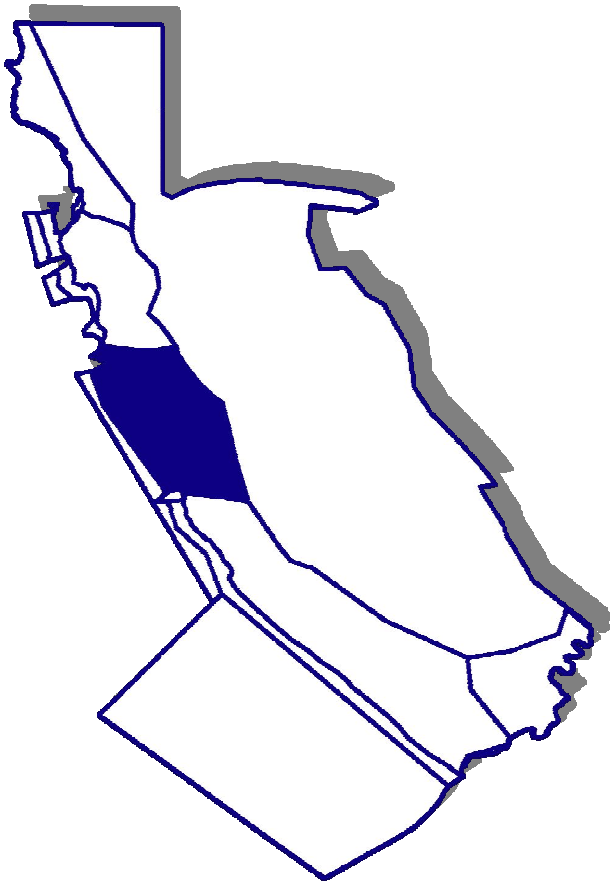

Environmental Management Programme Report Update for Namdeb's Mining Licence 44 (Bogenfels)

February 2022

ENVIRO DYNAMICS
Environmental Management Consultants

NAMDEB
A NAMIBIA DE BEERS PARTNERSHIP

Environmental Management Programme Report for Namdeb's Mining Licence 44

Update for period 2022-2025

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Acknowledgements

This report update included significant inputs from the Namdeb Environmental and Geological Sections.

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Abbreviations and glossary

AA	Anglo American
BP	Before Present
CTF	Contractor Treatment Facility
DEA	Directorate of Environmental Affairs
DMS	Dense Medium Separation
EMP	Environmental Management Plan
EMPR	Environmental Management Programme Report
EMS	Environmental Management System
ESA	Early Stone Age
HT	High Tension
IUCN	International Union for the Conservation of Nature (former World Conservation Union)
kV	kilovolt
LSA	Later Stone Age
MSA	Middle Stone Age
MA1	Mining Area 1
MET	Ministry of Environment and Tourism
MFMR	Ministry of Fisheries and Marine Resources
ML	Mining Licence
MME	Ministry of Mines and Energy
MSE	Middle Stone Age
MUN	Mine Workers Union of Namibia
MVA	Mega-volt ampere
MWh	Megawatt hour
NIMPA	Namibia Islands Marine Protected Area
Nemcom	Namdeb Executive Management Committee
SBP	Strategic Business Plan
SCM	Southern Coastal Mines
SME	Small and Medium Enterprises
SSSI	Site of Special Scientific Interest
TAC	Total Allowable Catch

Figures and tables

Chapter 1 Summary

1.1 Introduction

A series of Environmental Management Programme Reports linked to Namdeb's licence areas forms the backbone of Namdeb's Environmental Management System (EMS). This report is an update of the 2018 EMPR for ML44 (Bogenfels mining licence area). The report update highlights some of the information from the previous report for reference purposes, and focusses on activities for the past period 2018-2021, and planned period 2022-2025, with accompanying management strategies. The report will be submitted for the purposes of the Environmental Clearance Certificate (ECC) renewal, which expires in 2022.

1.2 Mining and exploration activities

Currently there is mining activity in the Shallow Marine part of the concession ((-7 to -50 bmsl), being conducted by Shallow Marine (SM) Diver contractors.

A sizeable diamond resource has been delineated in the Midwater portion (area deeper than 50m bmsl). A test mining campaign was completed in 2018 to define the geotechnical parameters and resource performance of the area. Further campaigns using the same or similar crawler technology will be conducted in the near future.

Apart from the diamond targets ML44 is very prospective for non-diamond commodities such as base metals. An exploration campaign to identify such potential resources further is planned for the next three-year period. Drilling sites as such have not yet been determined and an assessment with amendment to this Environmental Clearance Certificate (ECC) will be required once the drilling sites have been assessed and specific mitigation identified.

The last active terrestrial mine site in ML44 was at Bogenfels, where mining stopped in 2011. Infrastructure removal, pollution clean-up and landscape rehabilitation were completed in 2013. At the stakeholder forum meeting a decision was taken not to backfill the last remaining pond, but to monitor the biophysical parameters. A formal decision on the fate of the ponds needs to be made with the Ministry of Environment, Forestry and Tourism. The remnants of past mining activities of Sonnberg Mining Contractors need to be rehabilitated.

1.3 The natural environment

The licence area is positioned in the southern Namib Desert, which comprises parts of the Desert - and Succulent Karoo Biomes. The Succulent Karoo Biome is a global biodiversity hotspot (Myers et al. 2000) and managing impacts on biodiversity is therefore critical. Overall, the southern Namib coastline has been identified as environmentally sensitive because of abundance of bird breeding

sites, seal colonies and associated predators, such as brown hyena. The Bogenfels licence area is also a hotspot of plant endemism within the -Tsau //Khaeb National Park.

Figure 1: The Bogenfels area is particularly rich in plant endemics – here naturally re-established vegetation in areas mined out in the 1920s (Photo: Antje Bourke)

The marine environment is shaped by coastal, wind-induced upwelling with cold surface waters, high biological productivity, highly variable physical, chemical and biological conditions. The Lüderitz upwelling cell is the most intense upwelling cell in the Benguela. Marine communities are largely ubiquitous throughout the southern African West Coast region, being particular only to substrate type or depth zone. They consist of many hundreds of species often displaying much temporal and spatial variability.

The coastline is characterised by variable coastal landforms. Pocket Beaches are separated by rocky outcrops, headlands and coastal cliffs, with offshore reefs and islands being common. The coastline exposed to strong wave action, facing directly into the prevailing swells.

1.4 The socio-economic environment

Namdeb's overall contribution to the Namibian economy is substantial, with additional major positive spin-offs for secondary industries such as suppliers, service providers and contractors, a large part from the Karas region.

Figure 2: The former hospital at the historic Bogenfels village (the "Pink House") has been maintained by Namdeb (Photo: Antje Bourke)

Many sites of historic importance occur in the Bogenfels mining licence. The iconic rock arch and the Bogenfels and Pomona historic mining villages are some of the most important tourist destinations.

Figure 3: Mining in view of the "Bogenfels" resulted in stringent environmental measures to remedy all visual impacts and re-establish biodiversity

1.3 Environmental management to date

Namdeb's Environmental Section is responsible for all facets of environmental protection, such as planning, performance reporting, assurance, impact monitoring and stakeholder engagement. One environmental officer was dedicated to ML44. Namdeb's operations are ISO14001:2015 certified and follow De Beer's and Anglo American's corporate standards.

1.4 Environmental assessment

The key environmental risk in ML44 is presently associated with the remaining pond at the pocket beaches site 11-12, marine exploration and test mining, which

includes on-site tailings disposal on the seabed resulting in impacts on marine habitats and biota. The remaining mining infrastructure of Sonnberg Contractor Miners is another risk. Furthermore, the potential effect of terrestrial exploration on the sensitive biodiversity and habitat in ML44 is a potential high risk, due to the uncertainty of the locality of the proposed work coupled with the high sensitivity of the area in general.

1.5 Environmental management plan

The Environmental Management Plan has been updated and outlines overall environmental tasks, provides management actions for all high and significant impacts, describes rehabilitation activities and the required monitoring during operations and at closure.

1.6 Annex

The annex summarises the authors' credentials, presents all applicable legislation, provides an impact register, and a list of reviewed literature.

1.7 Report Review

This report was circulated to a list of stakeholders provided by Namdeb, and updated by advertising for registration of interested and affected parties in the press for two consecutive weeks. This document was circulated to the stakeholder list for a two-week window. The comments received and responses given are provided in Annex 4.

Namdeb is encouraged to communicate further with applicable stakeholders regarding targeted exploration sites as this information becomes available.

Chapter 2

Introduction

A series of Environmental Management Programme Reports linked to Namdeb's licence areas forms the backbone of Namdeb's Environmental Management System (EMS). This report is an update of the 2018 EMPR for ML44 (Bogenfels mining licence area). The update highlights some of the information from the previous report for reference purposes, and focusses on activities for the past period 2018-2021 (including a narrative of all rehabilitation activities over the years), and the planned period 2022-2025, with accompanying management strategies. The report will be submitted for the purposes of the Environmental Clearance Certificate (ECC) renewal, which expires in 2022.

2.1 Background

The backbone of Namdeb's environmental management is a series of comprehensive Environmental Management Programme Reports (EMPRs) linked to each of Namdeb's mining licence areas. These were compiled during 1995-1997 and updated in 2018. Management actions identified and described in these reports were supplemented by external Environmental Impact Assessments, Namdeb internal risk assessments and amendments to environmental assessments for altered projects. Research feeds into the assessment, which informs continuous improvement. The resulting management actions have been incorporated in an environmental management database which is the core tool of Namdeb's ISO 14001 certified Environmental Management System (EMS). Implementation of these actions lead to implementation, rehabilitation and continuous monitoring. This report will summarise actions for ML44 and specifically spell out the planned activities and accompanying management plans for the period 2022-2025.

2.2 Locality, legal and statutory requirements

Namdeb Diamond Corporation (Pty) Ltd mines alluvial diamonds in the Tsau//Khaeb National Park.

Namdeb currently holds four diamond mining licences on land and sea. Mining Licence (ML 44, also refer to as Bogenfels licence area) is a 25km wide terrestrial strip, but also includes a 5.5km narrow marine portion of shallow and midwater.

This EMPR update is a requirement of the Environmental Management Act (Act 7 of 2007). This and other relevant legal requirements to this report are provided in the 2018 EMPR and summarised in the updated EMP.

The Ministry of Environment and Tourism's Park Management Plan of 2021 zoned areas within the licence as managed resource use, development and infrastructure, special value and minimal disturbance area, resource protected area and strict nature reserve (Ministry of Environment, Forestry and Tourism 2020). Most of the area is also rated to have very high or high biodiversity importance, according to the Plan. The marine portion of ML44 falls into the Namibian Islands Marine Protected Area (Currie et al. 2009).

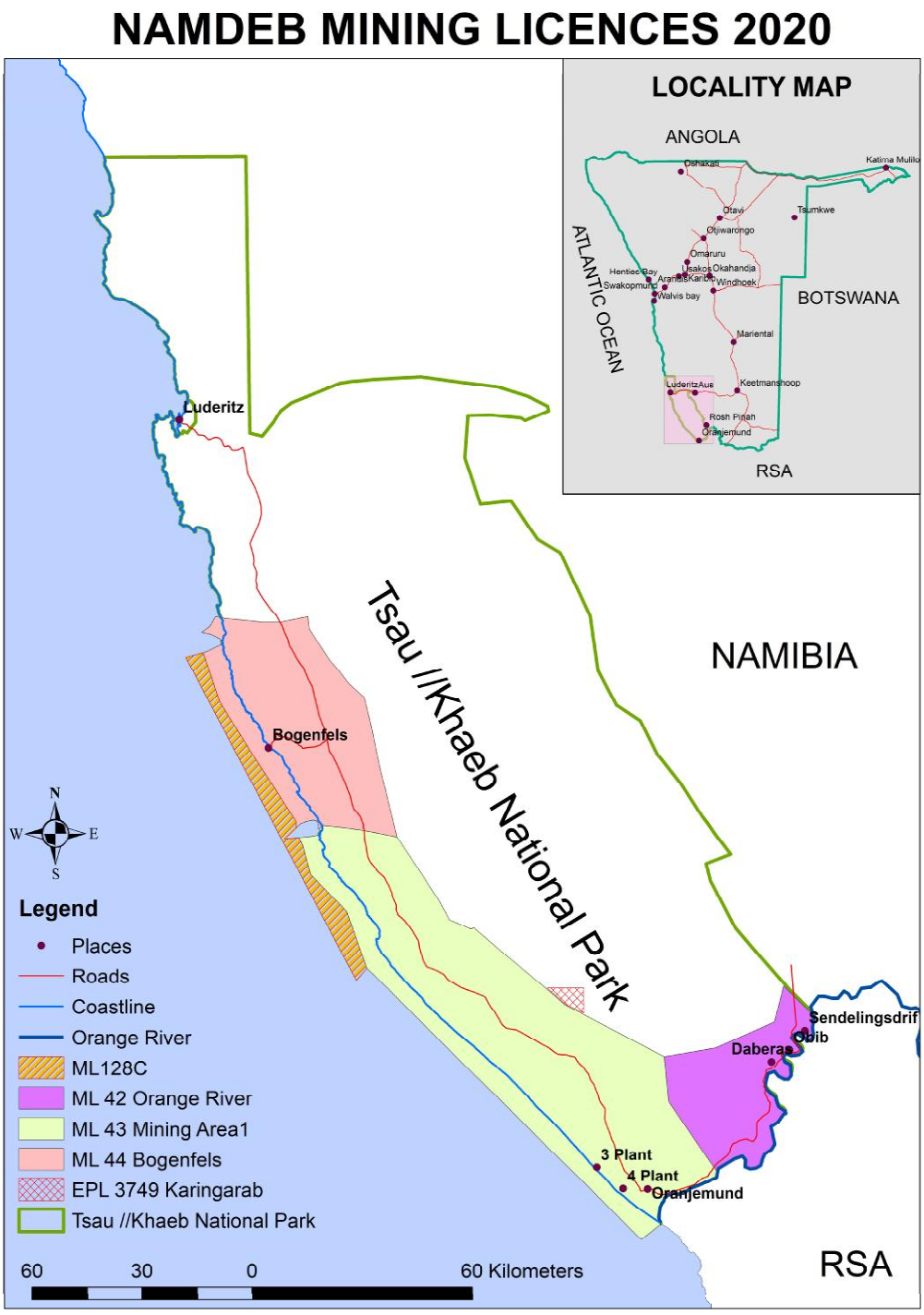


Figure 4: The position of Mining Licence 44 in Namibia and the Tsau//Khaeb National Park.

Chapter 3

Description of activities

Currently there is mining activitry in the Shallow Marine part of the concession ((-7 to -50 bmsl), being conducted by Shallow Marine (SM) Diver contractors.

