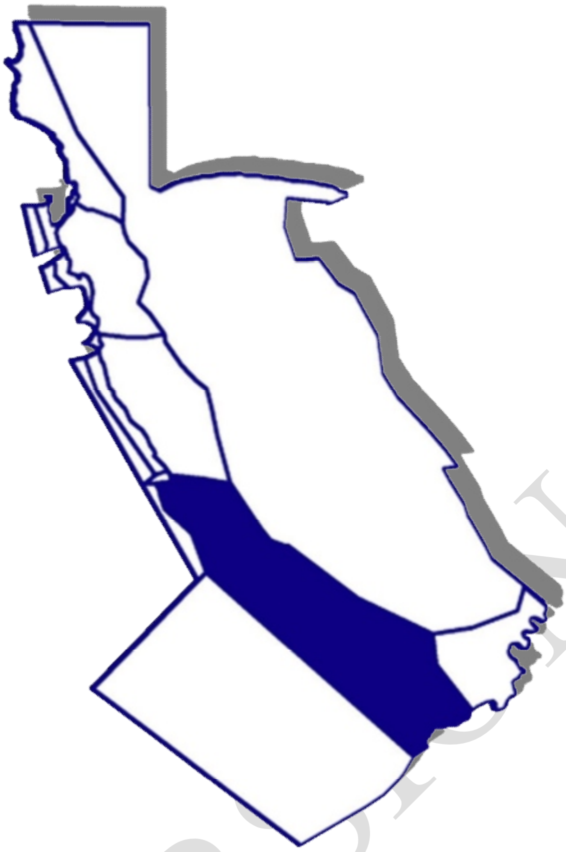

Environmental Management Programme Report for Namdeb's Mining Licence 43 (Mining Area 1)

November 2024

NAMDEB

A NAMIBIA DE BEERS PARTNERSHIP

Environmental Management Programme Report for Namdeb's Mining Licence 43 (Mining Area 1) for the period 2025-2028

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This report required input from a whole range of staff at Namdeb, coordinated by Namdeb's Environmental Section. Thanks to all.

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Abbreviations and glossary

AA	Anglo American
ADT	Articulated Dump Truck
ANE	Ammonia Nitrate Emulsion
BP	Before Present
CRD	Coarse Residue Disposal
CTF	Contractor Treatment Facility
DEA	Directorate of Environmental Affairs
DIFS	Dry Infield Screening plant
DMS	Dense Medium Separation
DMU	Dry Mining Technology
ED	Estuarine Delta
EMP	Environmental Management Plan
EMPR	Environmental Management Programme Report
EMS	Environmental Management System
EPL	Exclusive Prospecting Licence
ESA	Early Stone Age
FRD	Fines Residue Disposal
GSR	Geological Sampling Recovery
HT	High Tension
IUCN	International Union for the Conservation of Nature (former World Conservation Union)
kt	Kilotons (i.e. 1,000 tons)
kV	kilovolt
LTP	Long Term Plan
LSA	Later Stone Age
MA1	Mining Area 1
MD	Minimal Disturbance
MEFT	Ministry of Environment, Forestry and Tourism
MFMR	Ministry of Fisheries and Marine Resources
Midwater	Marine area between -50m and -129m depth below sea level
ML	Mining Licence
MME	Ministry of Mines and Energy
MMU	Mobilie Manufacture Unit
MRU	Managed Resource Use
MSE	Middle Stone Age
MUN	Mine Workers Union of Namibia

MVA	Mega-volt ampere
MWh	Megawatt hour
Nemcom	Namdeb Executive Management Committee
OPSCO	Operational Steering Committee
OREX	Orange River Exploration Plant
PCC	Personnel Control Centre
PDP	Probe Drilling Platform
PML	Post Mining Landuse
PTF	Pre-Treatment Facility
RAC	Red Area Complex
SASP	Southern Areas Sampling Plant
SBP	Strategic Business Plan
SCM	Southern Coastal Mines
Shallow marine	Marine area between -7m and -50m below sea level
SSSI	Site of Special Scientific Interest
Surf zone	Marine area west of shoreline or seawall to -7m depth below sea level
TAC	Total Allowable Catch
Transvac	Industrial vacuum machine
XRT	X-Ray Transmission plant
WIFS	Wet Infield Screening plant

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Summary

1.1 Introduction

A series of four Environmental Management Programme Reports linked to Namdeb′s licence areas forms the backbone of Namdeb′s Environmental Management System (EMS). This report is an amendment of the 2018 EMPR for ML43 (Mining Licence 43, i.e. Mining Area 1 which includes Southern Coastal Mines and EPL 3749). The assessment process and structure of the report have been adapted to suit the amendment and the main report is deliberately concise and refers to supplementary information in an annex.

1.2 Description of activities

Exploration takes place on accreted beaches with the sonic probe drill and the BG36 large diameter drill. Probe drilling is planned throughout the license area. Vessel-based contractors′ prospect for and mine offshore diamonds in the ultra-shallow and midwater area. Exploration for rare earth elements takes place in EPL 3749.

Dry mining activities take place behind seawalls on accreted beaches, where overburden as well as process plant tailings are deposited onto the beach to aid in accretion and push the shoreline seawards. The potential life of mine extension of accretion mining to 2037 is projected to result in a westward shift of the shoreline up to a maximum of 1.2 km from the current shoreline.

Ore mined using a combination of a surface miner, excavators, rock breakers and bulldozers is loaded and hauled with earth-moving trucks to the main treatment facility, No.3 Plant. The remaining ore that cannot be collected through mechanical bulk excavation is collected using industrial vacuum suction units called Transvacs and hauled to No. 3 plant as well. All ore received by No.3 treatment plant undergoes a concentration process that involves crushing, screening, scrubbing and dense-medium separation after which the material produced is hauled to the recovery plant at the main entrance to the mine for further concentration and then finally, hand-sorting at the Sort house.

An enormous amount of metal (137,628 metric tons to date) has been cleared from previous scrap yards and demolition projects and four large plant complexes have been demolished over the last thirteen years.

Figure 1. Loading (left) and deposition of overburden material onto the beach with conveyors (right) to achieve accretion.

Figure 2. Conveyors transport material from overburden dumps as well as process plant tailings onto the beach to accrete the coastline, thereby making diamonds available to dry mining, which would normally be below sea level; view from west to east at No.3 plant, in October 2020 (Photo: Namdeb).

1.3 The natural environment in ML43

ML43 falls into the Succulent Karoo Biome which is characterised by aridity (51mm annual mean rainfall at Oranjemund), winter rains and leaf-succulents forming the dominant vegetation. Combined with windy conditions all year round (mainly southerlies) and regular fog the area supports diverse, arid-adapted vegetation and fauna with many species of conservation importance (e.g. window plants (*Fenestraria rhopalophylla*), stonecrops (*Crassula* species), desert rain frog (*Breviceps macrops*) and brown hyena (*Hyena brunnea*)).

Massive amounts of sediments are moved by wind and the long-shore littoral drift of the Benguela current, which provide the landscape-shaping forces in this environment. As a result, dunes and sand plains are prominent, interspersed by gravel plains and occasional rocky outcrops.

The coast is characterised by largely exposed, linear sandy beaches in the southern portion of the licence area, with rocky shores becoming more frequent to the north. The ocean floor is composed of sand, grit and gravel forming an interlaced mosaic of these different substrates. Although most marine macrofauna species are widespread along the southern African West Coast and the beaches and subtidal areas of ML43′s coastline are comparatively species poor, there are nevertheless some invertebrates (e.g. giant pill bug (*Tylos granulatus*) which are sensitive to disturbance. Red-listed seabirds (e.g. Cape Cormorant, African Black Oyster Catcher), kelp beds, which serve as nursery areas for rock lobsters and nearshore fish species are some of the ocean-dependent biota and habitats of conservation importance.

SCM′s ponds created by mining are an active ecosystem supporting 36 species of birds, including the red-listed African Black Oystercatcher *Haematopus moquini*, Bank Cormorant *Phalacrocorax neglectus*, Greater and Lesser Flamingo *Phoenicopterus roseus* and *Phoeniconaias minor* and the charismatic African Spoonbill *Platalea alba*, Goliath Heron *Ardea goliath*, Pied Kingfisher *Ceryle rudis* and Sacred Ibis *Threskiornis aethiopicus* (Maritz 2020). Ten bird species are endemic and five are listed in Namibia′s Red Data Book.

Figure 3. Biodiversity has developed even in the vastly disturbed landscape in Southern Coastal Mines– here egrets roosting on islands in the man-made ponds (left, photo: Namdeb), and a young *Othonna furcata* plant taking foothold on overburden dumps (right).

1.4 The socio-economic environment

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

Southern Coastal Mines currently employs approximately 2209 people, of which approximately 987 are directly employed by Namdeb, another 1222 are contractors. This is a 40% increase in the workforce since the extended life-of-mine and the focus of mining on accreted beaches.

The mining areas in ML43 are zoned as managed resource use, and the adjoining areas as wildlife management, special value and minimal disturbance zones. The licence area contains many sites of historic interest, largely related to the history of diamond mining. The most spectacular archaeological find ever made in Namibia was the uncovering of a shipwreck (due to mining operations) dating back to the time of the voyages of early marine explorers in the early 16th century. The armed trade vessel was laden with ivory, ingots, gold and silver and other trade wares, and its excavation turned up priceless specimens of nautical equipment and armoury.

Figure 4. Big excitement on 1 April 2008: A 16th shipwreck with a treasure of gold and other trading wares was uncovered during mining. Dr Dieter Noli was assisted by Namdeb staff during the excavation (left); a Portuguese gold coin (right).

1.5 Environmental management to date

Namdeb's Environmental Section is responsible for environmental management. Currently eleven full-time staff, inclusive of one intern are responsible for planning, performance reporting, assurance, impact monitoring and stakeholder engagement. One senior environmental officer, with the assistance of two environmental officers, is solely dedicated to Southern Coastal Mines (Mining Area 1). All Namdeb's operations are ISO14001:2015 certified and follow De Beers and Anglo American's corporate standards.

1.6 Environmental assessment

The environmental impact assessment followed a process using a risk assessment matrix prescribed by Anglo American. All activities resulting in "high" and "significant" impacts will be managed. These are compiled in an impact register. As this is an amendment to an existing EMPR, focus is on new operations and their impacts and prioritising previously identified impacts. Overall, no impacts were rated "high", but a fair number were rated "significant".

Mining in ML43 focuses on accretion of the coastline with concomitant activities of overburden dump stripping and the creation of seawalls resulting in significant impacts on terrestrial and marine habitats and biota. Annual biological monitoring of the rocky shore, sandy natural and accreted beaches take place to assess and quantify the extent and duration, and consequently the significance of the impacts. The monitoring has shown that accretion and marine mining result in significant impacts on marine habitats and their associated biota. However, the complete magnitude and extent of the cumulative impacts of accretion, erosion of seawalls and tailings disposal on marine habitats and communities adjacent to the mining area have not yet been established with certainty.

Figure 5. Seawall on accreted beach in Southern Coastal Mines.

1.7 Environmental management plan

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

1.8 Annex

The annex summarises the authors′ credentials, presents all applicable legislation and provides an impact register, a list of reviewed literature and Namdeb′s environmental policies and procedures applicable to environmental management in ML43 and Namdeb overall.

Chapter 1. Introduction

A series of four 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 ML43 (Mining Licence 43, i.e. Mining Area 1 which includes Southern Coastal Mines). The assessment process and structure of the report have been adapted to suit the amendment and the main report is deliberately concise and refers to supplementary information in an annex.

1.1 Background

The backbone of Namdeb's environmental management is a series of four comprehensive Environmental Management Programme Reports (EMPRs) linked to each of Namdeb's mining licence areas. These were compiled during 1995-1997. An update was done in 2018 and in 2021. Management actions identified and described in these reports were in subsequent years supplemented by external Environmental Impact Assessments, Namdeb internal risks assessments and amendments to environmental assessments for new projects. The resulting management actions have been incorporated in an environmental management database which is the core tool of Namdeb's Environmental Management System (EMS). This EMPR update will also form part of Namdeb's EMS.

The approach to this EMPR update has been as follows:

1) Review of legal and regulatory requirements, introducing changes where appropriate.

2) Review of the activities and accompanying environmental management actions, for the past three years since the compilation of the 2021 EMPR update.

3) Description of expected activities for the next three-year period.

4) Review of the 2021 impact assessment and management plan with the view to prioritise management actions for the next three-year period.

With the wealth of baseline information presented in the original 2018 EMPR, updated with ongoing research, no new baseline studies were conducted. Where new findings have been made by Namdeb staff and contactors, these are reported on.

Information on monitoring work, plans for rehabilitation, waste management and removal, and heritage conservation, independently commissioned during 2020 and 2021 have been used to summarise Namdeb's efforts to sustainably manage the activities at SCM. Namdeb also provide plans for the period: 2025-2028.

This report builds on the foundation of the 2018 EMPR and follows its structure for the sake of continuity. It does however not repeat all its information for sake of brevity. The 2018 EMPR is available on request. Information particularly pertaining to new directions being taken since 2018, and for the period:2022-2025 is the focus of this report.

1.2 Locality, company, legal and statutory requirements

Namdeb Diamond Corporation (Pty) Ltd mines alluvial diamonds in the south-western part of Namibia in the Tsau//Khaeb (Sperrgebiet) National Park (Figure 6).

The company is equally owned by the Government of the Republic of Namibia and De Beers Group forming Namdeb Holdings (Proprietary) Limited. Namdeb Holdings owns Namdeb and De Beers Marine Namibia. Namdeb is led by the Chief Executive Officer (CEO), and operations are governed by the OPSCO team (mine managers, strategic projects and mineral resources), headed by the Chief Operating Officer (COO). OPSCO and departmental heads form the Namdeb Executive Management Committee (NEMCOM), which reports directly to the Namdeb Holdings Board. The Environmental Manager reports to the department head Mineral Resources and Environment.

Namdeb Holdings holds five mining licences on land and offshore; Namdeb holds four of these licences. Mining Licence 43 ('Mining Area 1', also referred to as 'Southern Coastal Mines' (SCM)) is the largest land-based licence. The licence area also includes a strip of shallow water marine and coastal habitat up to 5 km offshore and EPL 3749.

This EMPR is a requirement of the Minerals Act (1992, Clause 14), Minerals Agreement of 1994 and the Environmental Management Act (Act 7 of 2007).

According to the Ministry of Environment, Forestry and Tourism's Park management plan (2020), zones applicable in ML43 are managed resource use, wildlife management, minimal disturbance and special value zones. Future land use for ML 43 is guided tours as per the TKNP Tourism development Plan. The town of Oranjemund has been excised from this licence area in 2011.

The northern marine portion of ML43, north of Chameis Bay, overlaps with the Namibian Islands Marine Protected Area (Currie et al. 2008, GRN 2009).

These and all other legislation relevant to this report are provided in further detail in Annex 2.

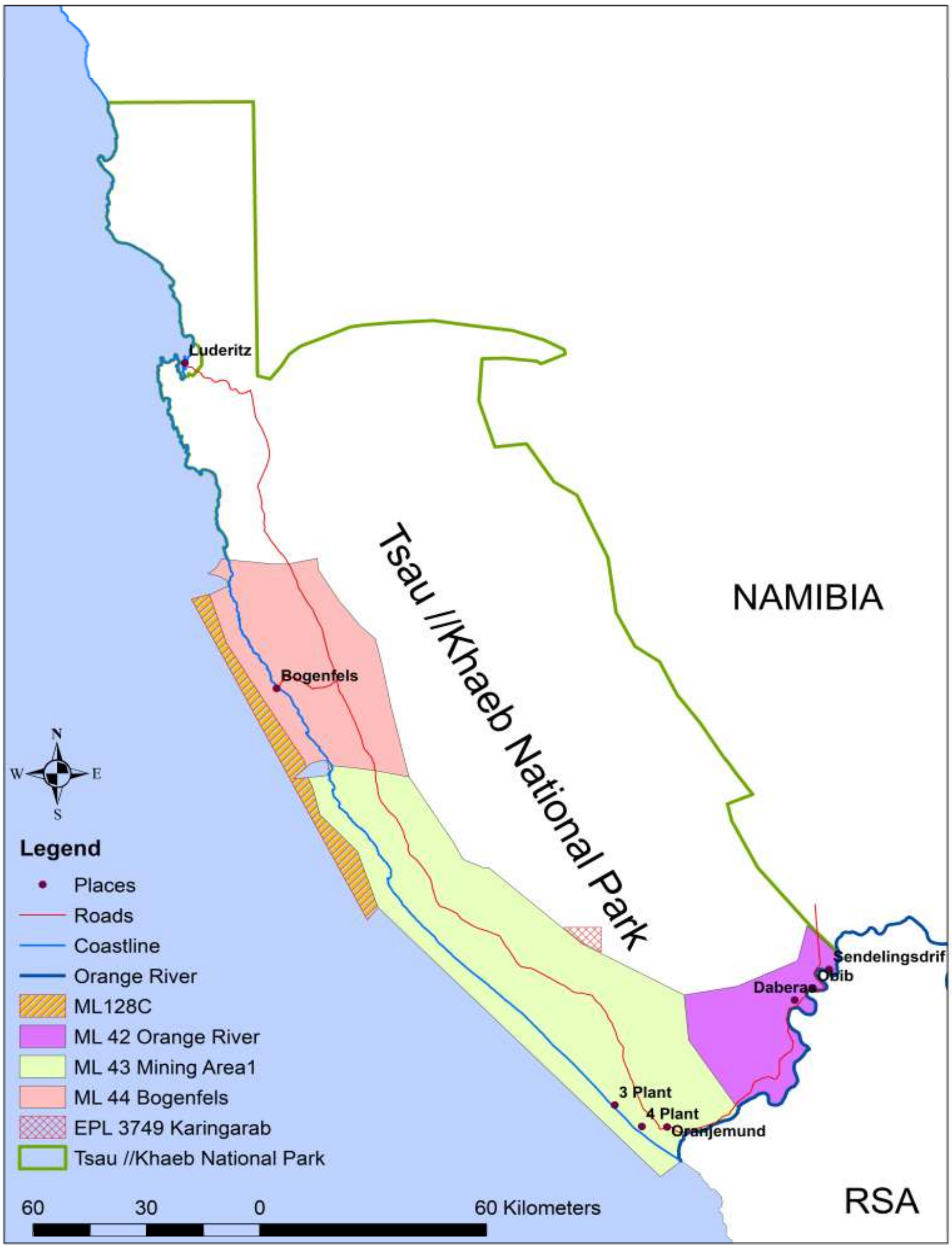

Figure 6. The position of mining licence area 43 in Namibia and the Tsau//Khaeb (Sperrgebiet) National Park.

Chapter 2 Description of activities

Exploration takes place on accreted beaches with the sonic probe drill and the BG36 large diameter drill. Probe drilling is planned throughout the license area. Vessel-based contractors′ prospect for and mine offshore diamonds in the ultra-shallow and midwater area. Exploration for rare earth elements takes place in EPL 3749.

Dry mining activities take place behind seawalls on accreted beaches, where overburden as well as process plant tailings are deposited onto the beach to aid in accretion and push the shoreline seawards. The potential life of mine extension of accretion mining to 2037 is projected to result in a westward shift of the shoreline up to a maximum of 1.2 km from the current shoreline.

An enormous amount of metal (137,628 metric tons to date) has been cleared from previous scrap yards and demolition projects and four large plant complexes have been demolished over the last thirteen years.

All stages of the mine life cycle are relevant in Mining Licence 43, and these will provide the headers in this chapter. However, mining is a dynamic business, and these different stages are in a continuous flux of change. The current EMPR provides a snapshot of the status at this point in time, with a 3-year forecast until 2028.

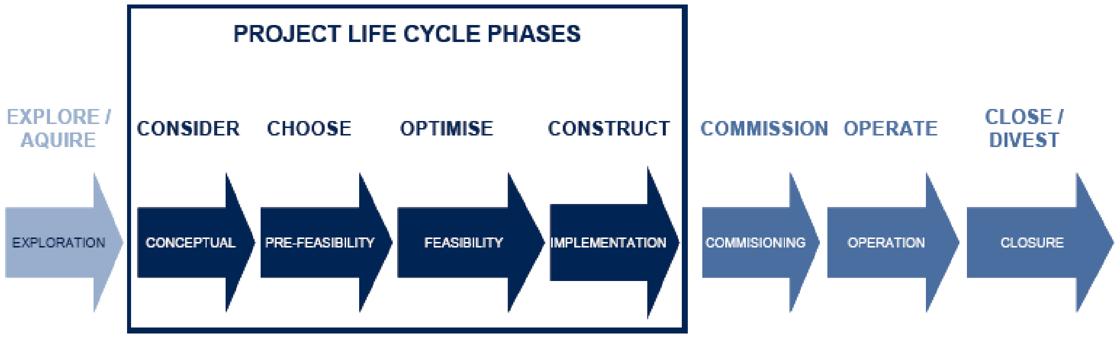

Figure 7. Stages in the life cycle of a mine.

Mining in Mining Area 1 started in 1928 (Corbett 1989) and has continued almost uninterrupted since then. The current Strategic Business Plan predicts a life of mine until 2029.

