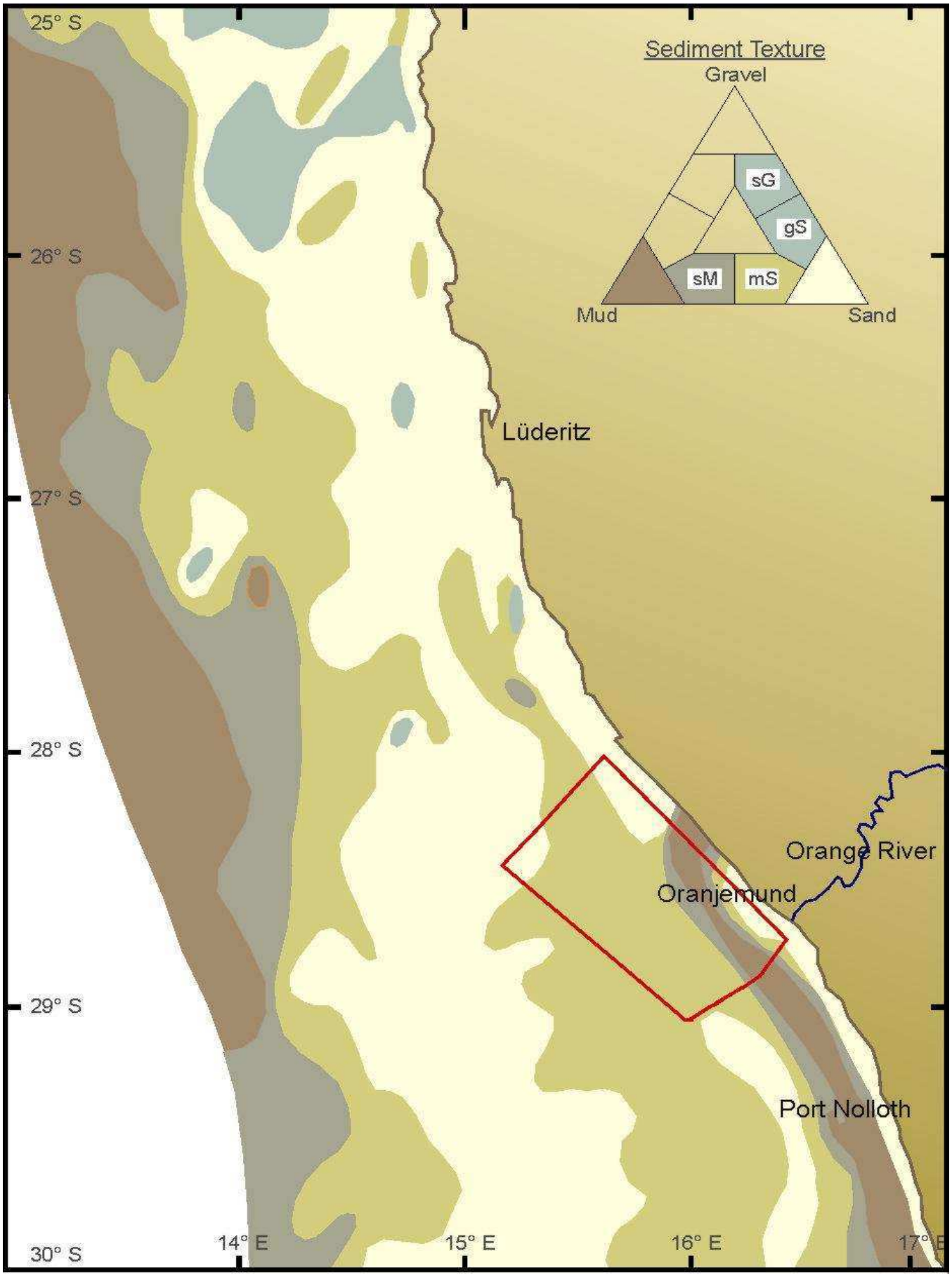


Figure 5.16: The licensed area (red polygon) in relation to sediment distribution off the west coast of southern Africa (Adapted from Rogers 1977).

5.6 Socioeconomic Governance, Infrastructure and Archaeology

5.6.1 Political Governance

The Republic of Namibia is a unitary State. Administratively, it is divided into three tiers, with separate spheres of responsibility – central, regional and local governance. The central government consists of the President and the two Houses of Parliament: The National Assembly and the National Council. The regional sphere is made up of Regional Councils. Each of the regional councils runs one region, which are fourteen in total and these are (Fig. 5.17): Zambezi, Erongo, Hardap, Karas, Khomas, Kunene, Ohangwena, Okavango East, Okavango West, Omaheke, Omusati, Oshana, Oshikoto and Otjozondjupa. Regional Councils have powers under the Regional Councils Act of 1992, which established a regional council in each region. They can, among other things, advise the President and central government on matters relating to the region. The political head of a region is the Governor, who is appointed by the President.

The regions are divided into constituencies for electoral purposes. Each constituency elects one member to the regional council using a first-past-the-post electoral system. The term of office of the regional council members is six years. The regional councils elect from amongst their members two persons as members of the National Council. The local authorities are established in urban areas, and the regions cover the rural areas. The regional councils are presently responsible for specified service delivery in rural areas, while the local authorities are responsible for service delivery in urban areas. Currently the only service provision responsibility of the regional councils specified in the Regional Councils Act is the provision of basic services in areas where settlements are proclaimed, but no local authorities are established. There are four types of local government: Municipal (of two types), town, village and settlement councils.

There is no upper or lower tier in Namibian local government. The fourteen (14) Regional Councils run the regions. Municipal, Town and Village Councils are not sub-ordinate to them. The municipal councils are the most autonomous local authorities of the local authority categories. Under the Local Authorities Act of 1992, the Minister responsible for regional and local government may further classify the municipalities into two types: Part I municipalities and Part II municipalities. Currently there are three Part I municipalities (Windhoek, Walvis Bay and Swakopmund), 15 Part II municipalities, and in total 30 towns and villages in Namibia. Part I municipalities generally have a solid financial basis and considerable autonomy with regard to the determination of property tax and obtaining loans under the provisions of the Local Authorities Act. Part II municipalities have a more fragile financial basis and are subject to control exercised by the Ministry of Regional and Local Government, Housing and Rural Development. Most of the town councils cannot balance their budgets without substantial transfers from the central government or donors, and their financial autonomy, in general, is limited.

5.6.2 National Socioeconomic Setting

According to Namibia Statistics Agency (NSA) Multidimensional Poverty Index (MPI) Report, 2022, more than 43.3 percent of Namibia's population are still living in multidimensional poverty. Unemployment is particularly acute for rural women. Over 44% of the female rural labour force was unemployed in 2016 compared to 34% in urban areas (a 10% spread); for men, the 2016 unemployment figures were 34% in rural areas compared to almost 27% in urban areas (a 7% spread). Despite Namibia being classified as am upper-middle-income country, the country has high socioeconomic inequalities, high youth unemployment and high rural poverty.

The Namibian economy rests on four main pillars, namely: Mining, agriculture, fishery, and tourism. Namibia is middle income country with natural resources including a great variety of minerals, mainly diamonds, uranium, gold, silver, zinc, copper, lead, tin, marble, and granite as well as semi-precious stones among others. Marine diamond production accounted for approximately 10% of the gross domestic product, 40% of export revenue and 7% of annual government revenue in 2022. Marine minerals exploration and mining operations are undertaken in shallow waters of less than -200m (Fig. 5.17).

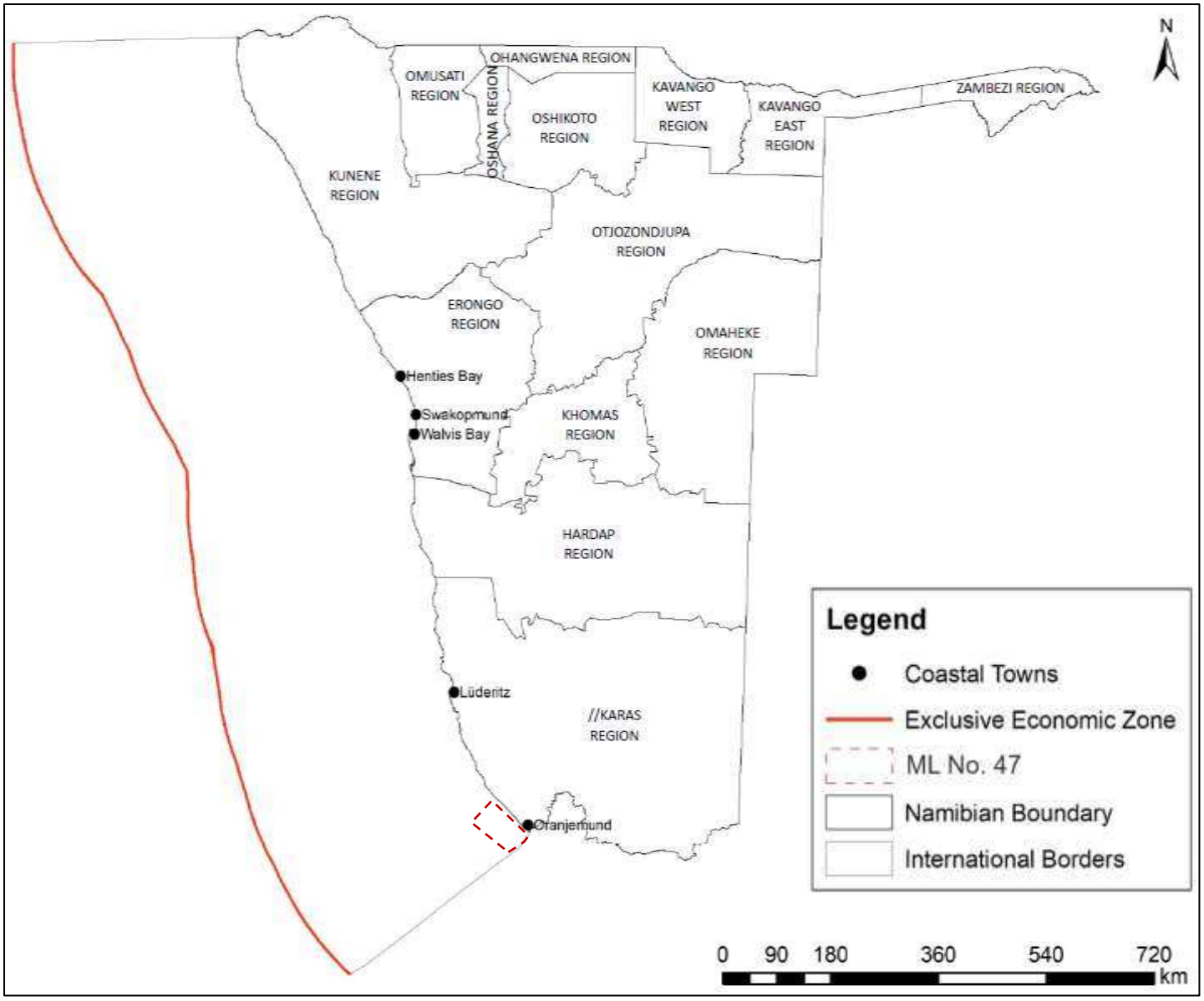


Figure 5.17: Regions of Namibia with respect to the location of the ML No. 47.

5.6.3 Regional Infrastructure and Services

The various activities and logistical arrangements of the ML 47 marine diamond exploration, recovery and production operations falls opposite the following regions, towns, and general coastal areas with respect to the available infrastructure and services:

(i) The ML 47 location is located in the marine environment of Namibia and it is opposite the //Karas Regional coastlines (Fig. 5.17).

(ii) Oranjemund is only the coastal town opposite the ML No. 47 with logistical links to Lüderitz (shore Base) and Walvis Bay Port.

(iii) The Port of Lüderitz that is used as the shore / operation base are situated in the //Karas Region, and.

(iv) The entire southern coastlines fall within the coastal national park with the exception of the municipal areas of Lüderitz and Oranjemund coastal towns.

The economies of the coastal towns of Lüderitz and Oranjemund are dependent on local resources of fishing, mining, trading, and tourism.

5.6.4 National Socioeconomic Contributions of Mineral Sector

According to the Chamber of Mines Annual Review Report, (2024), the mineral sector contributes on average 11.5 per cent of GDP, over 50 per cent of foreign exchange earnings, and employs 2 per cent of the country's total population. Government's tax revenue in 2023, grew by 55.9% from N$4.402 billion in 2022 to N$6.861 billion (Chamber of Mines Annual Review Report, 2024). This was primarily driven by the exceptionally high corporate taxes paid to Government which amounted to N$3.967 billion, representing an increase of 98.5%. The industry's robust profitability directly contributed to these high corporate tax payments, underscoring the government's substantial gains from corporate income taxes when mines reach profitable levels.

According to the Chamber of Mines Annual Review Report, (2024). the increased Government revenue was due to an increase in royalties and export levies which grew by 17.6% and 45%, respectively. This was evidenced by the strong growth of the sector which recorded 18.9% in 2023, and is increasing its relevance and GDP contribution to the Namibian economy from 11.9% in 2022 to 14.4% in 2023. Namibia contributes around 25% of global rough diamond production by value. Diamond recovery and production operations is also the largest single industry in Namibia, where it consistently contributes around 8% of GDP and 40% of foreign exchange earnings.

5.6.5 National Socioeconomic Contributions of DBMN

DBMN is a key player and economic driver on the socioeconomic landscape of Namibia. The company employs 1107 people (https://debmarinenamibia.com), with a workforce that is sourced countrywide and from outside Namibia and not accommodated in Oranjemund. Only a smaller share of contractors servicing the operational base are staying in Oranjemund. DBMN has a significant number of women working in all aspects of the operations. The company's employees are from different parts of Namibia, South Africa and Europe and are flown from Windhoek and Cape Town to the operational base (Oranjemund) to be flown to their place of work onboard the exploration or recovery and production vessels.

The company covers the transportation cost for the duration of a 'shift', i.e., the number of days when they are 'on roster', and provided with food and accommodation (offshore). Fly-in/ fly-out (FIFO) arrangements by DBMN are not contributing to the negative change of socio-demographic characteristics in Oranjemund town. In such way the company's workforce has very little interaction with local community in Oranjemund and does not affect the socio-demographic composition (e.g., gender and/or age composition) of the town.

5.6.6 Social Corporate Responsibility of DBMN

The Company's social responsibility programme focuses on all the regions of the country, including the labour sending areas as well as the social well-being of employees. DBMN awards full bursaries to deserving young Namibians on an annual basis for study in various fields. The bursary programme offers study opportunities in various areas depending on the Company's needs, such as: Marine Engineering, Mechanical Engineering, Electrical Engineering, Chemical Engineering, Metallurgy, Geology, Environmental Science, Surveying and Commercial Services related studies, amongst others.

The company participates in several career and trade fairs in various regions throughout Namibia to promote development and placement opportunities to Namibian learners and students. As a responsible corporate citizen, the Debmarine Namibia Social Responsibility Fund (SRF) was established in 2004 to facilitate the Company's social responsibility activities across the communities of Namibia, and has made a significant contribution to society over the years.

The fund undertakes a number of activities across a broad spectrum of community development areas 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.

5.6.4 Archaeology

A number of shipwrecks are known to exist along the west coast of southern Africa. According to Namibian law, any wreck within Namibian territorial water that is older than 50 years is declared a national monument and therefore a protected historical artefact (Gribble, 1997).

Most known wrecks lie inshore in relatively shallow waters and their location are known on charts drawn up by and available from the Hydrographic Office of the South African Navy (SAN Charts). The annual *Summary of South African Notices to Mariners No. 5* also describes the position and nature of submarine hazards along the southern African West Coast.

5.7 Marine, Coastal and Onshore Protected Areas

5.7.1 Namibian Islands' Marine Protected Area (NIMPA)

The Ministry of Fisheries and Marine Resources has prepared draft regulations pertaining to the Namibian Islands' Marine Protected Area (NIMPA), indicating the position of the NIMPA, including the islands, and the positions of the line fish sanctuary and Rock Lobster sanctuary as per Government Gazette no. 4210 of 16 February 2009 (Tables 5.4 and 5.5 and Fig. 5.18).

The Namibian Islands' Marine Protected Area includes all islands, rocks, islets, marine resources, and marine area as follows:

(a) The northern border is constituted by a line drawn from a Point just north of Meob Bay at 24 ° 29' 10''S, 14 ° 30' 00"E, running due east to the high water mark.

(b) The southern border consists of a line drawn from a Point south-west of Chamais Bay at 27 ° 57' 34"S, 15 ° 28' 05" E, running due east to the high water mark.

(c) The western border is constituted by a line connecting the co-ordinates referred to in regulation 3 below.

(d) The eastern border runs along the high-water mark of Namibia's coast-line, between Meob Bay in the north and Chamais Bay in the south of the Marine Protected Area.

Tables 4.5 and 4.6 shows the islands, islets, rocks, line fish sanctuary and rock lobster sanctuary falling within the buffer zone of the Namibian Islands' Marine Protected Area.

The ML No. 47 area is situated outside and south of the Namibian Islands' Marine Protected Area (NIMPA) and coastal sensitive environments (Fig. 5.18).

Table 5.5: PART III Coordinates of the Namibian Islands' Marine Protected Area.

All-encompassing buffer zone of the Namibian Islands' Marine Protected Area	**Latitude South**	**Longitude East**
North-West corner extends from this point straight east to the high-water mark on the coastline	24°29'10"	14°30'00"
Point west of Black Reef	24°33'19"	14°29'15"
Point west of Easter Point	25°17'34"	14°35'29"
Point west of Dolphin Head	25°44'24"	14°39'16"
Point south-west of Douglas Point	26°20'32"	14°44'25"
Point west of Elizabeth Point	26°55'28"	14°55'44"
Point north-west of Van Reenen Bay	27°21'13"	15°04'00"
South-West corner extends from this point straight east to the high-water mark on the coastline	27°57'34"	15°28'05"
The eastern border is the high-water mark on the coastline opposite the western border		

Table 5.6: Islands, islets, rocks, line fish sanctuary and rock lobster sanctuary falling within the buffer zone of the Namibian Islands' Marine Protected Area.

Islands	**Latitude S**	**Longitude E**
Hollamsbird Island	24°38'22"	14°31'51"
Mercury Island	25°43'10"	14°49'58"
Ichaboe Island	26°17'20"	14°56'11"
Seal Island	26°35'45"	15°09'22"
Penguin Island	26°37'00"	15°09'14"
Halifax Island	26°39'04"	15°04'47"
Possession Island	27°00'45"	15°11'37"
Pomona Island	27°11'37"	15°15'28"
Plumpudding Island	27°38'30"	15°30'49"
Sinclair Island	27°39'55"	15°31'13"
Islets and Rocks		
Neglectus Islet	26°08'11"	14°56'46"
Disused jetty in Hottentot Bay	26°08'30"	14°56'44"
Unnamed rock (near Danger Point)	26°14'45"	14°57'16"
Marshall Rocks	26°21'21"	14°57'31"
Staple Rocks	26°21'15"	14°58'46"
Boat Bay Rocks	26°25'16"	15°05'24"
Dumfudgeon Rocks	26°29'34"	15°07'01"
Ladies Rocks (N Rock)	26°51'26"	15°09'10"
Ladies Rocks (S Rock)	26°51'37"	15°09'11"
Long Island – North	26°49'10"	15°07'30"
Long Island – South	26°49'54"	15°07'41"
Albatross Rock	27°07'08"	15°14'17"
Line Fish Sanctuary		
North-West corner of sanctuary (Northern border extends from this point straight east to the high-water mark on the coastline)	24°29'10"	14°30'00"
Point west of Black Reef	24°33'19"	14°29'15"
Point west of Black Rock	24°57'23"	14°42'25"
South-West corner of sanctuary (Southern border off Sylvia Hill extends from this point straight east to the high-water mark on the coastline_	25°09'57"	14°44'02"
Rock Lobster Sanctuary		
North-West corner of sanctuary (Northern border extends from this point straight east to the high-water mark on the coastline)	27°03'43"	15°11'56"
Point west of Prinzenbucht	27°06'33"	15°12'44"
Point west of Pomona	27°12'02"	15°13'25"
Point west of Van Reenen Bay	27°24'42"	15°19'25"
Point west of Baker's Bay	27°40'17"	15°27'00"
SW corner of sanctuary (Southern border off Chamais Bay extends from this point straight east to the high-water mark on the coastline)	27°55'52"	15°38'15"

5.7.2 Ecologically or Biologically Significant Marine Area (EBSA)

The following is the summary of the Ecologically or Biologically Significant Areas (EBSAs) that have been delineated in Namibia (Fig. 5.18): Orange Seamount and Canyon Complex, Orange Cone, Namibian Islands, Namib Flyway, Walvis Ridge Namibia, Cape Fria, and Namibe. There are two (2) biodiversity zones ('Conservation' and 'Impact Management') that have recently been defined within the EBSA as part of the ongoing Marine Spatial Planning (MSP) process being undertaken by the MFMR in Namibia (Figs. 5.18 and 5.19). The following is the summary of the key management objectives of each demarcated biodiversity zones:

- Conservation Zone: Strict place-based biodiversity protection aimed at securing key biodiversity features in a natural or semi-natural state, or as near to this state as possible, and potentially destructive activities conditionally permissible through regulatory consent, and.