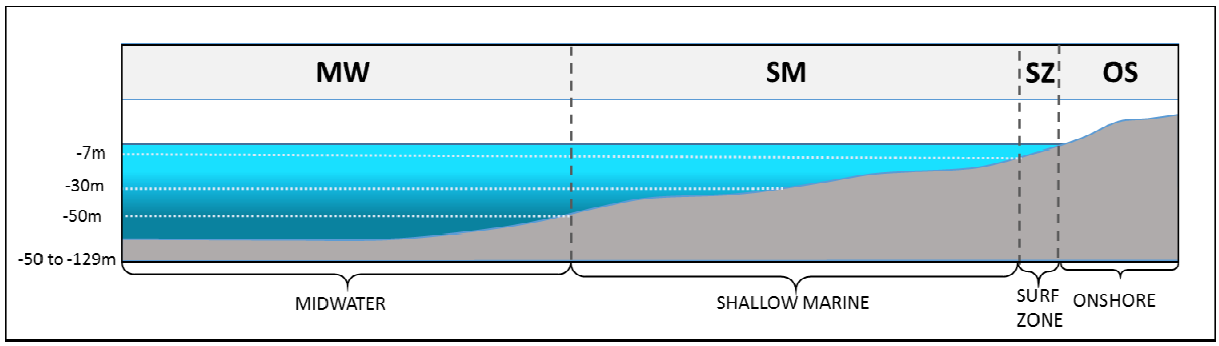
A sizeable diamond resource has been delineated in the shallow water portion (area deeper than 50m bmsl). A test mining campaign was completed in 2018 to define the geotechnical parameters and resource performance of the area. Further campaigns using the same or similar crawler technology will be conducted in the near future.

The last active on-shore mine site in ML44 was at Bogenfels, where mining stopped in 2011 and restoration completed in 2013. One last remaining pond formed during these works still exists, to monitor the biophysical parameters. Monitoring results indicate that the pond supports a healthy ecosystem. Restoration of Salsola beach hummocks is on-going.

Three stages in the mining life cycle currently apply in the Bogenfels licence area – exploration (including bulk sampling/ testing mining), marine mining and rehabilitation. The licence area holds three types of diamond deposits: (1) shallow surface deposits in deflation valleys, (2) pocket beach deposits (diamonds concentrated in south-facing j-bays) and (3) marine deposits. All these deposits, except the deflation valleys have been mined in the past.

3.1 Marine based mining and exploration

ML44 includes a marine portion in which exploration and remote mining operations take place. Figure 5 provides the standard classification used for off-shore mining activities.



Operation Depth (mbsl)	Operation Type
7m-25m	Diver Assisted
15m-35m	Shallow Water Remote Tool
35m-50m	Midwater Remote Tool

Figure 5: Marine water depth classification used in the EMPRs

Prior to 2018, and as reflected in the 2018 EMPR the Shallow Marine operations extended to 30mbsl. In 2018, Namdeb received exemption to extend the operations of the Shallow Marine operations from -30m to -50m. This is to facilitate the organic growth of the business from the Shallow Marine into the Midwater regions.

As mining operations in the midwater areas cannot proceed until economically viable accumulations of diamond-bearing gravel have been located with some certainty, Namdeb historically conducted a large-scale multibeam bathymetry survey over the entire mid-water area, followed by a geophysical survey. Following processing and interpretation of the geophysical data, a regional geological drilling campaign was undertaken beyond -30m depth (known as the Midwater at that stage, it now extends to -50m) in 2013. This opened up several new areas in the mid-water region where further sampling was targeted in 2015-2016. A testing mining campaign was completed in 2018 to define the geotechnical parameters and resource performance of the area.

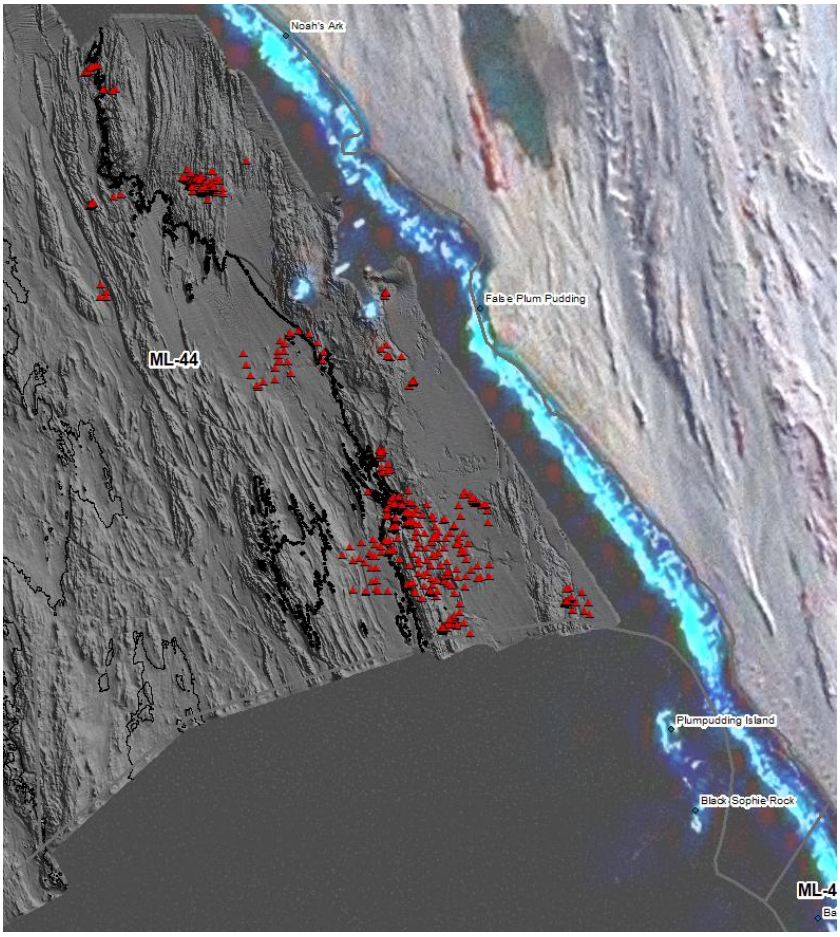


Figure 6: Existing sampling sites in ML44.

3.1.1 Midwater sampling and testing mining

The Midwater water area is to be sampled using a sampling vessel employing an airlift system deployed vertically to take single point samples (approximately 5m²) in size. The information from the samples will be used to compile a resource evaluation report. This report will be used to draw up a test mining programme

which would more than likely use a horizontal mining tool (i.e. crawler). The crawler system uses a dredge pump and/or airlift technology to transport the diamondiferous material from the seafloor to the deck of the vessel for processing. The non-diamondiferous material is released back into the sea and only the recovered diamonds are retained.

Figure 7: A typical mining vessel (left) and seabed crawler (right).

3.1.2 Shallow water mining

Currently there is mining activity in the nearshore part of the concession ((-7 to -50 bmsl), being conducted by Shallow Marine (SM) Diver contractors.

They use suction hoses and pumps, either operated by man or by remote operated vehicle (ROV).

A typical boat-based operation consists of a 14 - 18m vessel with a 6- to 8-man crew, of which 2 - 3 are divers. The duration of their activities are limited to daylight hours for 3 - 10 diving days per month. Divers, operating on surface air supplies equipped with underwater communications, guide the suction nozzles into gullies, potholes and basin areas to retrieve gravel. On board jig screens classify the material to a concentrate (-12 to +2mm size) with over- and undersize tailings discarded over board directly at the mining site. The concentrate is transported to the Contractor Treatment Facility (CTF) in Lüderitz for final diamond recovery.

Mining from smaller vessels is highly weather dependent and usually limited to no more than 21-days per month, or as dictated by weather windows. Mining rates are comparatively low, ranging from 100-500m^2 for a single diver-assisted mining vessel and averaging a total of ~500m^2/year for all diver-assisted operations in ML44. This equates to ~1,300t of sediment excavated annually per vessel, of which ~90% is released directly overboard at the mining site.

The SM Remote Tool Contractors, also active in this area, will use dredge pump, airlift suction technology connected to a riser hose system. This riser system will connect either a digging head, crawler or ROV mounted suction end to the

processing system onboard. The material is processed onboard and only the diamonds will be transferred to Lüderitz.

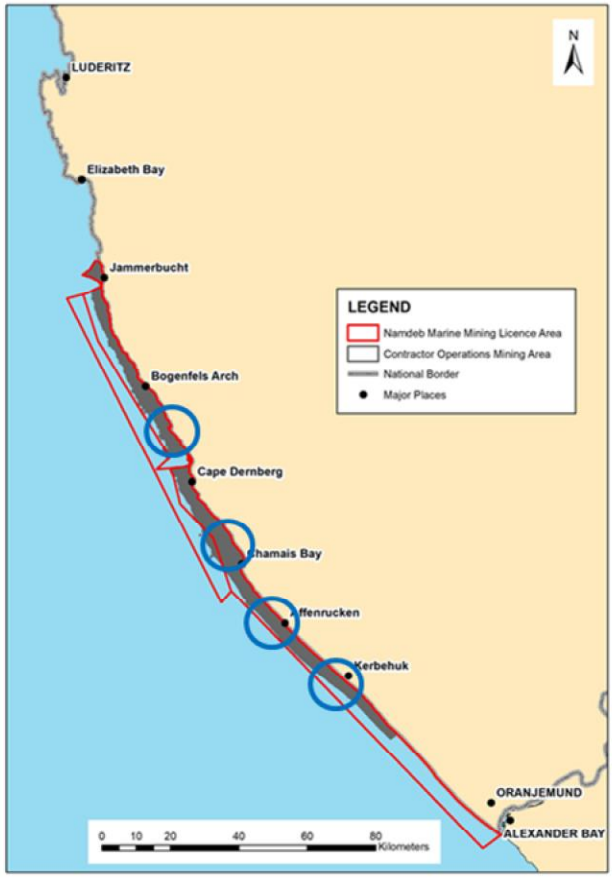


Figure 8: **Current production nodes (blue circles) in the contractors operations mining area**

3.2 Terrestrial (land-based) mining and exploration

3.2.1 Historic terrestrial Mining

No terrestrial mining currently takes place in the Bogenfels licence area, but the area had been mined repeatedly in the past almost since the discovery of diamonds in the "Sperrgebiet". The "Deutsche Diamanten-Gesellschaft mbH" started mining in the Bogenfels area in 1911 which continued intermittently until 1981. The mining of deflation deposits and German worked-out areas started in 1990 and eventually resulted in the mining of the pocket beaches site 11 and 12 at Bogenfels during 2007-2011. Infrastructure removal, pollution clean-up and landscape rehabilitation continued until 2013 and biodiversity restoration was completed. Results from the 2020 vegetation (biodiversity restoration) monitoring programme and as reported in the Biodiversity Action Plan (2021), show that even if the closure criteria are not yet fully met, the programme was successful. Monitoring, however will need to be done and the programme kept in line with the broader Biodiversity Action Plan for Namdeb.

Figure 9: The dredge in the pond area towards the end of the historical mining activities at Bogenfels – this has since all been removed and only one pond however currently remains after rehabilitation .

In the past shore-based, small-scale mining was undertaken by contractors in the beach area and valleys close to the beach (Diaz Point Exploration, Yam Diamond Recovery) and in the Pomona area (Sonnberg Diamante). Sonnberg's operations stopped in 2013.

3.2.2 Terrestrial exploration

ML44 contains diamond deflation deposits as well as pocket beach marine deposits. Although not high priority targets at this stage the long term strategy is to develop these diamond deposits further. Exploration on the pocket beaches will be conducted using drilling and sampling as well as probe drilling. The large diameter drilling operation will consist of a drill, a drilling additive mixing plant, a front end loader, a dump truck and a crane truck.

The drilling operation will be manned by a maximum of 14 crew members and transported using 2 LDVs and one 16-seater bus. Shipping containers for an office, tearoom, storeroom, elementary workshop and ablution will be erected.

Samples will be treated at the sampling plants within Southern Coastal Mines (SCM,M43) and will be trammed to the plants by making use of highway trucks.

The probe drilling operation will consist of 7 crew members operating a probe drill (sonic drilling, RC drilling or aircore drilling), and two support trucks. F

Furthermore, both airborne and ground geophysics will be employed to enhance the regional geological model. Airborne geophysical surveys will be conducted by airplane taking off and landing at the Oranjemund Airport.

Ground geophysics will be conducted by a field team of maximum 15 staff using a maximum of 4 LDVs.

Apart from the diamond targets ML44 remains very prospective for non-diamond commodities such as (but not limited to) base metals. Exploration for non-diamond commodities will include:

- **Geological mapping. Mapping will be done by a team not exceeding 3 staff making use of 2 LDVs**
- **Grab and stream sampling. Relative small samples (~1-3kg per sample) are collected by hand and shipped to designated laboratories for processing and chemical assays. A sample collection team is not expected to exceed 4 staff and 2 LDVs**
- **Ground truthing of geophysical and remote sensing data and findings. This activity will be conducted by a team not exceeding 3 staff making use of 2 LDVs**
- **Airborne and ground geophysical surveys as described above.**
- **Reverse circulation (RC) and/or diamond core (DD) drilling. Each drilling rig will require ~7 crew members, a support truck and 3 LDVs. The RC drilling operation might also require a booster compressor depending of hole depths and ground conditions.**
- **Downhole geophysical surveying of drill holes. The geophysical crew will consist of 2 crew members and a LDV with probes and survey equipment.**
- **Sediment movement studies. These studies will entail monitoring equipment and 3-4 geoscientists using 2-3 LDVs.**
- **Rehabilitation monitoring conducted by 2-3 scientific personnel using 2 LDVs**

Accommodation for all activities will be at established facilities such as the Pink House at Bogenfels or Fort Reef at Chamais. For more remote areas temporary camps will be established according to Namdeb's policies and procedures. Strict track disciplined and environmental protocols will be employed at all times.

The specific localities for drilling can only be determined following the above exploration efforts. Impacts and mitigation therefore needs to be identified once drilling sites have been identified.

3.3 Infrastructure and services

Gravel roads, tracks, fibre optic and power lines pass through the licence area. These provide the main service links between Oranjemund and the operations at Elizabeth Bay (now owned by Sperrgebiet Diamond Mining).

A fibre optic link was established to Bogenfels during the mining operations. It has however become redundant and has been removed. Six poles could not be removed due to moving dunes and therefore remain. Should these poles become exposed, they will be removed.

The marine vessel is serviced in Lüderitz harbour and no land base is therefore necessary.