A long term Business Plan was developed and has been approved by the Namdeb Holdings Board and indicates an extension to the current life of mine untill at least 2037. Business plans will be developed at 3-year intervals to coincide with the validity of the Environmental Clearance Certificate.

The overall method of future mining employs similar technologies to the way Namdeb currently mines but at a larger scale in terms of the square meters mined per year. The business plan allows for mining between 1,400,000 m^2 and 1,600,000 m^2 per year compared to 860,000 m^2/year in 2021.

Namdeb mines ancient linear beaches, which extend from the Orange River mouth to some 100 km northwards along the west coast (Spaggiari & Ward 2004). Sheets and pockets of diamond-bearing gravel in these ancient beaches form the largest alluvial diamond placer on earth (Bluck et al. 2005). Most economically viable diamond deposits on land have now been depleted and the focus is shifting towards extracting the anticipated large diamond resources offshore. However, viable diamond deposits are presently still available in the most lucrative mining blocks (ED area, central blocks and western blocks on Precambrian and fluvial footwall) (Namdeb 2014).

Historically the licence area included ten major plant sites (from north to south: Chameis plant, No.1 plant, No.2 plant, Marine Dredging Trial plant, No.3 plant, 50G, No.4 plant, Pre-Treatment Facility, German plant and Red Area Complex) and five large building complexes (Affenrücken, Mittag, Uubvlei hostels, Uubvlei workshops and Personnel Control Centre) having supported or supporting the oldest to the most recent mining activities in this area (

Figure 8). Over 90 years of mining alluvial diamonds, deposited in former linear beaches, has created an almost uninterrupted man-made landscape of seawalls, ponds, mined out bedrock and dumps, with the shoreline pushed out to sea. This landscape forms a strip tapering northwards from 4 to 0.5 km width on land.

Some of the older processing plants (Chameis, No.1, No.2, 50G and Pre-Treatment Facility) have now been demolished and the sites rehabilitated. No.4 plant have been partially demolished and Marine Dredging Trial plant have been refurbished as a sampling plant.

2.1 Exploration

2.1.1 Land-based exploration

While technology to mine marine diamonds has been available for decades, accessing the diamond resources in the coastal area (encompassing inshore, mid-water, shallow-water and surf-zone) still proves a challenge.

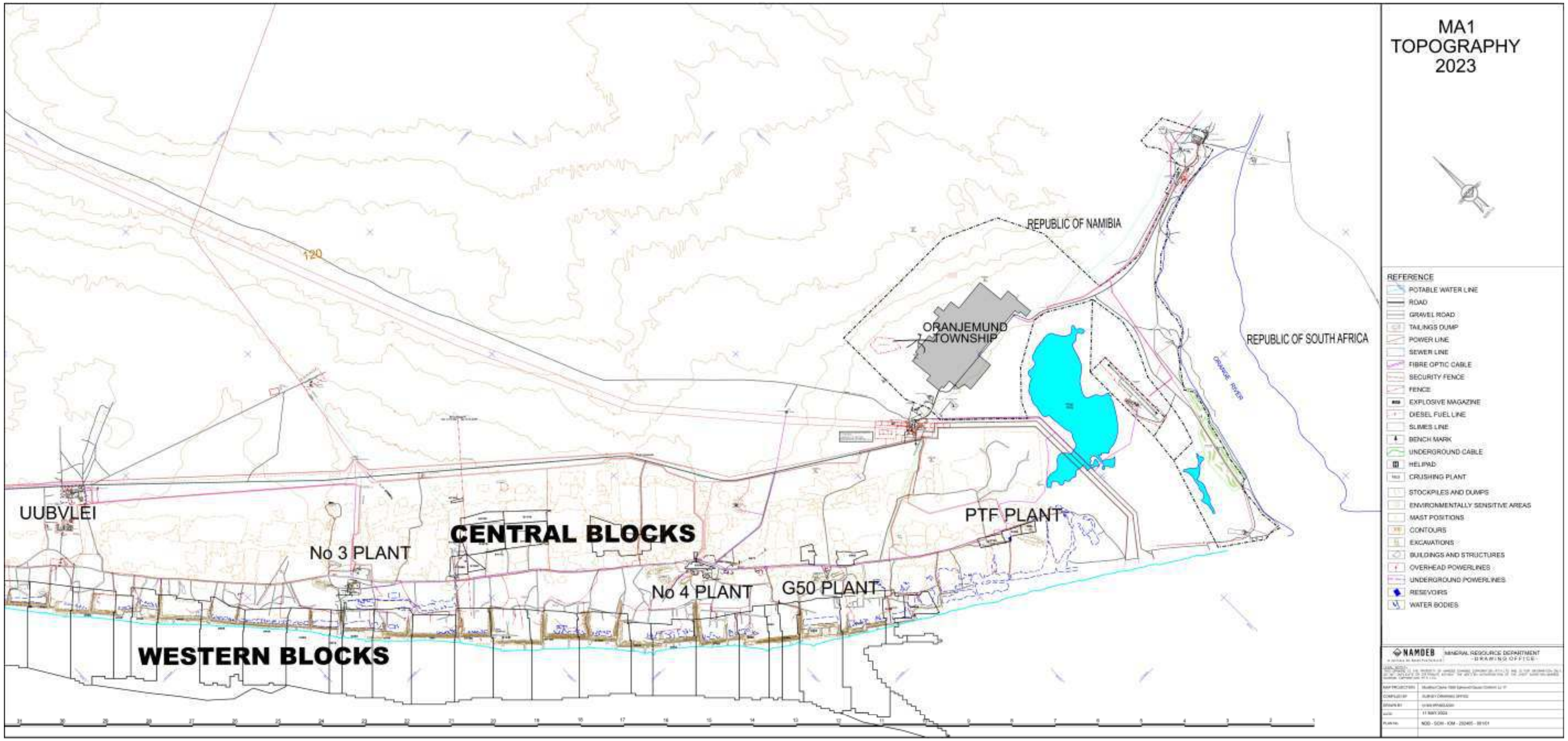

Figure 8. Locality of the main facilities and mining blocks within ML43.

In order to establish geological characteristics of future potential mining areas, current exploration activities target accreted beaches with the sonic probe drill and a augler-sampler tool (BG36), which is accompanied by a mobile mud mixing plant. BG36 samples are excavated from a 5 m^2 hole, stockpiled close by and then loaded in an articulated dump truck (ADT). Mud is mixed with attapulgite (a clay mineral) on site and pumped down the hole. It is recycled to replace the extracted sand and gravel. The samples are transported to either the Southern Areas Sampling Plant or the OREX for treatment, and then to the Geological Sampling Recovery for further treatment and diamond recovery at the geological laboratory.

Sonic probe drilling is one of the drilling techniques employed since 2011 to sample accreted beaches and sea walls in the mining blocks from GN003 to U130. The sonic probe drill uses two methods of drilling: (1) the blow–up technique, whereby the material is discarded without taking any samples to determine the depth overburden, and (2) drilling with coring rods, whereby a sample is retrieved and processed.

A BG36 operating team accompanied by a geologist and surveyors (maximum 12 people) access the sampling sites on existing haul roads and on accreted beaches and operate in a 1 km radius, before moving to the next drill site. The only support structures are mobile containers serving as offices, a mobile chemical toilet, storage and workshops. Waste management, re-fuelling and accommodation is provided at mine sites or in Oranjemund (and is therefore described under ‵mining′ and ‵infrastructure′).

In addition to the current exploration activities, probe drilling (Reverse Circulation) is planned in areas other than the accreted beaches throughout the licence area, east of the F-cliff. A RC drilling operation usually includes a truck-mounted drill accompanied by a compressor truck, some form of mobile water supply and a relatively small fuel bowser RC drill chips are collected in plastic tubing for lithological logging and analysis. Positive probe drilling results will be followed up with trenching and/or sampling pits the dimensions and quantity of which are determined by the initial exploration results.

It is anticipated that the same exploration methods will continue in the future until the end of life of mine. There is a high likelihood of an equivalent increase in the number of large diameter BG36, or similar grab sample tools, due to the increase in yearly production square meters.

Linear assays will be generated within the active mining faces as part of the mining process and life of mine. Once the linear assays are generated, the samples will be transported by a load and haul fleet to the sampling plants for treatment. The number of linear assays will increase/decrease proportionally as the annual mining area increases.

Sampling for non-diamondiferous minerals takes place in EPL 3749 within the eastern portion of ML43. This EPL is subjected to its own impact assessment and clearance certificate application process.

2.1.2 Marine exploration

ML43 also includes a marine portion in which exploration and remote mining activities take place. These overlap with those activities underway in Namdeb's offshore ML128C. For consistency, the following classification is used in the EMPRs:

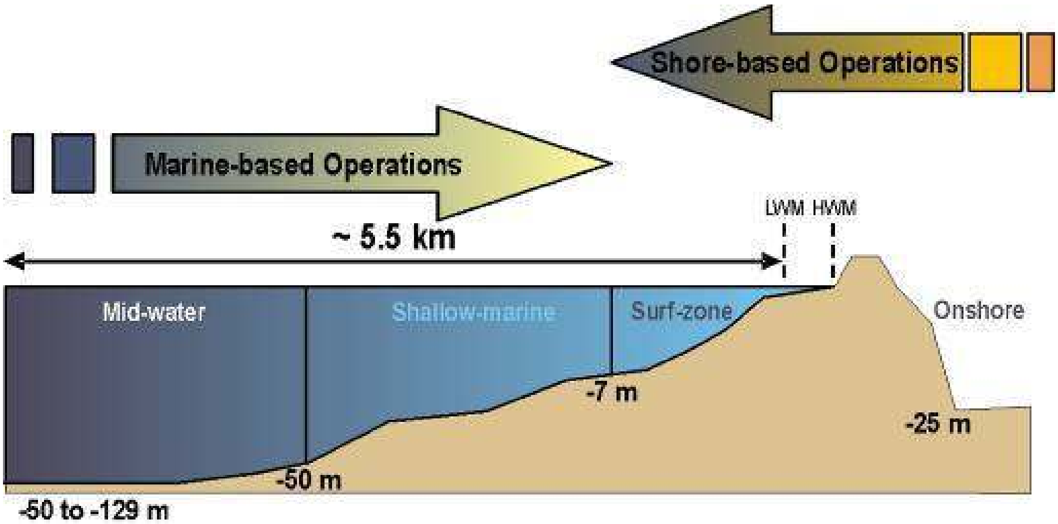

Figure 9. Marine water depth classification used in the EMPRs.

2.1.2.1 Seimic and bathymetric surveys

Earlier seismic and bathymetric surveys opened up several new areas in the mid-water region. Further exploration campaigns are envisaged in the marine portion of ML43 over the next three years.

2.1.2.2 Drones, offshore hydrographic and geophysical surveys

Survey methods include the use of remotely piloted aircraft (RPA) more commonly known as drones. The drones are used to collect images or lidar data depending on the type of sensors that are attached. The data collected is then processed into digital terrain models.

Single beam surveys are undertaken from small survey crafts for accretion monitoring. Data is used to track changes to the seafloor. Surveys are conducted several times a year.

Multibeam along with seismic surveys are conducted to further delineate potential mining areas in the shallow marine and mid-water portions of the license areas. These surveys are conducted to provide infill on the regional geological models.

Planned campaigns are between 2 Pant and North of Chameis bay. Further infill surveys will most likely also be required towards the south (Orange River Mouth) extending to the license boundary to the west.

Multibeam surveys planned within the marine protected areas for habitat monitoring considering natural and seasonal changes in sediment transport. Surveys are dependent on good weather and therefore very opportunistic throughout the year. Several monitoring sites have been identified that will be surveyed periodically.

2.1.2.3 Sampling

Vessel-based geological drilling and sampling had been undertaken in 2013 to 2018. Geological modelling and resource evaluation are underway. A suitable sampling tool is presently being investigated to explore areas offshore of Kerbehuk in more detail.

A variety of tools were developed and implemented during the course of the sampling operations undertaken since 1999. These are described briefly below:

Megadrill: a drill sampling bit typically 3.6 m in diameter; during an intensive bulk-sampling programme between 15-25 sample holes can be drilled per day, equating to an area of 153-255 m^2 per day.

Borer: a subsea sampling tool, which comprises a 2.5 m diameter drill bit operated from a drill frame structure, which is launched through the moon pool of the support vessel and positioned on the seabed. The tool has a 5 m^2 footprint and can be implemented in water depths up to 180 m. The drill frame structure has a base of 6.5x6.5 m, stands 23 m high and weighs 147 t. The drill bit can penetrate unconsolidated sediments up to 8 m depth above the rock or clay footwall. A sample spacing of as little as 20 m can be achieved by the dynamically positioned vessel. Depending on sea conditions and the soil′s geotechnical conditions, up to 60 samples can be successfully taken per day.

STR2: a drill bit with six slots of equal dimensions, which is fitted onto the tool in the drill frame structure of the sampling vessel. The tool similarly has a footprint of 5 m^2.

STR2.1: a reinforced version of the STR2, which was developed to sample areas with thin overburden and competent footwall. The bit with six slots, of which four have the same dimensions as the STR2 and two slots being slightly larger. The tool similarly has a footprint of 5 m^2.

Sampling in the mid-water areas was undertaken by a contracted vessel the *MV The Explorer*. With an overall length of 114.4 m and a gross tonnage of 4,677 t, the vessel is equipped with sampling tools as described above, which are operated from a drill frame structure launched through the moon pool of the support vessel and positioned on the seabed. Similar exploration equipment is proposed to be used going forward.

Figure 10. The sampling vessel *MV Explorer*.

Figure 11. The 2.5 m diameter drill bit within the drill frame structure.

2.1.2.4 Diamond-gravel processing

The sediments extracted by the sampling tool are fluidised with strong water jets and sucked up riser pipes **to the support vessel** using compressors to create pressure differentials. The material is discharged onto a series of screens, which separate the oversize (>16 mm) and undersize fractions (<1.3 mm). All oversized and undersized tailings, which comprise almost 90% of the material pumped to the surface, are immediately discharged back to the sea on site.

The gravel fraction of interest (1.3-16 mm plantfeed) is fed through a comminution circuit to fragment the shell, clay and conglomerate components, before being mixed with a high-density ferrosilicon (FeSi) slurry and pumped into a Dense Medium Separation (DMS) plant. Low density materials (floats) are separated and discarded overboard. Most of the FeSi is magnetically recovered for re-use in the DMS plant.

The remaining high-density fraction is dried and passed through an X-ray sorting machine to separate the diamonds, which fluoresce under X-ray illumination. Non-fluorescent material is discarded overboard and the fluorescent fraction is automatically sealed in cans for transport to shore and final hand sorting. In total, of the material pumped to the surface, over 99% is therefore returned directly to the sea.

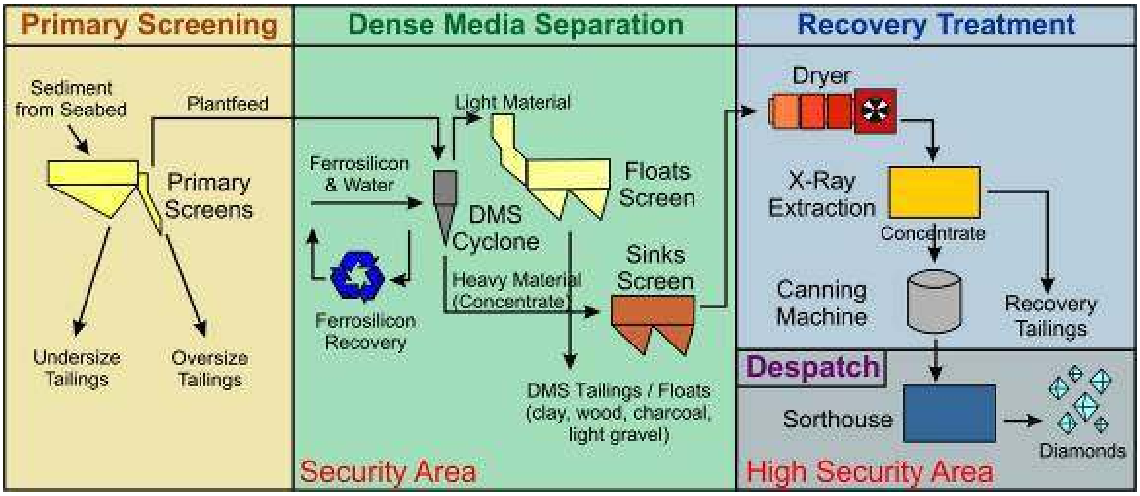

Figure 12. Simplified flowchart of the stages and processes during shipboard processing of marine diamond gravels.

2.1.2.5 Resource development, delineation and definition

Exploration data collected to date have revealed numerous targets, which have been grouped on the basis of their geological complexity into distinct geological zones. Through an Advanced Exploration Study and ongoing exploration, the identified targets will be tested and measured against specific resource development criteria to:

◊ Determine their resource potential,

◊ Assess their prospectivity using available and applicable technology to test the deposits, and

◊ Determine their economic potential through an assessment of the sampleability, mineability and processability of the different deposits.

The resource will then be delineated through identification and development of concepts to economically and sustainably exploit the selected targets. Ultimately the resource will be defined through the development and evaluation of options and the selection of the optimal solution to exploit the selected targets.

Further exploration approaches will include:

- Sonic coring,
- Geophysical surveys,
- Drilling and sampling following development of appropriate tools and
- Test mining.

The teams implementing these exploration campaigns, are 7-13 people, depending on the technology used. A chemical toilet is always present at the exploration site.

Bulk sampling is envisaged for ML43 in the near future, as ongoing exploration and resource delineation may yield potential bulk sampling targets in the mid-water marine portion of ML43. A total of 292,091 m^2 had been sampled by 2018, with no additional sampling undertaken beyond then.

2.2 Technology Development

While current mining methods will proceed with the current Business plan, several technologies are being explored to access diamond reserves in shallow water areas. Future solutions, integrating alternative accretion, alternative dry and wet stripping, and alternative dry mining methods, aim to optimize operational costs.

2.2.1 Alternative Stripping Technologies

2.2.1.1 Wet Stripping of Overburden in Ponds Behind Seawalls

Incorporating wet dredging technology to conduct stripping within the Southern Coastal Mines area including both G and U Blocks areas involves using specialized equipment and processes to efficiently remove overburden sand from the beach and transport it into the sea for future accretion. The operational principles of wet dredging amongst others, the use of Cutter Suction Dredgers (CSD), Plain suction dredgers, bucket ladder dredgers, Clamshell dredgers and Trailing Suction Hopper Dredgers (TSHD), some of which are equipped with powerful pumps and rotating cutter heads to loosen and extract sediments. The extracted sand is then transported as a slurry through pipelines to designated disposal sites on the adjacent beaches. This process not only clears the overburden to access underlying mineral deposits but also contributes to coastal management by promoting natural sediment accretion.

The equipment used, such as high-capacity pumps, pipelines, and dredging vessels, ensures efficient and environmentally responsible operations. Monitoring and adaptive management strategies would be implemented to minimize environmental impact and ensure compliance with regulatory standards.

2.2.1.2 Dry Stripping of Overburden Behind Seawalls

Following the alternative dry stripping study, there is an opportunity to introduce mobile fluidisers with oversize removal capability, known as Dry Mining Technology (DMU), as an alternative stripping solution to the current conventional stripping methodology. Implementing DMU technology will transform the current stripping process, resulting in lower costs and a reduced carbon footprint. The DMU operates by feeding material into the unit through either a tipping bin using loaders or excavators, or through a dozer trap using dozers. The overburden is transported via a belt feeder to a sizing screen, where oversized particles are removed and stockpiled for future use as rip-rap for seawall cladding. The remaining undersized material is fluidized and pumped as slurry through pipelines to designated disposal sites on nearby beaches. To ensure a sustainable water supply for the DMU, seepage water will be channelled and directed to a sump located within close proximity of the mining site. The aforementioned seepage water shall be sourced in the same manner as the current practice.

2.2.2 Alternative Mining Technologies

After stripping behind seawalls, mining focuses on the bulk excavation and removal of the remaining diamondiferous material on the bedrock with transvacs (industrial vacuum machines). Due to the bedrock's geology, deep gulleys and other features exist where excavation with transvacs is less effective. Alternative mining technologies are constantly investigated to increase the effectiveness of extracting materials from these features, as follows.

2.2.2.1 Surface Miner

A surface miner is a mechanical drum cutter mining unit, combining dozing, excavating and rock breaking into one single operation by cutting the bedrock and gravels to the depth of the gulley bottom.

Figure 13. Example of a Surface Miner

First tested successfully in SCM in 2019, the surface miner cuts the area in 30 cm layers (flitches), which are dozed away before the next cut is made. Once the desired depth is reached, conventional bedrock cleaning is performed to complete the final cleaning process (More on the Surface Miner under 2.3).

2.2.2.2 Production Blasts

Production blasts have been successfully tested in SCM active dry mining areas to fragment hard rock and loosen cemented gravel that is difficult to handle with conventional mining equipment. Blasting creates smaller fragments that are easier to excavate, load, and haul for processing. While the need for blasting depends on varying geology, it is expected to be used throughout active mining areas during the Life of Mine.