- ❖ Impact Management Zone: Is a multiple use area with management objectives focused on keeping key biodiversity features in at least a functional state.

Although EBSAs area have been delineated within the framework of the ongoing Marine Spatial Planning (MSP) process driven by the Ministry of Fisheries and Marine Resources, these areas are not formally proclaimed Marine Protected Areas (MPAs) or no-go areas. Various marine based activities including marine diamond exploration, recovery and production operations are conditionally permissible through the current existing general regulatory consent frameworks such as the EIA Regulations 2012. The following is the summary of the EBSAs close to or overlapping with the ML No. 47 (Fig. 5.18).

(i) Namibian Islands' Marine Protected Area (NIMPA): There is no overlap with the ML No. 47.

(ii) Orange Seamount and Canyon Complex: There is no overlap with the ML No. 47, and.

(iii) Orange Cone: There is an overlap with the southern portion of the ML No. 47.

An ECC shall be obtained from the Government before the Proponent starts with any operations within an EBSA area.

5.7.3 Summary of the Onshore Environment and Protected Areas

The entire Namibian coastline is virtually protected in one way or another, north to south this includes, Dorob National Park, the Skeleton Coast National Park (SCNP), the West Coast Recreation Area (WCRA), Cape Cross Seal Reserve (CCSR), Walvis Bay Nature Reserve (WBNR), Walvis Bay Lagoon sites, the Namib-Naukluft National Park (NNNP) and the Tsau //Khaeb (Sperrgebiet) National Park (Fig. 5.19).

The intertidal zone (i.e., the area between the low and high-water marks) provides foraging habitat to large numbers of shorebirds, including a number of migratory species, as well as two species of gulls. Foraging habitat for shorebirds includes both rocky and sandy substrates. stranded kelp and associated isopod, insect and polychaete communities may support high densities of shorebirds.

Because these wetlands are widely spaced and relatively small in extent, they offer crucial foraging and roosting habitat to a large number of birds, including resident species and a range of shorebirds migrating along the western coast of Africa and may support tens of thousands of birds (Whitelaw et al. 1978, Williams 1993, Wearne and Underhill 2005).

The Orane River Mouth, excluded from the ML No. 47 area, is among the array of wetlands, consisting of mudflats, shoreline and salt works (Plate 5.1). The coastal belt is a very pristine and sensitive area and should be protected under one or another measure or control (Plate 5.1).

These wetlands regularly support a minimum of 20000 birds at any time, but may support up to 250 000 birds. They support up to 70% of the global population of Chestnut-banded Plovers, 40% of the African sub-species of Black-necked Grebe and 80% of the southern African population of Lesser Flamingo (Robertson et al. 2012, http:// www. nnf. org. na / CETN / ramsar.htm).

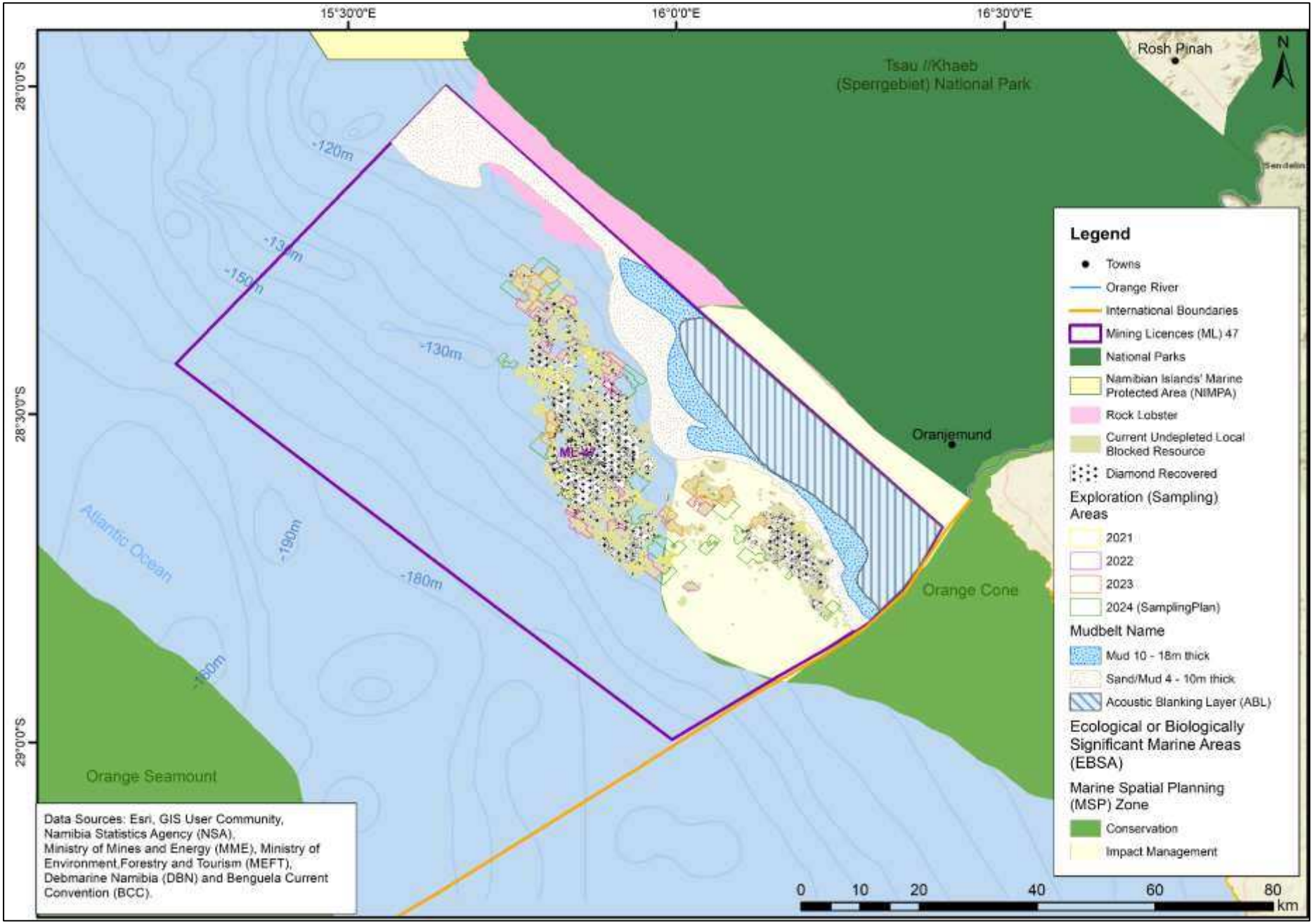


Figure 5.18: Ecologically or Biologically Significant Marine Area (EBSA) with respect to the ML No. 47 exploration, recovery and production operations (Data Source: MFMR, https://geodata.benguelacc.org).

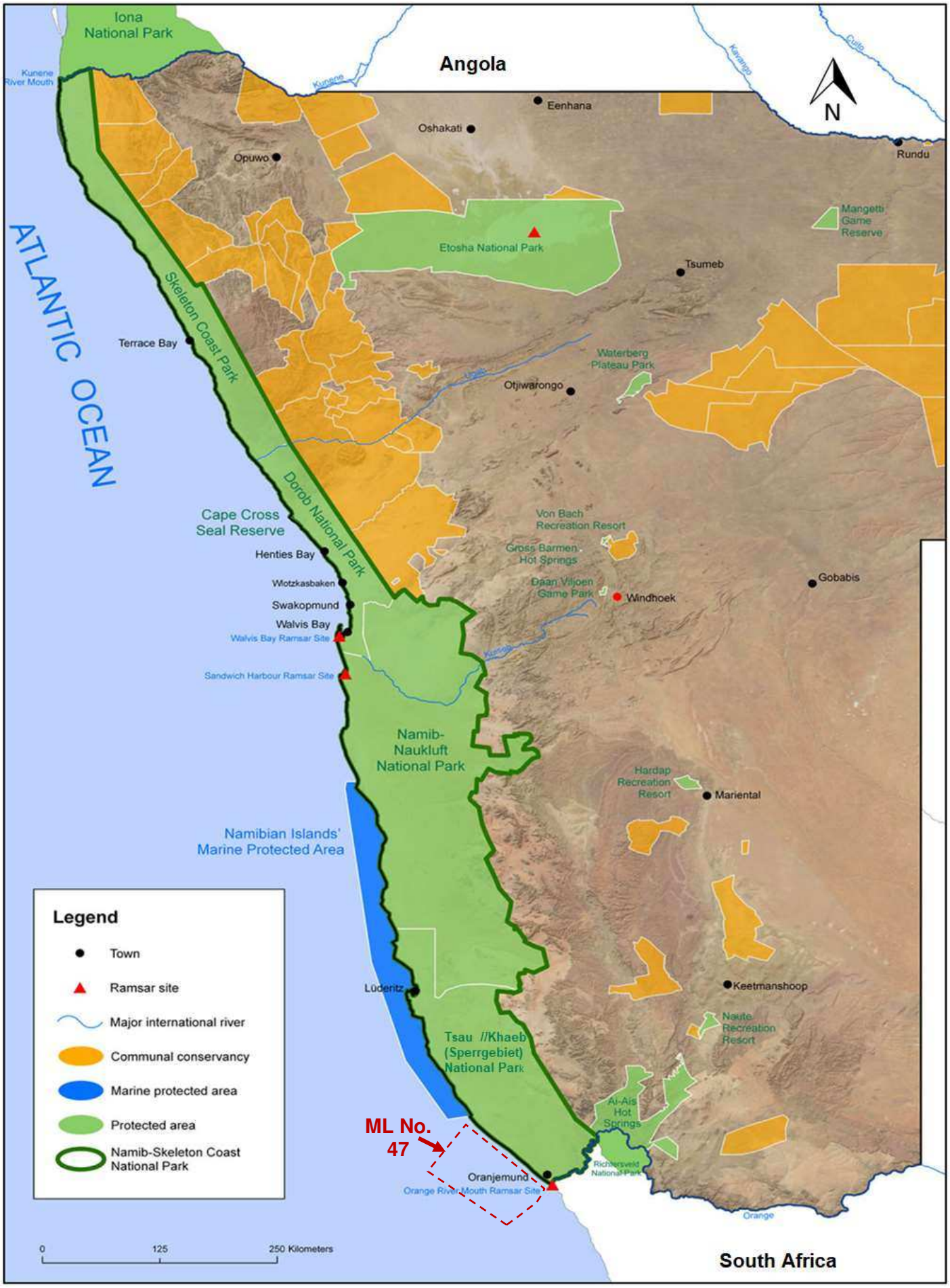


Figure 5.19: Sensitive protected areas along the Namibian coastline. The ML No. 47 is situated away from the coastline, south of the Marine Protected Area and excludes the Orange River Month Ramar Site (Source: http://www.meft.gov.na).

Plate 4.3: Orange River Mouth opposite the ML No. 45 near Oranjemund (RBS Geotagged Images Series 2024).

6. IMPACT AND RISK ASSESSMENT

6.1 Basis for Impact and Risk Assessment

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.

Existing environmental issues of concern under these categories were all identified during the scoping exercise conducted as part of preparation of the 2008 EIA and EMP for the licensed area, as well as the findings of specialist studies or whether the resources were the subject of protective legislation. All concerns raised at that time were addressed in the EMP table in the approved 1997 report. Furthermore, every attempt was made to ensure the fullest possible recognition of the sensitivities of the communities, people's lifestyle and historical heritage, and to identify positive and negative impacts on the local economy and infrastructure.

In addition to the specific EMP provisions, De Beers Marine (the operators at the time) had fully implemented ISO 14001 standards for environmental management systems for all aspects of their marine diamonds recovery and production operations, as well as the NOSA Seasafe System on the vessels.

6.2 Likely Sources of Positive Impacts

Not all activities of DBMN operations have negative impacts on the receiving environment. The following is summary of the positive socioeconomic impacts of DBMN operations:

(i) 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.

(ii) Employment – provision of work provides an income, with boosting the quality of life for employees and their families, reduce unemployment and sustain the Namibian economy.

(iii) 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 which has to be transferred to DBMN employees.

(iv) 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 around science and technology), health, welfare and supporting sustainable income-generating community projects, and.

(v) Secondary economic boost – the development will aid in sustaining secondary industries in Oranjemund, //Karas Region and elsewhere in Namibia.

6.3 Likely Sources of Negative Impacts

6.3.1 Key Sources of Likely Negative

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

1. Exploration, recovery, and production equipment and methods in use with respect to the following:

   (i) Seabed excavations and tailings disposal resulting in reorganisation of sediment structures.

   (ii) Associated creation of fine-tailings plumes on the seabed and around the vessel.

   (iii) Issues relating to water quality include the following:

   - ❖ light reduction.
   - ❖ Increased suspended sediment and nutrient concentrations.
   - ❖ Reduction in dissolved oxygen levels, and.
   - ❖ Possible re-suspension of heavy metals and pesticides sequestrated in seabed muds.

   (iv) Acoustic effects of seismic surveys.

   (v) Disturbance of archaeological shipwreck sites.

   (vi) Seabed excavations using airlift-drill and, crawler recovery technologies resulting in destruction and loss of soft-bottom benthos in and adjacent to the recovery target areas, and.

   (vii) Loss of soft-bottom benthos in and adjacent to the target areas due to smothering by depositing sediments and/or discharged tailings.

2. Recovery and production vessels operational at sea for extended periods resulting in the following likely impacts components:

   1. Creation of exclusion zones around recovery and production vessels and interaction with other users of the marine environment.
   2. Wastes produced onboard recovery and production vessels (including gases, hazardous and non-hazardous substances).
   3. Noise of moored vessels and crawler positioning equipment.
   4. Loss of equipment on the seabed.
   5. Visual effects of the recovery and production vessels and tailings plumes.
   6. Emission of X-rays during the plant-feed treatment process.
   7. Use of water and electricity and hydrocarbon products, and.
   8. Use of other hazardous and non-hazardous substances.

3. Support and supply services for the exploration and recovery vessels at sea with respect to the following activities:

   (i) Possible fuel spillage during re-fuelling at sea.

   (ii) Disturbance of seabirds and seals by crew-change helicopter flights, and.

   (iii) Disposal of wastes removed from vessels at sea.

   (iv) Pollution resulting from possible accidents or emergencies at sea due to:

   - ❖ Fuel spill during refuelling, or resulting from collision or shipwreck, or helicopter ditching.

   (v) Possible effects of environmental research and monitoring with respect to:

   - ❖ Environmental grab sampling, and light disturbance from underwater videoing and submersible use.

4. Possible cumulative Impacts because of the following:

   (i) Similar ongoing or proposed activities by other operators holding minerals and petroleum rights around the licensed area. Some operators may be planning to acquire seismic survey or drilling or recovery and production on selected localised areas or their licences.

5. Socioeconomic impacts resulting in the following likely negative impacts:

   (i) Stress for workers due to prolonged time away from the family and friends - Separations may mean added stress because one member is away for extended periods.

   (ii) Stress for the remaining family and friends - Those family members, dependents and friends left at home may also find that their ability to participate in community affairs is reduced either because of lack of support resources (e.g., care for a family member, child) or social obligations that may discourage participation of the temporarily single spouse or partner. This may mean less participation in volunteer, sports, or other political, cultural, and social activities.

   (iii) Increased incidences of antisocial behaviour due to workers stress and frustrations at the workplace, and.

   (iv) Frustrations over job security, particularly approaching the closure date - 2035.

6.3.2 Evaluation of Likely Negative Impacts

Research and monitoring studies conducted over the past 15 years have contributed considerably to the understanding of the mechanisms and intensities of various exploration, recovery, and production impacts on the environment.

Based on these improvements in knowledge of impacts that were not well understood in the past, and a necessity to identify and consider potential cumulative effects that may occur at a regional/national/international scale, it was thus considered appropriate to re-evaluate the environmental impacts of concern identified during compilation of the original EIA and EMP, and again reflect upon the first revision and update to this document, which was conducted in 2008 by CSIR.

As part of the Environmental Impact Assessment process, all the environmental aspects and their associated impacts included as part of the Environmental Impact Assessment have been reviewed and updated in line with any operational changes to DBMN activities in licensed area, such as removal of reference to the Marine Dredging Project activities, which are no longer conducted.

For most of these, the operational methods to be used, and therefore the nature of the impacts, have not materially changed. However, the former method of presentation (in both original reports and first revision in 2008) in the form of a matrix analysis and an impact register has been updated and presented in a simple manner below.

While there has therefore been no need to change the descriptions of the existing issues of concern (or in many cases their rankings), a more user-friendly assessment from which impacts ranked as having medium or high significance can be easily identified and presented after these were reviewed and updated.

The revision is based on improved understanding of impact mechanisms, inclusion of any additional impacts associated with DBMN activities since the previous revision of the EIA and EMP in 2008 and the results of monitoring programmes implemented by DBMN and specialists.

In line with DBMN's objective of focusing attention specifically on exploration and recovery 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 prospecting, recovery and production operations in the licensed 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.

6.3.3 Environmental Impact Assessment Rankings

To ensure consistency in the evaluation of environmental impacts associated with DBMN's 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 disturbed during the operations, 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.

6.4 Results of the Environmental Impact Assessment

6.4.1 Exploration Activities

Tables 6.3 - 6.5 summarises 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)

6.4.2 Recovery and Production Activities

The impact assessment results associated with the recovery and production operations are summarised in Table 6.6-6.21 with respect to removal of sediments, destruction of macrofauna, habitat alteration, removal of mud belt sediments resulting in biochemical processes, release of H_2S, changes in seawater quality, changes in hydrographic.

Tailings disposal during recovery and production processes resulting in suspended sediment plumes, smothering, re-mobilisation of contaminants, bacterial decomposition and increased organic loading.

Recovery and production operation may have some impacts on the 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 recovery and production processes	*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 recovery and production target areas are severely disturbed or eliminated, and environmental functions and processes in the directly and adjacent affected areas may temporarily and/or permanently cease.
	Significance	Medium

Table 6.7: Destruction of macrofauna.

The loss of macrofauna in the disturbed 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 disturbed areas and move to adjacent undisturbed areas.
	Significance	Low

Table 6.8: Habitat alteration.

Alteration of sediment structure / seabed habitat due to the sediments disruption 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 recovery and production rates) to Moderate (at proposed future increased recovery and production rates)
	Significance	Low

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

Release of hydrogen sulphide when conducting recovery and production operations 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 recovery and production 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: Recovery and production 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: Recovery and production excavations: Hydrographical changes.

Recovery and production 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 because of shoreline changes are unlikely to severely change the communities associated with this habitat
	Significance	Low

Table 6.13: Tailings disposal during recovery and production: 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 recovery and production 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 recovery and production operations 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 the recovery and production operations, or to longer exposure periods (>2 days) than typical life times of suspended sediment plumes.
	Significance	Low

Table 6.14: Tailings disposal during recovery and production: 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 disturbed (operated) areas and onto adjacent pristine 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 recovery and production operations.

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 recovery and production areas	Status	Negative
	Probability	Highly probable (most likely)
	Confidence	High (based on a generic operational plan which assumes recovery and production activities near reef structures)
	Extent	Regional. Emergent reefs in the form of cemented platforms occur adjacent to the recovery and production targets in any given subregions P,O,N,X,W and V.
	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 operated 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 the recovery and production 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 POM and/or damaged organisms that inhabited the disrupted 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 recovery and production operations.

Re- recovery and production / re-excavation of sediments in previously disturbed 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 recovered 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 / recovery and production activities	*Status*	Negative
	Probability	Unknown, but improbable
	Confidence	Low, regarding 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	Improbable (low likelihood). There are currently no other activities in the licensed area
	Confidence	High
	Extent	Local - Regional
	Duration	Medium-term. Until recovery and production ceases
	Intensity	Negligible
	Significance	Low

6.4.3 Vessel Operations

Tables 6.22 - 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 if the recovery and production vessels are at sea.
	Intensity	Mild: Most of the noise generated by recovery and production 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 recovery and production operations, 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 licensed area)
	Duration	Medium-term: The potential disturbance is ongoing if the recovery and production 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 DBMN 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 recovery and production 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 / recovery and production 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 recovery and production equipment are 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 around the operational area.
	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

6.4.4 Waste Management and Materials Management

Tables 6.29 – 6.33 summarises 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 DBMN 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

6.4.5 Onshore Logistical Support

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

Table 6.34: Air support to exploration and recovery 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. Flight paths adjusted to avoid most sensitive areas around the mouth of the Orange River
	Confidence	Medium
	Extent	Local (within 5 km of project area)
	Duration	Very Short. for duration of flight only
	Intensity	Mild
	Significance	Low

6.4.6 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 record of accomplishment
	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 / recovery and production equipment which cannot be contained on the vessel	*Status*	Negative
	Probability	Improbable. Based on standards and procedures implemented and long record of accomplishment
	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 record of accomplishment.
	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 / recovery and production 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 record of accomplishment
	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 dies, or their breeding success is reduced
	Significance	High

Table 6.39: Radioactive sources.