3.4 Existing disturbances and historic infrastructure

The EMPR and its update covers an area with over 80 years of various phases of exploration and mining since the discovery of diamonds in the "Sperrgebiet". Past mining targeted shallow extensive deflation deposits in valleys and the area around Bogenfels itself has been extensively mined, leaving in many parts an altered landscape with bare valley floors and small hummock-like tailings heaps, as well as larger tailings dumps in various places. These areas show various

stages of natural recovery, except where more recent contractor mining has disturbed these areas again.

The historic structures remaining are of tremendous importance to cultural heritage. The two most important sites are the historic mining villages at Pomona and Bogenfels. There is a concentration of historic artifacts at these two sites, but there are also numerous sites with individual structures which illustrate Namibia's diamond mining history. Namdeb currently maintains the old clinic at Bogenfels (Pink House) and had in the past renovated the old manager's house at Pomona. All other infrastructure is left untouched.

Figure 10: Small tailings heaps remain in many valleys around Bogenfels which were mined in the early 1920s. Natural vegetation has re-established and the altered landscape is now of historic value as a symbol of industrial heritage (Photo: Antje Bourke).

3.5 Demolition and Rehabilitation

The Demolition and Landscape Report (2021) identifies structures to be potentially demolished from the past activities by Sonnberg Contractors (Figure 11). These include the contractor's camp, treatment plant, Bogenfels satellite, accommodation buildings and linear infrastructure.

The report states that all the modern infrastructure at the camp and plant site will be removed. Some brick and steel structures may have been on site prior to the Sonnberg operations and could be historic. This requires further investigation to finalise the demolition schedule.

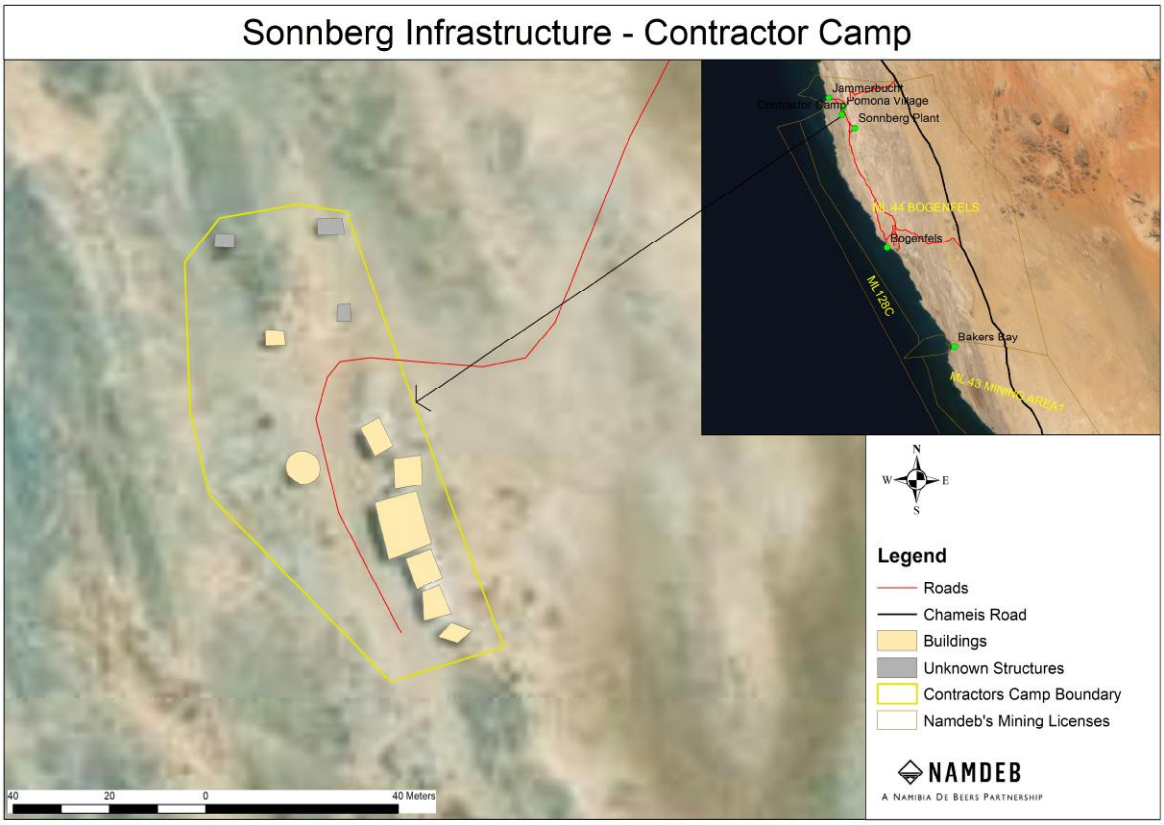


Figure 11: Buildings to be removed at Sonnberg Contractors camp.

Rehabilitation tasks (Figure 12) included the removal of containers, caravans, tyres, scrap metal and other industrial waste. Oil in drums also need to be removed. The rehabilitation of concrete foundations of the fuel station and plant area still need to be confirmed. There are no disposal sites near Oranjemund if these are to be demolished and as they reach up to 1.5m above ground, covering them with sand will be problematic. This issue is to be discussed with stakeholders.

The tailings dumps at the contractor site near Pomona have largely been shaped and show reasonable plant cover. Only one area on the dumps needs some landscaping. There are also small heaps and areas disturbed by infrastructure that require levelling. The report recommends that these tasks be done manually. With a small task force.

Although the pond at pocket beaches site 11/12 was discussed among stakeholders and it was decided to keep it and monitor its ecological progress, the formal decision to keep it still needs to be confirmed with MEFT.

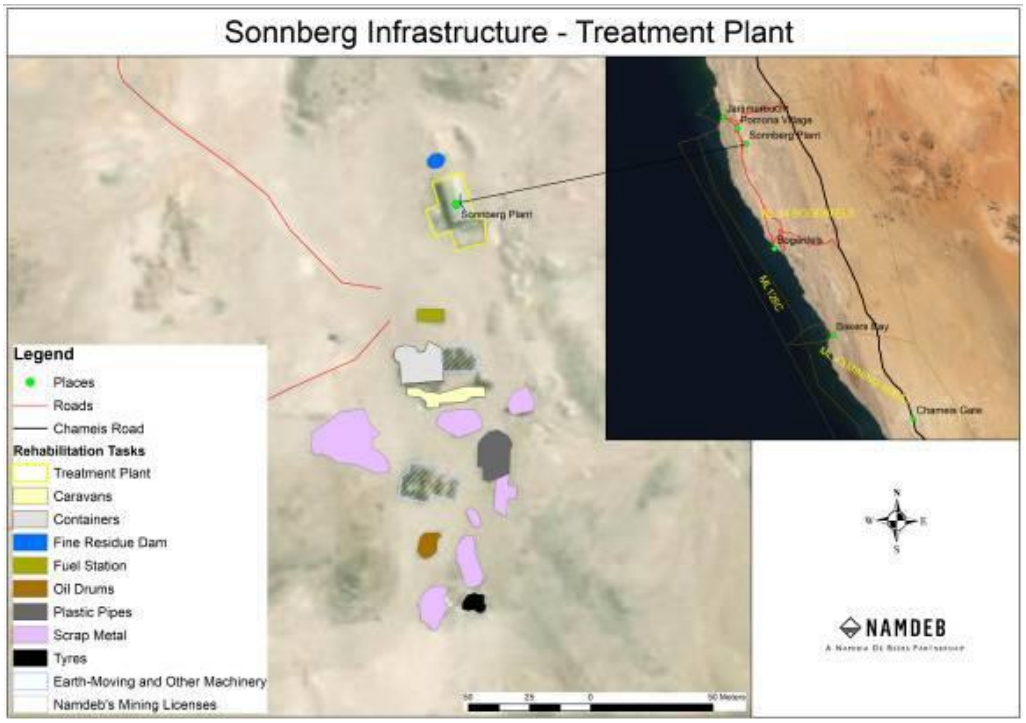


Figure 12: Sonnberg rehabilitation tasks (Demolition and Landscaping Report, 2021)

3.6 Rehabilitation

3.6.1 Infrastructure removal

Demolition and removal of infrastructure started in December 2011 and was concluded in December 2013.

Figure 13: The accommodtion camp before (top) and after (bottom) rehabilitation (Photos: Julien Cloete, Namdeb).

As all new accommodation facilities were mobile, only the conference building remained at the accommodation site, which was in existence before mining started. All mining structures, auxiliary facilities and equipment were also removed.

Figure 14: The mine site at Bogenfels with infrastructure still in place towards the end of operations (top) and once infrastructure had been removed (bottom) (Photos: Julien Cloete, Namdeb, 2013).

3.6.2 Landscape rehabilitation

Upon the completion of mining (and ceasing of pumping) the mine voids filled up to sea level and created ponds. To fulfil the commitments of the EMP for mining in the vicinity of the rock arch, most mine voids were backfilled to eliminate all signs of mining.

However, one pond remains and it has been agreed with Ministry of Environment, Forestry and Tourism that the newly created ecosystem will be monitored at present to establish the impact on marine and coastal biota. The decision to keep and monitor the pond was based on the fact that a number of different fish species had colonised the pond and it supports birdlife. Also the pond filled in naturally to a point where it resembled a natural-looking pond rather than a mining pond. Natural ponds occur occasionally along this coastline. Monitoring parameters include accretion, water level and depth, water quality and bird and fish surveys.

Figure 15: Large volumes of sand had to be moved to backfill the mine voids (top). Completely backfilled pond (bottom left) and remaining pond (bottom right) (Photos: Julien Cloete, Namdeb).

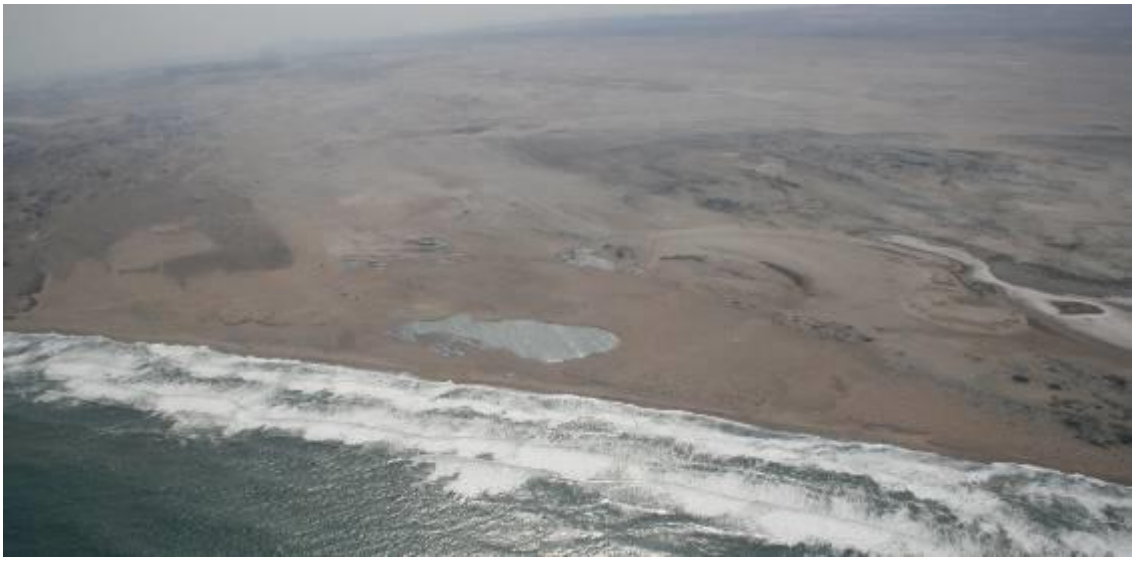


Figure 16: The remaining pond at Bogenfels (Photo: 2018 EMPR)

3.6.3 Pollution clean-up

All hydrocarbon contaminated soil followed a process of bioremediation and met the Total Petroleum Hydrocarbon (TPH) testing criteria before it was disposed into the environment. All industrial waste and scrap was removed from the area.

3.6.4 Biodiversity restoration

Restoration of *Salsola nollothensis* beach hummocks, the most sensitive vegetation that was affected by mining site 11/12, was finalised in 2018. This project was undertaken in collaboration with the Millennium Seed Bank Project of Kew Royal Botanic Gardens, UK, and Kew's local counterpart, the National Botanical Research Institute in Windhoek. Approximately 700 plants had been transplanted on rehabilitated sites (Katjirua 2016). Survival and establishment of the transplants was variable and likely affected by habitat (Lubke 2017), climatic parameters and logistic constraints (H. Kolberg, pers.comm., Oct. 2018). A review by a coastal restoration expert in 2017 regarded the programme as overall successful (Lubke 2017).

In the Biodiversity Action Plan (Pulfrich A, 2021), the restoration work is also described as being successful. Draft closure criteria are provided for biodiversity. The criteria are called "draft", meaning they need to be tested against results from monitoring. Ongoing monitoring will integrate these criteria going forward to attain successful closure.

Table 1: Applicable draft closure criteria (Biodiversity Action Plan, 2021)

	Criteria
Actively re-vegetated areas	• ≥ 30% of plant cover of undisturbed natural vegetation in surrounding • ≥ 75% of plant species richness of undisturbed natural vegetation in surrounding • ≥ 30% of re-established species are perennials • No invasive alien plants
Re-establishment of target species	• ≥ 50% survival of re-established target species on area to be re-planted

These values need to be achieved in at least three consecutive monitoring periods before the site can be proclaimed having achieved completion.