Figure 14. Example of Top Hammer Rig

Due to the unique nature of every blast and the area in which it is taking place, drilling and blasting activities will be guided by designs on merit of operational, technical, environmental and safety requirements.

Blasted material will then be loaded and hauled to various destinations dependent on its intended use (E.g. Ore will be hauled to stockpiles or treatment facilities whereas construction type or material required for geotechnical applications will be hauled to stockpiles or point of use).

Where possible, drilling and blasting activities will be conducted in areas below sea level in order to reduce or eliminate the need for active intervention to rehabilitate these areas. Where this is deemed not possible and the areas are visible from the envisioned Tourism Route, these blasted areas will be backfilled after use, according to Namdeb's approved Rehabilitation Plan. Due to the unique nature of every blast and the area in which it is taking place, drilling and blasting activities will be guided by designs on merit of operational, technical, environmental and safety requirements.

2.2.2.1 Types of Explosives

Ammonium Nitrate (AN) explosives will be used to break rock in dry areas. Due to the wet conditions of most of the mining areas, water-resistant Ammonium Nitrate Emulsion (ANE) will be used, preference will be given to packaged emulsion to prevent explosive seepage into the water. Alternative explosive solutions will be explored which is applicable according to standards. Both electronic and non-electric detonators will be used to fire the blasts. The tie-up design and timing will be carefully controlled to prevent excessive vibrations and noise and protect the stability of the seawalls.

Explosives magazines have been erected where packaged explosives (emulsion cartridges) and blasting accessories (detonators and boosters) are stored. These magazines are fully compliant with the requirements of the License of Explosives Magazines. The transportation of explosives from the magazines to blasting sites will be conducted using licensed explosives vehicles, ensuring safety and adherence to regulatory standards.

In the future, Namdeb will consider the establishment of an ANE (Ammonium Nitrate Emulsion) storage facility, should ANE bulk explosives be tested and approved for use in the Southern Coastal mines. The storage facility, if erected, will comply with all regulations with regard to the handling and storage of hazardous substances and will be included in Namdeb's EMS. The transportation of ANE explosives will be handled by a licensed Mobile Manufacturing Unit (MMU) truck, ensuring safe and efficient delivery to the site.

2.2.2.2 Suction Units

Given the manual labor involved in handling suction pipes for final bedrock cleaning, there is potential to explore automated suction solutions. One option under consideration is the use of suction units, which could be deployed to the mining site for more efficient bedrock cleaning.

2.2.3 Alternative Accretion Technologies

Alternative accretion technologies are under investigation to enhance the loading, hauling, and nourishment aspects of the accretion process.

The accretion areas are in the central and southern part of Southern Coastal Mines from No.2 plant to the southern boundary near the Orange River mouth. The map below (Figure 15) shows the original coastline in 1972 before the commencement of mining with seawalls, the status of the coastline on 11 April 2024 and the projected accretion up to the end of 2037 (referred to as 2038 accretion). The greatest westward extension of the coastline is expected in the area between No.3 plant and No.4 plant.

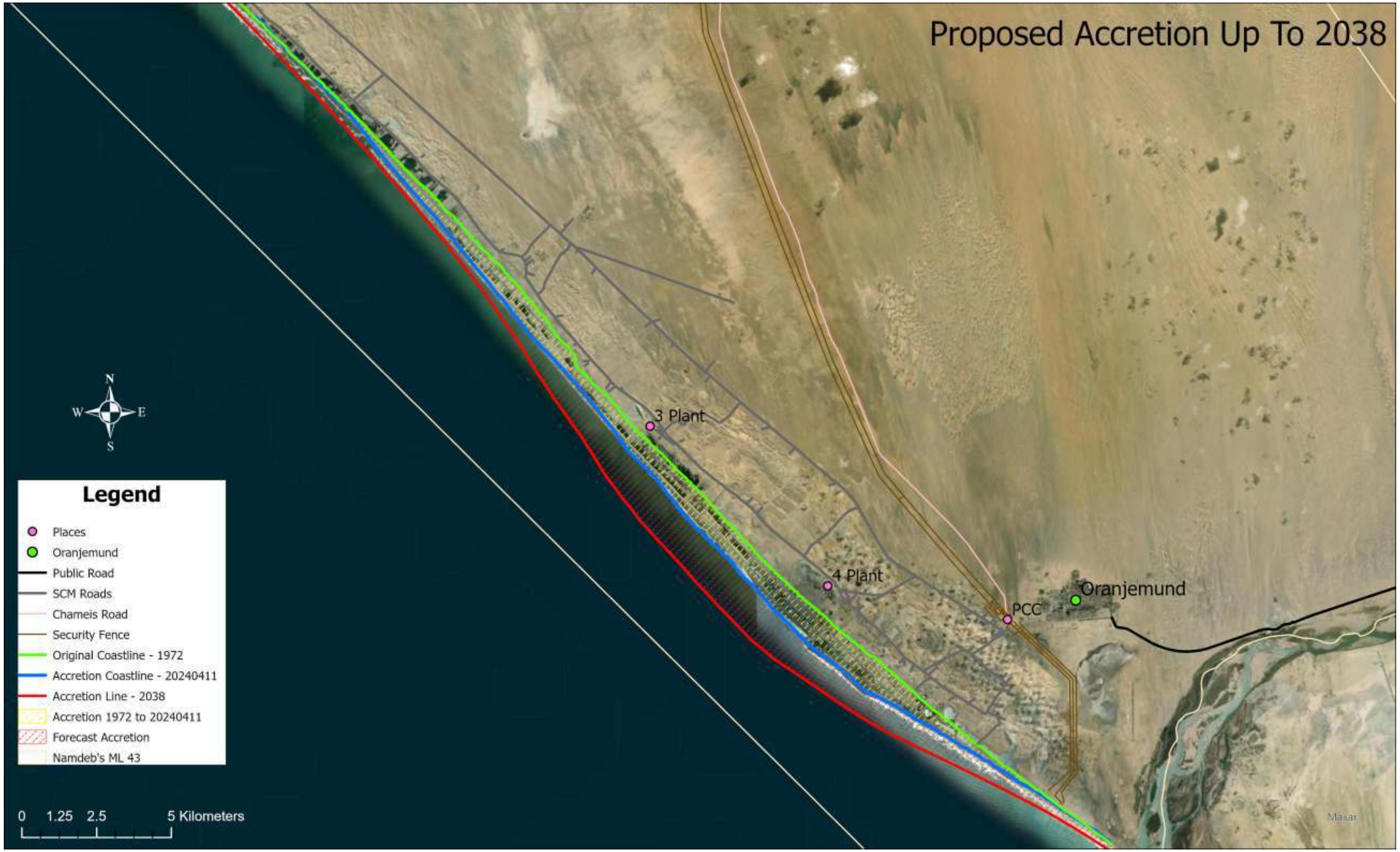

Figure 15. Overview map of proposed accretion in Southern Coastal Mines (map provided by Namdeb).

2.2.4 Mining in ponds behind seawalls

Some test work is planned to further investigate feasibility and refine technology and practical approaches to mining behind seawalls. Seawall stability is constantly monitored at Namdeb and the monitoring results and experience from nearly 50 years of seawall mining are incorporated in the engineering designs for the westward and deeper moving seawalls.

Beach accretion will continue as presently implemented, with a combination of groynes and beach nourishment. Groynes will be constructed into the sea to enhance accretion and plausibly reduce the northward transport of sediment.

Stripping in mining ponds will be tested with a plain suction or cutter suction dredge operating. This technology is not new to Namdeb and was successfully employed in the Southern fluvial footwall zone of the ML43 area. Mining post dewatering would be undertaken using the current equipment and vacuum suction cleaning units but will be supplemented by a surface miner. There are also considerations being made to drill-blast and bulk load ore, with the possibility of in-field beneficiation to reduce waste before hauling to main the treatment plant. The surface miner was successfully tested in three suitable, stripped, approximately 50x70 m bedrock test areas as well as in two larger 200 x 100 m production test areas. Bedrock cleaning was subsequently performed post surface miner to evaluate the efficiency of the surface miner.

The surface miner is a mechanical drum cutter mining unit, combining dozing, excavating and rock breaking into one single operation by cutting the bedrock and gravels to the depth of the gulley bottom. This machine can also be considered for use in road maintenance activities.

The mined gravel and bedrock are collected by a loader and truck and stockpiled for treatment. Further treatment will include blending with other product and finally batch treatment at No.3 plant.

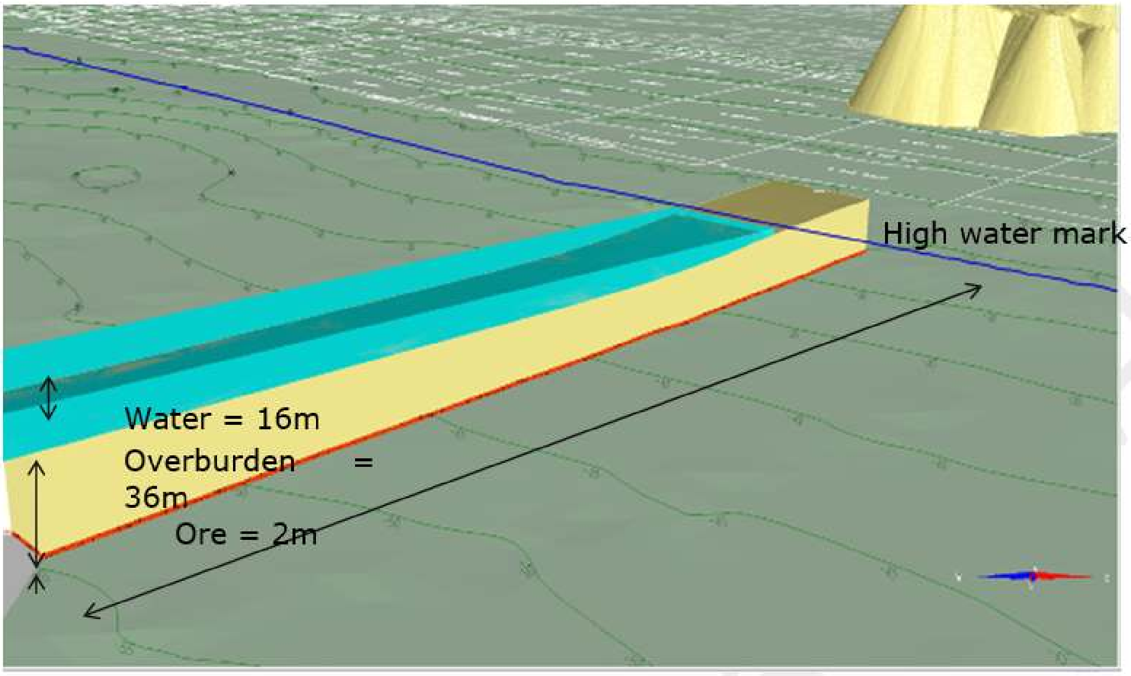

Figure 16. Schematic diagram of the area targeted for mining (ore = bottom layer).

In order to explore other mining options in future, dry blasting has been tested in Southern Coastal Mines in mined bedrock areas. Five 50x100 m test areas were created, with blasting depths between 2-4 m.

Based on the results of the dry blasting testing, drilling and blasting activities will take place in ML43, primarily to support geotechnical safety requirements and to meet production requirements. These activities will also support construction or project related activities that support the operation where other rock breaking activities prove to be less feasible.

Due to the unique nature of every blast and the area in which it is taking place, the drilling and blasting activities will be guided by designs on merit of operational, technical, environmental and safety requirements.

The blasted material will then be loaded and hauled to various destinations dependent on its intended use (e.g. Ore will be hauled to stockpiles or treatment facilities whereas construction type or material required for geotechnical applications will be hauled to stockpiles or point of use).

2.3 Mining

Ore is currently mined from an area within 25 km of the southern limit of the licence area. As most beaches have now been mined, mining has moved into the surf zone, which is accessed by accretion mining.

Figure 17. Conveyors transport material from overburden dumps as well as process plant tailings onto the beach to accrete the coastline, view from west to east at No.3 plant, in October 2020. The arrow indicates the former seawater intake tower which was the position of the former coastline some years back (Photo: Namdeb).

2.3.1 Accretion, stripping and mining

2.3.1.1 Accretion

Accretion mining pushes the shoreline seawards by depositing (overburden) sand and tailings onto the beach and swash zone, for the subsequent stripping process that involves building and maintaining seawalls to access the resource behind the seawall in a dry-mining operation. Access to the seawalls is achieved *via* cross walls.

Accretion is achieved through a combination of point deposition on groynes, as beach nourishment through distributed deposition along the coastline and through fluidized sediment. There are four overland long transport conveyors in Southern Coastal Mines of which two have been decommissioned (G-90 and U-40). The conveyor at U-40 was partly dismantled to allow for the mining of its cross-wall and will have to be refurbished and re-instated. A conveyor (at U-0) is not currently in operation. The only active conveyor is at N. 3-plant.

Coarse tailing from N.3 plant is discharged via a conveyor onto the beach adding to accretion. Fine tailings from No.3 plant are also pumped into the sea. Where possible, drilling and blasting activities will be conducted in areas below sea level to reduce or eliminate the need for active intervention to rehabilitate these areas. Where this is deemed not possible and the areas are visible from the envisioned Tourism Route, then these blasted areas will be backfilled after use.

Additional coarse material (riprap) may be required to strengthen the seawalls. This will be sourced from mined-out bedrock areas which will be blasted. If possible, these areas will be selected in currently dry zones below sea level.

Beach accretion is performed between GN006 (south of No.4 plant) and U130 (north of No.3 plant). Stripping of overburden material is carried out by conventional loading and hauling operations. The dumping of (overburden) sand onto the beach and pumping of fines into the swash zone has resulted in shoreline accretion of up to 400 m locally, which allows dry mining behind the seawalls in areas formerly below the high-water mark.

The business plan is informed by estimated tonnes of overburden material stripped, tailings generated, material to sea, area accreted, and additional land accreted, given as a distance. These estimated variables are plotted on the graphs to follow.

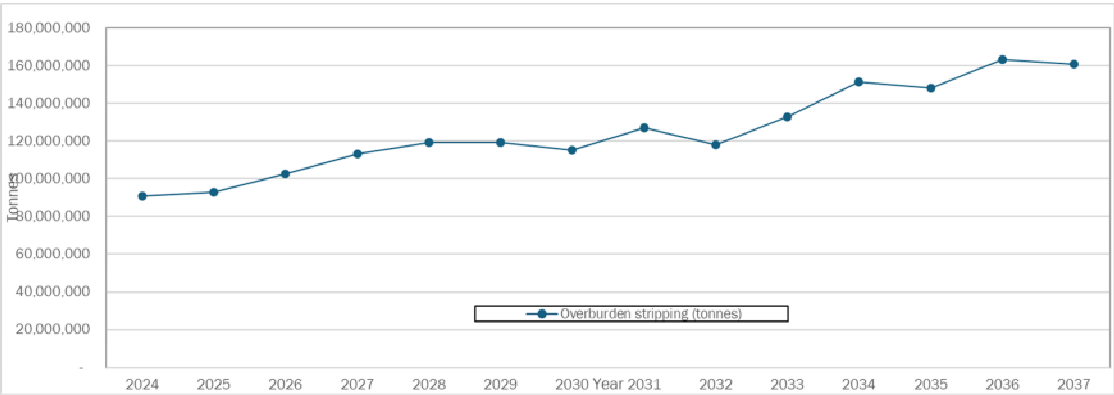

Figure 18. Projected tons of overburden material stripped for accretion

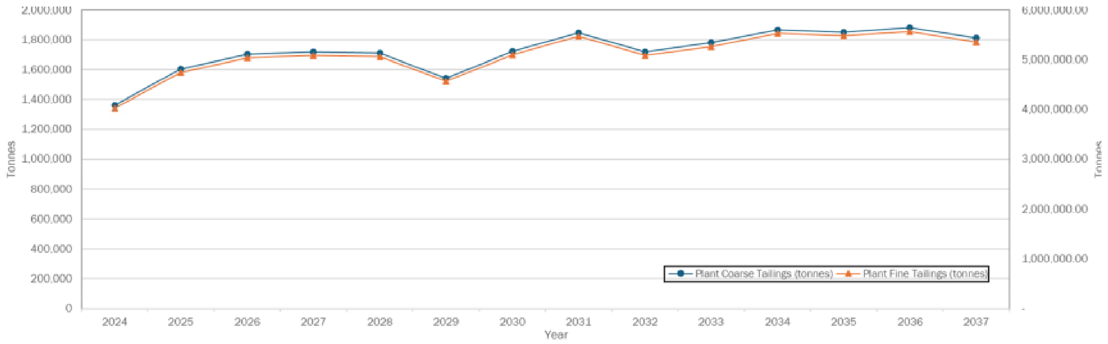

Figure 19. Projected tons of fine and coarse tailings generated at No.3 plant

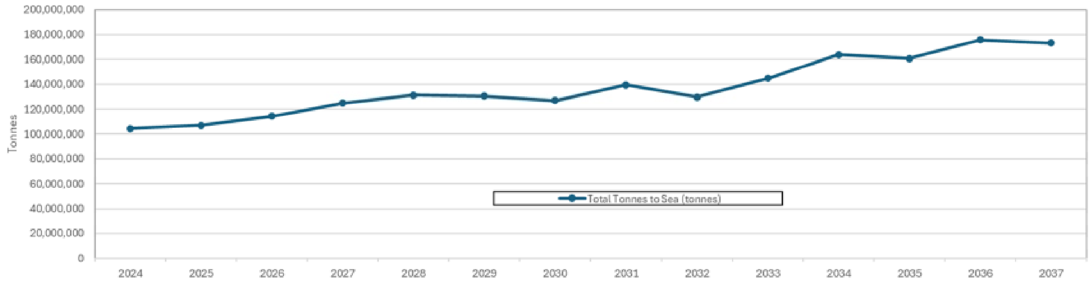

Figure 20. Projected total tons of material to sea per annum

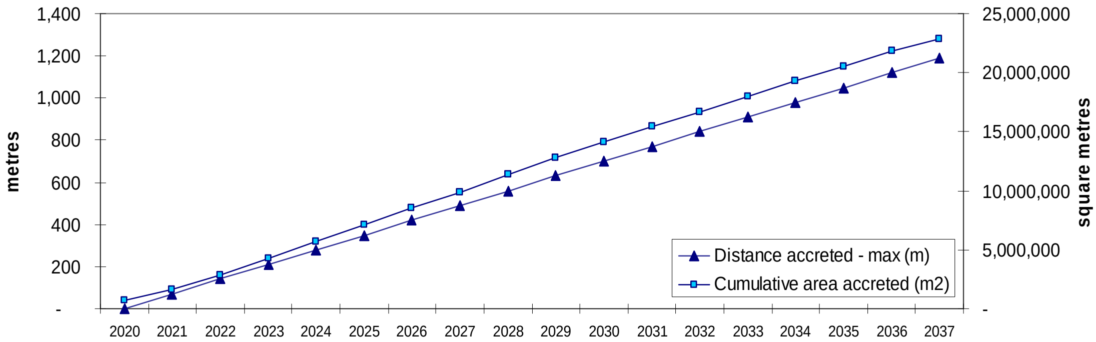

Figure 21. Cumulative area accreted and maximum distance of accretion

It is clear from the graphs above that the magnitude of accretion will increase as follows:

Total tons to sea will gradually increase from around 103,000 kilotons per year in 2024 to 140,000 kilotons in 2031 and eventually to 170,000 kilotons in 2037. The accreted area generated on a yearly basis will increase from around 5,000,000 m^2 per year (current) to more than 20,000,000 m^2 per year. This translates to a maximum additional westward accretion distance that ranges 500m to 700m by 2030 and 1km to 1.2km by 2037.

The distance of achieved accretion will vary according to local conditions such as distance from sand deposition points and nature of the coastline and adjoining bathymetry. The graph shows the maximum accretion that could be achieved. (Figure 21). The volume of course tailings is slightly more than fine tailings (Figure 19). Both coarse and fine tailings are disposed on the beach and assist with accretion.

Dedicated accretion, in addition to accretion generated from overburden stripping operations, will be achieved by a loading and hauling operation where previous overburden dump material will be loaded with front end loaders and excavators into dump trucks and transported to the beach. These dedicated accretion load and haul operations are taking place and will continue along the coastline between GN-006, and U-130 as dictated by an accretion model.

In the past, conveyors were used to assist with the transportation of the dedicated accretion sand over long distances, but in the short term only load and haul methods will be used in order to optimise flexibility of discharge.