Detrimental effects on the health of personnel because of damage to x-ray equipment resulting in the accidental release of ionising radiation	*Status*	Negative
	Probability	Improbable. Strict controls implemented in line with Government requirements
	Confidence	High
	Extent	Site specific. Limited to the vessel
	Duration	Medium-term
	Intensity	Moderate to Severe
	Significance	Medium

6.4.7 Positive and Negative Socioeconomic Impacts Assessment

Tables 6.40 - 6.48 summarises 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 DBMN 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. DBMN also uses South African contactors and vendors, the airborne services are provided by a Canadian Company
	Duration	Medium-term
	Intensity	Moderate
	Significance	High. DBMN 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 Oranjemund 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, recovery, production & 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 DBMN 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 DBMN 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

6.5 Impacts 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:

- 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
(i) Recovery and production 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 in each operational sub-region P,O,N,X,W and V.
(ii) 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.
(iii) Operational Closure	It is essential that DBMN embark upon the development of a Operational 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
(i) Sediment removal during seabed sampling (ii) Benthic community impacts of recovery and production (iii) Tailings disposal (smothering of benthic communities) (iv) 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 operational area that will not be directly or indirectly impacted by the recovery operations soon Such areas could also serve as unmined reference sites in long-term monitoring studies assessing recovery impacts.
(v) Habitat alteration	The alternative of no recovery operations, and the option of not disposing tailings overboard during the recovery operations.
(vi) Release of H_2S from muds	For safety reasons it is essential that on-board air quality is monitored during the recovery and production operations in the licensed 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.
(vii) Repeat seafloor diamond recovery	Optional measures include no re-recovery and production of areas.
(viii) 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 recovery 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.
(ix) Radioactive sources	Strict implementation of controls in line with Government requirements is essential.

6.6 Risk Assessment of Potential Impacts

6.6.1 Risk Assessment Criteria

Based on previous studies conducted in 2008, 2015, 2018 and, 2021 a risk assessment was conducted to identify medium- and high-risk aspects associated with DBMN exploration, recovery, and production operations in the licensed area. The overall objective was to identify key impacts that may result in environmentally unacceptable impacts. The review and updating process has been conducted in accordance with the Anglo-American Risk Matrix as shown in Annex 5.

6.6.2 Risk Assessment of Medium and High Significance Impacts

The environmental aspects and their associated impacts included as part of the Environmental Impact Assessment of all potential impacts associated with exploration, recovery, and production operations in the licensed area have been assessed as detailed in Tables 6.3 - 6.48 The potential impacts that were assessed to be of a medium or high significance are summarised in Tables 6.49 and 6.50.

In according with the Anglo-American Risk Matrix (Annex 5), a risk-assessment process for the negative impacts of medium and high significance was undertaken and the results are shown in Tables 6.51 and 6.52. What is noteworthy is the absence of any significant risk for rock lobsters associated with exploration, recovery, and production operations in the licensed area. Potential exploration, recovery, and production impacts on this commercially valuable resource has long been an issue of contention between the two industries, which is further explained.

The most important rock-lobster fishing grounds south of Lüderitz are located in 5-40 m depth in the area between Mittag and Affenrücken in ML 43 (Mining Area 1, which extends to 5 km offshore of the coastline). Although lobsters do migrate into deeper water during periods when near bottom oxygen concentrations are suitable, they are generally associated with reef areas and tend to avoid unconsolidated sediments.

The target area in the licensed area extends from ~30 m depth in the southeast corner to -140 m depth in the northwest corner and is located on the Orange River delta-front, which is exclusively dominated by sands and muds. Prospecting, recovery, and production operations in the licensed area are therefore located at a considerable distance to the south and offshore of the nearest known rock lobster reefs.

Overall, the ongoing exploration, recovery, and production operations by DBMN in the licensed area are therefore not seen as a risk to rock lobster resources in southern Namibia.

6.6.3 Socioeconomic Risk Assessment

The overall economic gain associated with the DBMN operations, made up of employment creation, improved social services, payment of Government taxes and increased forex exporting earnings has been rated “High”.

A significant number of Namibians benefit from employment opportunities, contractual and local procurement preferential support, the skills transferred, training, awareness raising in various subjects, and other direct and indirect benefits received by the wider society.

The employees are from different parts of the country and the positive gains from the operations of DBMN are widespread and for an extended period, benefiting extended families and various generations all over the country.

Table 6.51: Summary of risk assessment results for high significance impacts.

Significance	Impact	Industry experience			Current controls (Management measures and mitigation)	Client experience		
		Likelihood / Probability	Consequence (Hazard Effect)	Risk level		Likelihood / Probability	Consequence (Hazard Effect)	Risk level
High	Recovery and production in gullies and disposal of tailings onto adjacent reefs	5	4	23 (H)	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 the operational sub-regions P,O,N,X,W and V.	3	4	18 (S)
	Grounding / sinking of vessel or helicopter ditching (marine pollution from spills)	2	5	19 (S)	Strict enforcement of vessel and aircraft safety measures and stringent oil spill management systems are essential during all operations.	1	5	15 (S)
	Operational Closure	5	5	25 (S)	It is essential that DBMN embark upon the development of an Operational Closure Plan, which includes social and labour issues, to manage the risks associated with the closure of operations.	5	4	23 (H)

Table 6.52: Summary of risk assessment results for medium significance impacts.

Significance	Impact	Industry experience			Current controls (Management measures and mitigation)	Client experience		
		Likelihood / Probability	Consequence (Hazard Effect)	Risk level		Likelihood / Probability	Consequence (Hazard Effect)	Risk level
Medium	Sediment removal during seabed sampling	5	3	20 (S)	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 operational that will not be directly or indirectly impacted by recovery, and production operations in the foreseeable future. Such areas could also serve as unmined reference sites in long-term monitoring studies assessing the recovery and production impacts	5	3	20 (S)
	Benthic community impacts of recovery and production	5	3	20 (S)		5	3	20 (S)
	Tailings disposal (smothering of benthic communities)	5	3	20 (S)		5	3	20 (S)
	Benthic community and higher order impacts through tailings disposal	5	3	20 (S)		5	3	20 (S)
	Habitat alteration	5	4	23 (H)	The alternative of no recovery and production operations, and the option of not disposing tailings overboard.	4	3	17 (S)
	Release of H_2S from muds	3	5	22 (H)	For safety reasons it is essential that on-board air quality is monitored during the recovery and production operations in the licensed 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.	3	2	8 (M)
	Repeat recovery and production operations	3	3	13 (S)	Optional measures include no re- recovery and production of areas.	3	3	13 (S)
	Archaeological, palaeontological and historical aspects				It is essential that the relevant managers and specialists be informed on finding of historical material that artefacts are retained and recovery and production 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	3	5	22 (H)	Strict implementation of controls in line with Government requirements is essential.	1	4	10 (M)

6.6.5 Oil Spill Risk-Assessment

6.6.5.1 Overview

Based on the recommendation of the 2018 EIA and EMP review process, DBMN contracted Lwandle Technologies (Pty) Ltd to carry out an oil spill modelling study and risk assessment for certain vessel operations scenarios relating to the license area. PRDW has been appointed by Lwandle to undertake the oil spill modelling (PRDW, 2020a and 2020b). Detailed Oil Spill Modelling Specialist Study and Oil Spill Contingency Plan reports are available on request from DBMN Environmental Department.

6.6.5.2 Oil Spill Modelling Specialist Study

Oil spill trajectory and fate modelling has been undertaken for certain vessel operations scenarios relating to the licensed area (Tables 6.52 and 6.53 and Fig. 6.1). According to PRDW, (2020b), fifteen oil spill scenarios were modelled comprising three spill volumes and twelve spill locations within licensed area and en route to Cape Town, Lüderitz, and Walvis Bay Ports. Since all DBMN vessels uses Marine Gas Oil (MGO) from January 2020, only MGO was modelled, which is a less persistent oil than heavier oils such as IFO. The oil spill modelling was performed using the MIKE 21/3 Oil Spill Model by DHI and applying current vectors from the three-dimensional Hybrid Coordinate Ocean Model (HYCOM) and spatially varying wind fields from the Climate Forecast System Reanalysis (CFSR) hindcast dataset. Two hundred stochastic model simulations were performed for each of the fifteen spill scenarios to model the probability of oiling over a wide range of expected environmental conditions.

The inputs to the model included the currents and winds along with the type, location, and volume of oil spilled. The model outputs included snapshots of surface oiling for individual spill events over time, the probability of oiling of the sea surface and the shoreline, as well as the minimum time to oiling.

Table 6.52: Modelled oil spill scenarios (Source: PRDW, 2020b).

Oil spill no.	Description	Area	Location of spill [2]	Duration of spill	Total oil released
1	Operational spill during ship-to-ship transfer of fuel while on spread. Most likely worst-case operational scenario considered to be a loss of 5 m^3 of fuel.	Atlantic 1 MLA	a	Instantaneous	5 m^3 (4.46 t)
2			b		
3			c		
4	Spill resulting from a collision at sea resulting in sufficient structural damage to the hull to cause the vessel to sink in the operational area. Assuming loss of approximately 50% of fuel from the largest vessel, mv AMV3.[1]		a	3 hours	2 287 m^3 (2 038 t)
5			b		
6			c		
7	Spill resulting from a collision at sea resulting in sufficient structural damage to the hull to cause the vessel to sink en route to Cape Town for refurbishment. Assuming loss of approximately 50% of fuel from the largest vessel, mv AMV3.[1]	En route to Cape Town	d	3 hours	2 287 m^3 (2 038 t)
8			e		
9			f		
10	Spill resulting from a collision at sea involving the supply tanker resulting in sufficient structural damage to the hull to cause the vessel to sink en route to Lüderitz. Assuming loss of approximately 50% of supply fuel, based on largest bunkering trip between January 2018 and April 2019.[1]	En route to Lüderitz	g	3 hours	3 000 m^3 (2 673 t)
11			h		
12			i		
13	Spill resulting from a collision at sea involving the supply tanker resulting in sufficient structural damage to the hull to cause the vessel to sink en route to Walvis Bay. Assuming loss of approximately 50% of supply fuel, based on largest bunkering trip between January 2018 and April 2019.[1]	En route to Walvis Bay	j	3 hours	3 000 m^3 (2 673 t)
14			k		
15			l		

Notes:

1. A spill resulting from a collision at sea, resulting in sufficient structural damage to the hull to cause the vessel to sink, is considered a highly unlikely scenario but was assessed due to the potentially high severity of such an impact.
2. The locations are shown in Fig. 6.1 and described in Table 6.53.

Figure 6.1: Detailed modelling locations of the oil spill (Source: PRDW, 2020b).

Table 6.53: Coordinates of the oil spill moidelling locations (Source: PRDW, 2020b).

Location of spill	Latitude [°S]	Longitude [°E]	Detail
a	28.330	15.750	Observed historic operational locations in Atlantic 1 NW sector. Locations sampled from mv !Gariep, mv SS Nujoma and mv Coral Sea, 12 NM from shoreline.
b	28.565	15.875	Observed historic operational locations in Atlantic 1 central sector. Locations sampled mv Grand Banks, mv Debmar Pacific, mv Debmar Atlantic.
c	28.742	16.211	Observed historic operational locations in Atlantic 1 SE sector. Locations sampled from mv Mafuta, approximately 12 NM from shoreline.
d	33.510	17.945	En route to Cape Town: spill between Cape Town and St. Helena Bay, estimated from example track of the mv Coral Sea.
e	32.286	17.918	En route to Cape Town: spill north of St. Helena Bay, estimated from example track of the mv Coral Sea.
f	30.475	17.162	En route to Cape Town: spill between St. Helena Bay and Atlantic 1, estimated from example track of the mv Coral Sea.
g	26.650	15.049	En route to Lüderitz: offshore of Lüderitz Bay, estimated from a typical track of supply tanker from Lüderitz.
h	27.024	15.057	En route to Lüderitz: offshore of Elizabeth Bay, estimated from a typical track of supply tanker from Lüderitz.
i	27.584	15.315	En route to Lüderitz: offshore of Bogenfels, estimated from a typical track of supply tanker from Lüderitz.
j	22.845	14.431	En route to Walvis Bay: spill outside sheltering of Walvis Bay.
k	23.443	14.299	En route to Walvis Bay: opposite Sandwich Harbour (Marine Protected Area).
l	25.291	14.468	En route to Walvis Bay: opposite the Namibian Islands Marine Protected Area.

6.6.5.3 Summary Results of the Oil Spill Modelling

According to PRDW, (2020b), the model results show that most of the oil is likely to travel alongshore and disperse or evaporate before reaching the shoreline. The median duration that the oil remains on the sea surface is approximately 1 day. Under certain conditions, e.g., light winds, the oil remains on the surface for a maximum of 7 days. Once ashore, evaporation will continue resulting in minimal oil remaining on the beach at the end of the 7-day simulation. These results show that the maximum distance that the oil travels on the sea surface before dispersing, evaporating or reaching the shoreline ranges from 53 to 136 km depending on the spill size and location, whilst the median distance ranges from 2 to 20 km.

The probability of shoreline oiling is generally very low (P ≤ 2.5%, excluding Oil spill no. 10 and no. 13), which is attributed to the rapid evaporation and dispersion of MGO combined with a high prevalence of winds and currents which are aligned alongshore to offshore.

In licensed area, only the large spills result in quantifiable shoreline oiling, but with a very low probability of occurrence (P ≤ 1.0%). Most of the surface oil from the smaller spills will evaporates and disperses before reaching the shoreline and the remaining amount that comes ashore is too little to trigger the thickness threshold.

From the oil spill scenarios modelled by PRDW, (2020b), it is seen that a large spill en route to Walvis Bay is more likely to impact the shoreline (P ≤ 26.0%) compared to a large spill en route to Lüderitz (P ≤ 16.0%) or Cape Town (P ≤ 0.5%).

A large spill en route to Lüderitz (Oil spill no. 10) affected the greatest extent of the shoreline (72 km) and for this scenario the minimum time to shoreline oiling is the least of all scenarios (4 h in contrast to ≥17 h for all other scenarios). The proximity of the spill location to the shoreline is a major contributing factor to the probability and extent of shoreline oiling, especially in the case of Oil spill no. 10 (P = 16.0%) and no. 13 (P = 26.0%).

The probability, mass and affected extent of shoreline oiling are representative of the discrete oil locations and volumes modelled in this study. Similar oil spills occurring along the expected routes of the vessels or within licensed area are expected to mostly displace the extent of oiling north or south, given that the distance from the spill location to the shoreline remains in the same range. The quantitative impact of a change in spill location and/or volume, however, can only be assessed by additional modelling.

The presented results assume no spill response actions, e.g., the use of dispersants, skimming or burning, which provides a conservative result.

6.6.5.4 Oil Spill Contingency Plan

The licensed area handles exploration, recovery and production vessels and logistical support operations which are obliged to combat marine pollution in the area. A detailed review of the DBMN oil spill contingency plan is provided in PRDW, (2020a) and includes the following:

- Revised and updated the existing oil spill contingency plans that are in place (i.e., the SOPEP plans for the Debmarine Namibia vessel fleet).
- Review of statutory requirements - National Marine Pollution Plan for the Republic of Namibia and the Debmarine Company Oil Spill Contingency Plan(s).
- To determination of the equipment requirements for oil spill response based on the oil spill modelling results detailed in PRDW, (2020b). The equipment reviewed include: Containment booms, dispersants for offshore use, skimmers, support vessels, waste reception and containers (as appropriate), and.
- Recommendations based on the existing oil spill response plan, international best practice for the levels of response required for Tier 1, Tier 2 and Tier 3 and site visit observations.

DBMN has a pollution response contingency plan for the licensed area aligned with the National Marine Pollution Plan for the Republic of Namibia.

6.6.6 Cumulative Risks Assessment

Both DBMN and Namdeb have recognised the need to consider the “bigger picture”, or more strategic approach, and the importance of gaining an improved understanding of the cumulative impacts of individual projects.

One of the principal objectives of updating the current EMPs, is to implement improved integrated Environmental Management Systems for current and future recovery and production operations that reflect a better understanding of the cumulative impacts.

A joint social and labour plan combining efforts of DBMN and Namdeb shows commitment to jointly taking on cumulative socio-economic impacts. Collaborative efforts should also be more effective from a practical and financial point of view. DBMN and Namdeb could for instance plan environmental awareness raising campaigns, or strategically target certain social interventions from a Group level.

7. EMP AND MONITORING FRAMEWORKS

7.1 Overview

DBMN's environmental management plan outlines how the company intends to manage all its activities and associated aspects within the licensed recovery and production area that will significantly impact on the environment, or that may potentially be of high risk in the short and long-terms.

By implementing this management programme DBMN will minimise the negative effects and maximise the positive effects of its operations in the licensed area.

DBMN's commitments to responsible and sound environmental management of all their activities are reflected in their Environmental Policy, which has emanated from establishing the Company's ISO 14001 Environmental Management System (EMS), and in the Safety, Health, Environmental and Security Policy (Annex 1).

The ISO 14001 EMS was certified in August 2002 by the South African Bureau of Standards and ongoing surveillance audits ensure compliance to these requirements. Successful recertification audits have been completed since, and the most recent one is valid until September 2018.

A summary of DBMN's EMS is presented in this document in the form of the Company's Environmental Manual with all the applicable legislation, regulations and policies with respect to the EMP presented in the Legal Register Annex 4.

It is envisaged that the updated Environmental Management Plan can be successfully integrated with both DBMN's and Namdeb's ISO 14001 Environmental Management Systems (EMSs).

7.2 EMP Objectives

The following are Environmental Management Plan (EMP) objectives of DBMN:

- **EMP Process**: All action plans outlined in this EMP are achieved, including consultations with all stakeholders and compilation of a Performance Assessment for the licensed area.

- **Environmental and Safety Management Systems**: An ISO14001 certified Environmental Management System is maintained for all areas of the Company's activities, and all vessels have a NOSA grading.

- **Prospecting, recovery and production**: Research and monitoring is undertaken of the direct impacts of exploration, recovery, and production operations on the environment, such as disturbance of the seabed habitats and communities, and potential impacts on water quality.

- **Vessels at Sea**: Disruption to other legitimate users of the marine environment is minimised by respecting their rights, waste streams are managed effectively to minimise marine and air pollution are effectively managed by using a cradle-to-grave philosophy, promoting reuse/recycling, and being conservative in the use of natural resources.

- **Onshore Logistical Support**: Waste streams are managed in order to minimise pollution by using a cradle-to-grave philosophy, promoting reuse/recycling, and being conservative in the use of natural resources.

- **Emergencies**: Appropriate systems are in place to deal with emergencies to cater for at least legal requirements, and.

- **Socioeconomic Issues**: A contribution is made to the Namibian economy.

7.3 EMP for DBMN licensed area

In accordance with the results of the impact and risk assessment for the revaluated ongoing exploration and recovery 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 – 7.10:

(i) General company procedures (Table 7.1).

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

(iii) Exploration, recovery and production operations (Table 7.3).

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

(v) Emergency preparedness (Table 7.5).

(vi) Onshore logistical support (Table 7.6).

(vii) Waste management and pollution control (Table 7.7).

(viii) Biological diversity and resource use (Table 7.8).

(ix) Socio-economic issues (Table 7.9), and.

(x) Operational closure (Table 7.10).

Each of the EMP Table 7.1 – 7.10 framework covers aspect, impact description, risk / gain ranking, action plans and control measures, responsible person(s), timing, management objectives and applicable regulations.

All the relevant EMP applicable legislations, regulations and policies are detailed in the DBMN Legal Register in Annex 4.

Table 7.1: General company procedures.

#	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
1.1	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 Assessments ▪ ISO 14001 certified Environmental Management Systems are maintained for all certified areas of activities and all identified vessels and shore-based areas have NOSA grading ▪ Understanding about potential impacts of recovery and production operations and environmental management is increased ▪ An ethic of environmental responsibility is instilled in all staff and contract workers ▪ Adequate provision is planned and made for rehabilitation and restoration of impacts	Environmental Manager	Ongoing
1.2	Internal communication about the EMP	Improved Environmental Management and Awareness	High	▪ All personnel will be made aware of the contents of DBMN's and Namdeb's Environmental Policy Statements. ▪ 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 EMP.		Environmental Manager	Ongoing
1.3	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 area all contractors must undergo an environmental and safety induction. ▪ 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. ▪ Report all environmental incidents as specified in the Company Procedures.		Environmental Manager	Ongoing
1.4	EMP Monitoring and Performance Assessments	Improved Environmental Management and Awareness	High	▪ Undertake to conduct EMP monitoring on a continuous basis using the mechanism of DBMN's ISO14001 Environmental Management System. ▪ Undertake formal EMP performance assessments every 12 months to check progress in meeting the objectives and targets of this EMP,		Environmental Manager	First due 12 months after EMP approval date

#	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
				▪ Compile and submit EMP Performance Assessment Reports to the Ministries of Environment & Tourism and Mines and Energy 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 ▪ Evaluation criteria used ▪ Results of the assessment ▪ Recommendations on how and when non-compliances or deficiencies will be rectified. ▪ Submit revised and amended Environmental Management Programme Reports to the Permanent Secretaries: Ministry of Mines and Energy and Environment and Tourism as and when required. ▪ Request above Ministries to respond to the submitted reports within 4 months. beyond which time it will be assumed to have been accepted as is.			
1.5	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 Ministry of Mines and Energy and Ministry of Environment, Forestry and Tourism (Directorate: Environmental Affairs) for approval. ▪ Request Ministry of Mines and Energy to respond to the submitted report within 4 months.		Environmental Manager	Ongoing
1.6	Communications with stakeholders	Improved stakeholder relationships	High	▪ Maintain an up-to-date I&AP database. ▪ Maintain open communication with the relevant stakeholders listed in DBMN database informing them of proposed changes to the EMP, addressing any issues of concerns that may arise, maintain		Environmental Manager	Ongoing

#	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
				▪ 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.			
1.7	Pecuniary provision/ Allocation of environmental Management Funding	Improved Environmental Management	High	▪ Allocate operational costs to maintain an ISO14001 system and to meet EMP objectives, including all associated requirements, e.g. 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$ 700 million to allow for clean-ups in the event of oil spills, and unlimited (P&I) Insurance Cover for other eventualities.		Business Planning Manager	Ongoing

Table 7.2: Environmental and safety management systems.