Restoration monitoring of rehabilitated and recovering areas has been undertaken since 2007, but no evaluation against the proposed draft closure criteria has yet taken place. The Biodiversity Action Plan makes the following recommendations:

- ***"Obtain weather data for restoration sties, continue monitoring and evaluate results against closure criteria and in the context of climate conditions***
- ***Evaluate restoration monitoring and adapt management accordingly***
- ***Intensity data collection on vegetation monitoring during favourable seasons (average rainfall or more)".***

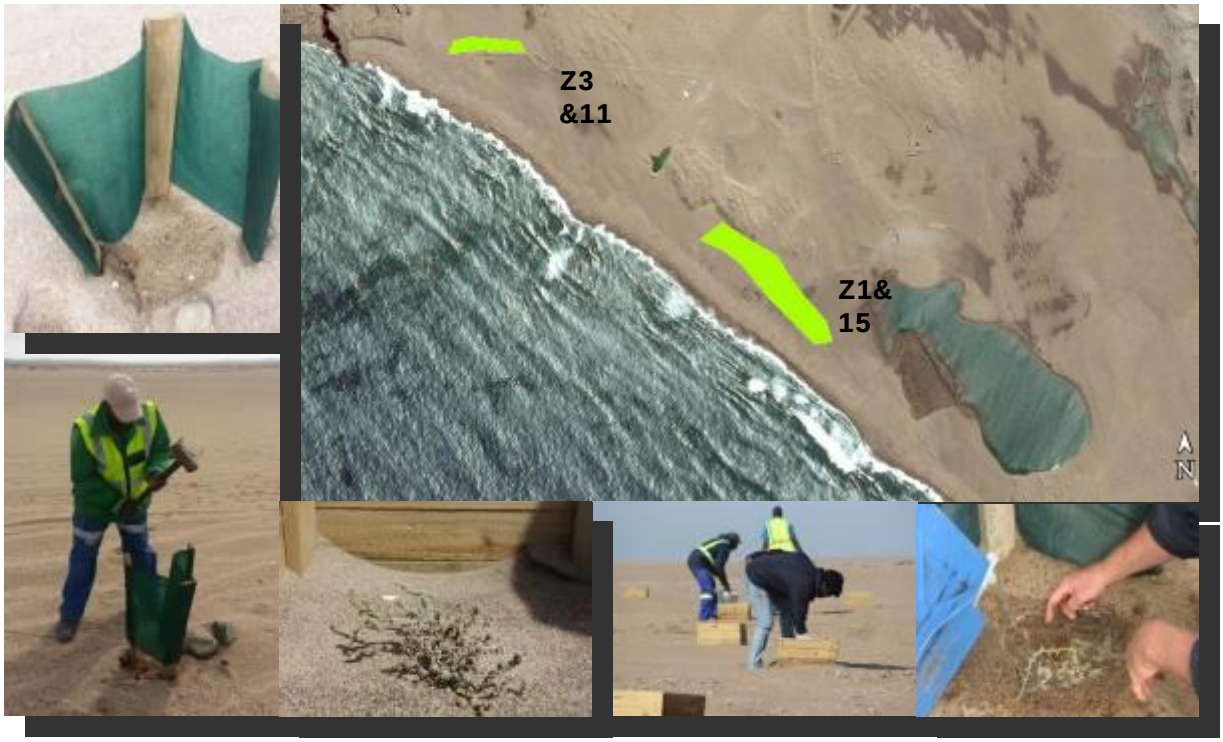


Figure 17: Transplanted areas (green – Z3&11 and Z1&15) and transplanting activities at Bogenfels (Photos: Julien Cloete, Namdeb).

Recovery within the highly dynamic shallow water area occurs rapidly and naturally (Pulfrich & Penney 2001; Pulfrich et al. 2003). Annual monitoring of the coastal marine ecosystems has been underway since 2004 providing a detailed long term data set. Rocky shores were assessed as being fully recovered from mining impacts in 2013, with full recovery of beach macrofaunal communities and the indicator species *Tylos granulatus* achieved in 2015. This process ws undertaken making use of independent service providers and supervised by the Marine Safety Advisory Council (MSCA).

Chapter 4

The natural environment in ML44

The licence area is positioned in the southern Namib Desert, which comprises parts of the Desert - and Succulent Karoo Biomes. The Succulent Karoo Biome is a global biodiversity hotspot (Myers et al. 2000) and managing impacts on biodiversity is therefore critical. Overall, the southern Namib coastline has been identified as environmentally sensitive because of abundance of bird breeding sites, seal colonies and associated predators, such as brown hyena. The Bogenfels licence area is also a hotspot of plant endemism within the -Tsau //Khaeb National Park.

The marine environment shaped by coastal, wind-induced upwelling with cold surface waters, high biological productivity, highly variable physical, chemical and biological conditions. Marine communities are largely ubiquitous throughout the southern African West Coast region, being particular only to substrate type or depth zone. They consist of many hundreds of species often displaying much temporal and spatial variability. The coastline is characterised by variable coastal landforms. Pocket Beaches are separated by rocky outcrops, headlands and coastal cliffs, with offshore reefs and islands being common. Coastline exposed to strong wave action, facing directly into the prevailing swells.

In more detail, environmentally sensitive areas in the Bogenfels mining area are:

- **Coastal dune hummocks,**
- **Rocky outcrops (particularly dolomite outcrops) and vegetated sand and gravel plains,**
- **Bird breeding sites,**
- **Large valleys serving as wildlife corridors,**
- **Rocky shores, subtidal reefs and sandy beaches,**
- **Kelp beds,**
- **Historic and archaeological sites and**
- **Sites of Special Scientific Interest (SSSI's, fossil and geological sites).**

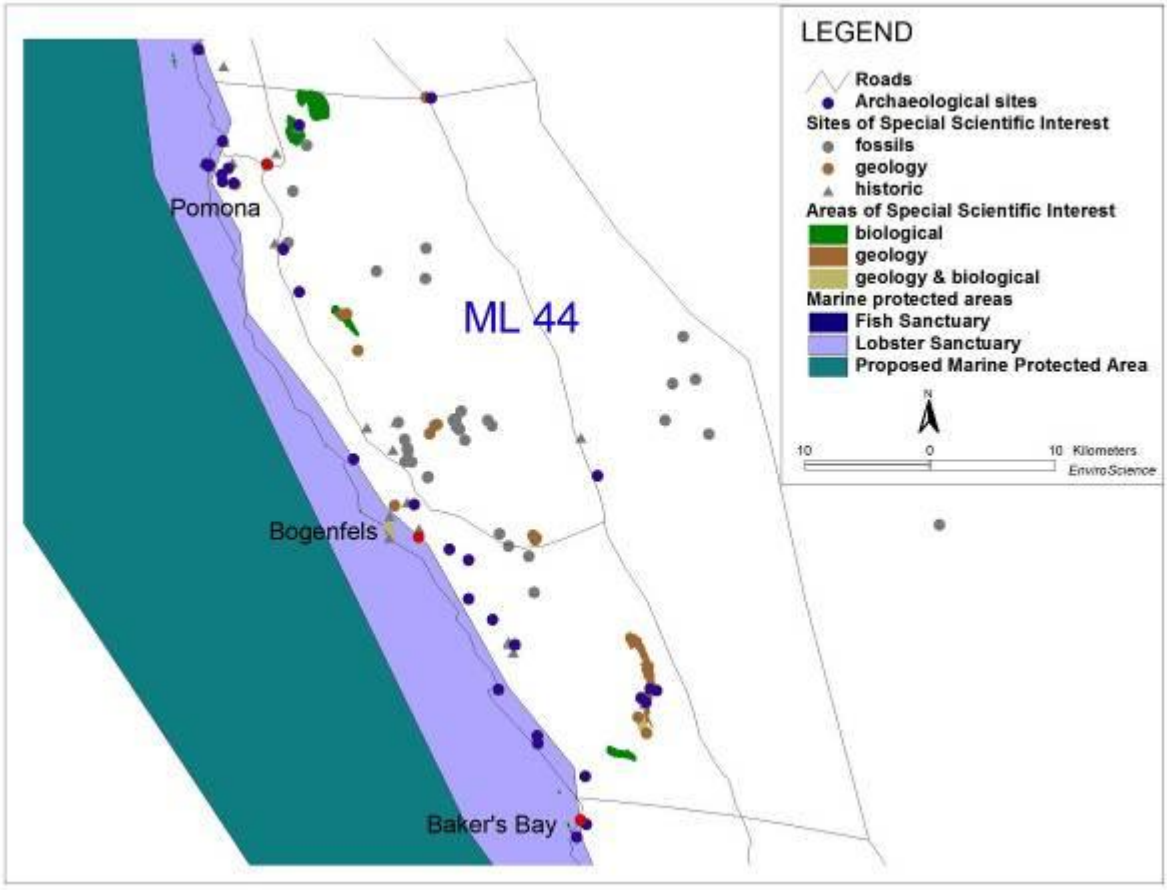


Figure 18: Environmentally sensitive sites and areas in ML44.

The biophysical conditions of ML44 are described in detail in the 2018 EMPR but is summarised in Table 2 below.

Table 2: Salient biophysical characteristics of ML44

Characteristic	Description
Climate	• Transitional area between the Desert and the Succulent Karoo Biomes. • Annual mean rainfall 16.4mm at Lüderitz. • Regular fog (between 50-75 days per year in the Lüderitz area). • Year-round strong, southerly winds (77% frequency in summer, 57% in winter, with very high velocities). • Mean annual temperate of 16°C at Lüderitz.
Geology geomorphology, paleontology	• Oldest metasedimentary rocks of the Namaqua Metamorphic Complex exposed as rocky outcrops in a narrow strip along the northern section of the coastline. • Younger rocks of the Gariep group (900-570 Ma), mainly dolomite and limestone, cover most of the remainder of the licence area. • Igneous complexes of the post-Gondwana break-up are presented by Schwarzer Berg at the northern border of the licence area, Signalberg near Pomona and Granitberg north of Bogenfels (Miller 2008). • Fossil sites in the area preserved from river drainage from the early Tertiary period. ML44 has the densest concentration of fossil sites along the Namib coast.

Characteristic	Description
	• Ancient shorelines preserved from 42-42Ma in areas around Bogenfels and Buntfeldschuh. • Diamond deposition started 56Ma with transportation from the Orange River and deposition on beaches, exposed when sea levels dropped. Diamonds were exposed and concentrated in deflation valleys when strong winds "screened"" the diamonds. Other deposits are the south-facing j-bays (pocket beaches). • Over 50 Sites of Special Scientific Interest have been identified, largely related to important fossil finds and characteristic diamond deposition sites
Landforms, soils and hydrology	• Mobile dunes, coastal dune hummocks, salt pans and gravel and sand plains are characteristic landforms in the licence area, intercepted by sandy and windswept valleys, shallow dry river courses and rocky outcrops and ridges, predominantly trending SW-NE. These continue out to sea as submarine edges, islands, exposed rocks and headlands. • Littoral sands along the coast and calcareous, sandy or gravelly soils are characteristic further inland.
Vegetation	• Characterised by a fog-dependent flora adapted to endure strong winds and sand-blasting conditions. Low succulent shrubs are dominant. • The Five main vegetation types are: Baker's Bay coastal dwarf shrubland (various protected species, very high conservation importance) and coastal Pelargonium dwarf shrubland along the coast (various protected species, very high conservation importance) and Grillental corridor shrubland (over 160 species recorded, very high conservation importance), western Klinghardt plain shrubland (higher vegetation cover than the coastal shrubland, with two Euphorbia species, high conservation importance) and Othonna dwarf shrubland in the inland areas (all southern namib endemics occur here, very high conversation importance). • Plant endemism in ML44 is high and many of the species occur only the Namdeb licence areas. • Plant species restricted to Namdeb's licence areas occurring in the Bogenfels licence are: *Frankenia pomonensis, Limonium dyeri, Lithops optica, Marlothiella gummifera, Namibia cinerea, Othonna clavifolia and Synaptophyllum juttae.*
Invertebrates	• Information scanty, but a high level of invertebrate endemism expected.
Reptiles and amphibians	• Several species associated with the coastal hummocks are of national conservation importance
Mammals	• Over 45 mammals species recorded in the Tsau//Khaeb National Park. • While antelopes and scavenging animals such as hyena and jackal migrate within a large territory, Cape fur seals (*Arctocephalus pusillus*) have established a colony onshore at Lion's Head near Baker's Bay at the southern border of the licence area. Because of dwindling numbers brown hyenas have been classified as vulnerable in Namibia. • The seal colony at Lion's Head presents a focal point of animal activity. Jackals and hyena are drawn to this important food source and frequently travel between Lion's Head and the freshwater seeps north-east of Baker's Bay. • Larger valleys terminating at the coast provide important animal corridors.
Birds	• Coastal and pelagic seabirds are an important wildlife component in this area. • Protected nesting and breeding sites in the licence area are

Characteristic	Description
	provided on Sinclair, Plumpudding, False plumpudding, Black rock and Pomona islands. • Most breeding species are listed Red Data species in Namibia. • Whitefronted Plovers (Charadrius marginatus) breed along the entire coast, usually in hummocks. • Other red-listed birds recorded in the licence area, but not necessarily breeding.

Figure 19: Sand plains with dwarf succulent shrubs are the typical habitats affected by land-based mining in ML44

Figure 20: *Pelargonium sibthorpiifolium* (left) and *Fenestraria rhopalophylla* (right) are near-endemics)Photo's: 2018 EMPR)

4.1 Marine environment

Table 3 below is a summary of the marine environmental features of ML44.

Table 3: Marine environmental characteristics

Feature	Description
Benguela current and the Lüderitz upwelling cell	• Environment shaped by coastal, wind-induced upwelling with cold surface waters, high biological productivity, highly variable physical, chemical and biological conditions. • The Lüderitz upwelling cell is the most intense upwelling cell in the Benguela. • Marine communities are largely ubiquitous throughout the southern African West Coast region, being particular only to substrate type or depth zone. They consist of many hundreds of species often displaying much temporal and spatial variability.
Landforms	• The coastline characterised by variable coastal landforms. • Pocket Beaches are separated by rocky outcrops, headlands and coastal cliffs, with offshore reefs and islands being common. • Coastline exposed to strong wave action, facing directly into the prevailing swells.
Macrobenthos	• Rocky intertidal habitats characterised by sand tolerant species. • The communities low on the shore are typically dominated by foliose algae, interspersed by limpets and whelks. • Filter feeders and the reef-building polychaete are common in some areas. • Further up in the mid-shore zone, *M. galloprovincialis* and *G. capensis* are the dominant space occupiers, together with *Scutellastra granularis* and occasionally the Cape false limpet *Siphonaria capensis*. Foliose algae characterising the mid-shore are dominated by *Mazzaella (=Iridea) capensis* and *Ulva* sp. • The mostly barren high-shore is characterized by the tiny snail *Afrolittorina (=Littorina) knysnaensis* and the opportunistic red alga *Porphyra capensis*. • The supralittoral zone, situated above high water spring tide mark, is characterised by a mixture of air-breathing terrestrial and semi-terrestrial invertebrates, most often associated with, and feeding on deposited kelp wrack.
Beaches	• Extremely dynamic with high wave energy, narrow and steep beach faces, course sands, harbouring an impoverished fauna. Beach zonation with typical species presented in Figure 22. • The abundance and diversity of surf-zone fish off the highly exposed beaches is very low.
Subtidal habitats	• In ML44 dominated by kelp beds which play a major role in dissipating wave energy, thereby creating semi-exposed habitats for a wide diversity of both marine flora and fauna. • Understorey algae provide both food and shelter for predators, grazers and filter-feeders associated with the kelp bed ecosystem. • These plants and animals all have specialised habitat and niche requirements, and together form complex communities with highly inter-related food webs. • Sublittoral Invertebrate fauna dominated by suspension and filter feeders, such as the ribbed mussel *Aulacomya atra* and Cape Reef worm *Gunnarea gaimardi*, a variety of sponges, and sea cucumbers. The dominant grazer is the sea urchin *Parechinus angulosus*. Key predators include the commercially important rock lobster *Jasus lalandii*, various isopods, echinoderms (starfish, feather and brittle stars), and gastropods (*Nucella* spp. and *Burnupena* spp.). • Further offshore community composition is largely determined by seabed type (i.e. unconsolidated sediments vs. reefs). The macrofauna on sand include seapens (*Virgularia schultzei*), sand-

Feature	Description
	crabs (*Ovalipes trimaculatus*) and plough shells (*Bullia laevissima*), whereas reefs are dominated by the urchin *Parechinus angulosus*, lamp shells (primarily *Discinisca tenuis*), the ribbed mussel Aulacomya ater, and a range of red algae, encrusting sponges, tunicates and bryozoans.
Benthic communities	• Structure and composition of benthic communities in unconsolidated sediments off southern Namibia is primarily a function of water depth and sediment grain size. • In general, species diversity, abundance and biomass increase from the shore to 80m depth, with communities being characterised equally by polychaetes, crustaceans and molluscs. Further offshore to 120m depth, the midshelf mudbelt is a particularly rich benthic habitat where biomass can attain 60g/m^2 dry weight. Outside of this rich zone biomass declines again.