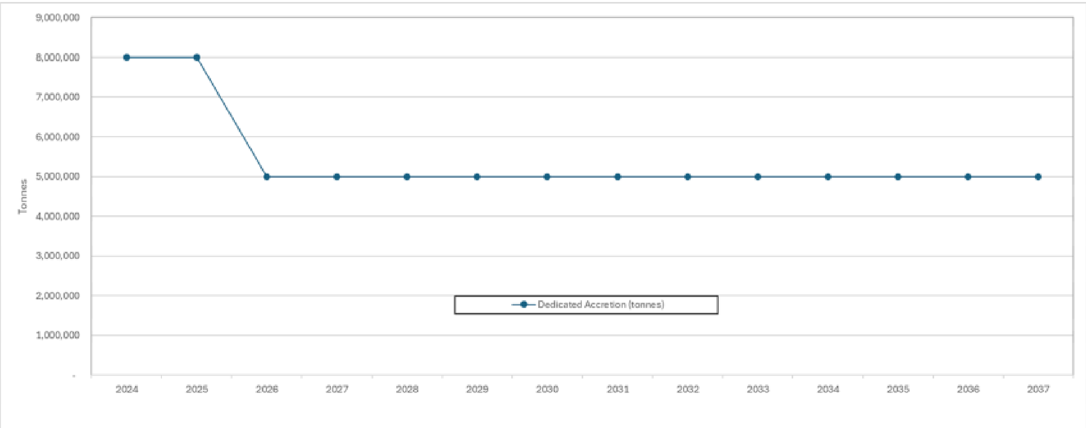

Figure 22. Dedicated accretion with material from old overburden dumps.

2.3.1.2 Stripping

Conventional dry overburden stripping is currently carried out primarily by articulated dump trucks (ADTs) and excavators. The majority of overburden material is transported to the seawall to protect the mining sites or advance groynes into the sea, thereby contributing to accretion. The basis of the business plan is to continue with this mining approach whilst continuously exploring alternative stripping technologies . These technologies will focus on improving cost effectiveness, whilst simultaneously also improving overall fuel and energy consumption (as further explained under 2.4).

The business plan is based on the introduction of larger ADT's and matching excavators, which will already achieve part of the cost and energy savings objectives.

Dewatering takes place continuously in the mining areas by pumping seawater back to the sea to keep mining areas dry for depletion.

The business plan provides for the continuation of dewatering behind the seawalls along the coastline from the southern boundary of Southern Coastal Mines up to U130. Although the distance across which dewatering has to take place is not increasing substantially, the progressive deepening of the target blocks as the mining operation moves westwards will result in an increase in energy consumption due to increased seepage caused by sea-level differential as well as an increased pumping head. The changes to the current mining operations are summarised in chapter 2.7.

2.3.1.3 Wet dredging technology for stripping of overburden

Incorporating wet dredging technology to conduct stripping within the Southern Coastal Mines area including both G and U Blocks areas involves using specialized equipment and processes to efficiently remove overburden sand from the beach and transport it into the sea for future accretion. The operational principles of wet dredging amongst others, the use of Cutter Suction Dredgers (CSD), Plain suction dredgers, bucket ladder dredgers, Clamshell dredgers and Trailing Suction Hopper Dredgers (TSHD), some of which are equipped with powerful pumps and rotating cutter heads to loosen and extract sediments. The extracted sand is then transported as a slurry through pipelines to designated disposal sites on the adjacent beaches. This process not only clears the overburden to access underlying mineral deposits but also contributes to coastal management by promoting natural sediment accretion. The equipment used, such as high-capacity pumps, pipelines, and dredging vessels, ensures efficient and environmentally responsible operations. Monitoring and adaptive management strategies would be implemented to minimize environmental impact and ensure compliance with regulatory standards.

2.3.1.4 Mining and bedrock cleaning

The exposed ore is currently excavated and the remaining bedrock finally cleaned manually with transvacs (industrial vacuum machines). The mining activities are supported by a substantial fleet of machinery and vehicles.

After stripping, the gravel and sand layer covering the bedrock will be dozed and transported to a stockpile or No.3 Plant as per current methodology. Hereafter, the Surface Miner will cut the bedrock and gravels to an average depth of 0.3-2.5 m. The product will be dozed, loaded and hauled to a stockpile or to No.3 Plant for processing.

The remaining gravels will be conventionally cleaned using excavators and Transvac equipment. Improvements to the remaining gravel cleaning is being evaluated and will be introduced as and when they are proven successful. These potential improvements could include mechanical brushes, mobile mechanised gravel suction units, and possibly smaller excavator units. The business plan provides for one Surface Miner unit and team, which will enable the scale up to above 1,200,000 m^2 with minimal increase in dozers, excavators and Transvac equipment and labour.

The Surface Miner operation will generate an increased amount of coarse oversize material as part of the run-of-mine (R.O.M) to the plant. This will be screened out early in the process and utilised as buttress material to strengthen the seawalls.

The number of active mining sites at any given time will increase from the current five sites to seven or eight sites.

The partially diluted R.O.M. material is loaded and transported to No.3 Plant using dump trucks. The Long-Term plan provides for the possible use of more cost-effective and energy-efficient trucks with a higher capacity e.g. 50 t or 70 t. These trucks will be procured from 2022 onward as replacements for the current RFTs. The use of larger trucks would also improve fuel efficiency measured in litre/ton.

Table 1. Summary of earth-moving fleet and support equipment.

	2025	2026	2027	2028
Summary of fleet type				
Articulated dump trucks	14	10	10	10
Rigid frame trucks	22	14	14	14
Excavators	50	50	50	50
Mobile rockbreakers	17	17	17	17
Front end loader	14	14	14	14
Track dozers	12	12	12	12
Wheel dozers	2	2	2	2
Surface miner	1	1	1	1
Graders	4	4	4	4
Water tankers	2	2	2	2
Fuel bowsers	2	2	2	2
Transvacs	54	54	54	54
Tractors	8	8	8	8
Silo trailers	67	67	67	67
Annual total earth-moving fleet	**269**	**257**	**257**	**257**
Support vehicles and equipment				
Sprinters	1	1	1	1
Ambulance	1	1	1	1
Buses	9	8	8	8
Fuel transport	0	0	0	0
Special purpose trucks	2	2	2	2
Crane trucks	18	18	18	18
Fire trucks	1	1	1	1
Horses	5	5	5	5
Service trucks	2	2	2	2
Silo trucks	2	2	2	2
Tipper trucks	2	2	2	2
Backhoe loaders	3	0	0	0
Forklifts	13	12	12	12
Mobile cranes	3	3	3	3
Skidsteer loader	1	1	1	1
Telehandlers	8	8	8	8
DMS concentrate dumper trailer	3	3	3	3
Lowbeds (plus earth-moving integreated)	5	5	5	5
Trailers	3	3	3	3
Elevated work platforms	3	3	3	3
Annual total support fleet	**85**	**80**	**80**	**80**

2.3.1.5 Northern block mining

An extension to the northern mining blocks (M, K, H and C areas) is considered, initially in a trial mining phase to verify feasibility and costs. Similar to the mining operations in the south, a berm/seawall would be established to protect the mining sites with overburden and possibly material from tailings dumps. The mining site would be dewatered, stripped with excavators, dozer and trucks in a conventional dry mining operation. Bedrock cleaning would be employed using Transvacs. Employing a surface miner is being considered as a second option for stripping and excavation of material. Should this operation prove profitable, further mining blocks would be included in the business plan.

The current plan does not include the mining in the northern blocks due to its marginality and the uncertainty around the available resource. Test-work in the area will, however, continue and if mining proves feasible, it will be considered as an addition to the Business Plan.

If mining in the northern blocks does continue, it would initially be undertaken in the potential target areas currently available on land (i.e. 20 m inland of the +2 m high water line) at approximately 200,000 m^2 per year.

If found to be feasible, mining of the intertidal zones below the high-water mark, would only commence post 2026. It is currently assumed that a similar accretion approach as used in the southern blocks would be applied. Trial mining and testing will continue to test and evaluate various alternative mining approaches. Current approaches include temporary seawalls to protect rapid mining landward of them, and seawall support using geo-fabric bags, tarpaulins or similar.

A mobile screening plant may be positioned on site to reduce haulage volumes. Alternative hauling equipment is also being evaluated in order to select the most effective long distance hauling solution.

Tailings from the screening plant would be used to maintain the seawall. The screened material would be transported to No.3 plant or the OREX Sampling Plant for treatment.

Figure 23. Northern block test mining: Stripping by dozer only (photo: Namdeb).

Figure 24. Northern block test mining: Temporary seawall (photo Namdeb).

Figure 25. Northern block test mining: Fast, narrow strip mining (photo Namdeb).

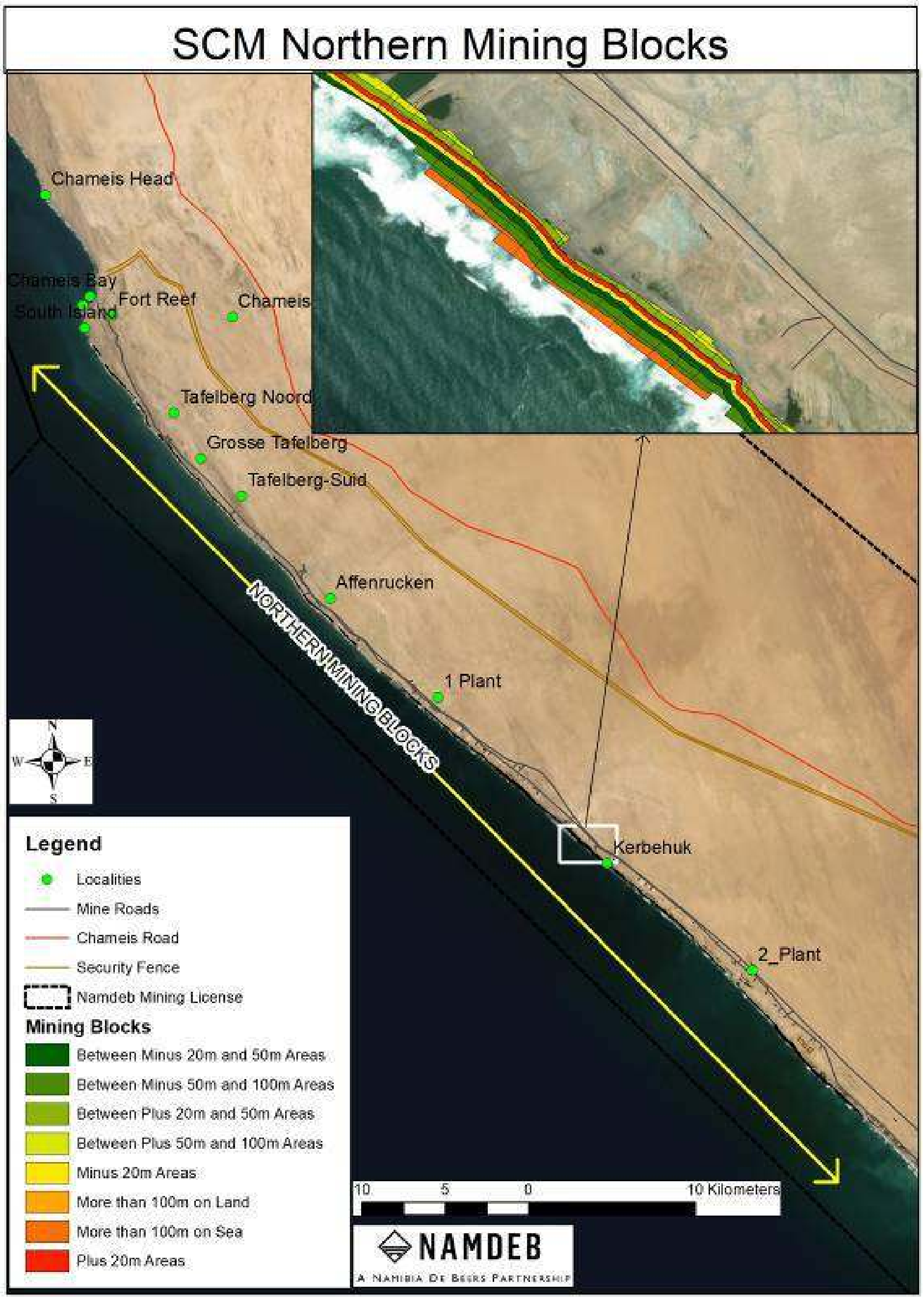

Figure 26. Position of northern mining blocks in Southern Coastal Mines. The insert shows an example of the proposed mining in detail (map provided by Namdeb 2020).

2.3.2 Infield screening

Previously unmined deposits were pre-processed using the dry-infield screening plant (DIFS) in the ED area in the south-east corner of ML43. This material was hauled to No.3 plant. The DIFS plant is also utilized for boulder generation from existing waste dumps.

Previously, material from the Precambrian western blocks was transported to the Wet Infield Screening facility (WIFS) near the 50G area to reduce bulk by pre-processing diamondiferous material. The WIFS operation has been discontinued and will be recommissioned if required in future business plans.

2.3.3 Treatment of ore

Ore processing entails liberation and separation to recover the valuable mineral, through crushing to reduce to smaller sizes, deagglomeration to free locked ore, and separation based on density (A chemical called Ferro Silicon is used as a media, which is recovered via the Magnetic Separators for continual usage) and mineral luminescence beforehand sorting. Various types of equipment are involved, namely crushers, scrubbers, conveyors, surge bins, Dense Medium Separation (DMS), and X-ray machines.

2.3.3.1 No.3 plant

The diamondiferous gravel is transported with haul trucks to No.3 treatment plant where it is crushed (where necessary), conveyed, scrubbed, screened, re-crush before entering the DMS. The coarse tailings are deposited into the sea via conveyor belts to aid accretion activities, and the fine tailings is pumped into the ocean via pumps. Process water is pumped from mined-out ponds at an average of 4,200 m^3/hr. No process water is recycled. The concentrate from the DMS section is then transported to the Red Area Complex (RAC) near the mine entrance and diamonds are recovered with X-ray machines and final manual sorting.

The treatment plant currently operates on a 21/7 continuous operation, a 4-team system with 3 teams on shift doing 7 days consecutive on day, afternoon and night shift while a 4th team is off cycle for 7 days.

2.3.3.2 Alternative Feed System (AFS)

In 2023, due to an increase in the number of bedrock faces Namdeb will be mining meant an increase in ore generated for processing hence the need to increase treatment capacity with a 300 tph facility which also solves the current challenges of clay and high moisture ore at the front-end.

2.3.3.3 Southern Areas Sampling Plant

The Southern Areas Sampling Plant (SASP) treats geological exploration samples and consists of a scrubbing and wet-screening, crushing and Dense Medium Separation section. Supporting structures include conveyors and a water abstraction pond, workshops, offices, containers, storage yard, storerooms and High Tension (HT) transformer. Oversize is used for cladding for seawall stabilization and wet fines are disposed of onto the beach.

2.3.3.4 OREX sample plant

An increase in the number and quantity of samples to be processed due to a current backlog and due to the planned scale-up in production, required an additional sample plant facility. The OREX plant, which has been based and utilised at the Orange River Mine complex, has been relocated to the ML43 area to treat linear assay samples. The OREX plant has been erected near the Uubvlei workshop area haul road.

2.3.3.5 Red Area Complex (RAC)

The Red Area Complex (RAC) is located at the Personnel Control Centre (PCC), the entrance to Southern Coastal Mine (SCM). Components of the new recovery plant are Source bins with a retaining wall, a Front-end, Sizing screen, Effluent system, X-ray machines and Tailings bins. A system of conveyors links the different components. HT transformers, weighbridge, workshops, offices and changerooms, helipad, water tanks and MCC are supporting infrastructure. The RAC is located adjacent to the Geological Sampling Recovery (GSR) and geological laboratory (Geolab). RAC and GSR use Orange River water for treatment. The process water circulates back to the process water tank and water meters are installed to measure and monitor water consumption.

Coarse tailings for the various sources are re-treated to quantify recovery efficiency for each source. Alternatively, coarse tailings are dumped at the RAC Tailings Dump allocated within a mined-out area in SCM. Fines tailings are pumped into an effluent pond, where settling methodology is applied to recycle clean water back to the plant for treatment purposes.

2.4 Infrastructure and services

The mining operations and earth-moving fleet are supported by technical services and workshops, waste management, administrative, safety and security personnel. These occupy several buildings linked to the main plant sites or separate complexes built for these services (e.g. Uubvlei workshops).

2.4.1 Transport: roads, machine and vehicle maintenance

An extensive network of roads and tracks crosses Mining Area 1. This currently includes a 20 m wide main haul road, major access roads (12 m width) and minor access roads (7 m width). These dimensions are updated from time to time as supported by change management process. Roads are built up with suitable material, often sourced from mined out areas or overburden dumps and tailings dumps and transported to the road site. The East-cliff road is tarred as far as the Affenrücken hostel (but only presently maintained up to Uubvlei), while all other roads are gravel roads.

The tar road and haul road from Uubvlei to Affenrücken hostel will be refurbished and maintained if mining of the Northern Blocks commences post 2024.The road will be designed according to Engineering Standards, which include the standard EMP applied to the construction works. The roads will be made on an existing footprint, therefore the existing construction EMP should be adequate to mitigate all expected impacts. However, should new borrow pits be made, or a signficiant deviation from the existing route apply, a separate internal EIA will have to be carried out. Borrow pits require a separate ECC.

2.4.2 Infrastructure

Workshops are currently still utilised at Uubvlei, No.3 plant, 50G and No.4 plant. The No.4 plant production centre, building complexes east of the haul road and south of No.4 plant supply additional office space for the operation. The former laboratory at Mooimeisies is used for metallurgical analysis.

Fuel tanks and fuelling stations are available at No.3 plant and the Personnel Control Centre (PCC) transport section. Fuel is supplied to the W63 bulk tanks near No.3 plant *via* the diesel pipeline from the Vivo Energy Namibia (VEN) depot near Oranjemund. The line runs from the mine entrance along the East-cliff road to Mooimeisies and to No.3 plant. Current storage capacities in Mining Area 1 are 217,000 ℓ diesel tanks; and another 10 x 83 000 ℓ diesel tanks; 2 x 83, 000 ℓ petrol tanks, of which one tank is empty and not in use), outside the high security area. One underground petrol tank is located north of production centre (this tank is decommissioned).

Diesel requirements for the business plan will increase from 24 million litres to around 45 million litres per year (inclusive of Orange River Mines) based on the dedicated accretion plus stripped and mined tonnages, assuming load & haul operations. This value can be lower with the use of suitably placed conveyors for long

distance sand transport, and the use of higher efficiency large trucks. The value however excludes the Northern Block mining fuel requirements and potential reduction of 7 million litres when Orange River Mines closes.

A requirement to increase the storage capacity within Mining Area 1 exists to meet the increased demand Four 83, 000 ℓ tanks will be required and an exercise to find an optimum solution in this regard has been initiated. All permitting requirements will be met in this regard.

2.4.3 Telecommunications and water and energy supply

The power supply to the mine comes from Eskom (South Africa) and is relayed to the different plant sites and Oranjemund town at Namdeb′s Control Substation (32MVA, 66kV) south of Uubvlei (15 km north-west of Oranjemund). In addition to the main HT substation, there are 16 active (37G, 11G, 103G, G45, U0, U11 No.1, U11 No.2, No.3 plant and No.4 plant, Uubvlei, HRT, 380, 500, Compressor, Reclaim and Uubvlei Hostel) substations and one abandoned substation (38G).

A network of HT power lines runs from the main Namdeb substation to Oranjemund town, to the different mine sites and north along the East-cliff Road to the Kerbehuk radio masts. The main lines to Uubvlei, No.3 plant and No.4 plant are permanent, while t-offs to mining sites in between these areas are re-positioned according to the mines′ needs.

A fibre optic line runs from PCC along the East-cliff Road all the way to the security fence north at Chameis. The line crosses the fence and continues north to Lüderitz. A network of shorter fibre optic lines connects the main plant sites and building complexes, with temporary extension to active mining sites. All lines are above-ground on single, wooden poles.

Potable water is pumped from the Orange River Fehlmann Wells and supplied *via* pipelines to a number of reservoirs, and from there gravity fed to the different mine sites.

SCM consumes about 364 m^3/day of potable water. The potable water is supplied to SCM from Oranjemund Town, which in turn is extracted from the Orange River aquifer by means of a series of boreholes and the Fehlmann Wells on the banks of the Orange River. From the mine reservoir, situated in the centre of the town, water is pumped to the East-Cliff reservoir inside the mine. From here, water is reticulated to the various areas within the mine. The quality of the water is critical to the health of the employees and is maintained within standards at all costs. To ensure that a quality supply of potable water is maintained, a series of purification and filtration processes are carried out before consumption. At the water source, the aquifer borehole, a natural filtration process is carried out. Dosing 800g/h of chlorine gas occurs at the Swartkops reservoir. Moreover, chlorine refills are carried out bi-weekly at the Eastcliff, 3 Plant, 4 Plant and the Uubvlei reservoirs, to ensure that the water quality is not compromised. The RAC is the only mineral processing plant that utilises potable water supplied from the mine reservoir for the treatment process, due to the

sensitivity of the X-ray machines used at the plant. The effluent generated at RAC is recycled back into the plant, which reduces the total water demand there.