#	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
2.1	Maintain Environmental Management System (EMS)	Improved Environmental Management	High	▪ Ensure that all requirements of the Company's ISO14001 Environmental Management System are met, including compliance with legislation, environmental awareness training, environmental monitoring, waste management and pollution control. ▪ Those items not covered elsewhere in this EIA and EMP because of the practices in place within De Beers Marine Namibia: ▪ 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). ▪ 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.	▪ An ISO14001 certified Environmental Management System for all areas of the company's activities is maintained ▪ Air pollution is prevented and/or minimised ▪ There is compliance with the standards in the Labour Act and minerals recovery and production regulations	Environmental Manager	Ongoing

#	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
				▪ 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 Cape Town 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 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 external Surveillance and re-certification Audits are conducted by an accredited ISO14001 certifying body. ▪ Submit copies of External Audit Reports with Environmental Performance Reports	▪ There is compliance with occupational standards regarding exposure to dust and noise ▪ International recommendations regarding the use of CFCs are complied with ▪ A NOSA 5-star rating in identified areas is maintained		
2.2	Integration of Environmental Management	Improved Environmental Management	High	▪ Include environmental management in DBMN's Strategic Long-term Business Plan, by integrating environmental management through the operational life cycle, starting with the exploration phase through to recovery and production stages. Key environmental concerns that have been identified include: ▪ How to cost-effectively quantify natural variability in the ecosystem by integrating data-collection requirements with other research and monitoring initiatives (to be addressed through the DBMN long term benthic monitoring programme). ▪ Potential improvement of the current approach to sediment plume modelling and monitoring. ▪ Modelling of potential oil spill scenarios and development of appropriate contingency plans. ▪ An improved approach to benthic macrofaunal surveys,		Environmental Manager	Ongoing

#	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
				and development of appropriate research and monitoring programmes, which make additional use of geological and survey information and suitable technologies (e.g., *Jago*/AUV/ROV). ■ Integration of future operational plans with existing Marine Protected Areas as well as proposed MPA's in the future.			
2.3	Establishment and review of Environmental Risks and Improved Environmental Performance	Improved Environmental Management	High	■ Develop a set of environmental risks (using standard risk assessment methodology), to be reviewed and, where necessary, updated in line with Environmental Aspects Procedure. ■ Adopt more results-driven research and monitoring approach, focusing attention specifically on recovery and production - and exploration-related impacts of potentially medium and high risk, and how best to mitigate for these. ■ 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
2.4	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. ■ Undertake NOSA grading for all shore-based areas of De Beers Marine Namibia.		Chief Safety Officer	Ongoing
2.5	International Safety Management (ISM) Code for the Safe Operation of Ships and for Pollution Prevention	Improved Health and Safety	High	■ Ensure compliance with the International Maritime Organisation's International Safety Management (ISM) Code developed for the proper development, implementation and assessment of safety and pollution prevention management in accordance with good practice. ■ Ensure that the required external assessments of compliance to the ISM Code are conducted. ■ Submit certificates of compliance with Environmental Performance Reports.		Operations Manager	Ongoing

Table 7.3: Exploration, recovery and production operations.

#	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
3.1	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 recovery and production vessels, particularly when the sonar is in operation, and/or whilst operating. ▪ 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 (particularly beaked whales) may be necessary.	▪ Direct effects on the marine environment such as compromised water quality and/or damage to, or loss of, benthic habitat, are minimised ▪ Research and monitoring of the direct impacts of prospecting/ recovery, and production operations on the environment is undertaken ▪ Recovery and production - related impacts on the marine environment are managed, to avoid compromising future exploitation of renewable marine resources ▪ The information base that will provide improved insight into the cumulative impacts of recovery, and production	Environmental Manager and onboard Environmental Monitors	Ongoing
3.2	Removal of sediment	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 other research and monitoring initiatives such as geological mapping.		Environment Manager / Environmental Scientist	Ongoing
				▪ 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 recovery (ongoing)
				▪ Develop an appropriate medium- to long-term benthic macrofaunal monitoring programme using the techniques mentioned above to assess: ▪ natural variability in undisturbed areas. ▪ impacts of recovery, and production operations on benthic macrofaunal communities. ▪ recovery rates of impacted communities.		Environmental Manager / Environmental Scientist	Ongoing
				▪ Determine areas that could be considered as “conservation corridors” in consultation with the Namibian government.		Exploration Manager / Environmental Manager	Ongoing
				▪ Calculate annual and cumulative area sampled, recovered and produced and compare to limit of 1% per year of the total concession area suggested by Currie *et al*. (2007).		Environmental Manager	Annually
3.3	Recovery, and production excavations	Destruction of geological record, and reorganisation of	Medium	▪ If requested, provide non-sensitive information on the geological record and sediment structure, derived from sampling, to specialist scientists. ▪ Publish non-sensitive information to make it available to scientists and the public.		Exploration Manager	Ongoing

#	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
		sediment structures		▪ Conduct high resolution geophysical surveys (SSS, bathymetry and seismic profiling) prior to recovery, and production operations, and of the target areas ~2-3 years post-operations to determine the depth, wall steepness and infilling rates of the disturbed areas.	operations on marine biota is monitored ▪ Recovery rates of marine habitats impacted or destroyed during prospecting/ recovery, and production operations are established, recolonisation of areas within a reasonable period of time is allowed ▪ Key habitats of high ecological sensitivity and importance (e.g. nearshore reef areas and kelp beds) are protected ▪ Conflict between the fishing industry and diamond recovery, and production operations are minimised by maintaining open and frequent communications ▪ Archaeological and historic sites are protected, thereby		
3.4	Recovery, and production operations in the mudbelt	Hydrogen sulphide eruptions	Medium	▪ Monitor on-board air quality during recovery, and production operations in the licensed area. ▪ Consider training of Health and Safety personnel in handling of personal safety issues in the event of H_2S eruptions during recovery, and production operations. ▪ Consider conducting a coring survey to determine the presence of H_2S pockets before recovery, and production operations is conducted in thick mud overburden areas.		Onboard Environmental Monitors Exploration Manager	Ongoing When targeting of mudbelt planned
				▪ Undertake to obtain information about the sediment type, concentrations of organic matter (carbon), trace metals and H_2S to determine if there is any risk of exceeding the water quality guidelines in the tailings plume. This can be achieved in either one of the following ways: • From mega-drill sediment cores taken during prospecting and resource determination, • During the recovery, and production operations take sufficient samples of the fine tailings discharge in the operational area, and/or • During a benthic sampling survey analyse the sediment for each sample (taken over a grid, designed to cover a range of benthic habitat types).		Environmental Scientist	Prior to recovery, and production operations
3.5	Disposal of all tailings overboard during recovery, and production operations	Suspended sediment plumes	Low	▪ Obtain specialist opinion on the potential risks to the environment posed by the sediment types in terms of the potential effects of reduced oxygen, H_2S emissions and/or remobilised trace metals and suspended solids. ▪ If the risks are assessed as low, then confirm with a tailings analysis and/or plume modelling study during the start-up phase of the new project only, to ensure that the discharged seawater conforms with the relevant Water Quality Guidelines. ▪ If the risk is assessed as being high or severe, and the plume modelling results of suspended sediment concentrations and deposition suggest that set water quality criteria may be exceeded, then monitor water quality in the plume during recovery, and production operations and compare with background values collected outside the sacrificial mixing zone.		Environmental Scientist	Prior to recovery, and production operations During recovery, and production operations
				▪ 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 recovery, and

#	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
					preventing the loss of information and research material ▪ Information exchange with all relevant stakeholders is promoted		production operations
				▪ 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 MME and MAWF.		Environmental Scientist	Ongoing
				During recovery, and production 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.		Onboard Environmental Monitors Environmental Manager	During recovery, and production operations
3.6	Disposal of operational tailings overboard	Smothering of benthic invertebrates	High	▪ Use video footage from the *Jago* submersible (if available and feasible), side-scan sonar and AUV images to assess effects of the tailings plume on seabed life in unconsolidated sediments and on rocky outcrops. ▪ 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 the disturbed and pristine areas.		Environmental Manager Environmental Scientist	Ongoing Ongoing
3.7	Archaeological Sites	Destruction of wrecks	Medium	While no wrecks have been identified from surveys in ML 47, the following actions will be undertaken if shipwreck material is encountered in the course of sampling/ recovery and production: ▪ Immediately inform the Marine Marine/Designated Person Ashore 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 prospecting or recovery and production 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		Vessel Master / Marine Manager/Designated Person Ashore / Environment Manager	If shipwreck material is found
3.8	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).

#	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
4.1	Presence of vessels	Potential exclusion of alternative resource use (e.g. fishing, oil exploration/exploitation, shipping)	High	At least 14 days in advance of commencement of recovery and production 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 industry) 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 recovery and production is minimised by maintaining open and frequent communications ▪ Pollution of marine and fresh water habitats and resources is prevented ▪ Manage waste streams to reduce wastage and promote reuse/recycling of resources are in an effective manner ▪ Natural resources are used conservatively	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
4.2	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 recovery and production vessels, particularly during recovery and production operations. ▪ Consider providing specialised marine mammals observer training for the relevant monitors.		Environmental Manager and onboard Environmental Monitors	Ongoing
				▪ 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.		Environmental Manager and onboard Environmental Monitors	Ongoing
4.3	Refuelling at sea	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		Marine Manager	Prior to refuelling at sea

#	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
				is approved by the Namibian Directorate of Maritime Affairs. ▪ In terms of the Emergency Plan De Beers Marine Namibia's Marine Superintendent will inform the following Namibian authorities (as deemed applicable): Marine Division of the Ministry of Works, Transport & Communication. MFMR. MME, MEFT and the Lüderitz and Walvis Bay Harbour Masters. and, if applicable, the South African Departments of Transport, and Environmental Affairs and Tourism, and Kudu Gas (once the power station and pipeline has been built)			
4.4	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
4.5	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. ▪ Replace the use of concrete blocks with suitable alternatives as these become available.		Marine Manager	Ongoing
4.6	Incidental loss of equipment	Seabed hazards	Low	▪ Maintain hazards database listing the type of gear left on the seabed and/or in the operational area with the dates of loss and locations and where applicable, the dates of retrieval. ▪ If requested, report these data to the relevant authorities.		Vessel Masters / Surveyor	Ongoing
4.7	Waste Management onboard contracted vessels	Marine Pollution	Low	▪ Ensure that waste management practices in place within DBMN, are enforced on all contracted vessels (where applicable).		Vessel Manager	Ongoing

Table 7.5: Emergency preparedness.

#	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
5.1	Grounding / sinking of vessel, vessel collision or helicopter ditching	Marine pollution	Low	▪ Seek to reduce the probabilities of accidental and/or operational spills through enforcement of stringent oil spill management systems. ▪ Prepare monthly fuel/oil consumption reports are, which provide information on remaining oils onboard each vessel. ▪ Maintain all emergency procedures as required legally and by ISO14001 and NOSA. ▪ In the event of an emergency including fire, grounding or sinking, helicopter ditching, oil spill or collision follow procedures in DBMN's Shipboard Emergency Response Manual, Shipboard Oil Pollution Emergency Plan (SOPEPs Manual), Shore-based Emergency Response Manual, Shipboard Hazardous Spill Manual, Helicopter Operation Manual and the Fire Attack Plans and Muster Bills. ▪ In terms of the DBMN's Emergency Plan, DBMN's Marine Manager will inform the following Namibian authorities (as deemed applicable): Marine Division of the Ministry of Works, Transport and Communication. MFMR. MEFT and the Lüderitz and Walvis Bay Harbour Masters. and, if applicable, the South African DOT, and DEAT. ▪ In the event of an oil spill, where feasible, provide facilities to rescue, stabilise, and fly oiled seabirds to SANCCOB or MFMR Lüderitz for further rehabilitation.	Appropriate systems are in place to deal with emergencies that cater for, at least, legal requirements.	Marine Manager and Vessel Manager	Ongoing and in the event of an emergency
5.2	Oil-spill Contingency Plans	Marine pollution	Low	▪ Follow the appropriate notification requirements as provided for in the Oil Spill Contingency Plan ▪ Reconfirm the oil spill modelling results by PRDW, 2020a and 2020b. ▪ Use spill trajectories and shoreline oiling results in PRDW, 2020a and 2020b to prioritise response in the event of a spill. ▪ Mobilise resources and prioritise response accordingly.		Environmental Manager	Ongoing

Table 7.6: Onshore logistical support.

#	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
6.1	Control and use of aircraft	Disturbance of estuarine birds	Low	▪ Ensure that helicopter flight paths avoid the Orange River mouth, unless in an emergency situation.	▪ Disturbance of fauna and flora is minimised ▪ 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	Helicopter pilots	Ongoing
				▪ Maintain a log taken of random flights over the Orange River mouth to ensure this practice is adhered to.		Environmental Management Coordinator	Ongoing
6.2	Instructions to all staff, including contractors	Improved environmental management and awareness	Low	▪ All contractors working in the area are to sign an Environmental Code of Conduct.		Environmental Manager	Ongoing
6.3	Vehicle and equipment maintenance (light vehicle use for transporting DBMN staff and contractors between airport and accommodation during periods of crew changes)	Hydrocarbon pollution	Low	▪ Restrict vehicle maintenance to the existing maintenance yard area, except in emergencies. ▪ Vehicles used for the activity should have a spill kit (peatsorb/drip trays) onboard in the event of a spill.		Logistic Manager	At all times

Table 7.7: Waste management and pollution control.

#	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
7.1	Waste generation – general (Oranjemund logistics base, (excluding aircraft chartered services))	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 (align with Namdeb policies). ▪ Conduct environmental awareness programmes for waste management. ▪ Ensure jackal proofing for interim (soft refuse) waste collecting points ▪ 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 7.8: Biological diversity and resource use.

#	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING

8.1	Illegal hunting, fishing and plant collection	Destruction and loss of flora and fauna (note that recovery and production is only limited to the marine environment and does not take place outside of this)	Low	▪ DBMN's 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.
				  ▪ Break, damage, destroy, disturb or remove any birds egg or nest.
				  ▪ 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
					▪ Energy and fresh water are conserved
					▪ Wastage is reduced and fuel use is minimised
						Environmental Manager	At all times
							
							Ongoing

8.2	Access roads (in and around Oranjemund logistics base)	Destruction of terrestrial habitat	Low	▪ Erect clear wildlife warning signs in areas of high animal activity. ▪ Implement speed limit of 60 km/hr in areas of high animal activity. ▪ Impose rigorous penalties for animal road kills caused by speeding. ▪ Publicise mortality events to enhance awareness of destruction. ▪ Report potential road kills of Brown hyena to Namib Desert Brown Hyena Project (I. Wiesel: 063-202114).		Environmental Manager	At all times
8.3	Freshwater Consumption at Oranjemund logistics base	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.		Environmental Manager	Ongoing Monthly Ongoing
8.4	Fuel consumption of light vehicles used to transport DBMN 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 7.9: Socioeconomic issues.

#	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING

9.1	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 recovery and production licensed area and/or in adjoining areas (MEFT, MFMR).
				  ▪ Representatives of any other interest group (e.g. fishing 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 for Namdeb and DBMN 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. ▪ Ensure regular feedback from marine and rehabilitation monitoring programmes at the Namdeb Environmental Steering Committee.		Environmental Manager(s)	Ongoing
				▪ Publicise and make available information on DBMN's and Namdeb's environmental monitoring programmes and environmental performance.		Environmental Manager(s)	Ongoing
				▪ Where feasible, comply with the local development objectives, spatial development framework and integrated development planning of the area, and promote co-operative governance and integrated decision-making.		Environmental Manager (s)	Ongoing
9.2	Employment	Boosts Namibian economy and development of skills	High	▪ Continue to increase number of Namibians employed by De Beers Marine Namibia, and to provide them with training to develop skills. ▪ Maintain Windhoek office and sort-house. ▪ Outsource services where possible. ▪ Include local Small and Micro enterprise service providers in the tendering process for supplies and services, giving preference to companies with a labour-intensive focus and Black Economic Empowerment (BEE) companies. ▪ Where possible, develop and support Small and Micro Enterprises, in order to provide employment opportunities.		Human Resources Manager	Ongoing

#	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
9.3		Contribution to Lüderitz and Oranjemund communities and Karas region	Medium to High	▪ Minimise net loss of employment opportunities either within DBMN/Namdeb or via potential contracts. ▪ Give hiring priority to suitably qualified or experienced local Namibian citizens, as positions become available.		Human Resources Manager	Ongoing
				▪ Within the resources available to DBMN, support appropriate initiatives to improve community welfare, particularly in Lüderitz and also Oranjemund. ▪ Ensure that Namdeb's wellness programme covers all Namdeb workers in the area (includes DBMN). ▪ Consider expanding some wellness programme interventions to sub-contractors.		Financial Manager Human Resources Manager	Ongoing
9.4	Taxes / royalties	Contribution to national economy	High	▪ Pay all applicable taxes and royalties to the government as required. ▪ Pursue targets and standards set out in the DBMN and Namdeb's Strategic Business Plan. ▪ Maintain or increase current level of production. ▪ Internally track the efficiency to ensure maintenance of profits.		Financial Manager	Ongoing
9.5	Use of harbours	Financial contribution to harbours	Medium	▪ Pay all applicable fees at harbours. ▪ Use Lüderitz/Walvis Bay harbour infrastructure and services where possible.		Supply Chain Manager	Ongoing

9.6	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 all staff required to implement specialised aspects of all the licensed area activities.
				  ▪ Conducting 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

9.7	Research and development	Technological advancements in prospecting, recovery and production systems	High	▪ Continue to develop prospecting, recovery and production, and metallurgical technologies for marine diamond operations.		Operations Manager	Ongoing

#	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
9.8	Sponsorships of research, education and community projects	Improved environmental knowledge/awareness of the region	High	▪ Where possible supply research/exploration data to the marine science and fisheries communities, and the database maintained by AfrOBIS – such as records of marine mammal and bird sightings, weather patterns and *Jago* video footage. ▪ 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. ▪ Continue with regular activities initiated by Namdeb Environmental Department (normally involving school children) in different areas, including those areas outside DBMN's responsibility (e.g. Agate Beach clean-up campaign). ▪ Provide social contributions within the Karas Region.		Environmental Scientist Environmental Manager	Ongoing

Table 7.10: Operational closure.

#	ASPECT	IMPACT DESCRIPTION	RISK / GAIN RANKING	ACTION PLANS AND CONTROL MEASURES	MANAGEMENT OBJECTIVES	RESPONSIBLE PERSON(S)	TIMING
10.1	Closure of DBMN Operations	Termination of all contributions to the economy including taxes, employment, support to secondary industries	High	▪ As an interdisciplinary initiative between all involved DBMN internal and external stakeholders, undertake to develop a Rehabilitation and 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 operational closure, ✓ provisioning for the development of a social and labour plan for closure, ✓ identification of end land use, ✓ rehabilitation actions required to obtain end land use, ✓ human resources and community plan of action, ✓ communication Strategy, and ✓ actions required for sustainability.	All Closure Objectives outlined in the Rehabilitation and Closure Plan, and in the Social and Labour Plan, are met	Environmental Manager	**Ongoing**
10.2	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 operations to ensure that environmental risks are quantified and managed proactively. ▪ Make provision as part of ongoing environmental management for post- recovery and production surveys of selected areas to demonstrate recovery (3–5-year intervals). ▪ Ensure that Safety and Health requirements are complied with.		Environmental Manager	Ongoing
10.3	Closure Certificate	Improved management of closure and rehabilitation	High	▪ When Namdeb/DBMN intend closing operations in ML47, 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

#	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 the Permanent Secretaries of Ministry of Mines and Energy and Environment and Tourism: ✓ The Closure Plan ✓ An Environmental Risk Report ✓ The Final Performance Assessment Report ▪ An application form to transfer environmental responsibilities and liabilities, if such transfer has been applied for.			
10.4	Financial Provisioning	Improved management of closure and rehabilitation	High	Ensure that requirements in terms of financial provision for remediation of environmental damage are met by: ▪ Allocate operational costs to maintain an ISO14001 system and to meet 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 cleanups in the event of oil spills and other eventualities. ▪ Allocate operational costs to monitor and demonstrate natural recovery of the seabed through pre- and post- recovery and production 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

7.4 Environmental Performance Monitoring

7.4.1 Environmental Monitoring Plan

As per the provisions of the EMP, the environmental performance monitoring activities are recommended to be undertaken before, during and after exploration, recovery, and production operations because this approach makes it possible to identify unpredicted effects and take the necessary precautions to eliminate the likely negative impacts before the effects become significant.