Figure 21: Typical rocky intertidal communities along the coast of ML44 (left) the diverse subtidal communities associated with kelp (*Laminaria pallida*) (right) (left photo: Pisces; right photo: Kolette Grobler).

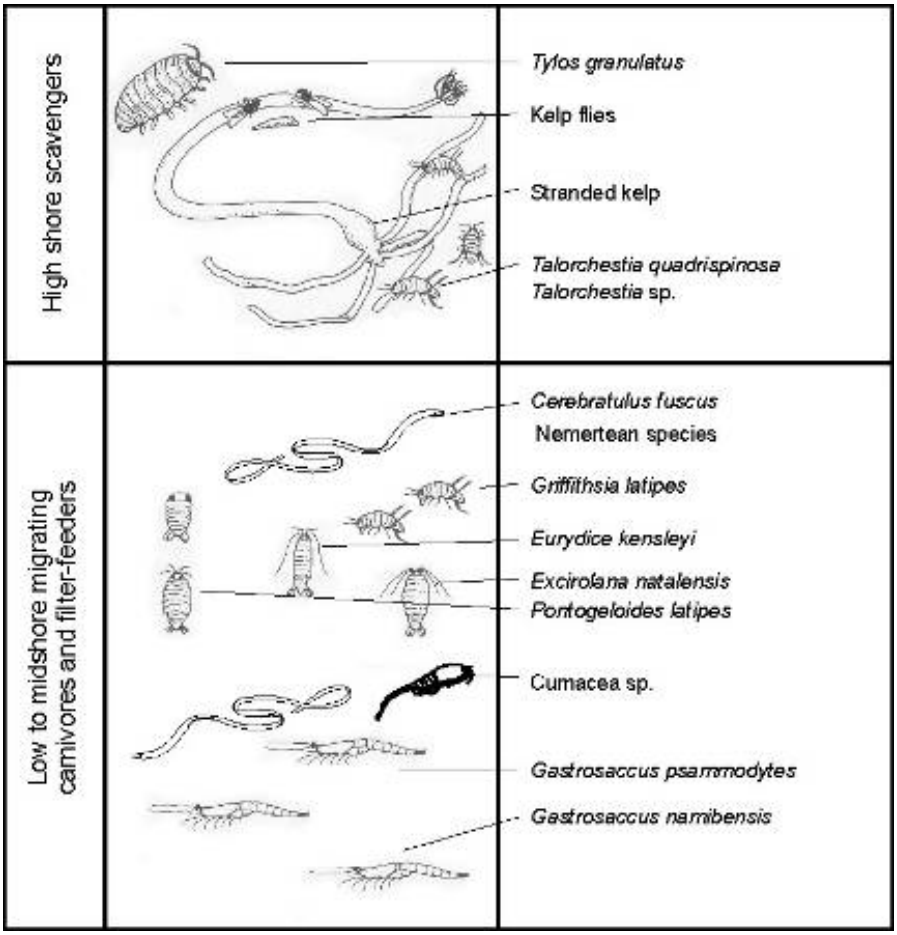


Figure 22: Schematic representation of the West Coast intertidal beach zonation (adapted from Branch & Branch 1981 for the EMPR, 2018). Species commonly occurring on ML44 beaches are listed (Pisces 2011).

Figure 23: The benthic communities typical of the reefs in 10-30 m depth off Bogenfels Arch: at Bogenfels (left): urchins, holothurian and ribbed mussels with pink crustose coralline algae, at Dreimaster Bay (right): lacy bryozoan (centre), holothurian, urchin, ribbed mussel with crustose coralline algae (Photos Pisces).

Chapter 5

The socio-economic environment

Namdeb's overall contribution to the Namibian economy is substantial, with additional major positive spin-offs for secondary industries such as suppliers, service providers and contractors, a large part from the Karas region.

Many sites of historic importance occur in the Bogenfels mining licence. Namdeb's operations are prolonged to a ensure an extended life-of-mine, but simultaneously the area is being prepared for access to tourism and other diversified land uses, in consultation with key stakeholders.

This section provides an overview of the Bogenfels socio-economic environment, by way of pointing out key features from the 2018 EMPR, supplemented with trends that occurred since its release.

There are currently no mining operations in ML 44, with no staff or contractors employed to that end.

The Ministry of Environment and Tourism's Park Management Plan of 2020 zoned areas within the licence as managed resource, development and infrastructure, special value and minimal disturbance area, resource protected area and strict nature reserve (Ministry of Environment, Forestry and Tourism 2021).

Initial growth projections for the mining industry in 2020 stood at 11.1%. However, the preliminary National Accounts, released by the Namibia Statistics Agency, show that the industry recorded a negative growth rate of 14.5%. This was a further contraction from the negative growth rate of 9.5% posted in 2019.
The demand for diamonds plummeted as a result of the pandemic. Reduced salaries and wages meant that consumers changed their spending patterns away from luxury goods to essential items. Sight holder sales were concluded with excess supply, creating an overflow in the diamond value chain. Rough diamond sales were also negatively impacted by frequent closures of major diamond cutting and polishing factories in India, and the major trading center in Belgium. This resulted in bottlenecks along the entire value chain, causing diamond mining operations to curtail production.

In the second half of 2020, a slowing rate of COVID-19 infections, rapid vaccine developments and improved health infrastructure and capacity, led to a gradual lifting of restrictions and easing of lockdown measures. Global trading thus resumed, along with normal commercial activity, and this propelled the recovery of some economies, particularly in China. In the IMF's latest April World Economic Outlook, it revised global growth upwards to - 3.3 %, resulting from a quicker recovery, a surge in oil and base metals prices towards the end of 2020, as well as supportive financial conditions and fiscal policies, and improving financial markets.

TTable 4 provides key socio-economic events for Namdeb from 2018-2020.

Table 4: Socio-economic highlights and events from the 2018-2020 Namdeb Annual Reviews (in Chamber of Mines Namibia, 2018-2020)

	2018	2019	2020
Highlights	• Wins "Gender is my agenda" award, and inter-safety competition • Five new mining faces at Southern Coastal operations • Orange River Mines exceed production targets	• Commencement of Sale of Elizabeth Bay • Commencement of property sale in Oranjemund, previously owned by Namdeb • Good production year	• Covid-19 Pandemic response • Sale of the Elizabeth Bay mine handed over to Sperrgebiet Diamond Diamond Mining (SDM). • Closure envisaged in business plan from closure in 2020 to 2038
Output	• 571,847carats	• 407,986 carats	• 322,376 carats
Employees	• Permanent 1533 • Temporary 42 • Contractors 726 • Expatriate 15 • Expenditure training and skills development N$ 7.91 million	• Permanent 1339 • Temporary 37 • Contractors 964 • Expatriate 10 • Expenditure training and skills development N$ 8.8 million •	• Permanent 1394 • Temporary 45 • Contractors 963 • Expatriate 10 • Expenditure training and skills development N$ 9.55 million •
Financial	• Total procurement spent N$ 2.71 billion • Total local procurement spent N$ 2.27 billion	• Total procurement spent N$ 2.132 billion • Total local procurement spent N$ 1.68 billion	• Total procurement spent N$ 1.84 billion • Total local procurement spent N$ 1.50 billion

5.1 Human resources

Namdeb still provides the benefits to its employees as offered during the 2018 EMPR. Most employees are members of the Mines Worker's Union and there is a grievance mechanism and stakeholder engagement plan in place. Employees benefit from Namdeb technical and non-technical training programmes.

5.2 Land use

The Bogenfels mining licence falls into the Tsau//Khaeb National Park and all IUCN zoning categories apply in the licence area. Bogenfels (rock arch) is zoned as National Monument, Baker's Bay and van Rheenen Bay as habitat/species management areas, the Grillental dolomite outcrops as strict nature reserve, the coastal areas as managed resource protected area (in case of mining rehabilitation is conditional), and the remainder as national park and wilderness (MET 2013, again presented in the update MEFT, 2020). The entire stretch of coastline in ML44 is part of a marine protected area and lobster sanctuary. At present only mining and limited tourism (day trips from Lüderitz to Bogenfels and Pomona) take place.

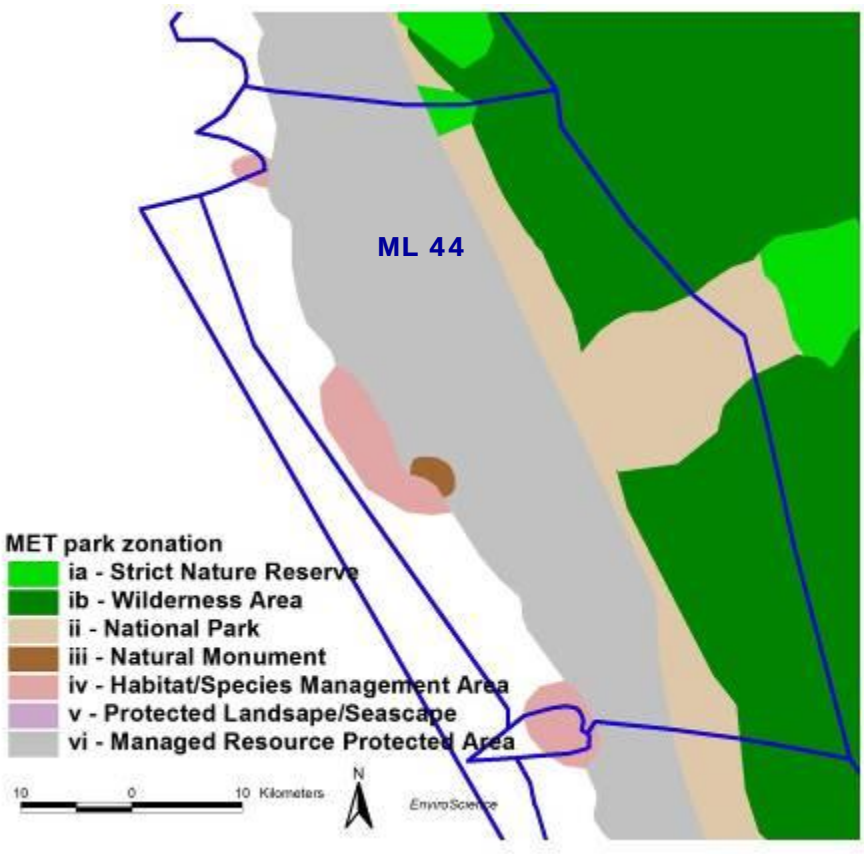


Figure 24: Zoning of the Tsau//Khaeb (Sperrgebiet) National Park in mining licence 44 (Ministry of Tourism 2013).

The 2020 MEFT Park Management Plan places great emphasis on tourism development of the area. The Bogenfels licence falls within the Coastal and Mining History Tourism Development Area (TDA) and Oranjemund Coastal and History TDA. Grullental, Pomona and Bogenfels are of particular interest and are planned for inclusion in the concessions for the area.

5.3 Cultural heritage

Artefacts of human occupation have been dated up to 300,000 years ago in the Sperrgebiet and people have frequented the coast repeatedly, drawn by the abundant marine resources and sustained by freshwater springs, two of which occur in the Bogenfels licence area. Numerous Early, Middle and Later Stone age sites, including shell middens, bear witness of pre-historic human activities.

More recent activities are all related to mining, including diamonds, guano, copper and a variety of other base metals and the evidences of these activities left a rich legacy across ML44. Remnants of mining activities stretch from the very early days to recent times (e.g. 1948 plant at Bogenfels) and are scattered throughout the licence area. ML44 is a keystone in the preservation of diamond mining history.

Figure 25: Signs of historic mining activities are particularly prevalent in ML44 – here remains at Pomona (left) and the Bogenfels historic village (right). (Photo's: Pulfrich in 2018 EMPR)

The Cultural Heritage Management Plan (2020 highlights the importance of Namdeb's identified sites of Special Scientific Interest (SSIs) in the Namdeb mining areas, including ML44.

There is a significant number of geological sites of importance in Namdeb's mining licence areas. Some sites illustrate the depositioning processes on the beaches and fluctuating sea levels. Fossils help to determine the age of these geological features and strata and palaeantological research has been supported by Namdeb for many decades.

Some sites demonstrate geological forces and processes in the more distant geological past. These include erosion remnants of the Gariep Group such as Bogenfels.