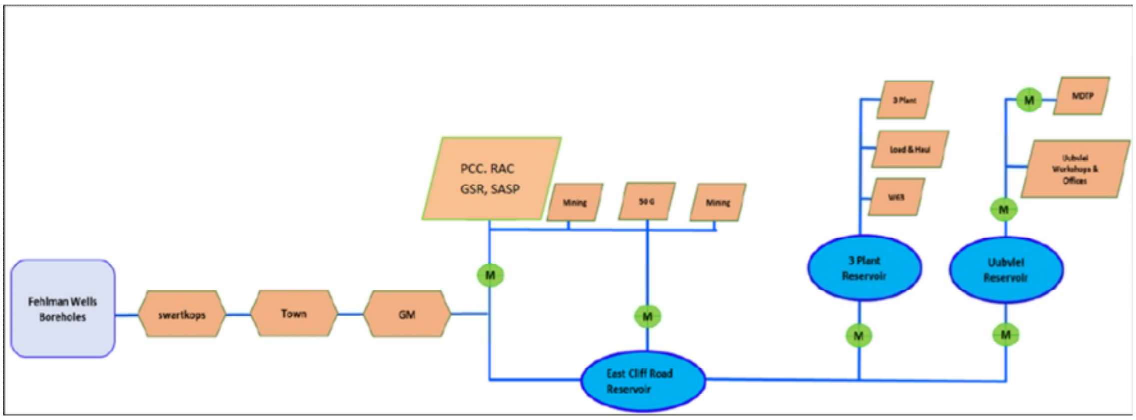

Figure 27. Potable water supply flow in Southern Coastal Mines (M = meter installed)

2.4.4 Waste management

Waste management at Namdeb is recognised as a key challenge and opportunity. The company implements integrated pollution management to move waste management practices up the waste hierarchy, to ensure waste is limited or otherwise re-used and recycled. Namdeb recognizes that pollution prevention and waste management are critical operational components in the mining industry, and innovative techniques and appropriate technologies (remediation, reclamation, restoration, and re-use) are some of the key elements for long term environmental protection. Waste Circularity is an objective that Namdeb intends to implement. Southern Coastal Mines has a dedicated soft refuge landfill site. Waste is separated at source into dedicated skips, drums and bins and is categorized into general and hazardous waste.

General waste includes:

- **Soft refuse (e.g. cardboard, boxes, paper, wood, plastic bags and glass).**
- **Metal waste (e.g. ferrous metals, plate cut-offs, used parts, structural steel cut-offs, soft drink cans, concentrate tins/cans, steel idlers, v-pulleys, steel plates, steel wet ends, flanges, bearings and bolts).**
- **Rubber products ((e.g. High-density polyethylene (HDPE) idler rollers, rubber pipes, rubber pump liners, screen panels, pieces of conveyor belt, gaskets and v-belts)).**
- **Building rubble and garden refuse.**

Hazardous waste includes:

- **Batteries, fluorescent tubes, asbestos, radio-active waste (e.g. x-ray tubes), e-waste, contaminated soil, petroleum products (e.g. waste oil), saturated spill absorbent products (including oily rags), paint and protective coating waste.**

The main expected increase in waste materials due to scaled-up operations and longer Life-of-Mine (LoM), as well as continuous decommissioning, refurbishment and and scrapping activities are:

- ◊ Scrap steel mainly from:
  - o Scrapping of redundant earthmoving equipment
  - o No.3 plant maintenance
- ◊ Waste oil from:
  - o Increased mining equipment
  - o Extended LoM
- ◊ Tyres and plastic piping and screen panels from:
  - o Increased mining equipment tyres
  - o Increase in dewatering pipes replacements
  - o Ongoing plant and services infrastructure maintenance
- ◊ Hazardous waste:
  - o Continuous refurbishment of Uubvlei Complex and No.3 plant (asbestos)
- ◊ Domestic waste and sewerage from:
  - o Increased number of employees and contractors

The waste generated is disposed of at a dedicated waste site within SCM. The waste streams are handled differently at waste sites, where most of the waste generated is stockpiled onsite pending the identification of suitable circular economy approach or removal of the mine. Waste management sites are as follows:

- **Soft refuse site: the soft refuse waste generated on site in disposed of at this site, where it is burned on a regular basis to prevent the waste from being blown away.**
- **Rubber yard: all the rubber containing waste (e.g. tyres, conveyor belts) are currently stockpiled at the rubber yard east of the Uubvlei complex.**
- **Bio-remediation site: The bio-remediation site is located south of the Uubvlei complex, where hydrocarbon contaminated soil is disposed of. The contaminated soil is treated with a fertiliser like chemical called Map, then sprinkled with water and aerated for a period of 6 to 8 months. Once the soil is treated to the desired petroleum content level (1000 ppm), the soil is then disposed of into open bedrock site.**
- **R1 site: this site is deemed as hazardous waste site, though the different waste streams are disposed of at different areas at the site. Asbestos-containing material is disposed of at a dedicated asbestos landfill site also located on the northern side of site. There is a workshop were waste batteries and florescent tudes are stockpiled. Scrap metal waste is also stockpiled at the R1 site.**
- **SCRAB Sewage Treatment: Domestic effluent generated in SCM is treated through the SCRAB treatment plant. The final effluent is reused for dust**

suppuration on the haul road as per the Wastewater and effluent disposal license for SCM.

2.4.5 Personnel Control Centre

The Personnel Control Centre (PCC) is a system of gates, doors and corridors with X-rays facilities to manage movement of people and to prevent diamond theft. Offices, change and storage rooms as well as the freight/transfer yard and a baggage section are part of this complex. This also includes Namdeb′s transport section with offices, garages and parking bays for vehicles and buses.

The capacity of this section to handle future manpower quantities will be evaluated and possibly shift start and completion times would be optimised accordingly.

2.4.6 Accommodation

All mine employees live in Oranjemund and enter the high security mine daily through the Personnel Control Centre, the main gate separating the mine from Oranjemund town. The former hostels are abandoned and there is no active accommodation inside the high security area.

Future accommodation requirements in the Oranjemund town need to be assessed, since current mine-owned accommodation is being sold. This could lead to a shortage in suitable accommodation. It is highly likely that the current contractor approach of building single accommodation units for operators will be expanded based on the increase in its labour complement. The Oranjemund Town Council and other developers and stakeholders in town have however also started with the construction of additional accommodation.

2.4.7 Inactive infrastructure

Due to the long history of mining activities there was a significant amount of inactive infrastructure in Southern Coastal Mines. Demolition of most of this inactive infrastructure has been completed and only the currently still remaining structures are described here. As part of the Namdeb Integrated Closure Plan, consideration of retaining some of these structures for the sake of retaining the industrial heritage of diamond mining is being considered and discussed with relevant stakeholders.

Three hostel complexes exist in Mining Area 1; from north to south: Affenrücken, Mittag and Uubvlei. The two oldest hostels, Affenrücken and Mittag, are of historic interest and have been signed off by the relevant authorities (MEFT and MME) to remain in place. The old German plant to the west of Oranjemund is historic and will also remain. Uubvlei hostel and part of the workshops have also been identified of importance for future land use and have been recommended to remain (Namdeb CHMP 2021). The Uubvlei hostel was refurbished during 2020 to serve as a possible quarantine facility during the Covid 19 pandemic. There is still a workshop at the old No.2 plant site, which is presently inactive.

2.5 Marine mining

Vessel-based contractors operate in the shallow-water area, using either remotely operated suction tools or diver-operated suction hoses from custom built vessels to extract target ores. Contractors can select a maximum of 20 mining and 20 prospecting blocks at a time from areas pre-determined by Namdeb. These mining blocks are registered for variable periods depending on the economic viability of the blocks. Contractors operate in different areas at different times, so all areas with shallow water blocks and beach mining blocks are indicated on the map below. Although all these areas are provisionally available to the contractors, restrictions on environmental sensitive areas would apply. The contractors follow all Namdeb's security, health and environment policies and procedures, and a contractor-adapted set of safety procedures.

2.5.1 Bulk sampling

Following analysis of the drill samples and establishment of a potential resource in the marine portions of ML43, further bulk sampling and/or test mining would be conducted to confirm the economic viability of the resource. Bulk sampling was undertaken by a seabed crawler, deployed off a dedicated, contracted mining vessel. The vessel has an overall length of 150 m and a gross tonnage of over 9,000 t and was equipped with a track-mounted subsea crawler capable of working to depths up to 200 m below sea level. The crawler, which was fitted with highly accurate acoustic seabed navigation and imaging systems and equipped with an anterior suction system. It is lowered to the seabed and controlled remotely from the surface support vessel through power and signal umbilical cables. Water jets in the crawler's suction head would loosen seabed sediments, and sorting bars would filter out oversize boulders. The sampled sediments are pumped to the surface for shipboard processing. Bulk sampling was conducted using a sea-bed crawler unit from the shipping vessel YA Toivo during 2018. A total of 8,874m2 was sampled in the ML43 midwater are known as 'Purple'. Further areas of seabed to be sampled by crawler will be determined following analysis of drill samples and development of a resource model. Benthic biodiversity sampling will continue as part of environmental management for the midwater areas. Baseline surveys were conducted in 2015 and post exploration campaigns were conducted 2018, 2021 and 2023.

Figure 28. Seabed crawler.

2.5.2 Production mining

Details on the vessels or tools that will ultimately be implemented for production mining operations in the marine portion of ML43 cannot at present be provided as these have not yet been finalised. Research and development of appropriate sampling and mining tools will form part of the conceptual studies and prefeasibility and feasibility phases of the project following development of the inferred resource.

Namdeb has committed to maintaining on-going communication with key stakeholders on the progress of exploration and mining operations in ML43 and ML128C. To this end, Namdeb will engage with stakeholders once the mine plan has been finalised.

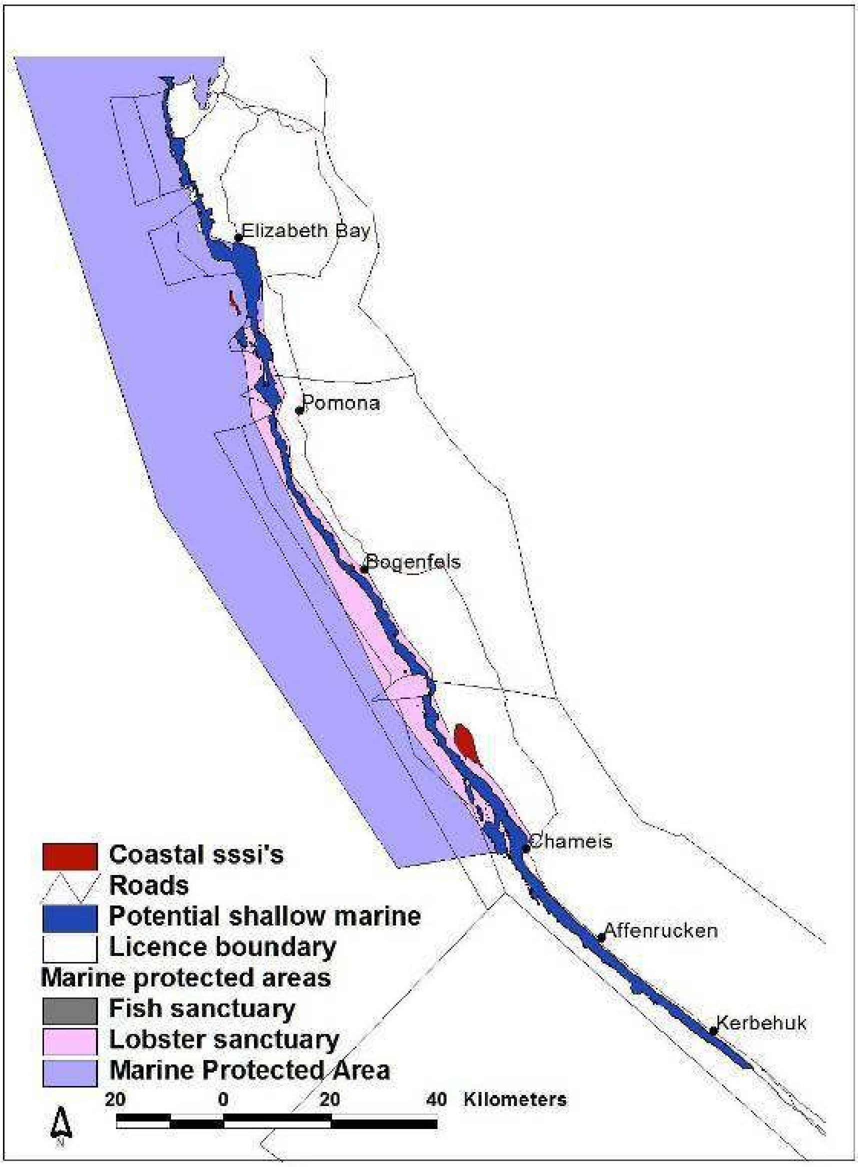

Figure 29. Potential marine contractor mining areas ("potential shallow marine") in relation to Marine Protected Area and Sites of Special Scientific Interest (SSSI's) such as islands, seal and bird breeding sites.

All vessels and their equipment are maintained during docking in Lüderitz harbour. Sewage generated on board is discharged overboard at sea, but all other waste is collected and disposed at the Lüderitz municipal landfill. Waste oil is collected in drums and delivered to Namport for reuse or disposal.

The contractors follow all Namdeb's security, health and environment policies and procedures, and a contractor-adapted set of safety procedures.

Further offshore in the mid-water portions of the mining licence sampling and test mining is undertaken by contracted vessels, which operate as semi-mobile mining platforms, anchored by a dynamic positioning system, commonly using a spread of three to four anchors. These vessels are fully self-contained sampling/mining units, potentially able to operate 24-hours a day for 11 months of the year with all major servicing of the ship and mining equipment being undertaken in the home port. The vessels are supported by a crew of 50-60 persons, have a water maker onboard and waste management practice in place. During the current relatively short sampling campaigns, the vessel does not need to return to port to refuel or to take on potable water.

2.5.3 Diving operations

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 100-500 m^2 for a single diver-assisted mining vessel and averaging a total of ~2,500 m^2/year for all diver-assisted operations in ML43 (Table 3). This equates to in the order of 6,500 tons of sediment excavated annually per vessel, of which ~90% is discarded directly overboard at the mining site.

The remaining concentrate is transported to the CTF in Lüderitz. The CTF plant has screening, Dense Medium Separation (DMS) and X-ray facilities. The material pre-screened by the contractors is treated to -12 mm to +1.4 mm size fraction, and finally hand-sorted. Undersize is temporarily stored in sort tailings bins, oversize in tailings bins. The tailings from the plant are also stored in tailings bins and transported to and disposed on the Elizabeth Bay tailings dump in ML45. The tailings remaining from sorting are stored temporarily, re-introduced into the CTF plant and finally sorted by Namdeb. The tailings are then discarded with the oversize tailings on the Elizabeth Bay tailings dump.

Using a Remotely Operated Vehicle (ROV, Cougar33) as a mining tool to replace the divers is presently being investigated for 2021-2022, in addition to the conventional diver-operation. The additional area potentially mined annually through implementation of the ROV is in the region of 3,500-5,000 m^2. Tailings will be disposed overboard on site and the concentrate transported to CTF in Lüderitz for further treatment.

2.6 Closure and Rehabilitation

Large-scale rehabilitation in Southern Coastal Mines has focussed on pollution remediation and infrastructure demolition. Trial studies in landscape rehabilitation and biodiversity restoration have also been undertaken. This section describes the criteria set for rehabilitating the terrain and facilitates to ensure it is conducive to accommodating appropriate development and biodiversity restoration post-mining.

2.6.1 Closure planning

2.6.1.1 Identification of Post-Mining Land Use for ML 43

Southern Coastal Mines falls into the Tsau//Khaeb (Sperrgebiet) National Park. The mining disturbed grounds in ML43 has been zoned as 'managed resource use' and Minimal Disturbance (MD, the area outside the disturbed footprint as 'wildlife management' in the management plan for the park (Ministry of Environment, Forestry and Tourism (MEFT) 2020a). The remainder of ML43 also includes 'special value' and 'minimal disturbance' zones where conservation is the primary land use. This is the area around Boegoeberg, which also includes an area with high density of lichens and the spring at Chameis, which is important for wildlife (Table).

Table 1. Definition of the Managed Resource Use and Minimal Disturbances zone

Management zone	Description of area	Key properties	Management guidelines
Managed Resource Use	8. Mining licences / active mining	• Areas subject to mining licenses	The same management guidelines as for the minimal disturbance zones, except that mining can take place or that horses are protected as outlined in this management plan
	9. Namib horse management area	• Area designated for the protection and management of the Namib horses	
Minimal Disturbance	6. Buffer zones	• Areas of medium biodiversity[12] that interconnect areas of high or very high biodiversity or provide a buffer zone around such areas	• No new roads should be constructed in this area • Only guided tourism • No harvesting • No permanent structures to be developed (except possible rest / picnic points, which must be developed in a way that blend into the environment) • No off road driving • No mining or prospecting is allowed according to the policy on mining and prospecting in protected areas

In summary, the MRU management guidelines specify a post-mining land use of "guided tourism".

Namdeb's standard approach to rehabilitation and closure is to demolish and remove all infrastructure and to strive to return the land surface, as far as possible, to its natural state. However, an awareness has grown that this approach is possibly destroying aspects of tourism and heritage value. Namdeb consequently raised this possibility at a number of stakeholder engagement forums, including the:

- **Hospitality Association of Namibia Conference, Luderitz, February 2022**
- **Namdeb PML ideas Engagement Meeting, Keetmanshoop, August 2023**
- **Namdeb Environmental Stakeholder Forum, Windhoek, May 2024**
- **Ministry of Environment, Forestry and Tourism Directors, Windhoek, June 2024**

Feedback from these forums was an overwhelming confirmation: Namdeb is indeed possibly unwittingly destroying aspects of tourism and heritage value. In response,

Namdeb set about identifying potential ML43 post-mining land uses that would support guided tourism, as well as fulfil the MRU zone management guidelines.

In seeking external, professional opinions on these land use ideas, Namdeb approached the following organizations;

- **National Heritage Council of Namibia**
- **Hardrock Safaris CC**
- **Namibian Motorsport Federation**
- **Namibia Film Commission.**

Representatives from each of these organizations undertook a detailed site visit to Namdeb's ML43 and very kindly generated short reports on the feasibility of the proposed post-mining land uses. All of the land uses proposed for ML 43 were viewed very favourably. Four potential land uses were identified for ML43. These are:

- **Cultural (built) heritage tourism. The registration of the Daberas Mine complex with the National Heritage Council of Namibia as a site of cultural (built) heritage.**
- **Geological and mining tourism of the old mine workings and infrastructure. The retention of old mining infrastructure and vehicles, and the creation of a small visitor's centre where geology, mining and heritage would be discussed.**
- **Recreational vehicle facility. The creation of a 4x4 obstacle course (or similar) facility in the mining-disturbed ground. This facility would be an additional, and complementary, activity for the tourists participating in the Park's 4x4 self-drive excursions.**
- **Film sets. The retention of the mining infrastructure and landforms for film production purposes. In addition to filming revenues received, large film productions have the potential to generate "film tourism".**

Other Post Mining land uses were identified for ML 43 and the assessment process is on-going. These include cycling trails, a Motor Industry Testing Facility, Photovoltaics, Biomass Cultivation, Accommodation, Habitats, and Environmental Education.

Whilst Namdeb is proactively planning for mine closure, ongoing techno-economic changes in the diamond mining industry currently preclude an exact specification of the mine closure date. Namdeb's ML43 mining license is valid until 2035.

2.6.2 Closure Criteria

2.6.1.1 Biophysical closure criteria

Namdeb's Demolition and Landscape Report (Enviro Science, 2021), provides the following closure criteria for all Namdeb's mining licence areas.

Table 2: Closure Criteria applicable to all Namdeb's Mining Licences (Enviro Science, 2021)

Component	Closure criteria
Rehabilitation objectives	• **Mitigate safety risks to humans and ensure that there is no threat to wildlife.** • **Hand over ecologically functional and stable landforms which are visually acceptable.** • **Restore, where feasible, natural flow conditions.** • **Minimise pollution of soils, ground- and surface water and residual management thereof.**
Infrastructure	
Demolition of structures	• **Formal agreement with future land-user on structures to remain and maintenance thereof** • **Structures not to remain demolished** • **Footprint rehabilitated** • **All litter and waste removed** • **No residual management of demolished structures and associated footprint**
Rehabilitation of roads and tracks	• **Agreement with future land-user on roads and tracks to remain** • **Compacted areas loosened (scarified) where necessary, or covered with a minimum of 10 cm suitable substrate to support plant growth, ideally from disturbed areas nearby** • **Rehabilitation applied to redundant roads/tracks for 300 m off identified access routes to remain** • **Surface blends in with the natural environment in terms of colour and texture**
Pollution	
Removal of waste and scrap	• **Disposed in accordance with Namdeb waste management procedures (scrap to be recycled, waste to be disposed in managed landfills, asbestos disposed in asbestos landfill)** • **Footprint of scrap yards and waste disposal sites rehabilitated** • **No residual management required**
Removal of hazardous waste	• **Disposed to managed landfill for hazardous waste** • **No residual management required**
Ameliorating soil pollution	• **Remediated soil has less than < 1% hydrocarbon content**

Ground- and surface water	• Water quality at monitoring sites meets legal standards
Landscape	
Soil compacted areas	• Scarifying only where necessary and rip marks and tracks erased • Surface matching natural surroundings in terms of colour and texture • No soil erosion
Steep slopes	• No major soil erosion

These are general recommendations and should be viewed as guidelines, with adjustments made for specific contexts.