The following is summary of the environmental performance monitoring covered in this report for the period under review:

- **Monitoring Plan:** Environmental monitoring is partly in-house (data collection during exploration and recovery processes) and outsource (employ a consultant) to undertake the assessment and recommend measures to be implemented. Key aspects that are monitored include: Water quality, marine fauna and bathetic compositions and variability. The monitoring programme is supported by an external laboratory and technical facilities on water quality monitoring and benthic communities with respect to the ongoing exploration and recovery processes.

- **Implementation of the EMP**: The implementation of the EMP monitoring plan by DBMN is focused on collecting and analysing 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 EMP implementation is undertaken as an in-house activity.

- **EMP Auditing**: Compliance auditing of the EMP implementation and monitoring thereof is a key component of the environmental performance monitoring. The EMP auditing is an internal activity that is often supported by an external consultant and linked to the EMS monitoring and auditing requirements, and.

- **EMS Auditing**: Personnel within DBMN are responsible for the management of these impacts through regular environmental audits to evaluate compliance and effectiveness of the company's EMS to the ISO 14001 standard, as well as compliance with statutory requirements. This includes both internal audits and external surveillance audits.

7.4.2 Objectives of the Monitoring Plan

The main objectives of the monitoring plan are the following:

- Verify of the correct application of the monitoring measures as presented in the Environmental Management Plan (EMP).

- Establish a monitoring program for the most relevant environmental parameters, identifying the monitoring activities and frequencies.

- Identify the impacts foreseen by the project and any unforeseen deviations, allowing for the implementation of corrective measures as needed.

- Provide assurance to stakeholders requirements with respect to environmental and social performance.

- Check the overall effectiveness of the operational procedures in protecting the receiving environment.

- Comply with regulations, standards and ML and ECC licences conditions, and.

- Compare actual impacts with those predicted in the EIA and EMP Report and thereby aim to improve the assessment and monitoring processes.

7.4.3 Benthic Environmental Monitoring Programme

7.4.3.1 Overview of the 2021-2024 ECC Validity Period Benthic Sampling Campaigns

According to Biccard et al. (2024), historical sampling campaigns have also included surveys of hard substratum communities using a towed benthic camera system (SkiMonkey) but this was not undertaken in 2021 and 2022 due to equipment failure (Table 7.11). No sampling campaign was undertaken during 2020 due to the global COVID-19 pandemic.

Table 7.11: Historic summary of the components of the DBMN Benthic Environmental Monitoring Programme (Source: Biccard et al., 2024).

Study	2005	2006	2007	2008	2011	2013	2014	2015	2016	2017	2018	2019	2021	2022
Mudbelt Natural Variability Study	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
Impact Monitoring Study V								✓	✓	✓	✓	✓	✓	✓
Impact Monitoring Study IV					✓	✓	✓							
Impact Monitoring Study III				✓										
Impact Monitoring Study II			✓											
Ski Monkey - Monitoring impact on										✓	✓	✓		
eDNA metabarcoding													✓	✓
Water Quality Monitoring								✓					✓	✓
Species new to science											✓	✓	✓	✓
Orange Cone EBSA										✓	✓	✓		

Benthic sampling and assessment studies were conducted for the period under review 2021-2024 ECC validity period described in Biccard et, al., (2024). Anchor Environmental Consultants (Pty) Ltd were appointed to collect and report on macrofauna and sediment samples from the ML No. 47 area offshore of southern Namibia as part of the Debmarine Namibia (DBMN) Benthic Environmental Monitoring Programme. Sediment and macrofaunal samples were collected from the vessel "DP Star" at 91 sites in the ML No. 47 in 2022 (Table 7.12 and Fig. 7.1).

The study is a continuation of the work by Steffani (2012), Biccard & Clark (2016) and Biccard et al. (2016, 2017, 2018, 2019, 2020, 2021, 2023) and is divided into five discrete components as follows:

(i) Mudbelt Natural Variability Study (MNVS).

(ii) Impact Monitoring Study V (IMS V).

(iii) eDNA Metabarcoding.

(iv) Water Quality Monitoring, and.

(v) Species New to Science.

The above listed monitoring components are described in detail in Biccard et, al., (2024) and the executive summary extracts are provided in this report. The location of the 91 sites sampled during the 2022 DBMN benthic sampling campaign are shown in Fig. 7.12. Sites sampled include those from the Mudbelt Natural Variability Study (MNVS) and Impact Monitoring Study V (IMS V) (Table 7.12). Sampling equipment used for collecting and processing samples during each DP Star grab sampling campaign are shown in Plate 7.1 with the example of benthic invertebrate macrofauna found in grab samples from the ML No. 47 are shown in Plate 7.2.

Table 7.12: Benthic Grab Sampling programme. Red = sampled post-mining, orange and grey = excluded from analysis. Coding for site names is explained in the text (page 4). Historic site names are shown in parentheses (Source: Biccard, *et, al.,* 2024).

Study	Site Name	Latitude (S)	Longitude (E)	Depth	2005	2006	2007	2008	2010	2011	2013	2014	2015	2016	2017	2018	2019	2021	2022
MNVS	SS/22 (C_MDPJ)	28.747895	16.251481	107.1	✓			✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	NA_A (Atlantic North 1)	28.550352	15.998659	107.8	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	NA_AB (Atlantic North 2)	28.459008	15.962512	109.0	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	SA_C (A1 South C)	28.652689	16.196438	100.8	✓	✓	✓	✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	MB/1	28.574531	16.117971	89.2													✓	✓	✓
	MB/2	28.607402	16.160947	91.2													✓	✓	✓
	MB/3	28.660211	16.231303	87.4													✓	✓	✓
	MB/4	28.792432	16.257545	115.2													✓	✓	✓
Impact Monitoring Study V	NS/1	28.40126	15.881061	116.3										✓	✓	✓	✓	✓	
	NS/2	28.402644	15.901397	112.0										✓	✓	✓		✓	
	NS/3	28.405327	15.901072	114.0										✓	✓	✓	✓	✓	✓
	NS/4 (C5)	28.489135	15.946051	116.0			✓						✓	✓	✓	✓	✓	✓	✓
	NS/5	28.417563	15.875325	120.2										✓	✓	✓	✓	✓	✓
	NS/6/M	28.483727	15.881908	129.3										✓	✓	✓	✓	✓	✓
	NS/7	28.414437	15.884172	119.0										✓	✓	✓	✓	✓	✓
	NS/8	28.46282	15.887802	123.8										✓	✓	✓	✓	✓	✓
	NS/9/M (C7)	28.409636	15.836752	124.7			✓	✓					✓	✓	✓	✓	✓	✓	✓
	NS/10/M (C1)	28.412663	15.836225	124.6				✓					✓	✓	✓	✓	✓	✓	✓
	NS/11/M	28.415564	15.817840	127.5										✓	✓	✓	✓	✓	✓
	NS/12 (C0113)	28.403924	15.817250	125.9							✓	✓	✓	✓	✓	✓	✓	✓	✓
	NS/14/M (I0113)	28.40463	15.801719	127.0							✓	✓	✓	✓	✓	✓	✓	✓	✓
	NS/15/M (I409)	28.330415	15.757642	120.5						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	NS/16 (C409)	28.346014	15.778240	121.7						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	NS/17/M	28.407181	15.867114	120.4											✓	✓	✓	✓	✓
	NS/18/M	28.41498	15.888107	117.5											✓	✓	✓	✓	✓
	NS/19/M	28.418192	15.847234	122.7											✓	✓	✓	✓	✓
	NS/20	28.422147	15.809835	128.6											✓	✓	✓	✓	✓
	NS/23/M	28.495815	15.910259	126.2											✓	✓	✓	✓	✓
	NS/24/M	28.474352	15.865895	129.0											✓	✓	✓	✓	✓
	NS/26	28.333941	15.767879	117.9											✓	✓	✓	✓	✓
	NS/27/M	28.477165	15.925289	119.4											✓	✓	✓	✓	✓
	NS/28	28.506778	15.891848	130.1											✓	✓	✓	✓	✓
	NS/29	28.455157	15.858283	127.9												✓	✓	✓	✓
	NS/30	28.453572	15.914564	119.6												✓	✓	✓	
	NS/31	28.401062	15.808307	125.5													✓	✓	✓
	NS/32	28.370493	15.860876	114.5													✓	✓	✓
	NS/34	28.34673	15.799590	119.3													✓	✓	✓
	NS/35	28.342308	15.852977	112.4													✓	✓	✓
	NS/36/M	28.370991	15.835980	120.4													✓	✓	✓
	NS/37	28.287200	15.754173	114.0														✓	✓
	NS/38	28.290632	15.764055	114.0														✓	✓
	NS/39	28.295420	15.733828	115.0														✓	✓
	NS/40	28.266703	15.752390	110.0														✓	✓
	CS/1/M	28.601303	16.039394	108.8									✓	✓	✓	✓	✓	✓	✓
	CS/2	28.619974	16.026761	111.0									✓	✓	✓	✓	✓	✓	✓
	CS/3	28.614581	16.012972	118.0									✓	✓	✓	✓	✓	✓	✓
	CS/4	28.628042	16.056291	109.4									✓	✓	✓	✓	✓	✓	✓
	CS/6 (C8A08)	28.664112	16.075266	118.4				✓		✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	CS/7/M (I0313)	28.655488	16.059769	117.7							✓	✓	✓	✓	✓	✓	✓	✓	✓
	CS/8	28.651676	16.038049	114.9									✓	✓	✓	✓	✓	✓	✓
	CD/11	28.693321	15.991026	126.0									✓	✓	✓	✓		✓	✓

Table 7.12: *Cont.*

Study	SiteName	Latitude (S)	Longitude (E)	Depth	2005	2006	2007	2008	2010	2011	2013	2014	2015	2016	2017	2018	2019	2021	2022
Impact Monitoring Study V	CD/12	28.716585	15.965393	135.0									✓	✓	✓	✓			
	CD/13	28.663433	15.996444	124.0									✓	✓	✓	✓		✓	✓
	CD/16/M	28.654688	15.926454	132.7										✓	✓	✓	✓	✓	✓
	CD/17	28.669749	15.913559	135.0										✓	✓	✓		✓	
	CD/18	28.685179	15.977500	126.6									✓	✓	✓	✓	✓	✓	✓
	CD/19/M	28.65994	15.965304	126.0										✓	✓	✓	✓	✓	✓
	CD/20	28.696643	15.919371	138.4									✓	✓	✓	✓	✓	✓	✓
	CD/23/M	28.620774	15.869824	135.3										✓	✓	✓	✓	✓	✓
	CD/24	28.641926	15.873426	137.8										✓	✓	✓	✓	✓	
	CD/25/M (I909)	28.652336	15.831294	145.9						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	CD/26	28.654729	15.849998	142.0										✓	✓	✓	✓	✓	✓
	CD/27 (C909)	28.671625	15.851577	145.5						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	CD/28/M	28.626132	15.869020	135.9											✓	✓	✓	✓	✓
	CD/29/M	28.643405	15.850940	141.3											✓	✓	✓	✓	✓
	CD/30/M	28.680492	15.929158	134.3											✓	✓	✓	✓	✓
	CD/31	28.639113	15.823957	145.6											✓	✓	✓	✓	✓
	CD/32	28.664338	15.863328	141.0											✓	✓		✓	
	CD/33	28.651898	15.876466	138.1											✓	✓	✓	✓	✓
	CD/34/M	28.591124	15.822018	140.2											✓	✓	✓	✓	✓
	CD/35	28.596781	15.811968	140.9											✓	✓	✓	✓	✓
	CD/36/M	28.623712	15.819847	142.0											✓	✓	✓	✓	✓
	CD/37/M	28.618697	15.823777	139.8											✓	✓	✓	✓	✓
	CD/38	28.613648	15.810849	141.5											✓	✓	✓	✓	✓
	CD/39	28.681544	15.907920	138.5															✓
	SS/1 (C2)	28.747426	16.158375	125.8			✓						✓	✓	✓	✓	✓	✓	✓
	SS/8	28.659487	16.184001	106.5									✓	✓	✓	✓	✓		
	SS/9 (C8B08)	28.680713	16.201546	107.3				✓					✓	✓	✓	✓	✓		
	SS/10/M (I0211)	28.696202	16.147298	118.6						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	SS/12/M	28.673928	16.135399	113.8									✓	✓	✓	✓	✓	✓	✓
	SS/13	28.729249	16.162485	122.5									✓	✓	✓	✓	✓	✓	✓
	SS/14/M	28.732788	16.162463	124.4									✓	✓	✓	✓	✓	✓	✓
	SS/16	28.742556	16.171542	123.8									✓	✓	✓	✓	✓	✓	✓
	SS/17 (C0111)	28.752617	16.186238	122.3						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	SS/18/M	28.740868	16.186064	120.8									✓	✓	✓	✓	✓	✓	✓
	SS/19/M (I0111)	28.744361	16.194173	119.6						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	SS/20	28.621041	16.142726	100.1									✓	✓	✓	✓	✓	✓	
	SS/23	28.668317	16.134029	111.7									✓	✓	✓	✓	✓	✓	✓
	SS/24	28.684428	16.139268	116.8											✓	✓	✓	✓	✓
	SS/25/M	28.700022	16.139540	120.8											✓	✓	✓	✓	✓
	SS/26/M	28.71757	16.175092	116.8											✓	✓	✓	✓	✓
	SS/27	28.703859	16.158550	119.0											✓	✓	✓	✓	✓
	SS/28	28.751658	16.181342	123.5											✓	✓	✓	✓	✓
	SS/29	28.712056	16.117516	125.3												✓	✓	✓	✓
	SS/30	28.717045	16.124316	125.2												✓	✓	✓	
	SS/31	28.726189	16.134919	123.6												✓	✓	✓	
	SD/2/M (I509)	28.769668	16.135532	131.2						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	SD/3 (C509)	28.788859	16.150145	130.3						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	SD/4	28.793228	16.129671	133.3									✓	✓	✓	✓	✓	✓	✓
	SD/5	28.816407	16.107714	135.9									✓	✓	✓	✓	✓	✓	✓
	SD/6/M (I709)	28.820278	16.085639	140.4						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	SD/7 (C709)	28.840932	16.107307	138.0						✓	✓	✓	✓	✓	✓	✓	✓	✓	✓
	SD/8	28.780907	16.102647	132.3													✓	✓	✓

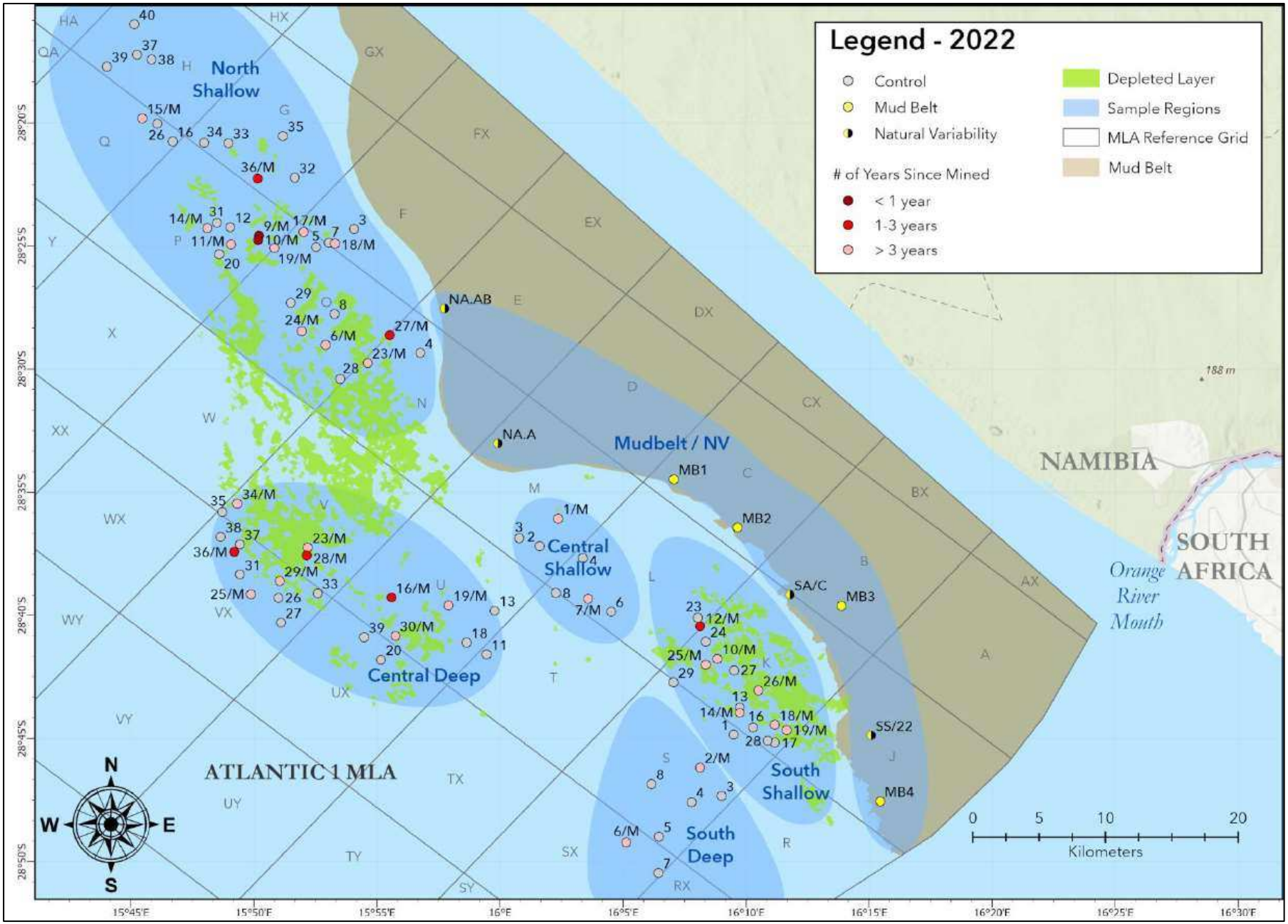


Figure 7.1: Location of the 91 sites sampled during the 2022 DBMN benthic sampling campaign. Sites sampled include those from the Mudbelt Natural Variability Study (MNVS) and Impact Monitoring Study V (IMS V) – see Table 7.13 for sites and years sampled (Source: Biccard, et, al., 2024).

Plate 7.1: Sampling equipment used for collecting and processing samples during each DP Star grab sampling campaign: A – Van Veen Grab with impact trigger; B – collection of sediment; C – seamless transfer of sample from processing tray to 1 mm sieve bag; D – washing of sample through 1 mm sieve bag; E – washed macrofauna sample; F – addition of chalk and 10% formalin solution; G – drop-camera (Source: Biccard, et, al., 2024).

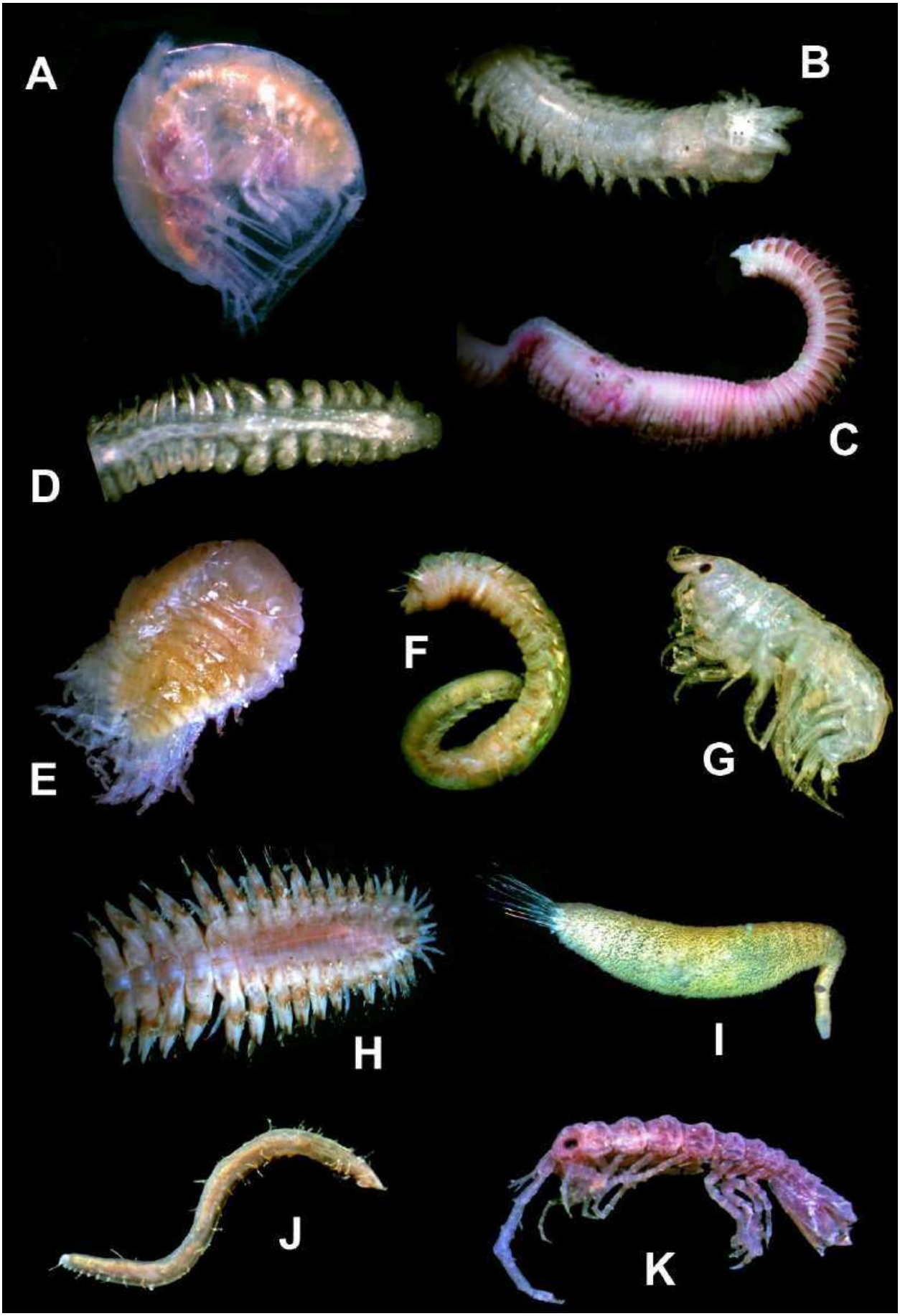


Plate 7.2: Examples of benthic invertebrate macrofauna found in grab samples from Atlantic 1 MLA: A – Ampelisca palmata; B – Nereis sp. (undescribed); C – Orbinia angrapequensis; D – Spiophanes sp.; E – Bopyridae (parasitic isopod); F – Amphicteis gunneri; G – Paraphoxus oculatus; H – Harmothoe sp.; I – Pherusa swakopiana; J – Ophelia sp.; K – Microarcturus quadricornis (Source: Biccard, et, al., 2024).