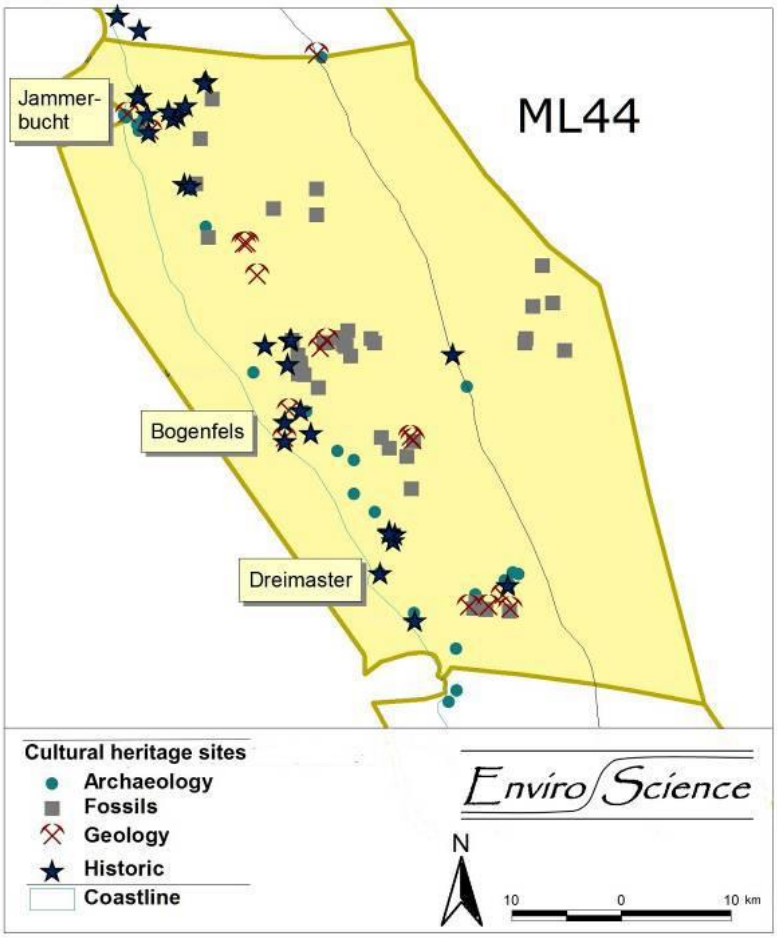


Figure 26: Extent of Cultural Heritage Sites in ML 44 (Source: Cultural Heritage Management Plan, 2020)

5.4 Social transition and sustainability

In support of the proclamation of Oranjemund as a Town and ensuring its longevity, Namdeb embarked on developing a strategy to leave behind a sustainable town, in 2014. During the formulation of the strategy, extensive consultation was facilitated with different interest groups. The Oranjemund Town Transform Implementation Strategy (TT Strategy) was developed as a result, and is in an advanced stage of implementation.

The TT Strategy is Namdeb's key approach to social transition. It includes Oranjemund's opening as a town in and appointment of the Oranjemund Town Council (OTC). The town was officially opended in 2017. A Town transformation programme was further drawn up in 2014, which has three focus areas,namely Transfer, Transition and Transform.

- **Transfer refers to the transfer of municipal services to the OTC and the Namdeb properties to private ownership.**
- **Transition is the term assigned for the normalisation of the healthcare and education sectors in the town. It also includes the mobilization of the citizenry of the town.**
- **Transform refers to the transformation of Oranjemund to become an ecomomically diversified town.**

In 2019 Namdeb commissioned a Social Impact Assessment (SIA) to determine the potential social and economic impacts on the direct and indirect communities of Namdeb operations during its closure. These impacts are not directly related to ML 44, where no social closure activities are envisaged over the next three years, although these matters do play a role in overall mine planning. Social transition objectives include:100% property ownerships by the end of aftercare, sustainable education and health care by the end of LoM, and diverse and quality reskilling resources offered.

Chapter 6

Environmental management to date

Namdeb's Environmental Section with currently ten full-time staff is responsible for all facets of environmental protection, such as planning, management, performance reporting, assurance, impact monitoring and stakeholder engagement. One environmental officer was dedicated to the Bogenfels licence area. All Namdeb's operations are ISO14001:2015 certified and follow De Beer's and Anglo American's corporate standards.

Environmental management at Namdeb today encompasses an intricate system of components relying on and informing each other to address the challenges posed by mining diamonds profitable while taking cognisance of environmental protection. For the purpose of this EMPR the headings below structure this section. All aspects described below apply to ML44, as well as Namdeb overall. Environmental management and monitoring activities conducted include planning using tools such as EIAs, internal risk assessments and specialist baseline assessments. Performance reporting is another crucial ongoing environmental management tool employed. Environmental performance is certified by auditors, externally and internally and backed by compliance visits from the authorities (e.g. Department of Water Affairs and Forestry) and corporate head office. All Namdeb's operations are ISO14001:2015 certified.

Monitoring of resource use and environmental impacts are also ongoing for the marine activities. Namdeb makes use of independent practitioners for assessments and their reviews, as well as for monitoring. The Marine Scientific Advisory Committee (MSAC) advisory committee is comprised of amongst others, internationally renowned academics and experts in fields of marine ecology and coastal modelling. Recommendations from the MSAC allows management to further refine and implement mitigation measures where appropriate.

6.1 Marine monitoring

The biological monitoring of rocky intertidal and sandy beach macrofaunal communities in ML44 was commissioned as part of the Pocket Beaches mining operation with the first survey undertaken in 1998, with annual sampling spanning the period 2004 – 2015. Sampling stopped in 2015 due to the functional recovery of the previously active sites demonstrated following sampling (Pulfrich, et. al, 2015).

Two subtidal surveys were undertaken off Bogenfels to assess potential impacts of sediments on offshore communities. The baseline survey was conducted in 2007, with a follow-up survey in 2012 and 2017. From the latter, is quoted as follows:

"A regional comparison of the data collected in 2017 confirmed that among-site differences in community coverage and composition tend to be more heavily influenced by the degree of wave exposure and shoreline topography than by any mining-related physical perturbations. Only in the case where mining impacts are

extreme and result in either substantial smothering (Pocket Beaches) and subsequent erosion of accreted sediments, or complete elimination of rocky shores (Elizabeth Bay), do mining-related impacts over-ride the effects of wave action on benthic community associations.
In 2017 the results of the monitoring surveys from the two study areas (Elizabeth Bay and Mining Area 1) confirmed that depositing sediments influence rocky-shore communities in four possible ways: (1) sand inundation that directly depletes all or some groups thereby reducing community diversity; (2) ripple effects in which depletion of taxa in higher trophic levels indirectly influences the abundance of those in lower trophic levels; (3) alteration of supplies of particulate materials with potential effects on suspension-feeders such as the reef worm *Gunnarea gaimardi*; (4) diminution of light, with affects on subtidal primary producers. While all of these predicted effects were observed to a greater of lesser extent along the *Sperrgebiet* coastline, the monitoring surveys also provided regional evidence of naturally induced sediment-effects on intertidal benthic communities." (Pisces, 2017)

A marine monitoring programme of benthic macrofaunal communities in unconsolidated sediments was initiated in 2008 as part of Namdeb's mid water operations. A further baseline survey, prior to testing mining, of the Purple, Bogenfels and Channel features in the offshore portions of ML43, ML44 and ML45, was undertaken in December 2015. The survey design intended to quantify the spatial and temporal impact of mining on benthic invertebrate macrofauna community composition in the midwater region. Sites sampled during 2015 study were all located in areas that have not been impacted historically.

Further geophysical prospecting was undertaken in 2016, and NAMDEB were forced to refine their mine plan for the Bogenfels, Channel and Purple regions based on findings from these surveys. Data from Historical sampling campaigns (2002-2008) were included to allow long term comparisons of baseline data.

Results from the 2015 and 2016 surveys indicated that each of the three different target regions, Bogenfels, Channel and Purple had distinct macrofaunal assemblages. The spatial variation in benthic macrofaunal community structure observed among sites within each of the regions was linked to the sediment particle size composition and depth. The data collected during this study were considered to provide a good baseline against which future impacts of mining can be assessed.

A benthic sampling survey was again undertaken in December 2021 by Anchor Environmental. The data is currently being interpreted. The programme includes a reassessment of the status of the monitored habitats and/or communities, revision of the sampling plan to reflect changes in the mining plan and/or to incorporate biological sampling requirements of new mining targets.

Namdeb supported the marine predator monitoring (Southern right whales and selected birds (African Penguin, Bank Cormorant and Cape Gannets)) project in 2015.

The marine life sightings programme at the Ministry of Fisheries and Marine Resources is also supported by Namdeb.

6.2 Bogenfels pond monitoring

Physical parameters as well as fish and birds are monitored at the remaining pond at Bogenfels regularly since 2013 to establish the impact on marine and coastal ecosystems.

Despite higher salinity than seawater, the catch-and-release monitoring so far recorded four fish species: shad/elf/bluefish (*Pomatomous saltatrix*), kabeljou (*Argyrosomus inodorus*), steenbras (*Lithognathus aureti*) and Cape stumpnose (*Rhabdosargus holubi*).

The pond attracts a variety of shorebirds – a minimum of 16 species have been recorded so far, including the red-listed Damara Tern (*Sternula balaenarum*), Cape Cormorant (*Phalacrocorax capensis*) Greater (*Phoenicopterus roseus*) and Lesser Flamingo (*Phoeniconaias minor*). Greater flamingos, with over 100 records during the period 2013 – 2017, top the list (Katjirua 2016).

6.3 Brown hyena monitoring

Namdeb has also been supporting the Namib Desert Brown Hyena project, a non-proft organisation with the aim to ensure the long-term conservation of this species, since 1999. Monitoring has occurred specifically in ML44 post-mining. Three brown hyenas were fitted with GPS telemetry collars between 2005 and 2008. Camera traps have been set-up continuously in the area since 2010. According to a monitoring report (Wiesel, 2013) the results indicate that the hyena populations at Van Reenen Bay seemed to have stabilised in their numbers and that activity in the area previously affected by mining was on the increase.

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6.4 Vegetation monitoring

Monitoring of rehabilitation pilot sites in ML44 and restored Salsola hummocks at site 11/12, near Bogenfels has been on-going since 2007.

Prompted by a stakeholder visit of the Marine Scientific Advisory Committee in 2017, a well-known expert in coastal restoration, reviewed the current restoration programme at Bogenfels. The programme was regarded mostly successful, but could have been even more successful by paying more attention to the natural zonation of the coastal habitats (Lubke 2017).

As discussed in Section 3.6.4, the Biodiversity Action Plan (Pulfrich A, 2021) recommends criteria against which the criteria for the rehabilitation will be gaged. Draft closure criteria are provided for biodiversity. Going forward these criteria will be used in the monitoring programme.

6.5 Stakeholder engagement

Effective environmental management cannot be achieved in isolation. Engaging stakeholders and creating awareness is therefore an important function of Namdeb's environmental staff. In addition to *ad hoc* public consultations related to impact assessments for specific projects, Namdeb has two regular, external channels for information exchange – the Marine Scientific Advisory Committee and the Namdeb Stakeholder Forum. The latter forum consists of a range of authority and NGO representatives on common interests and matters of concern.

Awareness for environmental matters is created through environmental inductions which form an integral part of the compulsory Safety, Health and Environment (SHE) inductions for all staff and contractors accessing Namdeb's operations. Contributions are also made to regular newsletters and presentations. Namdeb is represented on many working groups dealing with environmental matters affecting Namdeb's licence areas. Namdeb has committed to maintaining on-going communication with key stakeholders on the progress of exploration (including marine exploration) and mining operations in ML44.

For the purposes of updating this EMPR, Namdeb made known this intent to the stakeholders and invited the public to register as Interested and Affected parties. This report has been circulated to the current stakeholder database and any comments have been incorporated before the report was submitted to the Department of Environmental Affairs. Comments included: 1) an enquiry on the status of the Namibia Hydrogen initiative, but which falls outside the scope of the operations of this Mining Licence and is currently in its feasibility stage and 2) the correction of a bird species scientific name and a list of comments and questions from the Ministry of Fisheries and Marine Resources. The comments and responses trail is in Annex 4.

Chapter 7 Environmental assessment

This chapter contains the original impact assessment but updated and prioritised to include current issues and those identified for the coming three-year period. The environmental impact assessment follows a process prescribed by Anglo American, using a risk assessment matrix.

The key environmental risk in ML44 for the previous period was the remaining pond at the pocket beaches site 11-12; and marine exploration and test mining, which includes on-site tailings disposal on the seabed resulting in impacts on marine habitats and biota. These remain relevant.

Another risk for the current period is the remaining structures at the Sonnberg contractor's site that need to be demolished and rehabilitation work done.

7.1 Approach

Environmental risks at Namdeb are continuously reviewed and updated, depending on magnitude of the new disturbances to the environment, following the formal environmental assessment process or, in the case of minor changes to existing mining and exploration activities, internal risk assessments undertaken by Namdeb's environmental staff. To ensure that all environmental risks are covered, all these reports were reviewed, discussed and re-assessed, where necessary, at a risk assessment workshop with Namdeb's Environmental Section in Oranjemund 22-23 September 2015. Activities were reviewed in 2018 and the risk matrix updated accordingly. Following an agreed assessment methodology, environmental risks were summarised in an impact matrix for each licence area for the natural and socio-economic environment. This historical work was again reviewed and adapted to reflect current issues and the work envisaged in the area for the period 2022-2025.

7.2 Assessment methodology

Namdeb follows the Anglo American Risk Management framework, one of which is a pre-scribed risk assessment, referred to as the 5x5 matrix. This 5x5 matrix also underlies the assessment process for environmental aspects in the computerised EMS (IsoMetrix). The impact register (Annex 2) provides further detail and additional assessment criteria.

Table 5: Environmental assessment criteria from Anglo 5x5 matrix.

Score	Extent	Duration	Likelihood
1	Affecting small area (metres)	Days or less	Rare (7.5%)
2	Limited area (hundreds of metres)	Weeks	Unlikely (15%)
3	Extended area (kilometres)	Months	Possible (30%)
4	Sub-basin scale (marine: regional)	Years	Likely (60%)
5	Whole basin (marine: international)	Permanent	Almost certain (99%)
	Receiving environment		
1	Highly altered with no sensitive habitats and no biodiversity value/ no ecosystem services value		
2	Altered with little natural habitat and low diversity value/low ecosystem services value		
3	Largely natural habitat/moderate biodiversity value/moderate ecosystem services value		
4	Sensitive natural habitat with high biodiversity value/high ecosystem services value		
5	Sensitive natural habitat with very high biodiversity value/very high ecosystem services value		

Table 6: Significance levels based on the Anglo American risk assessment matrix (with colours indicated that are used in Table 8 to indicate significance)

Score	Significance
1-5	Low
6-12	Medium
13-20	Significant
21-25	High

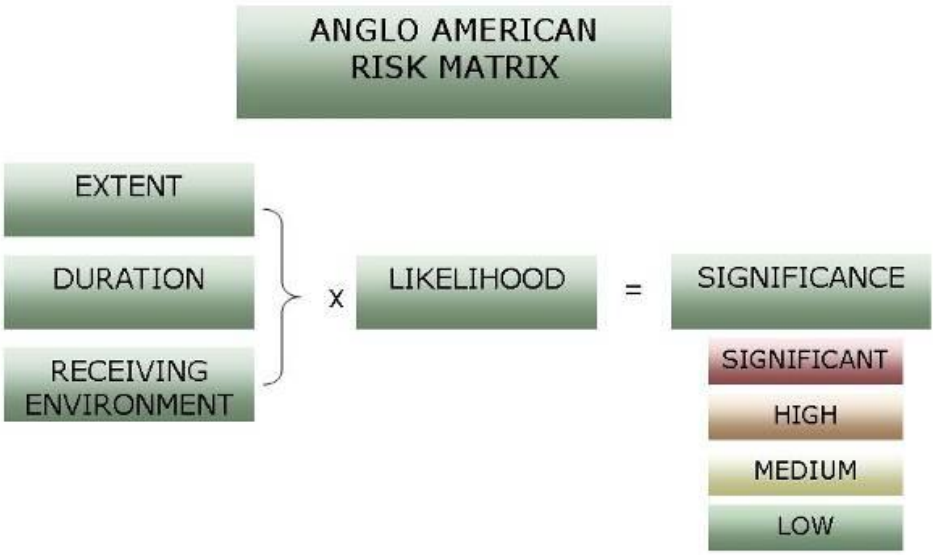

Table 7: The algorithm used in the Anglo-American risk matrix.