Certain closure criteria apply to ML43, exclusively, related to the shaping of dumps.

Most of the mining landscape is planned to remain at closure and will be left to recover naturally, but some earthworks rehabilitation tasks remain. As views on the level of intervention are subjective (focussed on visual aspects) these need further investigation and agreed with the Regulator (i.e. MEFT).

Where reshaping of dumps is required, the final landform should have gentle slope, which, for practical reasons, a slope angle of 15 ° should be aimed at all around.

ML43 has further area and operations-specific criteria, as follows:

Table 3: Additional closure criteria for earthworks rehabilitation in ML43

Component	Closure criteria
Landscape	
Steep slopes of dumps[1]	Rehabilitated slopes have a maximum of 15° slope angle
Tailings dumps used for accretion	Partly removed tailings dumps are stable and blend with the surrounding landscape.

2.6.1.2 Social closure criteria

According to the NICP (2021), the social closure criteria for Namdeb, focus on social transition from a mining-focussed social structure to a diverse economy. The success criteria to achieve these objectives, are as follows:

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[1] This refers to 'optional' reshaping of dumps which was agreed to reflect a range of opinions regarding visual aspects.

- **100% property ownerships achieved**
- **Implementation of a sustainable education and health care solution by end of LoM**
- **Adherence to the Town Transformation Strategy**
- **Diverse and quality reskilling courses offered to employees**
- **No closure-related industrial action**

2.6.2 Demolition of buildings and infrastructure and waste management

Demolition and waste management go hand-in-hand, as the demolition of the old processing plants and their supplementary infrastructure generated vast amounts of hazardous, asbestos-containing materials. An engineered landfill site for asbestos was therefore authorised by government and established near Uubvlei. Non-hazardous demolition waste is disposed in suitable mined out areas near the demolition sites.

A total of 29 scrap yards was cleared during 2008-2011. The three northern-most treatment plants (Chameis, No.1 and No.2 plant), 50G plant and the most southern treatment plant – the Pre Treatment Facility (PTF) have been demolished to date and the former plant sites have been rehabilitated. Since the inception of the scrap removal project in 2008, a total of 137,628 metric tons of scrap metal was removed (J. Katjirua, pers. comm. August 2018).

Infrastructure remaining in ML43, to be demolished, are listed in the Demolition and Landscape Report (Enviro Science, 2021), and includes buildings, plants and accessory works, as well as linear infrastructure. Of note are diesel and petrol tanks, waste sites for asbestos, scrap, domestic waste, tyres and asbestos. The asbestos site is lined and covered according to health, environmental and safety standards to prevent health consequences and contamination.

There is a vast amount of mining infrastructure which exemplifies Namibia's industrial history and would be valuable for future tourism (Namdeb Cultural Heritage Management Plan 2020).

Applicable stakeholders, including MEFT have agreed that some structures remain (Affenrücken and Mittag Hostel in Southern Coastal Mines' high security area, the tar road to Affenrücken, remains of the historic CDM plant south-west of Oranjemund and three buildings at Baker's Bay). Agreement with the authorities on which other structures should remain needs to be reached. Chameis gate is mentioned as a potential tourism site in MEFT's tourism development plan (MEFT,2020).

The Cultural Heritage Management Plan provides a list of items that should be considered to remain, as part of the planned mining-based tourism end land use. These include No.3 plant and associated manmade landforms such as tailings dump and pond, mining machinery like the bucket wheel excavator, remains of bowl-scraper and push-dozer unit, representative dumps created by the various stripping machinery and the Personnel Control Centre gateway illustrating the conditions in a high security area. More detail is contained in Namdeb's Cultural Heritage

Management Plan. The items to remain need to be agreed with stakeholders and a formal agreement with the regulator is required to preserve these items.

2.6.3 Landscape rehabilitation and biodiversity restoration

As many areas disturbed and/or created by mining have naturally re-vegetated during the over 100 years of mining, and erosion is limited, landscape rehabilitation in ML43 is driven by visual considerations, which by us subjective. limited to rehabilitating areas along future tourism routes, and interventions include:

- ◊ **re-establishing natural flow conditions**
- ◊ **tidying up unsightly areas along tourism routes and**
- ◊ **possibly some re-shaping of dumps.**

The most recent revision of earthworks rehabilitation tasks in the corridor along the future tourism route included a review of steep slopes of dumps that were initially scheduled to be reshaped. Using geological modelling software (Minesight), remote sensing information (Google Earth satellite imagery and Airborne Laser Survey) and field work, reshaping of slopes was narrowed down to some dumps where

1. reshaping would not set back the natural re-vegetating process and/or

2. there are visual scars (e.g. sides of dumps visible from the tourism route where material has been removed, or waste is emerging) and/or

3. the stability of the dump slope is questionable.

The details of these intentions are listed in the Southern Coastal Mines Restoration Plan (2021).

As active rehabilitation of the marine environment below the low water mark is neither feasible, nor necessary, no seabed rehabilitation and biodiversity restoration programmes are in place. Recovery within the highly dynamic shallow water area occurs naturally and rapidly (Pulfrich & Penney 2001; Pulfrich et al. 2003).

Provisions to continue monitoring the recovery of impacted marine ecosystems beyond mine closure, as well as the monitoring of restored areas on land are made.

Areas identified as Sites of Special Scientific Interest (SSSI) for geological and historic reasons are excluded from earthworks rehabilitation (Enviro Science, 2021). These include:

- **exposed bedrock areas illustrating the formation of diamond deposits and showing unique features of bedrock**
- **beach sequences with typical strata of diamond deposits**
- **strata with fossil indicators**
- **unusual diamond deposits and**

- dumps created by different types of machinery to illustrate the historic aspects of diamond mining.

Namdeb's Cultural Heritage Management Plan lists and describes these features in more detail (Namdeb 2020a - CHMP).

The inventory of earthworks possibly required (Table 5), as distilled from the above considerations, is detailed in the Landscape and Demolition Report (2021), which explains:

> "The inventory attempts to list all different types of mining-related landforms and disturbances, even if the majority of these will not be rehabilitated. Rehabilitation of dumps and other disturbed areas in SCM is proposed to be limited to a 500-600 m corridor along the envisaged future tourism route. Even within this corridor, only few areas were identified to require rehabilitation. However, as there are no clear guidelines from the regulator regarding the extent of earthworks rehabilitation required in SCM and this is a very subjective visual aspect, it is critical that this is discussed and agreed with key stakeholders and formalised as far as possible with the regulator."

Table 4. Areas agreed with Namdeb to require intervention based on 'steep slope' survey from south to north in SCM (Landscape and Demolition Report, 2021)

. Item	Description	Intervention
ED-SSSI A and B		Level heaps between road and dump
Waste rock between F44 and SL15	Waste rock	Cover with overburden and reshape or create visual barrier
SL12	Heaps and excavations	Level
F16	MDTP stockpile and	Remove stockpile and level

Table 5. Areas requiring further investigation, stakeholder engagement and possible intervention based on 'steep slope' survey from south to north in SCM

Item	Description	Intervention
Waste rock between SL11 and SL10	Waste rock	Cover with overburden and reshape or create visual barrier
SL09	Demolition waste emerging	Remove demolition waste and reshape slope?

SL04	Slope with 'scooped out' area towards road, erosion on dumps in surrounding	Reshape 'scooped out' slope
F15	Slope with "scooped" area towards road	Reshape 'scooped out' slope
BBp1	Bedrock borrow-pit	Backfill and reshape
BBP2	Bedrock borrow-pit	Backfill and reshape

2.6.4 Guidelines for progressive rehabilitation in Southern Coastal Mines

The Landscaping and Demolition Report recommends that the following progressive rehabilitation tasks continue:

- Backfilling of mined out areas, particularly exposed bedrock along remaining access routes, greater 500 m from the current shoreline, should be incorporated in future mine planning, wherever possible, which marks the average distance where natural re-establishment of the coastline took place. The distance is to be reviewed regularly and for each specific site.

- Future mining activities in the vicinity of scheduled landscape rehabilitation should incorporate rehabilitation requirements at such site as far as possible (e.g. covering of bedrock and levelling of small heaps and dumps along the future tourism route).

- Where dump material is removed for road building or rehabilitation, the remaining parts of a dump, if not to be utilised again in future, must be levelled or profiled to no more than 15° slope angle to fit into the surrounding landscape.

- New dumps are to be profiled to no more than 20 m maximum height or, in SCM South to the reference height on East-cliff road (46-50 m amsl at No. 4 plant, 20 m further south). They should have no more than 15° slope angle.

- Dumps removed for accretion should not be stripped to bedrock, but leave a minimum of an average of 30 cm substrate above the bedrock surface.

The ponds in SCM support diverse marine and coastal biodiversity and present a functioning ecosystem in the short- to medium-term (15-20 years) (Maritz 2020). Aquaculture is being tested in some of the ponds.

2.7 Summary of changes

Table 6 below summarises the changes in major mining methods, equipment and critical consumables between the 2020 and the Long Term plan (2020-2030), of which the current 2025-2028 business plan forms a part.

Table 6. Summary of major changes from current business plan to long term plan.

Activity	2020 BP	Long Term Plan 2030	Variance	Comment
Production				
LoM (Years)	3	>10	>7	
Area mined (m^2/y)	860,000	1,300,000	440,000	
Tons stripped (t/y)	44,000,000	94,000,000	50,000,000	
Dedicated Accretion (t/y)	0	24,000,000	24,000,000	
No.3 Plant tons (t/y)	3,300,000	6,300,000	3,000,000	
Total tons to sea (t/y)	60,000,000	104,000,000	44,000,000	No discounting for use on land
Area accreted (m^2/y)	760,000	1,400,000	640,000	
Equipment				
Equipment owner (no.)	155	242	87	Assume no Surface Miner
Equipment owner (no.)	155	226	61	Assume 2 x Surface Miners
Equipment contract (no)	57	118	61	Includes accretion load and haul
BG36 sampling (holes/y)	250	350	100	Proportional increase for m^2 mined
BG36 sampling area (m^2/y)	12,500	17,440	4,940	5 holes in 10 m x 25 m pad
Consumables				
Diesel Fuel (l/y)	18,000,000	35,000,000	20,000,000	Excl. ORM
Energy (Mw/y)	88,000	145,000	11,000	MA1 area excl. town & ORM
Dewatering (m^3/y)	10,000,000	23,000,000	13,000,000	At -35 m depth in 2030
Labour				
Labour -Owner (no)	687	913	226	Mainly Bedrock cleaning
Labour – Contractor (no)	656	963	307	Stripping and Accretion
Technology				
Stripping	40 t trucks + Excavator	60 t trucks + Excavator		Possible future migration to pond dredging
Mining	Doze, Excavate & rockbreakin	Surface Miner, doze & excavate	1-2 Surface Miners	1 or possibly 2 Surface Miners added

Activity	2020 BP	Long Term Plan 2030	Variance	Comment
	g			
Bedrock cleaning	Transvac	Transvac + brushes/hydraulic methods		New technology emerging as Surface Miner operation matures
Load & Haul	35 t RFT	40-70 t Tipper Road trucks		
Processing	No.3 Plant	No.3 Plant+AFS		Scrubbing and screening
Services		Wind Farm	No change	Future develop wind-power

2.7 Climate Change Mitigation

Namdeb has embarked on a path, that aims at having its future operations carbon neutral after 2030. This strategy is underpinned by defined strategic thrusts, that will address different aspects of the business over time and are broadly aligned to 'scopes' of emissions.

Greenhouse gas emissions are categorised into three groups or 'Scopes' by the most widely-used international accounting tool, the Greenhouse Gas (GHG) Protocol:

- **Scope 1 covers direct emissions from owned or controlled sources.**
- **Scope 2 covers indirect emissions from the generation of purchased electricity, steam, heating and cooling consumed by the reporting company.**
- **Scope 3 includes all other indirect emissions that occur in a company's value chain.**

The strategic thrusts referred to above, are outlined below, also indicating which scopes of emission they are expected to mitigate:

- **Strategic Thrust 1: Reduce energy intensity. (Scope 1 & 2)**
- **Strategic Thrust 2: Replace fossil fuel.**
  (with Strategic Thrust 2 aiming to find alternatives to fossil-fuels, i.e. primarily diesel fuel at Namdeb.) (Scope 1)
- **Strategic Thrust 3: Replace fossil electricity. (Scope 2)**
- **Strategic Thrust 4: Remove remaining carbon emissions. (Scopes 1 – 3)**
- **Strategic Thrust 5: Reduce or replace Scope 3 emissions. (Scope 3)**

Whilst the above list of strategic thrusts (also: STs) encompasses the full spectrum, Namdeb prioritises initiatives to support ST1 to ST3, as these are directly attributable to the activities in ML43.

However, none of the above can be reviewed in isolation. As an example: if grid-electrical power supply is converted to a source of renewable energy, it has potential to be utilised as

a replacement energy source for equipment powered by fossil-diesel, with appropriate replacement of technology. Thus, an advance in ST3 will make action under ST2 possible.

Following below, are descriptions against each of the strategic thrusts, to demonstrate where Namdeb is giving attention to projects and investigations which would contribute to achieving a reduction of emissions. Where trade-off studies are carried out, these would consider alternatives based on technology, operational efficiency and fitness-for-purpose, economics and ease of integration, etc.

2.7.1 Strategic Thrust 1 – Reduce energy intensity

a) Investigating the use of light vehicles, which have smaller engines or rationalising on fleet requirements where increased utilisation reduces specific fuel consumption.

b) Fleet management system: efficiency improvements result from more effective route- and production management of mobile equipment. A study has commenced to evaluate fleet tracking systems.

c) Fuel management system: understanding where fuel is used and comparing it to the production effort or the effectiveness of support operations, allows improvements to be quantified and implemented.

   A first-phase implementation of a fuel management system has been commissioned in the Southern Coastal Mine. Future options allow this to be expanded to fuel bowsers, which will improve the granularity of fuel-dispensing information to be obtained, possibly to the level of individual mining equipment units.

2.7.2 Strategic Thrust 2 – Replace fossil fuel

a) Investigate and if appropriate, implement the use of alternative liquid fuels for equipment that is not possible or effective to electrify.

   Together with sister-company Debmarine Namibia, Namdeb is participating in an opportunity study, that investigates the possibility

b) Electrification of bedrock cleaning equipment.

   Mobile equipment utilised in bedrock mining activities does not travel long distances, and potentially lends itself to electrification of these units. To that effect, Namdeb has commenced an opportunity study that will evaluate the use of electrically powered suction units in comparison to the currently-deployed diesel-powered suction units ('transvacs'). Should this prove successful, a phasing in could commence towards the end of the decade.

Once global technological readiness and market availability improve for electric- or battery-electric equipment equivalent to the other machine-types used in this process, further replacements can be evaluated in future years.

c) Namdeb has engaged with OEMs to consider the use of electric haul trucks (battery-electric powered or trolley-assisted); although limited technologically ready products are developed, unfortunately such trucks are currently not available in the market at this stage.

d) A possibility exists that operations, which rely primarily on diesel-powered mobile mining equipment, can be replaced with processes which deploy alternative plant and equipment, powered by electricity (which could then be sourced from renewable sources). Some of these processes are under consideration (e.g. alternative dry stripping, dredging, etc), and are outlined in this document for future consideration.

e) Battery-electric vehicles (BEV) in non-mining applications: As technology becomes market-ready for the region, Namdeb considers, evaluates and if found suitable, procures vehicles in these fleet types to replace conventional (eg. diesel- or petrol-engine powered) units when due for replacement. Examples are vehicles taken delivery of in 2023:
   - a battery-electric passenger bus, which is currently undergoing evaluation.
   - two hybrid passenger cars for evaluation
   - a battery-electric forklift for evaluation

2.7.3 Strategic Thrust 3 – Replace fossil electricity

The replacement of fossil electricity with renewable energy solutions is the approach applied world-wide. Namdeb currently receives electricity from the Eskom grid in South Africa.

Namdeb has the opportunity to implement local renewable solutions using the high-quality wind and solar in its region. Wave energy is also a consideration but unfortunately the technology readiness level is still too low for consideration at this stage. These renewable-energy sources are currently under investigation:

a) Wind Energy

Namdeb has initiated work towards establishing a wind farm within its own mining license area and has progressed to a point where feasibility study is currently in progress to establish a 33.6MW wind farm at Kerbehuk, located approximately 50km north of Oranjemund.

b) Solar Energy

A solar-energy concept study was conducted during 2023 which identified two preferred solar sites, namely a site near the Namdeb substation and another site near the Auchas mining area. A decision was made to establish a solar measurement station at the former site; this was commissioned mid-2024 and will collect data, which can be used, if a feasibility study commences, towards establishing a photo-voltaic power generation plant.

Both of the above renewable-energy power plants may be determined during feasibility stages to be established and operated by independent power producers, with Namdeb being an offtaker.
Another opportunity is the deployment of several rooftop solar power installations.

a) Rooftop Solar

The potential use of rooftop solar as an alternative to ground-mounted solar farms was investigated during 2023. It was confirmed that insufficient area exists on Namdeb's buildings to install the amount of solar energy required to make economic benefit. Many of the roofs on which solar would have to be installed are structurally not strong enough to carry solar-panel infrastructure.

Figure 30. Rooftop solar at Namdeb's Office Block buildings and indication of flat complex equipped with solar geysers

It does however have some merit to generally encourage and implement rooftop solar and/or solar geysers on suitable buildings especially in Town. Namdeb is already following a strategy to install some rooftop solar capacity from time to time and has installed a system of 160kW at the Management Office Block.

A recently upgraded accommodation complex was equipped with solar geysers, to further contribute.

It is expected, that awareness of these initiatives in the community could encourage private home-owners and other businesses in Oranjemund to also install rooftop solar systems and solar geysers.

2.7.4 Strategic Thrust 4 – Remove remaining carbon emissions

Carbon recovery or -capture from the atmosphere are often considered as the final option to achieve carbon neutrality when all the solutions available from strategic thrusts 1 -3 have been exhausted.

Carbon capture and removal can be achieved via technical carbon capture and storage or via nature-based capture and -storage. There is also an opportunity to purchase carbon credits for solutions which can capture and store carbon using these methods.

At this stage Namdeb shall not pursue options of technical carbon capture and -storage as a suitable solution.

Nature-based solutions for carbon-removal and -offsetting are currently conceptually considered, and for some of these, Namdeb relies on the collaboration with sister companies and the De Beers Technical Services to evaluate these.

Some opportunities could be explored within Namdeb's Southern Coastal Mines to establish nature-based solutions such as:

a) Planting succulents across large mining areas previously disturbed by mining operations

b) Using ponds created along the 100km coastline to grow seaweed and algae or create saline marshlands around these ponds

The main challenge with these nature-based solutions is the requirement for large areas to grow the trees, plants or sea-weed and then to subsequently successfully sequester these, to ensure that the carbon thus captured is stored sustainably.

Other areas supporting emissions abatement and carbon offsetting, which may be considered in the future, could include initiatives that provide novel ways of placing carbon back into nature. An example could be to place bio-char to improve soil conditions.

Projects to improve grasslands (which are of the most efficient known plants to take up carbon from the atmosphere) in Namibia, could be initiated to offset hard-to-abate emissions in a manner, that will also contribute to socio-economic development in remote communities. Successes have been seen in other countries on the continent (e.g. rotational grazing projects), and could be replicated with appropriate adaptation to local environments

These are just some examples of work that is currently in very early stages of being conceptualised (typical in desk-top studies). Over the next several years, more studies shall be carried out, to determine the potential application of such solutions, to assist in abating carbon emissions that remain after implementing emission-reduction projects. Pilot projects be embarked upon nearer to 2030 or thereafter.

2.7.5 Strategic Thrust 5 – Reduce Scope 3 Emissions

Because of their complex nature, Scope 3 emissions can only be reduced together with suppliers, customers and other stakeholders. Success requires an approach that combines innovation and collaboration. The strategy for reducing Scope 3 emissions is still in development but will focus primarily on upstream (i.e. procured goods and -services) and then by applying the 80:20 (Pareto) principle by targeting the suppliers and service providers who have the highest contribution to emissions.

The approach is envisaged to follow these guiding principles:

a) **Where Namdeb participates in groupwide procurement contracts and joint supply chains, the De Beers Group and Anglo American principals engage with those major suppliers to obtain commitments for reducing their carbon footprint. This shall take take of the biggest-spend commodities for Namdeb, such as production consumables (e.g. rubber products, tyres), production plant and -equipment (e.g. mining machinery and spares; process plant equipment and spares), etc.**

b) **Namdeb will identify local service contractors and:**

   - **Request them to stablish their Scope1&2 footprint.**
   - **Jointly agree on improvement opportunities and deadlines**
   - **Track progress on the improvements**

c) **Namdeb will continue to apply selection criteria, where carbon-footprint measures and local-content measures can be evaluated during the selection of service providers goods suppliers.**

   To assist in downstream reduction of emissions, Namdeb will commit to offer renewable electricity to Oranjemund Town, once such 'clean' electricity becomes available to the Namdeb grid.