7.4.3.2 Mudbelt Natural Variability Study (MNVS)

This section of the report is a direct extract from Biccard et, al., (2024). According to Biccard et, al., (2024), the MNVS was initiated in 2002 and consists of four study sites that have been sampled more or less annually since 2005 – no sampling campaign was undertaken during 2020 due to the global COVID-19 pandemic. Previously, it was recommended that the MNVS be expanded to include collection of baseline data from potential impact sites where future mining activity is planned (Biccard et al. 2020). Five new mudbelt monitoring sites (MB/1 – MB/5) were therefore selected in 2019 and have been sampled together with the four 'existing' MNVS sites during subsequent benthic sampling campaigns (note that site MB/5 has since been dropped from the MNVS as the faunal community present is not considered representative of the mudbelt). Samples collected in 2022 as part of the MNVS provide further evidence of the high levels of natural variability that characterise benthic macrofaunal communities in the Atlantic 1 MLA. Spatial differences in benthic macrofauna community structure between the northern and southern natural variability sites appear in part to be related to differences in sediment particle size composition between the two areas.

A dramatic change in sediment structure was observed between 2011 and 2013 at the southernmost natural variability sites (SA and SS/22), which was thought to be linked to a 1:20-year flood event from the Orange River that occurred in 2011. This flood deposited large amounts of coarse sediment onto the offshore Orange Delta, effectively smothering the benthos at the southern natural variability sites but also affected other sites further afield. Over the 17-year monitoring period (2005-2022) there has been significant variation in sediment particle size distribution; the most dramatic being the 2013-2014 shift to coarser, sandy material that appears to have had the greatest impact on macrofauna communities. Results from 2015 onward suggest that sediment structure has reverted to a state similar to that observed prior to the 2011 flood (and has become finer at the southern sites) when compared to the earlier part of the monitoring period (2005-2007), and macrofaunal community composition in the mudbelt has stabilised with almost no evidence of any disturbance remaining from the 2011 flood. The latest available flow data from the Orange River indicated that another 1:20 year flood occurred again in early 2022. Present (2022) results revealed a decrease in indices of abundance and biomass at the southern natural variability sites, particularly SS/22, which would suggest earlier detection of anticipated deleterious effects from this flood event. These results are important, as they demonstrate the magnitude of natural variability – in this case related to flood events – and its influence on spatial and temporal differences in sediments and, hence, faunal composition. Continuation of this monitoring programme and expansion to include oceanographic and sediment modelling components is key to our understanding of natural change in the ML No. 47 benthic communities.

7.4.3.3 Impact Monitoring Study V (IMS V)

This section of the report is a direct extract from Biccard et, al., (2024). According to Biccard et, al., (2024), Impact Monitoring Study V (IMS V) monitoring programme was initiated in 2015 and builds on four years of monitoring at a set of six paired impact and control sites that were part of the historic DBMN Impact Monitoring Study IV (IMS IV) programme. Monitoring at most of these original paired impact and control sites from the IMS IV programme (which started in 2011) is continuing but a large number of additional sites (n = 43) were added in 2015 to the monitoring programme to better accommodate the high levels of temporal and spatial variability that seem to be associated with benthic macrofaunal communities in the ML No. 47. According to Biccard et, al., (2024), and in terms of this new approach, impacts of diamond recovery are being assessed through direct comparison between impact stations and a suite of control sites (n = 3-5) that fall within a 5 km radius and similar depth range to the impact sites. According to Biccard et, al., (2024), a total of 83 IMS V sites were sampled in 2022 of which 34 were mined/impacted and 49 have been left undisturbed to serve as control sites. Findings from the 2022 survey agree with insights that have been gained from the analysis of IMS V samples in previous studies. However, the increase in the coverage of impact sites across all regions of Atlantic 1 MLA since 2018, and data that have been collected, have significantly improved our understanding of the impacts related to offshore diamond recovery in southern Namibia and associated recovery of these communities. In terms of mining-related impacts, univariate comparisons of macrofaunal abundance, biomass and species richness have not always been unequivocal.

Although most impact (mined) sites show clear lasting (>7 years) impacts of mining, others show less evidence of impact, or appear to have recovered to the point where there is now little evidence of mining

related impacts in a very short space of time (<4 years, based on information provided from the mining logs). In most cases, the corresponding control stations exhibited limited change over the same period. Multivariate analyses of macrofaunal community structure and sediment particle size data, however, highlight significant dissimilarities between impact and control sites for sites that have been recently (<3-4 years before) mined. According to Biccard et, al., (2024), evidence of recovery has been observed at many of the historical mined sites, particularly SS/14/M, SS/19/M and SS/26/M, which are in close proximity to the Orange River Mouth, where sediment refill rates seem to be higher than elsewhere. Biological traits driving similarity in samples among unmined sites included taxa that are not attached to the substrate, have low to medium mobility and/or live in burrows. In contrast, the biological traits driving similarity in samples among mined sites included taxa with permanent and/or temporary attachment (i.e., no mobility). This seems to be linked to impacts of mining, in as much as hard substrata (bedrock and boulders) are often exposed, which facilitates a shift in community structure from one dominated by infauna to one dominated by epifauna; which would explain the change in biological traits/functioning observed.

7.4.3.4 eDNA Metabarcoding in Atlantic 1 MLA (ML No. 47)

This section of the report is a direct extract from Biccard et, al., (2024). According to Biccard et, al., (2024), NatureMetrics was engaged by Anglo American (a shareholder of DBMN) to conduct eDNA metabarcoding analyses on sediment and water samples from the Atlantic 1 Mining Licence Area (MLA) that were collected during the 2022 DBMN benthic sampling campaign. This five-year programme, initiated in 2021, is intended to inform the evaluation of biodiversity on a greater scale than has historically been undertaken (e.g., by including additional faunal groups such as meiofauna and bacteria that have not historically been covered), and other site-specific monitoring requirements (e.g. including biota that are present in the water column only, or that are not effectively sampled by the sampling tools used in this study). This process will assist DBMN in making progress towards achieving their goals of Net Positive Impact.

According to Biccard et, al., (2024), the findings were presented in three reports compiled by NatureMetrics that detailed the diversity of vertebrates, fish, invertebrates, and bacteria that were detected. In this report we present a summary of these results and 1) interpret the 2022 eDNA results in context of DBMN's Benthic Environmental Monitoring Programme; 2) compare benthic invertebrate taxa that were detected by metabarcoding techniques to those identified via morphological taxonomy from the same sediment samples and; 3) provide recommendations for future eDNA work. In 2021, the vertebrate 16S marker1 that was used detected only 15 species of fish in water samples and no elasmobranchs. Historic trawl surveys undertaken in the same area, over a 10-year period, have recorded 133 teleost and 47 elasmobranch taxa. In 2022, based on recommendations that were made, double the amount of water was filtered at each site, with 3 L collected from both the pelagic and benthic environment, and a fish-specific marker was used in addition to the vertebrate marker. These changes enhanced detection, with more than double the number of fish (33 taxa – including one chondrichthyan) reported in 2022, and ten additional taxa detected only through the use of the fish metabarcoding pipeline. In addition, different fish communities were targeted, as suggested by the significantly different pelagic and benthic communities. Nevertheless, it should be acknowledged that the historic trawl data are based on a decade of sampling effort and that the eDNA results presented here were attained from a single sampling event.

According to Biccard et, al., (2024), it was thought that eDNA metabarcoding of water samples could provide insight into the relative importance of the proposed Orange Cone Ecologically or Biologically Significant Marine Area (EBSA) for teleost and elasmobranch fish (e.g. spawning/nursery habitat). Results from samples collected within the EBSA were compared to samples collected from outside, and no significant dissimilarity in ichthyofaunal communities was found. In retrospect, this is not particularly surprising given the poor diversity of pelagic and demersal fish detected. It is also important to note that metabarcoding cannot distinguish between different life stages, age or size class of an organism. However, the continued use of a fish-specific marker in combination with increased aquatic eDNA sampling effort conducted on a seasonal basis both inside and outside of the Orange Cone EBSA (possibly in the form of transects), may provide further insight into the relative importance of this EBSA as a spawning/nursery area for fish, but it would of course only produce presence/absence data. That said, it may still serve as a complementary tool to what would likely be a much more logistically complex and costly dedicated seasonal sampling programme for fish, and their eggs and larvae.

According to Biccard et, al., (2024), the utility of the metabarcoding approach to characterise benthic macrofaunal community structure at mined and unmined sites was also assessed in this study. Benthic macrofaunal communities, identified by eDNA metabarcoding of sediment collected in 2022, did not show significant differences according to station status. This is likely due to the fact that these data from only eight mined sites were compared to that from 34 unmined sites, and that very few sites were located in the North Shallow region. However, these communities did show significant differences according to region. Spatial variation that is known to occur throughout Atlantic 1 MLA was not controlled for in this study (only one sample from each sampling site was analysed). To address this, it is recommended that future surveys include the collection of a minimum of three replicate samples from a selection of impact and control sites within each region (i.e. NS, CS, CD, SS, SD).

According to Biccard et, al., (2024), in comparison to the conventional taxonomic approach, the eDNA metabarcoding technique detected more invertebrate taxa from the same sediment sample, but with poor taxonomic resolution at the lower taxonomic levels (genus, species). Only 16 taxa were identified to species-level via eDNA metabarcoding, compared to 65 from traditional taxonomy. In addition, no species was detected by both conventional and molecular techniques. There are several reasons for these observations. The most obvious is the lack of an established genetic baseline data for benthic marine macrofauna from southern Namibia. Very few of the organisms present have been sequenced to date, which would result in very few matches at species level (as evidenced by the high number of “morpho-species” assigned to taxa in the eDNA data). Alternatively, the nomenclature of the taxa that have been identified using conventional taxonomic keys does not correlate well (at the equivalent genus/species level) with that on the NatureMetrics reference database, i.e., a species that was identified using conventional taxonomic keys exists on the reference database under a different name (synonym), that has not yet been updated. Such challenges were anticipated during the proposal phase of this project, and the barcoding of voucher specimens was identified as paramount to its future success. In total, 60 and 18 voucher specimens were submitted to NatureMetrics for barcoding in 2021 and 2022 respectively, with the intention of submitting additional material each year. However, these have yet to be analysed, and the data incorporated into the appropriate databases. This will no doubt improve the resolution of the data with each successive year, while making a significant contribution to local and international genetic reference databases.

According to Biccard et, al., (2024), the results from this study suggest that eDNA metabarcoding of bacteria in sediment samples is a potentially valuable tool that could augment conventional benthic monitoring surveys, and also the understanding of mining impact and recovery, owing to the extremely high number of taxa (629) that were detected (and are hence present in this environment). Of these, most belonged to the phylum Proteobacteria, which is a diverse and abundant group of microbes that are known to drive carbon cycling in the deep ocean. The sediment bacterial community did not show significant differences according to station treatment (mined/unmined), likely due to the fact that these data from only eight mined sites were compared to that from 34 unmined sites, and that very few sites were located in the North Shallow region. Again, spatial variation was not controlled for, and should be considered in the upcoming survey. In addition, the individual and collective biogeochemical function(s) of the sediment bacteria would have to be explored in more detail to better understand the impact of mining on this community, and the resultant ecological implications. Further research in this field is recommended, which is currently being undertaken by NatureMetrics.

7.4.3.5 Water Quality

This section of the report is a direct extract from Biccard et, al., (2024). According to Biccard et, al., (2024), limited water quality sampling has been undertaken in the Atlantic 1 MLA by DBMN in the past with instruments having been deployed at a number of locations in Atlantic 1 MLA. The first of these was a series of instrument arrays deployed between Central Deep and North Shallow portions of Atlantic 1 (approximately 30 km offshore) in 128 m depth that recorded temperature and dissolved oxygen (DO) between 1995 and 1997. Almost 20 years later in 2015, a CTD (RBR Concerto) was deployed in 127 m depth in the South Shallow portion of Atlantic 1 for several months programmed to monitor temperature, dissolved oxygen and turbidity. These data provided some useful insights into trends in key physico-chemical parameters in the water column in an area that hitherto has been poorly studied. However, until such time that a comprehensive programme for the continuous monitoring of key water quality parameters such as temperature, dissolved oxygen, and turbidity (among others) in

the Atlantic 1 MLA is initiated, our understanding of water quality dynamics in this region and the impact of mining on water quality will remain incomplete. Procurement of additional instrumentation such as a moored/in-situ CTD has been recommended in the past and is reiterated here.

According to Biccard et, al., (2024), while collecting water samples as part of the eDNA metabarcoding study during the 2021 campaign, CTD profiling data were simultaneously collected. Such discrete/spot measurements can only make a limited contribution towards understanding trends and patterns in benthic biological data. However, understanding and managing potential water column impacts of diamond extraction is also recommended. It was also recognised in 2021 that water quality and oceanographic data are required for calibration and validation of a hydrodynamic model that is currently being set up for the Atlantic 1 area. Thus, as the eDNA metabarcoding study extended into the 2022 campaign, water quality data was again opportunistically collected using of a Sea-Bird Electronics CTD with a 6-bottle Niskin rosette; the results of this sampling are discussed in detail in this chapter. To foster operational continuity and to create an opportunity for better understanding of impacts associated with discharge of sediment into the water column, a predictive and prescriptive monitoring initiative was proposed by Anglo American as part of their Future Smart Mining (FSM) initiative.

According to Biccard et, al., (2024), one of the goals of the FSM was to expand current monitoring programs and foster the use of environmental data to enhance current management systems and operational decision making. The conceptual design of this project (Phase I) was completed in 2022, and subsequently rolled out (Phase II) in 2023. The Phase I portion of this initiative identified the need for continuous (12-month) deployment of sub-surface current speed and direction profiling instrumentation. Thus, a Nortek Signature 250 ADCP was deployed at a dedicated water quality monitoring station in the South Shallow region of Atlantic 1 on 24 November 2022. According to Biccard et, al., (2024), the data collected by this instrument is being used to setup and validate a purpose-built hydrodynamic model designed to study the environmental and water quality impacts of sediment tailings dispersion and settlement within the MLA. It is intended that the model be used to address some of the key risks and potential impacts arising from diamond recovery operations on the environment, such inhibition of photosynthetic production in the water column associated with sediment plumes, and remobilisation of carbon and trace metals from sediments. According to Biccard et, al., (2024), a comprehensive water quality monitoring program for the Atlantic 1 area is warranted and is currently in development. Updates and specific recommendations for this are outlined below in the section dealing with water quality.

7.4.3.6 Species New to Science

This section of the report is a direct extract from Biccard et, al., (2024). According to Biccard et, al., (2024), Polychaetes occur worldwide and often emerge as the most common taxa in benthic communities. Data from samples collected during the 2022 DBMN benthic sampling campaign confirm that polychaetes were by far the most abundant taxon in the benthic macrofaunal communities of Atlantic 1 MLA, equating to 58% of total abundance and 47% of total biomass. The DBMN environmental monitoring programme has yielded several undescribed species that cannot be identified using local/conventional guides. According to Biccard et, al., (2024), to date, at least 71 taxa have been identified that cannot be keyed-out to species level using existing guides. A project has been initiated by DBMN to formally describe these species, the first description of which (for Ninoe namibiensis), was just recently published (Sedick et al. 2023).

According to Biccard et, al., (2024), there is morphological evidence three ‘new’ species, one from the family Onuphidae (currently identified as Diopatra monroi Day, 1960), one from the family Nephtyidae (cat worms, currently identified as Nephtys hombergii Savigny in Lamarck, 1818) and the other from the family Trichobranchidae (currently identified as Terebellides stroemii Sars, 1835) collected in benthic grab samples from the Atlantic 1 Mining License Area (MLA) in 2021/2022. Other than being reported in various ecological and monitoring studies, no taxonomic and/or systematic work on southern African specimens of these families collected from southern Africa, has taken place since the work of Day (1967a). All three of these families have previously been highlighted as research priority taxa by Simon et al. (2022), requiring urgent systematic and taxonomic revision. Molecular results from the 2021 campaign suggested that both the Diopatra and Nephtys specimens could be new to science, particularly the latter which did not match with Genbank reference sequences for species of the same name (sampled in Europe). Here we provide further morphological evidence, in support of the 2021

molecular results, that the Nepthys specimens from Atlantic 1 MLA differ from N. hombergii material collected from the French Mediterranean Sea. Based on these differences and previous findings, we conclude that, pending a final comparison with the holotype, the Namibian Nephtys specimens represent a species new to science that require naming and a formal description. For the Diopatra specimens, further molecular and morphological work incorporating additional material from southern Africa is required to resolve taxonomic inconsistencies. Finally, we provide morphological evidence that Terebellides specimens collected from Atlantic 1 MLA (previously identified as Terebellides stroemii) differ from the neotype of T. stroemii collected on the southwest coast of Norway. The molecular results presented in this report support the morphological findings and further indicate that Terebellides specimens from Atlantic 1 MLA could be new to science, as the specimen that was sequenced does match with Genbank and BOLD reference sequences for species of the same name. The collection of additional material for sequencing is recommended.

7.4.4 Recommendations on the Benthic Monitoring Programmes

The recommendations on the benthic monitoring programmes provided in this Section of this Report are direct extracts from Biccard et, al., (2024) report. According to Biccard et, al., (2024), it is recommended that annual monitoring at the MNVS, IMS V and SkiMonkey sites be continued. According to Biccard et, al., (2024), it is also strongly recommended that the following, as well as suggestions put forward by Clark (2014) and Biccard et al. (2017), continue to be implemented for these and any future monitoring programmes:

(i) Benthic Monitoring Programme (IMS V, MNVS and Skimonkey).

(ii) eDNA Metabarcoding.

(iii) Water Quality Monitoring.

(iv) Species New to Science, and.

(v) Orange Cone EBSA.

(i) Benthic Monitoring Programme (IMS V, MNVS and Skimonkey):

1) Ensure that qualified and experienced personnel are on hand to observe and supervise all aspects of the sample collection process. This person should, if possible, be the same one responsible for analysis of the data and production of the final report as seemingly small variations in the approach used to collect and process the samples can ultimately have a huge impact on how the data should be analysed and interpreted.

2) Collection and analysis of Total Organic Carbon (TOC) and Total Organic Nitrogen (TON) data be continued for all samples to help interpret of natural background variations in community structure and assess impacts of mining.

3) Investigate the availability of recent high-resolution bathymetric data to assess changes in the physical habitat as a result of mining at these sites and, if at all feasible, make provision to resurvey these areas again as soon as possible and at strategic intervals thereafter, to better understand the rate of recovery of the physical habitat and also to assist in dealing with variations in the amount of sediment collected in grab samples from different sites. Any future impact monitoring surveys should be strategically placed in areas where recent high-resolution bathymetric data are already available.

4) The SkiMonkey study should be continued, and a concerted effort should be made to overcome the technical challenges that have prevented this component of the benthic monitoring programme from taking place during the 2022 and 2021 sampling campaign. Future SkiMonkey transects must conform to the BACI approach and should target areas that have yet to be mined in order to establish a pre-mining baseline representation of the benthos, as our statistical results have indicated that the natural rocky condition can be difficult to isolate from the tailings

deposited during mining. This will require access to data pertaining to the dates and types of historic, current, and future mining activity and bathymetric profiles. The positions of operational mining vessels must be considered when selecting SkiMonkey sites.

5) In addition to the above, the SkiMonkey study should be expanded to include the collection and identification of benthic epifaunal species.

6) The current system configuration of the SkiMonkey should be calibrated using the SeaGIS software CAL and TransectMeasure to facilitate greater quantitative analyses. A detailed method statement on how to do this has been submitted to DBMN as a separate document.