7.3 Environmental risks and their significance

Description of all high and significant impacts is provided in Annex 3. Mitigation measures are included in the Environmental Management Programme (EMP) for all high and significant impacts, and some medium and low impacts where mitigation is very effective/ presently applied.

Table 5 shows the main negative impacts on the natural environment associated with exploration and mining activities in ML44. This is a summary of the detailed impact assessment undertaken using the Anglo 5x5 risk matrix. In this overview activities with identical risk ratings were combined, where feasible, and impacts have been divided into nine main impact categories. More detailed descriptions of individual impacts are provided for significant impacts in the impact register (Annex 3). No "high" impacts were identified, but some impacts were rated "significant". The key environmental risk in ML44 is presently associated with the remaining pond at the pocket beaches site 11-12 and marine exploration and test mining, which includes on-site tailings disposal on the seabed resulting in impacts on marine habitats and biota.

Table 8: Summary of rating of negative environmental impacts on the natural environment associated with activities in ML44 based on 5x5 Anglo risk matrix.

ML44	Habitat loss	Habitat change	Loss of biota	Effect on biota	Water quality	Soil quality	Air quality	Natural resource use	Visual
MARINE EXPLORATION AND TEST MINING									
Geophysical surveying									
Seabed exploration/mining									
Oversize disposal to sea during marine exploration									
Fines sediment disposal to sea from vessel									
Effect of marine mining and exploration on NIMPA									
SERVICES AND INFRASTRUCTURE									
Road maintenance in natural areas									
Fibre optic lines and radio towers									
Waste management on vessels									
Natural resource use by marine exploration and contractor operations									
Loss of equipment from vessel									
Air support to mining vessels									
MINING-REHABILITATION									
Pond creation									
Sonnberg contractors camp and remains of plant									
LAND-BASED EXPLORATION									
Sampling and geophysics (including air support) (excludes trenching and drilling)									

Table 9: Summary of positive and negative impacts on the socio-economic environment related to activities in ML44.

SOCIO-ECONOMIC	Positive	Social structure
Positive		
Contribution to Namibian economy	S	
Increased skills and employment	S	
Development of technology	S	
Improved scientific knowledge (geology, biodiversity and heritage)	S	
Community support and awareness	S	
Sustained employment	S	
Sustained social services	S	
Negative		
In-migration		M
Labour migration system		M

7.4 Cumulative effects

7.4.1 External factors

7.4.1.1 Commercial fishing

Commercial fishing has a considerable effect on fish populations. The coastline of ML44 is thought to be an important recruitment area for rock lobsters and is thus not frequented by the commercial fishery. Protection of this recruitment area through the establishment of a rock lobster sanctuary (see Figure 18) within the Namibian Island Marine Protected Area between Albatross Rock/Prince of Wales Bay and Chameis Bay, exists.

The commercial rock lobster fishery in Namibia is based in Lüderitz, but the most important southern fishing grounds are located off Kerbehuk in ML43 and areas around Plumpudding Island and Chameis are occasionally fished (J. Calaca, Rock lobster fisherman, pers. comm.).

7.4.1.2 Climatic variations

The marine environment is most severely affected by changes in climate which could result in sea level rise, shifts in large currents, changes to the physical conditions of seawater and effects on local climate. Which way these climatic changes will manifest themselves is still poorly understood, but there is a potential that these either intensify or alleviate the impacts of changes to the coastline resulting from mining. While a sea level rise would facilitate natural rehabilitation of the mined areas, a possible change in local weather patterns, such as storm patterns and wind regimes may have the opposite effect.

Increased storm activity and deluges will impact on inshore exploration and survey, conventional terrestrial mining and possible future shallow water diamond recovery. As a worst case scenario it may result in the loss of equipment, injury to employees and work time being lost. Specific impacts may include:

- **Frequent flooding of coastal mines,**
- **Production delays,**
- **Decreased carat output, and**
- Decreased revenue.

Climate change may therefore cause substantial socio-economic losses if coastal structures (treatment plants, seawalls etc.) are impacted and mining cannot continue.

Namdeb does monitor its contribution to the global carbon footprint and constantly endeavours to manage consumption and emission patterns. Building Forever is the De Beers Group's commitment to creating a positive legacy that will endure well beyond the recovery of our last diamond. As part of this initiative, Namdeb adopts principles of carbon neutrality and nature based solutions.

7.4.1.3 Other marine mining operations

The Bogenfels mining licence is offshore directly adjoined by another Namdeb mining licence, ML128C, but also by other licence areas. Namdeb's aim is to

consistently apply impact mitigation throughout its four mining licences and this has a cumulative effect across the areas of influence. Activities in the adjoining offshore licences managed by others also affect many of the same marine habitats such as subtidal reefs.

7.4.1.3 Other developments

Namibia has ambitious plans to implement blue and green economies, as articulated in the Harambee Prosperity Plan II (2021)[1]. The blue economy centres around the ocean and aims at the development of renewable energy projects, seafood and marine production and offshore engineering and built on the tiers of environmental sustainability, economic sustainability and social inclusion[2] . Under the auspices of these strategies a hydrogen project has been made available on tender and has been awarded in November 2021.[3] This project aims at ultimately providing some 30000 jobs and will be located in the //Kharas region, of which the Tsau//Khaeb National Park will be a central location for the production of wind energy. The impact of this project on the Park, the Ocean and the people is potentially highly significant.

The Ministry of Environment, Forestry and Tourism has the challenge to consider the cumulative effects of Namdeb's operations, other mining operations, planned tourism, as well as planned projects such as this one. There is an urgent need for a Strategic Environmental Assessment for the Park to consider and steer its conservation and management in light of these upcoming initiatives. Namdeb could participate in such collaborations, if initiated by MEFT.

7.4.2 Namdeb external factors

In addition to the natural long-shore drift, there is sediment disposal from multiple sources along the southern Namibian coast which is all transported northwards with the Benguela current.

Seafloor mining and sediment disposal often occur repeatedly in the same areas. If a minimum of five years is allowed for natural recovery, this is likely not an issue in the ultra shallow and shallow water areas. The marine habitats affected by fines disposal are also targeted by contractor mining, so there are multiple, overlying impacts in the marine environment.

7.5 Shortcomings

7.5.1 Assumptions

The impact assessment and its updates increase understanding over time. Nevertheless, the mining environment changes continuously and this assessment is thus representative of the current thinking and scientific research done to date.

[1] https://www.kas.de/documents/279052/279101/Der+Harambee+Prosperity+Plan+II.pdf/

[2] https://www.eif.org.na/post/namibia-to-implement-blue-economy-policy

[3] https://allafrica.com/stories/202111050376.html

7.5.2 Uncertainties

The impact assessment has identified some gaps in knowledge, such as:

- ◊ **Effects of mobilised marine mining-related sediments on the offshore reefs and**
- ◊ **Namdeb's contribution to the overall health of the marine ecosystem.**

An attempt should be made to gather more information to investigate the effects of sediments on the offshore reefs, while the unravelling of natural versus mining-induced variation in the marine ecosystem is an on-going process which is addressed by Namdeb's marine monitoring programme.

Biodiversity information in the marine environment is largely from offshore areas, although some information to ~30m depth does exist (Pulfrich & Penney 2001). Monitoring on benthic communities is ongoing and the recent data interpretation from the 2021 study is awaited.

There is also still a lack of baseline information on some biodiversity components such as:

- ◊ **Invertebrates and soil biota, and**
- ◊ **Marine biodiversity information for unconsolidated sediments in ultra-shallow water and shallow-water areas, and for rocky seabed in the nearshore and offshore areas. Collection of baseline data in these habitats is severely hampered by the logistical difficulties of sampling in shallow water areas on a wave exposed coastline.**

Despite progress in beach restoration, poorly understood in this area are presently also

- ◊ **Natural recovery rates of different marine ecosystems related to long-term impacts of accretion**
- ◊ **Natural recovery rates of coastal and terrestrial ecosystems**
- ◊ **Effective restoration methods for all ecosystems impacted by mining**
- ◊ **Contribution of other environmental impacts such as climate change and overfishing and**
- ◊ **The links between marine ecosystems and coastal ecosystems. Many linkages are recognised (intertidal communities serve as food-source for waders and shore birds, fish in bay serve as food source for Damara Terns, penguins and gannets), but potential changes related to mining activities have not been quantified.**

Supporting biodiversity conservation projects in conjunction with other stakeholders, such as those mentioned under Section 6 are therefore commendable steps.

Contributing to overarching programmes such as biodiversity monitoring, undertaken or facilitated by the Ministry of Environment, Forestry and Tourism in the Tsau//Khaeb Park would be another opportunity to help closing knowledge gaps.

Chapter 8

Environmental management plan

The Environmental Management Plan outlines overall environmental tasks, provides management actions for all high and significant impacts, describes rehabilitation activities and the required monitoring during operations and at closure.

Environmental management tasks are organised according to overall tasks which are necessary for the implementation of the EMP, then significance, and within these according to aspects. These management actions need to be seen in the context of an existing environmental management system which has been in place for over 20 years and where all measures applicable to common environmental aspects such as waste management, pollution control and protection of habitat, fauna and flora are well entrenched and routine. The management actions in this EMPR therefore focus on new aspects and prioritising existing management actions.

Objectives applicable to all management tasks in this EMP are described below (Table 10) and are not repeated for each task. Impact descriptions are provided in the impact register in Annex 3. The management objectives link directly to Namdeb's environmental policy.

Table 10: Namdeb Environmental Objectives and Key Performance Indicators (2021)

NAMDEB
A Namibia De Beers Partnership

MINEWIDE ENVIRONMENTAL OBJECTIVES AND KEY PERFORMANCE INDICATORS 2021

KEY RISK AREA	OBJECTIVES & PERFORMANCE INDICATORS	OPERATIONAL PLANNING ACTION
System	Teams integrate responsible environmental practices across the operation by maintaining ISO14001:2015 certification.	All policies and procedures for the ISO 14001:2015 framework approved and loaded on intranet. 50% of competency training completed for priority areas (mining, treatment, engineering). Zero overdue actions on Isometrix. Zero major findings for external audits. Environmental Performance score of 4 (80%) at Year End. Isometrics Operational Risk Management (ORM) Maturity Score: ≥ 95%.
Permitting/ Legal/ License to operate	Fulfil national statutory legal requirements and increasing maturity of permitting systems, tools and processes.	100% compliance to all permit conditions. Obtain Environmental Clearance Certificate (ECC) for all Mining Licenses.
Environmental Incidents	To have ≤ 2 reportable environmental incidents. Level 4-5 potential (HPH) and actual (HPI) environmental incidents. Zero (0) repeats of Level 3 incidents.	Effectively implement ALL investigation actions. Report all High Potential Incidents and Hazards (HPI & HPH); No overdue actions items. Evaluate effectiveness of existing controls and determine critical controls.
Rehabilitation/ mine closure/ water	Plan and Implement biophysical rehabilitation.	100% compliance to the Sendelingsdrif and Obib concurrent rehabilitation plan (i.e. landscaping and biodiversity restoration). Backfilling - Sendelingsdrif: 1,991,437 tons Landscaping - Sendelinsdrif: 0.6 Ha; Orex:12Ha; Daberas:28Ha
Circular economy/ waste/ water	Reduce river/fresh water abstraction and reuse and recycle process water at operations. Avoid accumulation of non-mineral waste and minimize general waste going to the landfill.	**Water recycling targets:** Daberas: 61%; Sendelingsdrif: 86%; RAC: 55% ; Total Namdeb: 70% Develop a waste road-map and milestones (including town services for recycling of paper, plastic, glass, tins etc.)
Energy and Carbon (Carbon Neutrality)	Reduce energy consumption and greenhouse gas emissions.	Monitor GHG measurements to support future target setting and initiate Scope 3 emission calculations and reporting. Obtain ECC for erection of wind measurement masts for future wind farms for ML43 & ML 44
Biodiversity	Support Biodiversity Stewardship	Develop Net Positive Indicators (NPI) for Namdeb. Extend Brown Hyena Research Project to Karingarab EPL
Stakeholders	Maintain internal and external stakeholder relations.	2 x Engagements with Authoritative Targeted stakeholders for acceptance/approval of priority projects (MFMR, MEFT,MME) Formalize rehabilitation success and closure signoff criteria with competent authorities (MME & MEFT)



R.J. Jacob
Chief Operating Officer



The following legislation is directly applicable to the management actions (detail in Annex 2) and their link to particular management actions is indicated by the corresponding number (column "legal"):

1. **Mineral Act 1992**
2. **Minerals Amendment Act 8 of 2008**
3. **Namdeb's minerals agreement**
4. **Environmental Management and Assessment Act 7 of 2007 and regulations**
5. **Namibian Constitution Section 95(l)**
6. **Labour Act 6 of 1992, Act 11 of 2007, and amendment of 2012**
7. **Water Act 54 of 1956**
8. **Water Resources Management Act 11 of 2013**
9. **Forest Act 12 of 2001**
10. **Nature Conservation Ordinance 4 of 1975**
11. **National Heritage Act 27 of 2004**
12. **Marine Resources Act 27 of 2000 and regulations**
13. **Prevention and combating of pollution of the sea by oil Act 6 of 1981**
14. **Convention on Biological Diversity 2002**
15. **Ramsar Convention on Wetlands of International Importance especially as Waterfowl habitat, 1971**
16. **United Nations Framework Convention on Climate Change 1992**

The responsibility for implementation of all mitigation measures lies with the Environmental Manager. All tasks are on-going activities.

OVERALL MANAGEMENT TASKS	
Aspect	**Mitigation and control measures**
Implementation of EMP	• Incorporate all high and significant management actions in IsoMetrix EMS database • Identify new management tasks, discuss and explain to all environmental staff with particular attention to rehabilitation • Make financial provision for potentially new management actions
Awareness	• Adapt environmental inductions to include new environmental aspects and management actions (PR-EV-15) • Broadcast new environmental measures in all available forms of regular communications (briefs, monthly topic, etc.)
Reporting	• Follow ISO14001, MET, Group (Anglo American and De Beers) and Namdeb internal reporting standards (PR-EV-22, PR-EV-23) • Improve environmental data capture, storage and retrieval
I&APs	• Present relevant key features of updated EMPR at Namdeb regular stakeholder forum (PR-EV-16) • Continue sharing information on targeted samples sites with the stakeholder forum as it becomes available.