Chapter 3 The natural environment in ML43

ML43 falls into the Succulent Karoo Biome which is characterised by aridity (51mm annual mean rainfall at Oranjemund), winter rains and leaf-succulents forming the dominant vegetation. Combined with windy conditions all year round (mainly southerlies) and regular fog the area supports diverse, arid-adapted vegetation and fauna with many species of conservation importance (e.g. window plants (*Fenestraria rhopalophylla*), stonecrops (*Crassula* species), desert rain frog (*Breviceps macrops*) and brown hyena (*Hyena brunnea*)).

Massive amounts of sediments are moved by wind and the long-shore littoral drift of the Benguela current, which provide the landscape-shaping forces in this environment. As a result, dunes and sand plains are prominent, interspersed by gravel plains and occasional rocky outcrops.

The coast is characterised by largely exposed, linear sandy beaches in the southern portion of the licence area, with rocky shores becoming more frequent to the north. The ocean floor is composed of sand, grit and gravel forming an interlaced mosaic of these different substrates. Although most marine macrofauna species are widespread along the southern African West Coast and the beaches and subtidal areas of ML43′s coastline are comparatively species poor, there are nevertheless some invertebrates (e.g. giant pill bug (*Tylos granulatus*) which are sensitive to disturbance. Red-listed seabirds (e.g. Cape Cormorant, African Black Oyster Catcher), kelp beds, which serve as nursery areas for rock lobsters and nearshore fish species are some of the ocean-dependent biota and habitats of conservation importance.

SCM′s ponds created by mining are an active ecosystem supporting 36 species of birds, including the red-listed African Black Oystercatcher *Haematopus moquini*, Bank Cormorant *Phalacrocorax neglectus*, Greater and Lesser Flamingo *Phoenicopterus roseus* and *Phoeniconaias minor* and the charismatic African Spoonbill *Platalea alba*, Goliath Heron *Ardea goliath*, Pied Kingfisher *Ceryle rudis* and Sacred Ibis *Threskiornis aethiopicus* (Maritz 2020). Ten bird species are endemic and five are listed in Namibia′s Red Data Book.

Namdeb mines diamonds in the southern Namib Desert and ML43 is positioned in the Succulent Karoo Biome. Because it is a global biodiversity hotspot (Myers et al. 2000), managing impacts on biodiversity is an important task. ML43 is extensive and includes many nearly pristine areas which are not affected by mining or associated

activities. The description presented below covers the entire mining licence and thus not all these environments and associated species are affected by mining operations.

Of particular importance (i.e. environmentally sensitive) in ML43 are the following habitats and sites:

- Coastal dune hummocks,
- Rocky outcrops, vegetated sand and gravel plains and inselbergs,
- Lichen fields,
- Salt pans,
- Rocky shores, subtidal reefs and sandy beaches,
- Kelp beds,
- Historic and archaeological sites, and
- Sites of Special Scientific Interest.

3.1 Climate

Bioclimatically Mining Area 1 falls into the Succulent Karoo Biome in southern Africa and is part of the southern Namib Desert. It is characterised by an arid climate regime (long-term mean annual rainfall at Oranjemund 51mm) with, for a subtropical area, moderate temperatures (annual mean <16°C, Mendelsohn et al. 2002). Regular fog (over 100 days/a) and persistent, strong southerly winds are other key climatic parameters shaping landforms and plant and animal life in this desert environment. Occasionally easterly, hot berg winds blow during the winter months; then temperatures can reach 35°C, even near the coast.

3.2 Geology, geomorphology and palaeontology

The continental basement in SCM is formed of rocks of the Gariep Group (900-500 Ma) and more specifically the Marmora terrane (Frimmel 2008). Schist and other metasedimentary rocks form this basement which has been gullied and potholed during millions of years of erosion and then covered by more recent sediments. It dips gradually westwards below the ocean surface.

Deposition of diamonds started during the Eocene (56Ma) when the Orange River transported vast amounts of eroded material, including diamonds from kimberlite pipes in the Lesotho highlands and South Africa highveld from the interior into the sea (Corbett & Burrell 2001). During several phases of river rejuvenation and erosion during the Tertiary, terraces of diamond-bearing gravels were deposited along the Orange River at different elevations, in the river's fan delta and further offshore. Subsequent oscillating sea levels repeatedly re-worked the marine component of these deposits (Spaggiari 2011), concentrating the diamond-bearing beaches into the linear beaches and gravel lags of Mining Area 1 (Stocken 1962 in Miller 2008). The onshore raised diamond-bearing beaches rest on several wave-platforms and the eastern margin of the deposit is delineated by a steep cliff, the so-called "East-cliff". No viable diamond deposits have been found east of this cliff but geophysical data shows that the MA1-type deposit continues westwards beneath increasing overburden thickness and water depth.

Besides diamonds, some of these beach deposits are also rich in fossils and fossil finds unearthed during mining have generated a wealth of aquatic and marine fossils (e.g. plants remnants from former lagoons, mussels, barnacles and whale bones) (Corvinus 1983). These proved of great importance for dating the deposits, e.g. the white mussel *Donax (D. serra* and *D. rogersi*) has been used as a key indicator for certain strata. Some 14 important geological and palaeontological sites have been identified in ML43 to be preserved as Sites of Special Scientific Interest (SSSI) (Burke 2015).

Water-erosion towards the Atlantic, wind-driven erosion along the coast and shore erosion by the northwards flowing, strong longshore drift of the Benguela current are the main geomorphological forces in this area. Massive amounts of sediment are moved by these forces.

3.3 Landforms, soils and hydrology

Coastal sand plain and coastal hummocks are the main habitats in SCM (Burke 2006), with only few rocky outcrops emerging towards the north of the approximately 4km wide coastal strip. Here, the low ridges of Kerbehuk, Affenrücken and rocky outcrops near Chameis dot the otherwise rather uniform landscape. A large drainage system originating in the east ends at Uubvlei and forms an extensive pan here. Several smaller drainage systems, now partly blocked by the East cliff road and haul road, have evolved around the Kerbehuk and Affenrücken ridges as well as in the more rocky Chameis area. None of these have received sufficient run-off in the last several thousand years to create pronounced dry rivers. East of the high security fence some isolated outcrops such as Karingarab and the more prominent Boegoeberg rise from the sand and gravel plains (Burke 2006). The general area slopes gently from about 450m altitude towards the coast in the west and the Orange River valley to the south.

Soils in this licence area are deep dune sands, or shallow alluvium, gravel and calcareous soils with no agricultural potential (Coetzee in Mendelsohn et al. 2002). Natural surface water is encountered in a few springs (e.g. at Affenrücken), the "Pink Pan" southwest of Oranjemund and the Orange River. Groundwater reserves are linked to the Orange River basin.

3.4 Flora and vegetation

ML43 falls within the Succulent Karoo Biome, a global biodiversity hotspot, characterised by a high level of endemism and species richness (Myers et al. 2000).

3.4.1 Vegetation

Figure 31 shows the vegetation types occurring across Namdeb's Mining Licence areas. Four vegetation types are characterised in this licence area. Southern dune dwarf shrubland is associated with the Hohenfels dune field and extends west on sand plains towards the coast. The two conspicuous stem-succulents *Othonna furcata* and *Othonna cylindrica* characterise this vegetation unit on semi-stabilised dunes.

This unit grades into the largely disturbed coastal strip, where a dune sequence with large *Salsola nollothensis* hummocks framing the beach is present in the foredune area, followed by small, hummocks with *Amphibolia rupis-arcuatae, Brownanthus arenosus, Cladoraphis cyperoides, Drosanthemum luederitzii* and *Zygophyllum clavatum* on older foredunes and sand plains further inland.

Othonna dwarf shrubland grows on a narrow strip between Uubvlei and Chameis along the coast, with dune patches dominated by the dune grass *Cladoraphis cyperoides* and the stem-succulent *Othonna furcata*, and sand plains dominated by the dwarf succulent shrubs *Amphibolia rupis-arcuatae, Brownanthus arenosus* and/or *Eberlanzia sedoides*. Many protected plants species and southern Namib endemics occur in this vegetation type making it of very high conservation importance (Burke 2006). Adjoining east is southern dwarf-succulent shrubland on low ridges, sand and gravel plains with a continuous, but low vegetation cover of mainly dwarf succulents, such as *Amphibolia rupis-arcuatae, Brownanthus arenosus* and *Stoeberia beetzii* interspersed with patches of *Cladoraphis cyperoides*, where sand is mobile and with *Salsola* species on gravelly surfaces.

Inland, where substrates are more stable and plants are less impacted by drifting sand, the southern Boegoeberg plain dwarf shrubland, as well as the Boegoeberg dwarf shrubland are of high conservation importance. Here lichen fields and a variety of protected plant species such as *Cephalophyllum, Crassula, Eberlanzia* and *Fenestraria* species and other plants of conservation importance occur (Burke 2006).

Although vegetation has been observed to recover in the disturbed mining areas on overburden dumps (Williamson 1994, van der Merwe 2005, Burke 2007) and in mined out bedrock areas (Burke 2007), an extensive study of vegetation recovery in MA1 showed that even after 51 years, only about half of the vegetation cover of undisturbed sites was reached, although species richness comparable to surrounding, undisturbed vegetation was reached after 30 years on more gently sloped overburden dumps (Burke 2007).

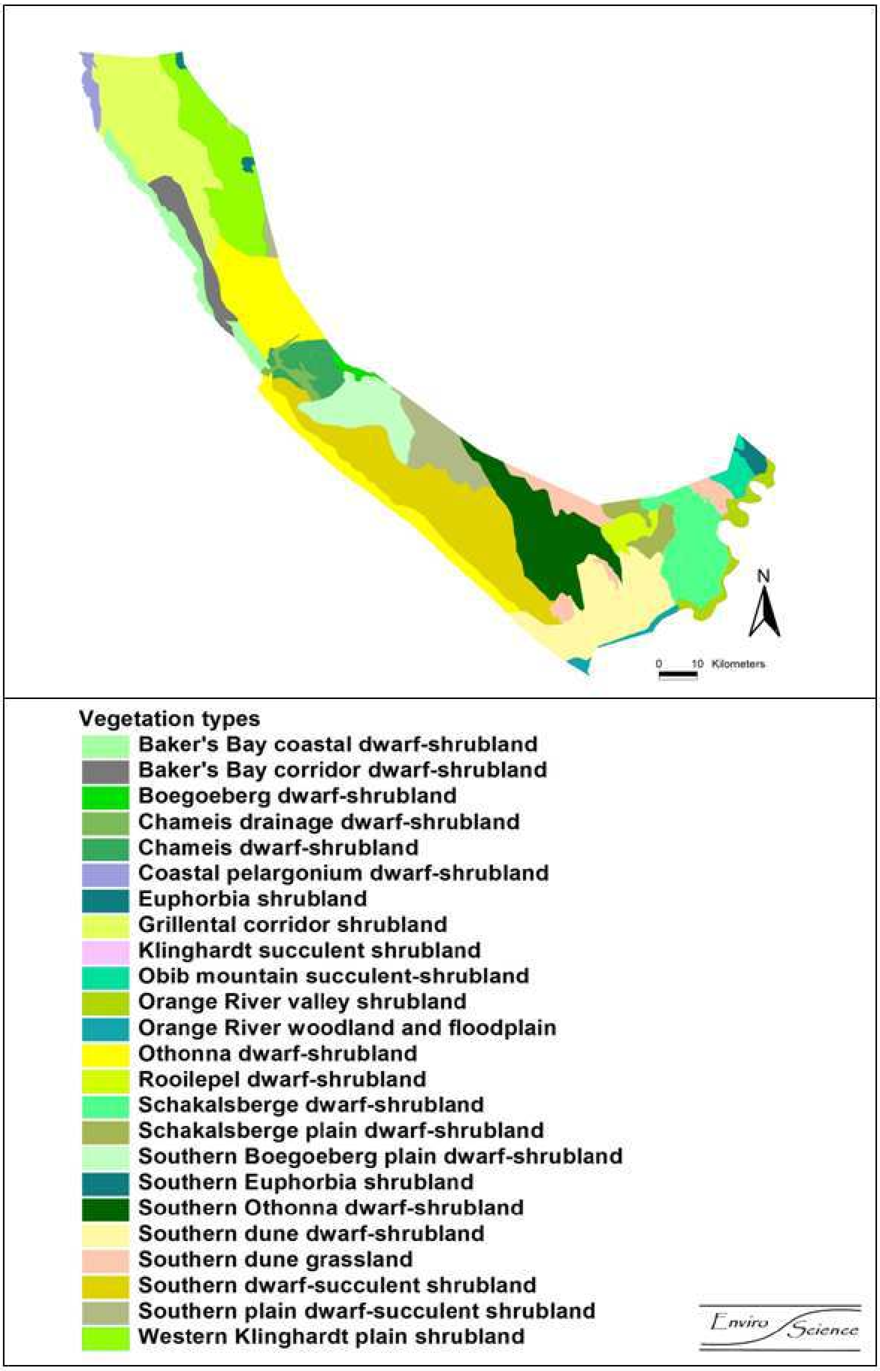

Figure 31. Location of vegetation types in Namdeb's Mining Licence areas (Bourke, 2024).

3.4.2 Plant endemism

The Sperrgebiet is characterised by a remarkably high level of endemism (Burke 2004), to the extent that some species only occur in the coastal area or Orange River valley. These deserve special consideration.

Figure 32. Three endemic plant species: the minute *Euphorbia angrae* (top left) and the small succulent *Othonna clavata* (bottom right) occur on rocky outcrops in ML43, and the unusual bulb, *Drimea secunda* (bottom left) grows on sandy plains also likely on those in the mining area. It is only present for short periods after good rains. The low shrub *Marlothiella gummifera (top right)* grows on outcrops along the coast (Photo's: Antje Bourke)

3.4.3 Wildlife

Since no systematic longer-term studies on fauna, except for brown hyena and birds, have been undertaken in ML43, all wildlife baselines compiled so far were based on desktop reviews, usually for the entire Sperrgebiet and supplemented by limited field observations. The information provided here needs to be seen in this context. Except for insects – and unlike for plants – the Sperrgebiet is not considered a centre of endemism for mammals, birds, reptiles or scorpions (Mendelsohn et al. 2002), but it is an important refuge for many species that have been hunted in more accessible areas or where their habitats have been disturbed.

3.4.4 Invertebrates

The Sperrgebiet is considered a major centre of insect speciation because of the diversity of habitats in the area and its position in the transition between major biomes in southern Africa (Marais 1993). However, mirroring the state of knowledge on insects in general, the Sperrgebiet insect fauna is poorly known, particularly in ML43. Amongst other invertebrates (e.g. spiders and its relatives, i.e. arachnids) intertidal spiders were identified of concern as possibly being affected by Namdeb's mining activities (Griffin 1993b).

3.4.5 Amphibians, reptiles and mammals

Some 20 Namib endemic reptiles are expected to occur in ML43 (Cunningham 2003), with the Namaqua dwarf adder *Bitis schneideri* listed as vulnerable and the desert rain frog *Breviceps macrops* as a flagship species. Eight small mammal species are expected to occur (Cunningham 2003). Gemsbok *Oryx gazella*, springbok *Antidorcas marsupialis*, brown hyena *Hyaena brunnea* and black-backed jackals *Canis mesomelas* have been confirmed to occur within the fenced high security area (Wiesel 2003), but also steenbok *Raphicerus campestris* and ostrich *Struthio camelus* occur (pers. obs.). The larger antelopes are believed to be contained by the fence and maintain isolated populations in the high security area. In addition, Cape fox *Vulpes chama*, bat-eared fox *Otocyon megalotis* and even baboons *Papio papio* and honey badgers *Mellivora capensis* (Maritz 2014) have been sighted in ML43 outside the fenced area.

3.4.6 Birds

Although relatively species poor, compared to other parts of the west coast (Hockey 2003; Simmons & Cordes 2000), birdlife in ML43 is nevertheless of importance. Wetlands species, including red-listed birds such as Cape Cormorant *Phalacrocorax capensis*, Black-necked Grebe *Podiceps nigricollis* and African Black Oystercatcher *Haematopus moquini* (Hockey 2003) as well as Greater and Lesser Flamingo *Phoenicopterus roseus* and *minor* have been observed in the disturbed mining area, attracted by the man-made ponds. The inland habitats of ML43 support chats,

coursers, korhaans, bustards, several raptors and likely the range-restricted Barlow's Lark *Calendulauda barlowi* (Ryan et al. 1996).

A recent baseline study (Avisense Africa, 2024) reveals that the afivauna receiving environment of the inland parts in ML43, is generally depauperate of avifauna, and weighted towards wetlands and coastal species, which are concentrated along the coastal strip. The mining ponds mostly attract Greater Flamingo, Lesser Flamingo and Black-necked Grebe. Barlow's Lark have been observed during this study's field workin significant numbers in the Kerbehuk area. Active nesting colonies of Damara Tern were confirmed at Uubvlei, and are confirmed to be regularly present at Orange River Mouth and Chameis Bay.

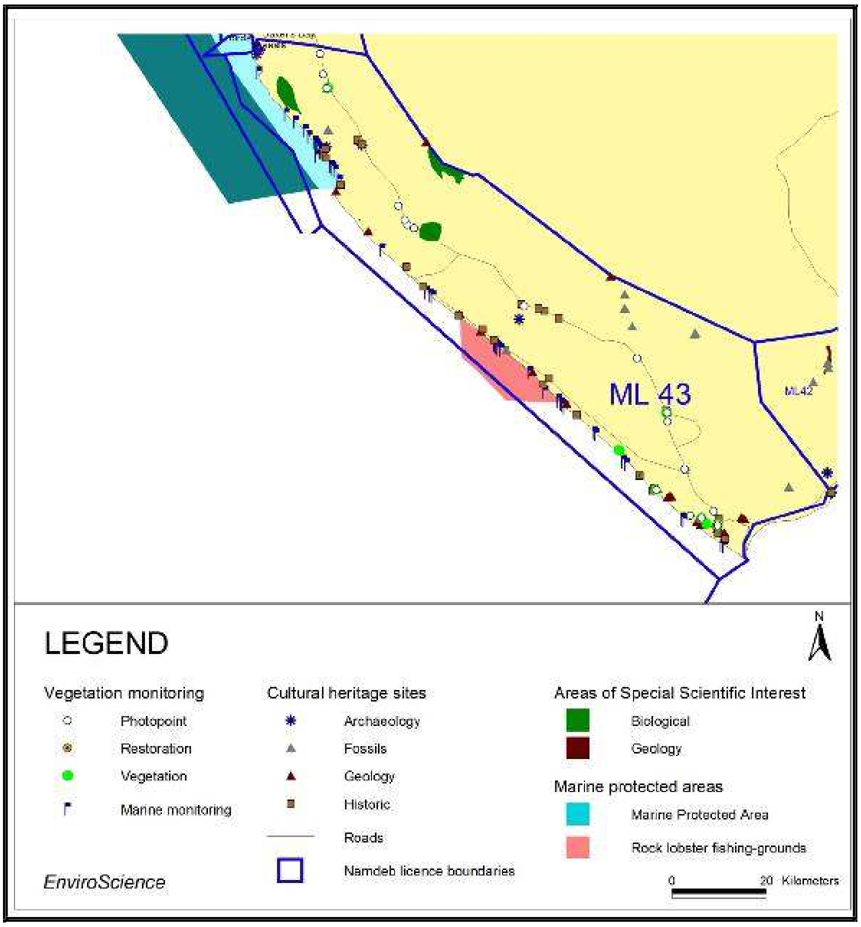

Figure 33. Environmentally sensitive areas in ML43, comprising Sites and areas of Special Scientific Interest (SSSIs), archaeological and historic sites, marine protected areas and environmental monitoring points.

Namdeb is currently in the process of identifying and developing the criteria for Significant Biodiversity Features, which are areas of great importance for biodiversity in the context of Anglo-American's Biodiversity Standard and Specifications. These

features include all forms of biodiversity, but in the case of Namdeb Mining Licence areas, they revolve around vegetation because of their high biodiversity value in this region. It is anticipated that this identification process will be completed by the next reporting period.

3.5 Marine environment

Biogeographically, the southern Namibian coastline falls into the cold temperate Namaqua Province, which extends from Cape Point to Lüderitz (Emanuel et al. 1992). The marine ecology of the southern Namibian coastline is shaped by coastal, wind-induced upwelling and is characterised by cold surface waters, high biological productivity, and highly variable physical, chemical and biological conditions (Barnard 1998). Communities within marine habitats are largely ubiquitous throughout the southern African West Coast region, being particular only to substrate type or depth zone. These biological communities consist of many hundreds of species, often displaying considerable temporal and spatial variability (even at small scales). The shoreline of Mining Area 1 is dominated by an almost continuous beach stretching from the Orange River mouth to Affenrücken, with rocky habitats being represented only by occasional small rocky outcrops that host benthic communities strongly influenced by sediments. North of Affenrücken to the beach in Chameis Bay the coastline is dominated by rocky cliffs. The coastline is exposed to strong wave action, facing directly into the prevailing swells.