7) Assessment of the carbon stocks in deeper-lying sediment across the whole of the Atlantic 1 MLA through collection of sediment cores samples using a gravity corer or similar tool.

(ii) eDNA Metabarcoding

8) It is recommended that replication of both water and sediment samples be increased at selected sites within each region (to control for spatial variation), and that routine species-level barcoding be undertaken, and results uploaded to BOLD (or an equivalent platform), in conjunction with traditional taxonomic identification, to boost genetic reference databases.

9) It is further recommended that a fish-specific primer continue to be applied to the eDNA metabarcoding of water samples, as well as any other relevant markers that might become available (and would add significant value to the monitoring programme).

10) Increased aquatic eDNA sampling effort conducted on a seasonal basis both inside and outside of the Orange Cone EBSA (possibly in the form of transects), to provide further insight into the relative importance of this EBSA as a spawning/nursery area for fish.

(iii) Water Quality Monitoring

11) Procurement of water-quality instruments to resume continuous monitoring (long-term permanent moorings) of a range of water-quality variables (dissolved oxygen, temperature, turbidity, and conductivity) at strategic locations in the Atlantic 1 MLA, ideally one in each region. Appropriate water quality data would have to include site-specific continuous monitoring of these water-quality variables. It should be reiterated that this cannot be substituted by discrete, or spot, water-quality measurements (CTD profiling) during periodic surveys.

12) Implementation of a water quality monitoring program that encompasses regular, vertical profiling of the water column throughout Atlantic 1 MLA that would capture seasonal and spatial variability in water quality parameters. Such data should be added to a database that could be used to undertake hydrodynamic modelling. It is further recommended that this monitoring program should consist of a series of transect lines, at regular intervals, perpendicular to the coast, ensuring adequate coverage across the mining licence area.

13) A modelling study should be commissioned to predict spatial changes in water quality parameters throughout any given year. This would allow for optimal siting of instruments. Greater coverage and extended continuous monitoring would provide valuable insight into seasonal fluctuations and changes in this environment over prolonged periods of time.

14) Ideally, estimates of the rates of bacterial production, respiration, growth efficiency and rates at which organic carbon is converted into CO2 should be specific to the Atlantic 1 MLA (or at least the Benguela region) and to carbon derived from sediments rather than senescent phytoplankton. Therefore, it is recommended that measurements of bacterial growth efficiency and respiratory electron transport system (ETS) of eukaryotes present in the sediment plumes during mining be conducted to enable more accurate estimates of carbon flux above the pycnocline.

15) Estimates of carbon remineralisation would also benefit from more detailed and more precise sediment-plume modelling studies to further elucidate carbon flux within the plume above the pycnocline or at specific depth profiles of interest.

(iv) Species New to Science

16) A final comparison of the Namibian Nephtys specimens with the N. hombergii holotype was undertaken.

17) Collect and prepare additional genetic material for barcoding of the Namibian Terebellides during the upcoming 2023 sampling campaign.

18) Further molecular and morphological work incorporating additional Diopatra material from southern Africa is recommended to resolve taxonomic inconsistencies.

19) Genetic material should also continue to be added to the genetic database under the BOLD initiative.

(v) Orange Cone EBSA

20) Further efforts be made to engage with the relevant EBSA task teams and key government representatives in both South Africa and Namibia to invite incorporation of data collected in DBMN's sampling programmes, and potential revision of the boundaries of the proposed Orange River Cone EBSA.

21) Publication of the analyses of samples taken inside and adjacent to the EBSA, to secure greater acceptance of the data.

A summary of the scheduling of baseline data and current monitoring plan for operations in the licensed area with respect to the ongoing and future DBMN exploration, recovery, and production operations are detailed in Table 7.13.

Table 7.13: Summary of scheduling of proposed monitoring for operations in the licensed area.

Aspect	Variables	Frequency
RECOVERY AND PRODUCTION OPERATIONS		
Excavations in the seabed	▪ Excavation depth, wall steepness and infill rates.	High-resolution geophysical surveys ~2-3 yrs post- recovery, and production operations .
Destruction of infaunal and/or epifaunal benthic organisms	Licensed Area: ▪ Pre- recovery and production benthic macrofaunal survey. ▪ Sediment sample analysis. ▪ Post- recovery and production benthic macrofaunal monitoring surveys to assess recovery. ▪ Sediment sample analysis.	~2-3 yrs after recovery and production operations have ceased. Concurrently with benthic survey.
Suspended sediment plumes during the recovery and production operations	▪ Water sampling of tailings plume. ▪ Aerial photographs of plumes. ▪ Monitoring H_2S, dissolved O_2 concentrations, organic content of sediments, turbidity and currents. ▪ Record wind speed and direction in vessel's bridge log. ▪ Conduct visual observations of the plumes.	When recovering and producing n in a new area In 4-hourly intervals during operations. Hourly during operations.
Release of contaminants from discharged sediments	▪ Water sampling of discharge ▪ Re-assess needs for regular water quality monitoring.	When recovering and producing in a new area Following results of water sampling exercise.
Release of hydrogen sulphide from mudbelt sediments	▪ On-board air quality monitoring. ▪ Conduct a coring survey to determine the presence of H_2S pockets.	Continuously during operations. Before recovery and production operations are conducted in thick mud overburden areas.
Smothering of seabed communities by depositing plume sediments	▪ Pre- recovery and production, geophysical and video surveys (e.g. SSS and AUV). ▪ Post- recovery and production, geophysical and video surveys (e.g. SSS and AUV).	Before commencement of operations. Directly after recovery and production operations have occurred ~2-3 years post- recovery and production operations.

Aspect	Variables	Frequency
Overburden stripping and dumping	■ Conduct a pre-dumping benthic macrofaunal survey of the dumpsite to record seabed topography and types of marine life present, using a suitable sampling device: ▪ Grab sampling surveys. ▪ Video footage collected from a Remotely Operated Vehicle (ROV). ▪ Geophysical (e.g. high resolution AUV and SSS) surveys. ■ Monitor the affected area using geophysical and/or benthic sampling techniques to assess the ecological recovery rate and redistribution of sediments in, and around, the sacrificial dump sites.	Before commencement of overburden dumping Commencing 2-3 years after disposal.
Shipwrecks and/or archaeological sites discovered during recovery and production operations	■ Record the date, time, location and types of artefacts found in the vessel's logbook.	On location of shipwreck/archaeological material.
Rock lobsters and other marine life	■ Keep a record of the numbers of rock lobsters/fish appearing on the screens during operations.	Continuously during operations.
Marine mammals and seabirds	■ Record the number of large mammals sighted, together with their proximity to the vessel and behaviour patterns. ■ Record the numbers and species of birds sighted during all activities associated with the operations.	Daily during operations.
Presence of vessels in the area	In the vessel logbook, record sightings of and interactions with other vessels to note potential conflicts over rites of passage and access to resources.	When they occur.
Noise	Monitor noise levels.	Monthly during operations.

Aspect	Variables	Frequency
Water use	Keep records of quantities of fresh water used, purposes of use, and sources of supply.	Monthly during operations.
WASTE MANAGEMENT		
FeSi	▪ Monitor FeSi consumption, set targets and put action plans in place should targets be exceeded.	Monthly during operations.
Energy use	▪ Oil and fuel consumption. ▪ Emissions (CO_2 per ton) from oil and fuel consumption. ▪ Visual inspection for oil spills and leaks.	Monthly during operations.
Hazardous substances	▪ Keep records of quantities of hazardous substances used and disposed of.	Monthly during operations.
Wastes and scrap	▪ Maintain an Official Garbage Record Book onboard vessels for all discharges of waste/incinerations. ▪ Maintain records of the types and amounts of waste disposed of. ▪ Keep records of any waste or scrap recycled.	Weekly during operations.
Incidental loss of equipment at sea	▪ Maintain a hazards database listing the type of gear left on the seabed with the dates of loss and locations and, where applicable, the dates of retrieval.	Continuously during operations.
Employment and expenditure	▪ Keep records of employees and sub-contractors involved in operations.	Annually
Economic benefits	▪ Keep a record of total expenditure.	Annually – to shareholders and investors

7.4.3 Monitoring Quality Control Measures

7.4.3.1 DBMN Marine Scientific Advisory Committee

The Marine Scientific Advisory Committee (MSAC) has been set up to provide advice to DBMN regarding the environmental impacts of marine diamonds recovery and production operations and the associated monitoring programme in the licensed operations area, and ensure that this advice is based on the best available scientific information at any given time. The key objectives are to:

- Review the results of the benthic monitoring programme and its effectiveness in providing scientifically defendable information with regards to the recovery of the seabed and its associated marine life in line with the scale of the recovery and production operations and related activities.
- Provide advice on the benthic monitoring design, analysis techniques and interpretation of the annual results to inform any changes to long-term benthic monitoring programme, and.
- Provide guidance on other environmental issues such as biological geophysical effects, tailings and plumes, marine life sightings, removal of hazards from the seabed, etc.

The MSAC may make proposals to DBMN concerning any scientific tasks to be included in its future work. Detailed Terms of Reference (ToR) of the MSAC as well as the composition of the membership are provided in Annex 6.

7.4.3.2 EMS Auditing

As stated in De Beers Marine Namibia's environmental policy, the Company is committed to conducting regular environmental audits to evaluate compliance and effectiveness of the Company's EMS to the ISO 14001 standard, as well as compliance with applicable legal and other requirements. This includes both internal audits and external surveillance and certification audits. A three-tier system of environmental auditing has been implemented at DBMN:

- Internal Vessel/Area Environmental Audits (conducted by the environmental monitors on either a monthly or quarterly basis).
- Environmental Management Team Audits (conducted by members of the Environmental Management Team for each vessel/area).
- Environmental Surveillance Audits (conducted by external auditors once a year). and.
- NOSA Grading Audits, which deal with Environmental Protection, Emergency Procedures, Drills and Equipment as well as Accident Reporting and Investigation.

7.4.3.3 Environmental Performance Monitoring Report

Based on the results of the ongoing environmental monitoring activities and in accordance with the provisions and conditions of the Environmental Clearance Certificate, written Environmental Performance Monitoring Reports will be compiled and submitted to the Environmental Commissioner, Department of Environmental Affairs Ministry of Environment, Forestry and Tourism, the Ministry of Mines and Energy and the Ministry of Fisheries and Marine Resources, demonstrating compliance with the EMP, legal and other requirements, and ongoing assessment of risks / aspects.

It is important that environmental performance monitoring is undertaken before, during and after exploration, recovery, and production 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.

7.4.4 Recommended Monitoring

Overall, DBMN has implemented all the applicable EMPs and monitoring thereof with respect to the Company's Strategic Business (exploration, recovery, and production operations) undertaken for the period under review (2021 – 2024 ECC validity period). Based on the recommendation of some of the specialist monitoring activities undertaken for the period under review 2021-2024, the following is the summary of the key recommendations that may be considered for implementation to further improve the quality of the baseline and monitoring data sets collected and interpreted with respect to the ongoing exploration, recovery, and production operations in the ML No. 47:

1. Review and undertake a detailed updated baseline mapping of key the coastal and shallow marine environmental resources / receptors and delineate key sensitive areas or targets that must be protected particularly closer to the Namibian Islands' Marine Protected Area (NIMPA).

2. Implement real time automated onboard seawater quality sampling and testing programme for each vessel. Monitoring data sets may be collected by either an environmental officer or through an automated system to support the ongoing Mudbelt Natural Variability (MNVS) and the Impact Monitoring Study V (IMS V) studies and contribute to the understanding of the natural, exploration, recovery, and production operations induced variabilities.

3. Undertake water column modelling to understand the short and long-term effects of fine sediments discharges and resultant plumes on the seawater column.

4. Undertake seabed modelling of sediments discharges (oversize) to understand the short and long-term effects of sediments discharges on the seafloor natural, exploration, recovery and production operations variabilities, and.

5. Undertake, underwater marine noise numerical modelling with respect to the ongoing geophysical survey (low energy acoustics) as well as noise from exploration, recovery and production operations and normal vessels operations, including cumulative impacts.

The following is the summary of the supportive studies that have already been completed by DBMN and will provide the much-needed input data sets / parameters / boundary conditions to some of above listed proposed modelling studies:

1. Biccard A, Payne RP, Ho Y, Malan A, Hutchings K, Clark BMC, Schmidt KM, Henry TT and S Mtsokoba. 2024. De Beers Marine Namibia Benthic Environmental Monitoring Programme: Atlantic 1 Mining Licence Area 2022 Sampling Campaign. Report prepared for De Beers Marine Namibia (Pty) Ltd by Anchor Environmental Consultants (Pty) Ltd. Report no. AEC2051

2. PRDW, 2020a. Debmarine Namibia oil spill study: Oil spill contingency plan review, S2001-142-RP-NV-003-R1, Cape Town, South Africa.

3. PRDW, 2020b. Debmarine Namibia oil spill study: Oil spill modelling specialist study, S2001-142-RP-CE-002-R2, Cape Town, South Africa, and.

4. Lwandle Technologies (Pty) Ltd, 2016, Environmental plume modelling study licensed area, Specialist Report Deliverable 1: Literature Review. This is indeed a literature review document which may be useful during the process of undertaking the plume modelling study because it provides some desktop assessment that will be validated by the mathematical modelling results as well as seawater quality measurements.

8. CONCLUSIONS AND RECOMMENDATIONS

8.1 Opportunities for Exploration and recovery in the ML 47

This updated EIA and EMP Report has been prepared to support the application for the renewal of the current ECC No. 01611 for DBMN expiring on the 9th September 2024. The report has been prepared in accordance with the provisions of the Environmental Management Act, 2007, Environmental Impact Assessment (EIA) Regulations 2012, the Minerals Act, 1992, DBMN Environmental and Sustainability Policies as well as all other related operational and contractual obligations and Terms of Reference (ToR) as provided by the Proponent, and described in the Scoping / Background Information Document (BID). As part of the preparation of this updated EIA and EMP Report, several thematic maps (Decision Support Tools - DTSs) have been reviewed and updated as sown in Figs. 8.1 - 8.3. The thematic maps provide summarised visual representation of the environmental resources (Fig. 8.1), constraints associated with the ongoing and future diamonds exploration, recovery, and production operations in the licensed area that have been delineated (Fig. 8.2) and opportunities for undertaking diamonds exploration, recovery, and production operations in prospective / economic zone (Fig. 8.3) in line with the EMP provisions. The updating of the thematic maps involved an iterative process of reviewing and defining likely positive and negative coastal and marine environmental effects and constraints, reviewing mitigation measures, and revising the monitoring plan or baseline data requirements in the light of predicted environmental effects. The licensed and the surrounding areas have been divided into the following environmental setting Zones for the purposes of the Thematic Mapping process and sensitivity analysis with respect to the ongoing exploration, recovery, and production operations:

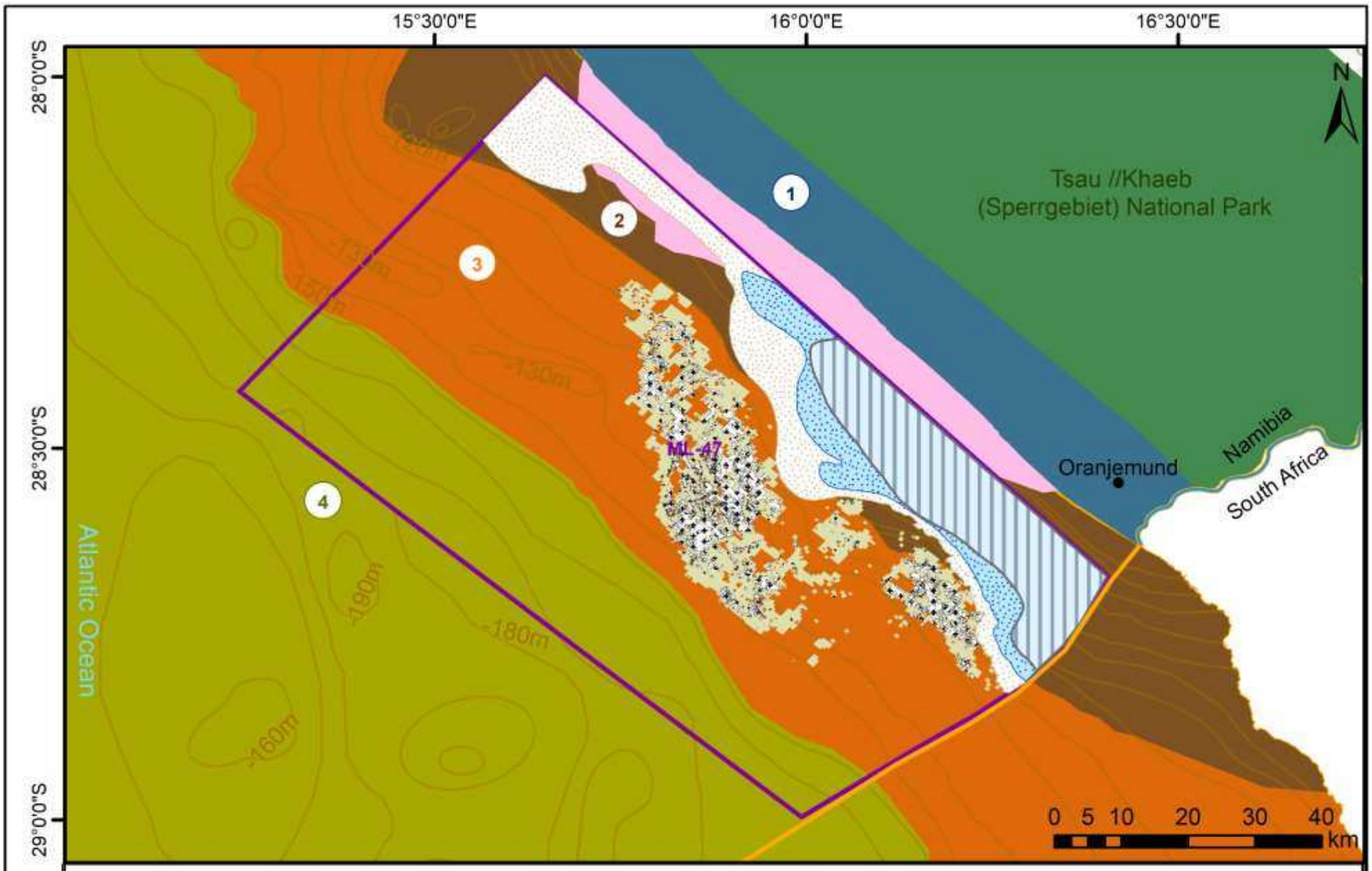
- **Zone 1:** Land-based coastal area is classified as highly sensitive zone with respect to minerals exploration, recovery, and production operations by Namdeb. DBMN does not undertake exploration or recovery and production operations operations in this Zone. This zone is used by DBMN for logistic air support to the vessels through the Oranjemund Airport. This coastal zone covers the Orange River Mouth and the western edge of the Tsau //Khaeb (Sperrgebiet) National Park.

- **Zone 2:** Coastal and shallow marine waters stretching from 0m – 100 m deep and classified as highly sensitive zone with respect to diamond exploration, recovery, and production operations. DBMN will in the future undertake exploration, recovery, and production operations in this Zone. This coastal and shallow marine zone covers the Orange River Mouth, the western adage of the Tsau //Khaeb (Sperrgebiet) National Park and the Namibian Islands' Marine Protected Area (NIMPA).

- **Zone 3:** Transitional Zone stretching from -100 m to –150 m water depth and classified as highly sensitive and strategic zone with respect to diamond exploration, recovery, and production operations. DBMN does undertake extensive exploration, recovery, and production operations in this zone. This key strategic minerals resources zone for DBMN operations, and.

- **Zone 4:** Beyond 150 m into the Deepwater offshore environment classified as low sensitive zone with respect to the diamond exploration, recovery, and production operations. DBMN does not undertakes extensive exploration or recovery and production operations in this Zone, however, with advancing technology, it is likely that future exploration and recovery will eventually take place in this zone.

The division of the above Zones 1 – 4 have been based on the ecosystem characteristics and constraints, environmental resources and bathymetric influences. The key potential exploration and recovery areas within the licensed area falls within the Zones 2 and 3, the Coastal and shallow marine and transitional zones (Figs. 8.1 – 8.3). The ML 47 is a very important and a strategic national protected resources area with proven diamond reserves and resources. The licensed area presents a greater opportunity for the current and future diamonds exploration, recovery, and production operations by DBMN beyond 2035. Based on the environmental assessments, EMPs and monitoring programmes that have been implemented by DBMN over the years, there is a great opportunity for the current and future marine diamond exploration, recovery, and production operations by DBMN to co-exist with the ecosystem, other marine users, and related services within the licensed area.