SIGNIFICANT AND HIGH ENVIRONMENTAL RISKS		
Aspect	**Mitigation and control measures**	**Legal**
Exploration		
Seabed exploration/ mining	**Keep easily retrievable spatial record of contractor's activities Continue with monitoring into impact significance and mining efforts**	**12, 14**
Oversize disposal to sea during marine exploration	**Keep easily retrievable, spatial records of activity Where practical, avoid disposal of tailings on reefs Continue with monitoring into impact significance and recovery efforts**	**12, 14**
Terrestrial exploration including drilling	**Define the drilling activities spatially, as they relate to sensitivities in the area. Update the ECC with the exploration details. Commission a survey of plant communities, habitats and heritage sites occurring in the area. Determine protection/transplant/rescue and rehabilitation requirements and integrate with EMS and drilling operations. Remote camps are to be located in consultation with the environmental section, preferably on previously disturbed areas and removed upon completion.**	
Mining / rehabilitation	**Reach an agreement on the rehabilitation responsibilities and responsibilities of the Sonnberg contractors camp and plant. Ensure all rehabilitation work is done according to the Demolition and Landscaping Report (2021) and the Waste Management Plan and Strategy (2021).**	
Pond creation	**Establish impact on fish populations, and other marine and coastal biota Upon conclusion of monitoring, reach agreement with key stakeholders regarding final rehabilitation requirements**	**1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 14**
Contractor mining	**See rehabilitation**	**1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 14**
Services and infrastructure		
Road maintenance in natural areas	**All borrow pits are to obtain Environmental Clearance. When road to Lüderitz is active again: • Rehabilitate borrow-pits when no longer in use or material is exhausted • Source new borrow-pits and their access routes in consultation with Environmental Office to ensure avoidance of environmentally sensitive areas (PO-EV-21)**	**1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 14**
Fibre optic lines and radio towers	**Erecting new radio towers or fibre optic lines require agreement from the Environmental Section in all areas Fibre optic lines and radio towers to be dismantled when no longer in use and not identified for future use**	**1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 14, 15**
Waste management on vessels	**All vessel operations, as well as waste management and pollution control is undertaken in accordance with the procedures and protocols of the prospecting/mining services provider and on condition that all legal requirements are met. Waste management procedures are to be submitted and kept on record.**	**12, 13, 14**

MEDIUM ENVIRONMENTAL RISKS		
Aspect	**Mitigation and control measures**	**Legal**
Exploration		
Effect of marine mining exploration on NIMPA (Namibian Islands' Marine Protected Area)	• **Monitor the impact of activities on affected marine ecosystems**	**12**
Services and infrastructure		
Natural resource use by marine exploration and contractor mining	• **No specific actions**	**12,16**

LOW ENVIRONMENTAL RISKS		
Aspect	**Mitigation and control measures**	**Legal**
Exploration		
Marine geophysical surveys	• **Avoid whale migration periods (June-November), if feasible – if not possible follow Joint Nature Conservation Committee's guidelines (on-board marine mammals observers, pre-scans limited to 15 min., soft starts, termination of survey if marine mammals seem affected, passive acoustic monitoring, *no surveys in Marine Protected Areas)***	**12**
Mining		
Fines disposal during mining operations	• **Keep easily retrievable spatial records of mining operations** • **Include these in regular reporting** • **Research and monitoring into impacts and recovery**	**12, 13**
Services and infrastructure		
Loss of equipment from marine vessel	• **All lost equipment must be accurately recorded in a hazards database, and reported to maritime authorities.** • **Every effort should be made to recover or remove lost equipment.**	**12, 13**
Air support to mining vessel	• **All aircraft to maintain a minimum height of 1000m within a radius of one nautical mile from each islands' low water mark in Namibian Marine Protected Area, except in the case of a medical emergency and for research purposes.**	**12**

REHABILITATION AND CLOSURE		
Aspect	**Rehabilitation tasks**	**Comments**
Landscape rehabilitation		
Ponds	• **Continue monitoring to track ecological processes to comply with stakeholder recommendation.** • **Obtain formal agreement with regards to the potential backfilling of the remaining pond.**	
Contractor mining	• **Ensure contractor's compliance with rehabilitation requirements**	
Prospecting sites of Special Scientific Interest	• **Demarcate "out of bounds" and secure, where necessary – especially where new works are to commence.**	
Biodiversity restoration		
Natural regrowth	• **Monitor success of re-establishment of Salsola hummocks according to set criteria in the Biodiversity Action Plan.**	
Aftercare		
	• **See "environmental monitoring at closure"**	

ENVIRONMENTAL MONITORING AT CLOSURE			
Aspect	**Parameter**	**Frequency**	**Comments**
Restoration monitoring			
Natural regrowth on restored areas	**Vegetation (plant species cover, richness, composition and structure)**	**Annually, during vegetation season**	**Monitoring for five years or until completion criteria are reached, if < 5 years**

Chapter 9

Annex

The annex summarises the authors' credentials, provides an impact register, a list of reviewed literature and a trail of comments received during stakeholder consultation (review of this document)

9.1 Annex 1*: The environmental practitioners*

2018 EMPR

Antje Burke

Academic qualifications

1993: Dr rer nat (Ph D), Major: Landscape Ecology, Minors: Botany, Geography; Westfälische Wilhelms-Universität, Münster, Germany
1987: Diplom (M Sc equivalent), Major: Geography, Minors: Botany, Geology
1984: First degree (B Sc equivalent): Geography, Botany, Geology

Dr Burke has 30 years of professional experience in environmental research and management in Namibia, Germany, Israel, South Africa and Botswana. She has coordinated coordinated and participated in over 50 Environmental Impact Assessments, Management Plans, Audits, Sectoral Reviews and Natural Resource Assessments in Namibia – the majority in the mining and infrastructure sector. She is author of over 70 scientific publications, 50 of these in peer-reviewed, international journals and books, and over 100 popular and educational publications and is a scientific reviewer for eleven international journals. Dr Burke is a scientist widely recognised in her field of expertise. Her strong research background in environmental sciences, combined with in-depth practical experience, has enabled her to always maintain an exceptionally high standard, but unique and realistic approach in all her assignments.

Andrea Pulfrich

Academic qualifications

1995: Dr rer nat (Ph D), Major: Fisheries Biology, Minors: Oceanography, Aquaculture; Department of Fisheries Biology of the Institute for Marine Science at the Christian-Albrechts University, Kiel, Germany.
1987: MSc (Zoology), University of Cape Town, South Africa.
1983: BSc (Hons) (Zoology), University of Cape Town.
1982: BSc (Zoology and Botany), University of Natal, Pietermaritzburg.

Dr Pulfrich is the director of Pisces Environmental Services and has 29 years of professional experience in marine and coastal environmental sciences. Since its founding in 1998, Pisces Environmental Services has successfully completed a broad variety of assignments, ranging from technical field surveys and baseline data collection and environmental assessments, to sophisticated statistical analyses, reporting and public presentation of results. The Company has acquired a reputation among its clients for reliable, efficient, and result-orientated work. A great number of studies have been published in the internationally reviewed scientific literature. Through its links with research and government institutions, universities and industry, the Company keeps pace with advancements in marine sciences and technology, thereby applying up-to-date information and methodologies to its products.

2021 EMPR Update

Stephanie van Zyl

Academic Qualifications:
Bachelaureus (Town and Regional Planning) University of Pretoria 1992
Masters (Environmental Management) University of the Orange Free State 1999

Stephanie has twenty-five years' experience in Environmental Management and Public Participation and Facilitation (Environmental and Social Assessment, Environmental Management Plans, Environmental Education, Environmental Management Systems, Environmental Monitoring and Evaluation), Urban and Regional Development Planning, Socio-Economic Research, Land Use Planning, and Project Co-ordination.
She has been involved in or acted as the principle consultant for a number of large-scale environmental and social assessments in the following sectors:

- **Land use and development plans for urban centres, regions, and nation-wide;**
- **Various other strategic initiatives;**
- **infrastructure including roads, railway lines, power lines, and water supply networks;**
- **tourism including tourism development plans and lodges;**
- **mining;**
- **processing and manufacturing projects;**
- **agriculture; and**
- **power generation projects.**

9.2 Annex 2: Impact register

All impacts rated "significant" (S) and "high" (H) require management and these impacts are listed in the impact register. A description of the impacts is included below and management actions are described in the Environmental Management Plan (Chapter 8). Many activities result in various impacts. In this case, if at least one impact is rated significant, the activity will require management. Not significant impacts associated with this activity are then also included in the description. Because this is an update of a previous EMPRs, the descriptions are deliberately concise and activities receiving the same impact ratings have been combined, where feasible.

A 4-scale rating has been included here for reversibility (none, low, medium, high) assuming that the management actions for this activity are implemented and thus reflecting an impact assessment with mitigation.

The activities are organized according to overarching categories marine exploration and test mining, land-based exploration, infrastructure and services, mining/rehabilitation.

9.2.1 Marine exploration and test mining

Impact category	Description	Significance	Reversibility
	Seabed exploration and test mining		
Loss of marine biota	Disturbance and loss of biota in impacted sediments	Significant	High
	Sediment release to sea during marine exploration and test mining		
Loss of marine biota	Smothering of reef biota by tailings disposal, change in community composition	Significant	High

9.2.2 Services and infrastructure

Impact category	Description	Significance	Reversibility
Loss of habitat and biota	Road maintenance in natural areas Establishment of new borrow-pits in undisturbed areas eliminates vegetation and associated biota	Significant	Medium
	Fibre optic lines and radio towers throughout the Sperrgebiet National Park		
Visual	Fibre optic lines and radio towers throughout the Sperrgebiet National Park are	Significant	High

	highly visible and detract from wilderness aspect		
	Waste management on vessels		
Water quality	Pollution of coastal waters through spilled hydrocarbons and litter	Significant	High

9.2.3 Terrestrial exploration

Impact category	Description	Significance	Reversibility
	Drilling, sampling, geophysical surveys and remote camps		
Habitat loss, Loss of biota, heritage	Disturbance and loss of biota in cleared areas	High	Medium

9.2.4 Mining / Rehabilitation

	Pond creation at Bogenfels		
Habitat change	Creation of aquatic habitat from previous sandy beach	Significant	Positive or negative?
Visual	Remnant of mining visible from rock arch	Significant	High, if backfilled
	Unrehabilitated Sonnberg camp and plant		
Water and soil quality	Leachates from mining waste and scrap pollute the water and soil (refer Section 3.5)	Significant	Medium
Visual	Mining remnants visible	Significant	High if removed

9.3 Annex 3: Literature

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9.4 ANNEX 4: COMMENTS AND RESPONSES TRAIL

Comments	Response
Comments from Kolette Grobler, Ministry of Fisheries and Marine Resources, Stakeholder Forum	
"I am definitely in support of removal of old contractors' camps and infrastructure (e.g. Sonnberg Contractors camp site) and am glad to see this is still ongoing."	**Noted**
"I am wary of the term "industrial heritage" (used in the report) as this can easily be used as an excuse to not remove mining site infrastructure that is not in use anymore, due to high costs involved, but which is usually a large source of pollution into the surrounding desert environment. Even during visits to our so-called "historic ghost towns", when I see material from the buildings having broken loose and blown around by the winds, I don't see this as inheritance, I consider it pollution."	**Noted**
"If the pond at Pocketbeach mining site 11/12 is still supporting a rich faunal community, and is not turning into a quick-sand death trap to larger animals, I still believe it is a good half-way feeding station between the Orange River Mouth and Lüderitz Lagoon, especially for coastal birds, and could remain thus as is."	**Noted**
"Concerns regarding pocket-beach mining: the impact of these are always the threat to the inshore kelp beds, of which I have always been very protective, since they shelter such rich and diverse benthic communities. In the ML 44 EMPR report it does not indicate exactly which bays will be targeted this time. It shows only the general area of ML44 and states "south facing j-bays" will be targeted. I understand that at this stage they will only explore the potential of new pocket beaches, as part of this EMPR. If they are successful in the exploration phase, will this report be updated before they start a possible mining phase of pocket beaches in ML44? Is it possible to provide me with a map of the exact bays they intend to target during the exploration phase?"	**The Pocket Beach targets are only in the opportunity phase and still require a desktop study to be done to identify which sites will be explored. Should any of the targets be explored it will build on the previous exploration project conducted in the early 2000's.** **Further information on targeted pocket beaches to be shared with the applicable stakeholders.**
"Midwater mining defined as -7 to -50 m, where diver operated activities take place (as indicated in the report). What depths will (are) the SM Remote Tool Contractors operate (the concern here is larger volumes of dredged material will be overcast during this mining method, so it is preferable that they don't operate at depths less than 15-20m, i.e. they should not operate close to sub-tidal kelp beds)."	**The Remote Tool Operations are targeting the -30m to -50m depth ranges. Divers are working Low Water Mark to -30m.**
"The report states on p40: "A benthic sampling survey was again undertaken in December 2021 by Anchor Environmental. The data is currently being interpreted." Was this monitoring done at all three	**Confirmed all three sites were sampled.**

sites referred to in the statement "Results from the recent 2015 and 2016 surveys indicated that each of the three different target regions, Bogenfels, Channel and Purple had distinct macrofaunal assemblages."?"	
Cosmetic corrections suggested	**Edited**
Ann Scott: Ecoserve (Avifauna specialist)	
One new name change: page 41, Section 6.2 (Bogenfels pond monitoring): the scientific name for Lesser Flamingo is now *Phoeniconaias minor* (previous name *Phoenicopterus minor*).	**Edited**
"Hyphen recently put up a map of the areas they intend to plant solar panels and wind turbines in - (see attached screenshot of the youtube video taken at the Cop 26 Commonwealth Pavilion on the afternoon of the 4th November 2021). Those familiar with the area (Luederitz to E-Bay is about 30km) will be able to see that the alleged Hyphen "concession" starts about 12 km North of Bogenfels. Well, EPL 44 only ends about 55 km north of Bogenfels (see attached map). As a result there is an overlap some 43 km long and 30 km wide. So why does Hyphen think it can trespass in ML44? Have I missed something? If they do NOT have such a concession, then why are they releasing images to the general public, clearly creating the impression that they do?"	**The Hyphen project is a directive from the office of the President to comply with the National Harambee Plan – Green Hydrogen project for the Southern Areas Corridor. Namdeb was engaged since it is our license area. Hyphen won the bid to do the feasibility study (2 years) and got the renewable energy concession issued by the Minister of Environment, Forestry and Tourism.**