Constraint Map Layer

Legend

- Towns
- Orange River
- International Boundaries
- Mining Licences (ML) 47
- National Parks
- Rock Lobster
- Diamond Recovered Areas
- Current Undepleted Local Blocked Resource

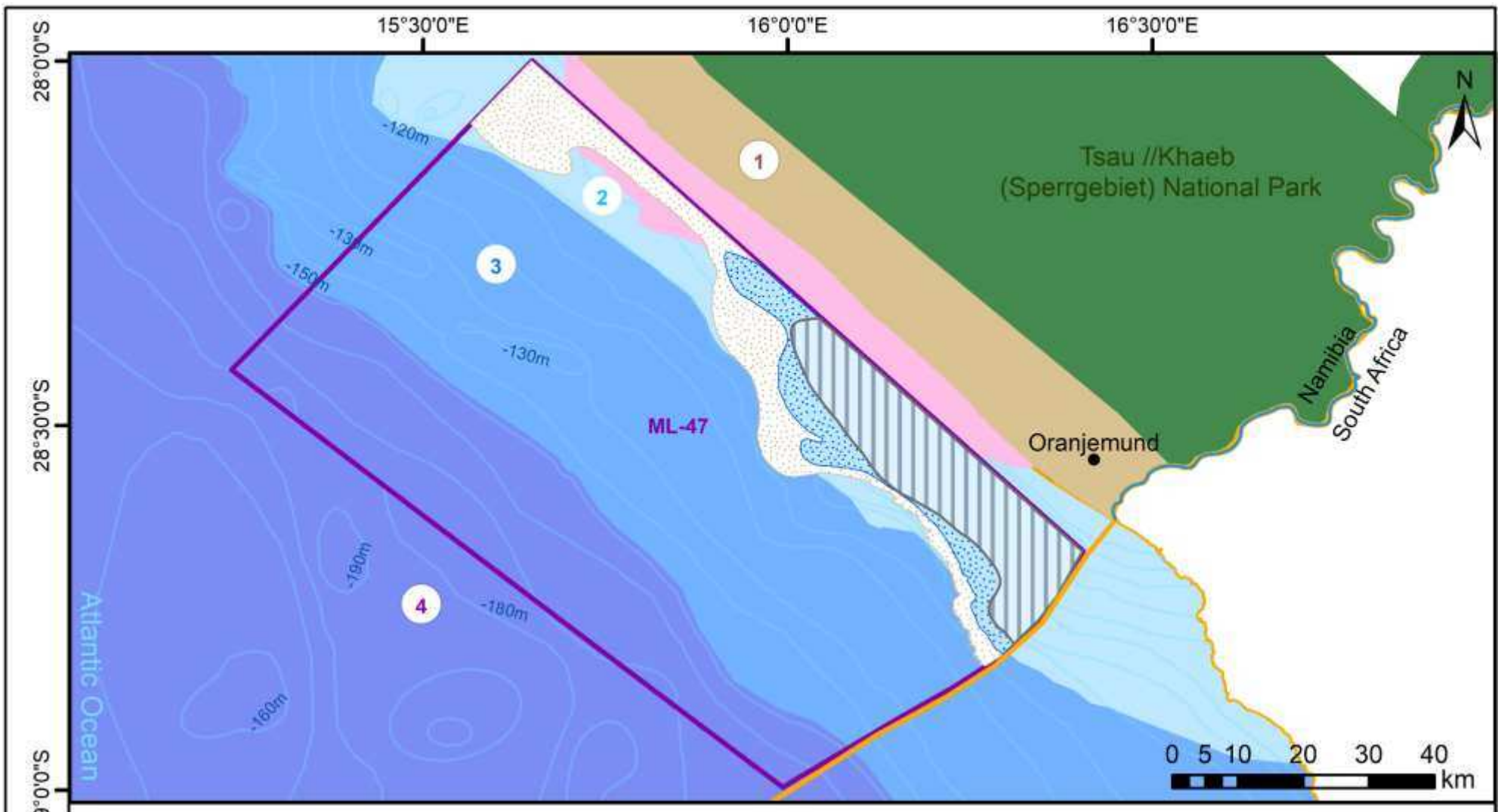
Mudbelt Name

- Mud 10 - 18m thick
- Sand/Mud 4 - 10m thick
- Acoustic Blanking Layer (ABL)

ZONE	DESCRIPTION	INDICATIVE LIKELY CONSTRAINTS TO EXPLORATION, RECOVERY, AND PRODUCTION OPERATIONS IN THIS ZONE
1	Land-based coastal area is classified as highly sensitive zone with respect to minerals exploration, recovery, and production operations by Namdeb. DBMN **does not** undertake exploration or recovery, and production operations in this Zone. This zone is used by DBMN for logistic air support to the vessels through the Oranjemund Airport. This coastal zone covers the Orange River Mouth and the western edge of the Tsau //Khaeb (Sperrgebiet) National Park	1. Tsau //Khaeb (Sperrgebiet) National Park 2. Orange River Mouth 3. Wetland, conservation (Coastal ecosystem) areas; 4. Sand and rocky beach zone; 5. Conservation zone; 6. Recreational Support zone; 7. Tourism Support zone; 8. Diamond exploration, recovery, and production operations by Namdeb; 9. Potential for renewable energy zone (wind and wave) 10. Other socioeconomic support system along the entire Southern Coastline of Namibia.
2	Coastal and shallow marine waters stretching from 0 m – 100 m deep and classified as highly sensitive zone with respect to marine diamond exploration, recovery, and production operations. DBMN **will in the future** undertake exploration, recovery, and production operations in this Zone. This coastal and shallow marine zone covers the Orange River Mouth, the western adage of the Tsau //Khaeb (Sperrgebiet) National Park and the Namibian Islands' Marine Protected Area (NIMPA).	
3	Transitional Zone stretching from -100 m to –150 m water depth and classified as highly sensitive and strategic zone with respect to marine diamond exploration, recovery, and production operations. DBMN **does** undertake extensive exploration, recovery, and production operations in this zone. **This a key strategic minerals resources zone for DBMN operations.**	Fisheries, marine ecosystems, very important marine diamonds exploration, recovery, and production operations for DBMN as well as support other socioeconomic activities in Zones 2 and 1. Important marine ecosystem support systems to both shallow and deep-water marine environment). Great contribution to Ecosystem Services and Value.
4	Beyond 150 m into the Deepwater offshore environment classified as low sensitive zone with respect to the marine diamond exploration, recovery, and production operations. DBMN **does not** undertake marine diamonds exploration, recovery, and production operations in this Zone, however, with advancing technology, it is likely that exploration, recovery, and production operations will eventually take place in this zone.	Important marine ecosystem support systems to both shallow and deepwater marine environment, potential for oil and gas exploration and production opportunities and key international transport and possible communication (seafloor cables) route. Great contribution to Ecosystem Services and Value.

Data Sources: Esri, GIS User Community, Namibia Statistics Agency (NSA), Ministry of Mines and Energy (MME), Ministry of Environment,Forestry and Tourism (MEFT), Debmarine Namibia (DBN) and Benguela Current Convention (BCC).

Figure 8.1: Environmental map layer with respect to exploration and recovery by DBMN in the licensed area.



Environmental Map Layer

Legend

- Towns
- Orange River
- International Boundaries
- Mining Licences (ML) 47
- National Parks
- Rock Lobster
- Diamond Recovered
- Current Undepleted Local Blocked Resource

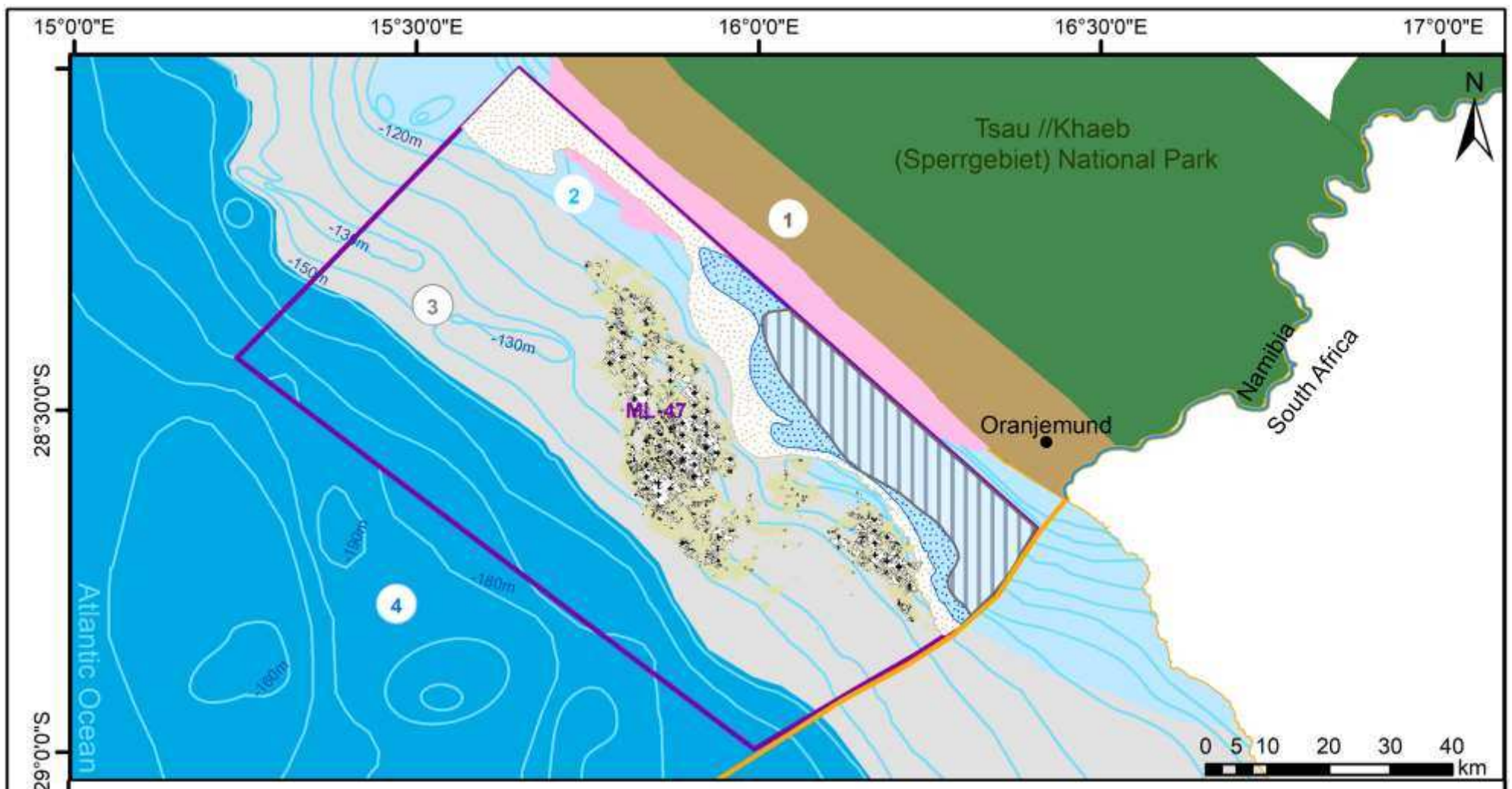
Mudbelt Name

- Mud 10 - 18m thick
- Sand/Mud 4 - 10m thick
- Acoustic Blanking Layer (ABL)

ZONE	DESCRIPTION	CHARACTERISTICS / ENVIRONMENTAL RESOURCES	ECOSYSTEM SERVICES / VALUE
1	Land-based coastal area is classified as highly sensitive zone with respect to minerals exploration, recovery, and production operations by Namdeb. DBMN **Does Not** undertake exploration or recovery, and production operations in this Zone. This zone is used by DBMN for logistic air support to the vessels through the Oranjemund Airport. This coastal zone covers the Orange River Mouth and the western edge of the Tsau //Khaeb (Sperrgebiet) National Park	1. Tsau //Khaeb (Sperrgebiet) National Park 2. Orange River Mouth 3. Wetland, conservation (Coastal ecosystem) areas; 4. Sand and rocky beach zone; 5. Conservation zone; 6. Recreational Support zone; 7. Tourism Support zone; 8. Diamond exploration, recovery, and production operations by Namdeb; 9. Potential for renewable energy zone (wind and wave) 10. Other socioeconomic support system along the entire Southern Coastline of Namibia.	❖ **Ecosystem Function (What the Ecosystem Does):** Key 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. ❖ **Ecosystem Services:** Food chain, harvesting of animals or plants, and the provision of clean water or scenic views. ❖ **Use Values**: Direct use for fishing, birdwatching, hiking 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. ❖ **Non-Use, or Passive Use**: Preserve what exists (Existence Value) with no consideration for direct use / benefits.
2	Coastal and shallow marine waters stretching from 0m – 100 m deep and classified as highly sensitive zone with respect to marine diamond exploration, recovery, and production operations. DBMN **will in the future** undertake exploration, recovery, and production operations in this Zone. This coastal and shallow marine zone covers the Orange River Mouth, the western adage of the Tsau //Khaeb (Sperrgebiet) National Park.	This zone supports both onshore and offshore multiple economic activities such as fisheries, tourism, conservation (marine ecosystem), potential hydrocarbon, diamond and other minerals exploration recovery, and production operations and other socioeconomic activities which in turn supports thousands of jobs along the southern and central coastlines of Namibia	❖ **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. ❖ **Ecosystem Services:** Food chain, harvesting of animals or plants, and the provision of clean water or scenic views. ❖ **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. ❖ **Non-Use, or Passive Use**: Preserve what exists (Existence Value) with no consideration for direct use / benefits.
3	Transitional Zone stretching from -100 m to –150 m water depth and classified as highly sensitive and strategic zone with respect to marine diamond exploration recovery, and production operations. DBMN **does** undertake extensive marine diamonds exploration and recovery, and production operations in this zone. **This a key strategic minerals resources zone for DBMN operations.**	This zone is characterised by its transitional position on the continental shelf and water column and plays a major role in supporting key economic activities such as fisheries, tourism, conservation, potential hydrocarbon occurrence, diamond exploration recovery, and production operations and other socioeconomic activities in Zones 2 and 1	
4	Beyond 150 m into the deep water offshore environment classified as low sensitive zone with respect to the diamond exploration recovery, and production operations. DBMN **does not** undertake extensive exploration or recovery, and production operations in this Zone, however, with advancing technology, it is likely that future marine diamonds exploration, recovery, and production operations will eventually take place in this zone.	Characterised as a key recruitment and support balance of the marine ecosystem systems, international transport route and potential deepwater petroleum resources.	

Data Sources: Esri, GIS User Community, Namibia Statistics Agency (NSA), Ministry of Mines and Energy (MME), Ministry of Environment,Forestry and Tourism (MEFT), Debmarine Namibia (DBN) and Benguela Current Convention (BCC).

Figure 8.2: Constraint map layer with respect to exploration and recovery by DBMN in the licensed area.



Legend

Opportunity Map Layer

- Towns
- Orange River
- International Boundaries
- Mining Licences (ML) 47
- National Parks
- Rock Lobster
- Diamond Recovered Areas
- Current Undepleted Local Blocked Resource

Mudbelt Name

- Mud 10 - 18m thick
- Sand/Mud 4 - 10m thick
- Acoustic Blanking Layer (ABL)

ZONE	DESCRIPTION	ENVIRONMENTAL RESOURCES	DEVELOPMENT OPPORTUNITY (EXPLORATION, RECOVERY, AND PRODUCTION OPERATIONS)
1	Land-based coastal area is classified as highly sensitive zone with respect to minerals exploration, recovery, and production operations by Namdeb. DBMN **does not** undertake exploration or recovery, and production operations in this Zone. This zone is used by DBMN for logistic air support to the vessels through the Oranjemund Airport. This coastal zone covers the Orange River Mouth and the western edge of the Tsau //Khaeb (Sperrgebiet) National Park	1. Tsau //Khaeb (Sperrgebiet) National Park 2. Orange River Mouth 3. Wetland, conservation (Coastal ecosystem) areas; 4. Sand and Rocky Beach Zone; 5. Fisheries Resources and Conservation zone; 6. Recreational Support zone; 7. Tourism Support zone; 8. Diamond exploration, recovery, and production operations by DBMN and Namdeb; 9. Potential for Renewable Energy Zone (Wind and Wave) 10. Other socioeconomic support system along the entire Southern Coastline of Namibia 11. Great contribution to Ecosystem Services and Value.	Possible to implement exploration, recovery, and production operations in selected area but likely to be constrained by environmental resources, high ecosystem services and value with associated activities resulting in a tightly controlled activities scheduling and expensive environmental rehabilitation costs.
2	Coastal and shallow marine waters stretching from 0 m – 100 m deep and classified as highly sensitive zone with respect to marine diamond exploration recovery, and production operations. DBMN **will in the future** undertake exploration, recovery, and production operations in this Zone. This coastal and shallow marine zone covers the Orange River Mouth, the western adage of the Tsau //Khaeb (Sperrgebiet) National Park.		Current technology may be limiting the opportunity for exploration and recovery, and production operations in the shallow waters with mud belt.
3	Transitional Zone stretching from -100 m to –150 m water depth and classified as highly sensitive and strategic zone with respect to marine exploration, recovery, and production operations. DBMN **does** undertake extensive exploration, recovery, and production operations in this zone. **This a key strategic minerals resources zone for DBMN operations.**	1. Diamond exploration, recovery, and production operations by DBMN and Namdeb; 2. Potential for renewable energy zone (Wind and Wave) 3. Other socioeconomic support system along the entire Southern Coastline of Namibia 4. Great contribution to Ecosystem Services and Value.	Proven technology to undertake economic feasibility exploration, recovery, and production operations with less likely constraint by the environmental resources with high value diamond exploration, recovery, and production operations contributing to the balancing of the ecosystem services / value and associated activities resulting in a lesser tightly controlled activities scheduling and low environmental rehabilitation costs.
4	Beyond 150 m into the deep-water offshore environment classified as low sensitive zone with respect to marine diamond e exploration, recovery, and production operations. DBMN **does not** undertake exploration, recovery, and production operations in this Zone, however, with advancing technology, it is likely that exploration, recovery, and production operations will eventually take place in this zone.	Important marine ecosystem support systems to both shallow and deepwater marine environment, potential for oil and gas exploration and production and key international transport and possible communication (seafloor cables) route	Too deep water to undertake economic exploration, recovery, and production operations with current technology

Data Sources: Esri, GIS User Community, Namibia Statistics Agency (NSA), Ministry of Mines and Energy (MME), Ministry of Environment,Forestry and Tourism (MEFT), Debmarine Namibia (DBN) and Benguela Current Convention (BCC).

Figure 8.3: Opportunity map layer with respect to exploration and recovery by DBMN in the licensed area.

8.2 Conclusions

The environmental performance monitoring and research undertaken for the period 2021-2024 provides a great source of valuable data sets on the state of environmental around the licensed area (ML No. 47) with respect to the ongoing marine diamonds exploration, recovery, and production operations by DBMN. Previous environmental assessments as well as ongoing environmental monitoring programmes have all been reviewed in this report.

In accordance with the Thematic Maps prepared for this updated EIA and EMP report, the key minerals (diamonds) economic areas within the licensed area with greater potential for positive exploration outcomes and recovery and production operations with the current technology falls within the water depth range of between -90 m and -150 m and classified as Zones 2 and 3 as shown in Figs. 8.1–8.3. These zones are characterised by the coastal and shallow marine environments leading into the transitional position on the continental shelf and water column and plays a major role in supporting the other economic activities such as fisheries, tourism, conservation, potential, hydrocarbon occurrence, minerals exploration and recovery and other current and future socioeconomic activities possible in the area.

Furthermore, the zones have the following ecosystem services / values which have also been considered in the environmental assessment process:

- Ecosystem Function (What the Ecosystem Does): Key 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.

- Ecosystem Services: Food chain, harvesting of animals or plants, and the provision of clean water or scenic views.

- Use Values: Direct use for Fishing, Birdwatching, Hiking 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.

- Non-Use, or Passive Use: Preserve what exists (Existence Value) with no consideration for direct use / benefits.

- 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.

- Ecosystem Services: Food chain, harvesting of animals or plants, and the provision of clean water or scenic views.

- 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, and.

- Non-Use, or Passive Use: Preserve what exists (Existence Value) with no consideration for direct use / benefits.

However, the very high national socioeconomic benefits being derived from the ongoing diamonds exploration, recovery, and production operations by DBMN provide a positive balance of this zone with respect to its ecosystem services / value.

The management plan detailing how DBMN intends to continue managing all its exploration, recovery and production operations within the licensed area that will significantly impact on the environment has been provided in this report under Section 7.3.

The implementation of the EMP as provided in this report will minimise and maximise the negative positive impacts, respectively, and thereby enhancing the overall ecosystem services / value of the area being explored or recovered and produced within the licensed area (ML No. 47).

8.3 Recommendations for Environmental Clearance Certificate

Based on the results of this updated Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP) Report, it is hereby recommended that the Proponent (DBMN) be issued with a new Environmental Clearance Certificate (ECC) for the ongoing marine diamonds exploration (geophysical survey and sampling), recovery and production operations in the licensed area (ML) No. 47.

This updated EIA and EMP Report shall be integrated into the ISO 14001 Environmental Management System (EMS) of DBMN. The responsibility for implementing the EMP and monitoring plan rests with DBMN's Environmental Section.

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10. ANNEXES

Annex 1 - DBMN Environmental and Sustainability Policies - 2024

Annex 2 - Updated Stakeholders Register – June 2024

Annex 3 - DBMN Vessels Fleet Specifications - June 2024

Annex 4 - Legal Register for DBMN EMP- June 2024

Annex 5 - 2014 RISK MATRIX (ANGLO)

Annex 6 - Marine Scientific Advisory Committee (MSAC) Signed Terms of Reference (ToRs)