3.5.1 Sandy beaches

Biological studies of beach macrofaunal communities conducted in ML43 include those of McLachlan & De Ruyck (1993) and Clark & Nel (2002). As part of the Environmental Management Plans for the various mining projects within ML43, annual monitoring surveys have been undertaken since 2007 of both sandy beach and rocky shore communities (Pulfrich & Hutchings 2019). Sampling sites span the area between the Orange River Mouth (GN03) and Affenrücken (H159), being expanded recently to include Pocket Beach 1 and Pocket Beach 2 as part of the marine monitoring programme for the proposed Northern Blocks operations.

The beaches in ML43 are extremely dynamic, being characterised by high wave energy, and narrow and steep beach faces, often with a low-tide step at the low water mark. They are mostly reflective beaches, comprising coarse sands (mean particle size 544µm) and consequently harbouring a relatively impoverished fauna. 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. The assemblages are limited to the sand hoppers *Africorchestia quadrispinosa*, pill bugs *Tylos granulatus*, and cirolanid isopods (sand lice). An array of beetles and kelp flies may also occur. The mid-shore region is characterised by a diversity of cirolanid isopods (*Eurydice kensleyi*, *Exophaeroma truncatitelson, Excirolana (=Pontogeloides) latipes*), polychaetes (*Lumbrineris* sp., *Scololepis squamata*), and amphipods (*Talorchestia* sp., *Griffithsius latipes*), with molluscs being virtually absent and represented only by the whelk *Bullia digitalis*. Some mysid shrimps (*Gastrosaccus namibensis*), and nemertean worms occur on the low shore, extending to about -2 m depth in the inner turbulent zone. The diversity, abundance and biomass of the macrofauna of the beaches between the Orange River mouth and Chameis Bay is the lowest recorded anywhere in southern Africa (Clark & Nel 2002).

The abundance and diversity of surf-zone fish off the highly exposed beaches is very low being represented primarily by the southern mullet *Chelon richardsonii*, which make up over 95% of the fish caught in beach seines (Meyer et al. 1998; see also Romer 1988). Other species include juvenile galjoen (*Dichistius capensis*), white stumpnose (*Rhabdosargus globiceps*), super klipvis (*Clinus superciliosus*) and False Bay klipvis (*Clinus latipennis*).

3.5.2 Rocky intertidal

Rocky intertidal habitats in ML43 are sparse, being represented only by occasional small rocky outcrops and wave-cut platforms north of Mittag. These semi-exposed to exposed rocky shores include considerable amounts of sand intermixed with the benthic biota, and consequently the fauna and flora are generally impoverished when compared to more homogenous shores. The macrobenthos is characterised by sand-tolerant species whose lower limits on the shore are determined by their abilities to withstand physical smothering by sand (Daly & Mathieson 1977; Dethier 1984; Van Tamelen 1996). The low-shore communities are dominated by foliose algae, particularly by the red foliose algae *Gigartina scutellata*, *Sarcothalia* (=*Gigartina) stiriata* and *Gymnogongrus glomeratus*, and red filamentous ephemeral species such as *Ceramium capense* and *Polysiphonia virgata*, which often occurred in mixed stands with other unidentified turf-algae. At most sites, the alien invasive mussel *Mytilus galloprovincialis* and the sand-tolerant anemone *Bunodactis reynaudi* are also common. Interspersed in this low shore band are numerous limpets (*Scutellastra argenvillei*, *S. granularis* and *Cymbula granatina*) and whelks (*Burnupena* sp., *Trochia* (*Nucella) cingulata* and *N. dubia*). Further up in the mid-shore zone, *M. galloprovincialis*, the reef-building polychaete *Gunnarea gaimardi (=G. capensis)* and the sand-tolerant anemone *Bunodactis reynaudi* 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. Where not covered by sand, the mostly barren high-shore was characterized by the tiny snail *Afrolittorina* (=*Littorina*) *knysnaensis*, the limpets *Scutellastra granularis* and *Siphonaria capensis* and the opportunistic algae *Porphyra capensis*, *Ulva* sp. and *Phyllymenia belangeri*. Recently, the low shore at the southern-most outcrops now also support dense beds of the invasive mussel *Semimytilus algosus*.

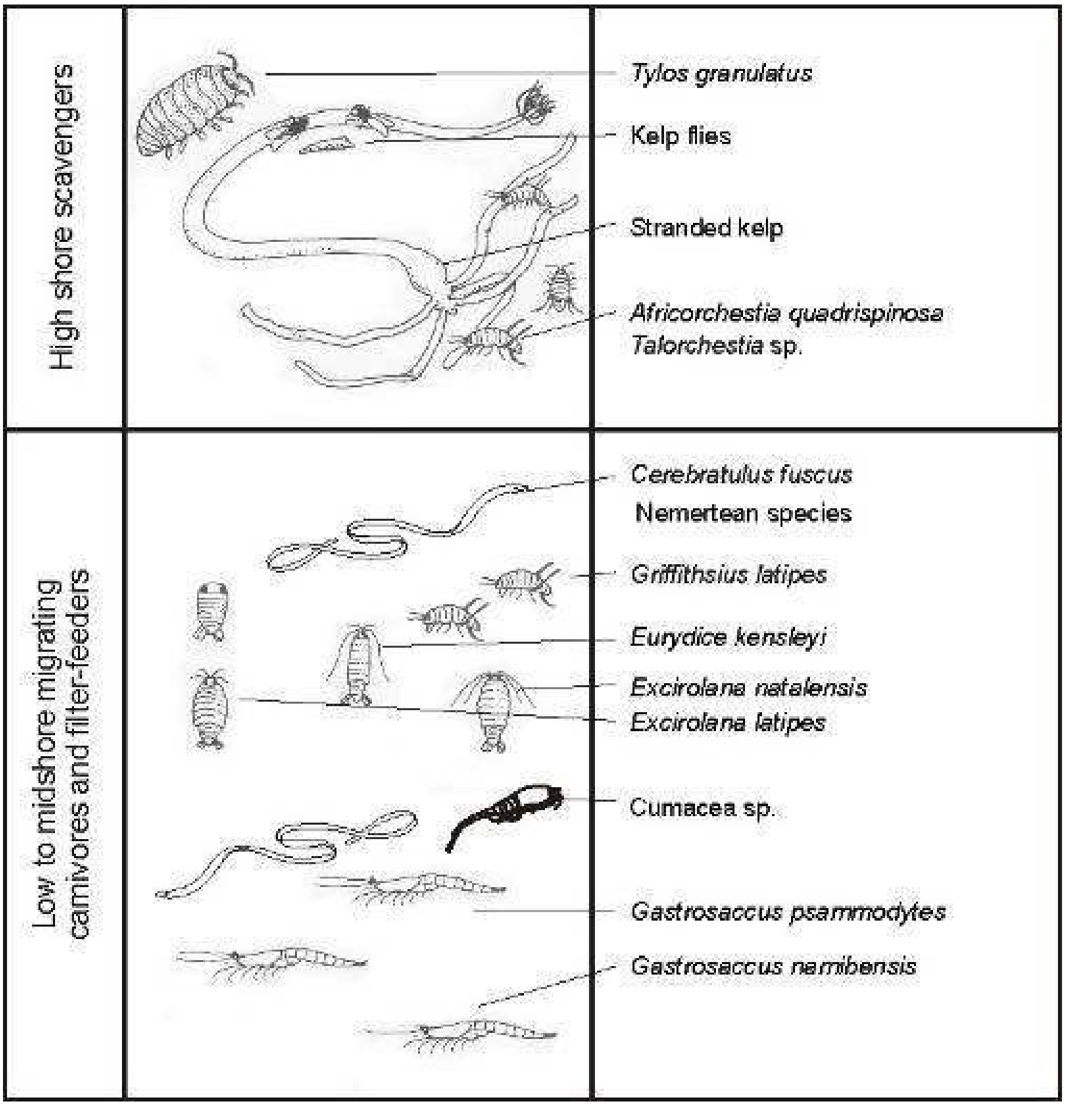

Figure 34. Schematic representation of the West Coast intertidal beach zonation (adapted from Branch & Branch 1981). Species commonly occurring on ML43 beaches are listed (Pisces 2011)

3.5.3 Subtidal

Research on subtidal organisms along the Namibian coastline has been limited, and current knowledge is restricted to reef communities in <30m depth in the area around Lüderitz (Tomalin 1993; Parkins & Branch 1996, 1997; Pulfrich 1998a, 1998b, 2007a, 2007b; Pulfrich & Penney 1998, 1999, 2001; Pulfrich 2007a, 2007b, 2012). In ML43, rocky subtidal habitats are limited to a series of coast-parallel reefs running northwards from approximately latitude 28°25′ S and extending ~4km offshore. In the nearshore areas these reefs are dominated by kelp beds (*Laminaria pallida* and *Ecklonia maxima*), which play a major role in absorbing and dissipating much of the

wave energy reaching the shore, thereby providing important semi-exposed habitats for a wide diversity of both marine flora and fauna. Growing beneath the kelp canopy and epiphytically on the kelps themselves are a diversity of understorey algae which 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. The sublittoral invertebrate fauna is 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.).

The structure and composition of benthic communities in offshore unconsolidated sediments off southern Namibia is primarily a function of water depth and sediment grain size (Steffani & Pulfrich 2004a, 2004b; 2007; Steffani 2007a; 2007b; 2009). 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 (Christie 1974; see also Steffani 2007b). Outside of this rich zone biomass declines again. Typical species occurring at depths of up to 60m included the snail *Nassarius* spp., the polychaetes *Orbinia angrapequensis*, *Micronepthys (=Nephthys) sphaerocirrata*, several members of the spionid genera *Prionospio*, and the amphipods *Urothoe grimaldi* and *Ampelisca brevicornis*. The bivalves *Tellina gilchristi* and *Dosinia lupinus orbignyi* are also common in certain areas. All these species are typical of the southern African West Coast (Christie 1974; 1976; McLachlan 1986; Parkins & Field 1998; Pulfrich & Penney 1999a; Goosen et al. 2000; Steffani & Pulfrich 2004a; 2007; Biccard & Clark 2016; Duna et al. 2016; Biccard et al. 2019; Giwhala et al. 2019).

3.5.4 Marine mammals and birds

The marine mammal fauna occurring off the coast of ML43 includes several species of whales and dolphins and one seal species, the Cape fur seal *Arctocephalus pusillus pusillus*. Seal colonies are located at van Rheenen Bay and Bakers Bay in ML44, with a further two colonies at Kleinzee (incorporating Robeiland), and at Bucchu Twins near Alexander Bay in South Africa. As seals are highly mobile predators they can be expected to occur off the coast of MA1 and individuals are sometimes seen coming ashore to rest on the beaches. Apart from the resident dolphin species such as the endemic Heaviside's dolphin and dusky dolphin, the coastline also falls into the migration routes of southern right whales *Eubalaena australis* and humpback whales *Megaptera novaeangliae* that migrate between Antarctic feeding grounds and warmer breeding ground waters. Whereas the small endemic dolphins are present year round, the migratory whales show a seasonal occurrence off the mining area, abundances peaking between June and September. Although the migration routes occur primarily off the continental shelf, in recent years a number of the sheltered bays along the coast of ML44 and ML45 (e.g. Chameis Bay and Elizabeth Bay) have become popular calving sites for Southern Right whales.

The Namibian coastline sustains large populations of breeding and foraging seabird and shorebird species, which require suitable foraging and breeding habitats for their survival. Birds likely to be encountered along the shoreline of MA1 include Bank *Phalacrocorax neglectus*, Cape *P. capensis*, White-breasted *P. carbo lucidus* and Crowned *Microcarbo coronatus* Cormorants, African Black Oystercatcher *Haematopus moquini*, Kelp *Larus dominicanus* and Hartlaub′s Gulls *Chroicocephalus hartlaubii* and Swift Terns *Sterna bergii*. Some of these species roost and nest in the ponds that have developed in the mining voids.

A recently completed study assessed the ecological function of the ponds, verifying that these are indeed supporting a diverse ecosystem (Maritz 2020). Bird numbers were highest for ponds that were being 'dewatered′ to remove water prior to mining, as this exposed a rich benthic epifaunal source of food. Blacknecked Grebe, Cape Cormorant, Greater and Lesser Flamingos, Kelp Gull and Common Tern were the most abundant birds. The mining ponds support seven seabird species nesting on the offshore islands, i.e., Bank Cormorant, Cape Cormorant, Whitebreasted Cormorant, Kelp Gull, Hartlaub′s Gull, Swift Tern and African Black Oystercatcher. Of the 36 species present around the mining ponds, five are endemic to southern Africa (African Black Oystercatcher, Bank Cormorant, Cape Cormorant, South African Shelduck, Hartlaub;s Gull), four are endemic subspecies (Blacknecked Grebe, Swift Tern, Kelp Gull and Greyheaded Gull) and one is an endemic to sub-Saharan Africa (Whitebreasted Cormorant) (Kemper et al. 2007; Sinclair et al. 2011; Simmons et al. 2015). Of these endemics, five are listed in Namibia′s Red Data book as being of concern: African Black Oystercatcher, Bank and Cape Cormorants, Blacknecked Grebe and Hartlaub′s Gull (Simmons et al. 2015).

Figure 35. Breeding and foraging birds in mine ponds (Photos by Namdeb)

Only two species of fish commonly occurred in the ponds, the west coast steenbras *Lithognathus auratus* and the southern mullet *Chelon richardsonii*, although small numbers of two other marine species were recorded. Thus, the ponds do serve as viable ecosystems, albeit with a limited range of saltmarsh and fish species, and support an impressively diverse avifauna. Their long-term viability (> 15 years) will, however, become limited by rising salinity as their age increases (Maritz 2020).

3.6 Existing disturbances

This EMPR covers an area with over 90 years of continuous mining. Along the coast large areas have therefore been disturbed and the original landforms completely altered to present a man-made landscape of overburden dumps, tailings dumps mined out areas and ponds today. However, most old mining areas are in various stages of natural recovery. All supporting infrastructure (processing plants, buildings, workshops, roads, power lines, pipelines and communication infrastructure) is in place.

Figure 36. The view from No.4 plant dump in 2014 to the south shows the extent of the mining operations and supplementary infrastructure such as roads and pipelines.

Figure 37. No.3 plant is a large processing complex with all typical components of a diamond processing plant such as crusher, scrubber, screens and Dense Medium Separation units.

Chapter **4**

The socio-economic environment

Namdeb operations are situated in the Tsau //Khaeb National Park (TKNP) in the scarcely populated //Kharas Region in Namibia. With the Atlantic Ocean bordering it to the west, the Orange River to the south, the town of Oranjemund was established to support diamond mining but has since been excised from the TKNP and the diamond mining license areas. According to the Namibia Statistics Agency Preliminary Census Report (2023), Oranjemund has a population of approximately 7441 residents. As a previously closed town, Oranjemund transitioned to an open town in 2017, which presented both challenges and opportunities.

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

The mining area in ML43 are zoned as managed resource use, and the adjoining areas as wildlife management, special value and minimal disturbance zones. The licence area contains many sites of historic interest, largely related to the history of diamond mining. The most spectacular archaeological find ever made in Namibia was the uncovering of the Bom Jesus shipwreck (due to mining operations) dating back to the time of the voyages of early marine explorers in the early 16th century. The armed trade vessel was laden with ivory, ingots, gold and silver and other trade wares, and its excavation turned up priceless specimens of nautical equipment and armoury.

4.1 Demographic overview

Based on a recent socio-economic baseline conducted, (SLR, 2024) the average household size of Oranjemund is significantly smaller (2.7 people) than for the rest of Namibia (4.4) and the //Kharas Region (4.2). The Oranjemund population is skewed towards males (72.4%) . Male households are predominantly employed at the mine (65%), while female households are more involved in domestic work (22%) (SLR, 2024). The dominance of formal employment as the primary income source underscores the significance of wage=based work for household livelihoods. The disproportionate representation of men in the mining sector, indicates the significance of this industry for male employment and income generation. The

disproportionate female participation in mining, on the other hand, indicates the persistence of traditional gender roles (SLR, 2024)

Current businesses in Oranjemund are largely formal, which includes large businesses such as the mining contractors, suppliers, shops and telecommunications, as well as medium size and small businesses (e.g. maintenance contractors, retail, restaurants, cleaning and beauty services).

4.2 Economic contribution

The mining industry contributes significantly to Namibia's Gross Domestic Product (GDP). In 2023, the mining sector's average contribution to Namibia's GDP was 14.4% (Chamber of Mines, 2024). It also contributes to infrastructure and community development and employed 8,950 individuals permanently, 8,436 through contractors and 803 individuals on a temporary basis in 2023. Wages and salaries amounted to N$ 6.8 billion in 2023 and total employee taxes to N$ 1.2 billion (Chamber of Mines, 2023).

Mining accounts for 50% of exports from Namibia on average. It is the dominant economic sector in the Karas Region where Namdeb operates. Although employment rates are slightly above the national average, besides the formal sector (mining, fishing, agriculture) there are few other opportunities for employment, as subsistence farming is very marginal in this arid region. Developments in other sectors (e.g. tourism, manufacturing) are progressing very slowly.

Namdeb Holding's (constituting both Namdeb and Debmarine Namibia) turnover in 2023 was N$ 4.48 billion with a corporate tax bill of N$ 445 million. Wages and salaries in 2023 amounted to N$ 1.083 billion (Chamber of Mines, 2023).

In addition to the direct contribution to Namibia's economy, Namdeb has a profound positive effect on secondary industries through suppliers, contractors and service providers supported by the diamond mining business. A total of N$ 4.419 billion was procured from businesses in 2023, of which N$ 3.47 billion was spent on local procurement, which is 83.7% of total procurement (Chamber of Mines, 2023).

4.3 Human resources

4.3.1 Staff complement

With the extension of Namdeb's Life of Mine, the staff complement of Southern Coastal Mines increased from 687 in 2020 to the current figure of 987 in 2024, which is a substantial 43% increase (Table 7).

Table 7: SCM Staff complement from 2020 to 2024

	2020	2022	2023	2024
SCM Staff Complement	687	826	1021	987
Average recordable contractors' workforce			1232	1222

The long term mine plan of Namdeb determines the human resources required by the company into the future, to cover the operations.

This impacts on the employee numbers and levels, which is forecast and managed in a controlled manner. The company, for instance, approaching a foreseen market slump, considers overheads in order to sustain the company. This is when initiatives such as voluntary separation (voluntary retrenchment) are implemented to limit overheads.

There is an ever-present cycle of economic prosperity vs. recession. If the company does well, the focus shifts to a long-term focus on training and development, bursaries, interns and understudy programs as well as adjustments of renumeration practices to attract and retain top talent. As soon as we move into a slump again or face possible closure these initiatives become obsolete.

The use of contractors also remains a great part of our business as that is one way to remain agile and be able to stop and start processes.

The permanent and fixed contract positions for Namdeb's entire operations, and as planned for 2025-2028, are as follows:

Table 8: Past (2021-2024) and projected (2025-2028) staff complement (permanent staff and fixed term contractors) for the entire Namdeb operations

2021	2022	2023	2024	2025	2026	2027	2028
1587	1801	1826	1846	1827	1821	1666	1658

4.3.2 Staff benefits

All newly appointed Namdeb employees are paid a housing and utility allowance and have to source their own accommodation. Current employees who have not bought their houses still have the option to purchase their units.

72% of Namdeb's employees are members of the Mine Workers Union of Namibia. Formal monthly engagement sessions are held with the Union representing their members to discuss matters of mutual concern. Employee leave benefits at the lower grades was increased and employees allowed to encash leave once they comply to legislative leave taken as prescribed in the Labour Act.

4.3.3 Work hours and shifts

Office-based personnel work 8 hours daily 5 days a week. Mining and Metallurgy teams work a 21 day on 7 day off, 8 hours per day continuous shift to cover the 24-hour operation. Namdeb uses various shift patterns across its operations, varying from normal 5-day shift, 6-day shift, 14 days on /14 days off to 21 days on /7 days off in order to cover the requirements of the various sites and operation.

Employees are transported to and from work by the company using busses, coinciding with the shift times from all plants. Small buses run during the day hourly from between the plants and the Personnel Control Centre.

4.3.4 Skill development and training

Employees in Mining Area 1 qualify for Namdeb training programs offering technical and non-technical development and growth. The technical training is a compliance requirement based on the required work in the area of responsibility for the individual employee. Due to this compliance training it is accompanied by a valid permit to certify that compliance is attained. As the scope of work changes, so will the training as per the specialized equipment and site-specific requirements. In the non-technical training division, the focus is on future skills set and ensuring continuity of the business succession profile by ensuring leadership skills are in place to position the business for the future.

Namdeb has provided bursaries to promising, young Namibians for carbon neutral studies (looking towards the future of our business) and a medical occupational specialist bursary due to the scarcity in Namibia. Namdeb currently has thirty (30) growing talent professionals in various roles such as Graduates and Interns across different Disciplines. Namdeb also looks at creating opportunities through work integrated learning for those students still looking to finish their qualifications. These capacity building roles are in place to offer exposure to young, graduated professionals and for the business to create a talent pipeline towards upskilling and a talent pool of professionals that can assimilate into the business as opportunities arise. Namdeb has spent N$ 7 million on training and skills development, including the last 2 bursaries offered in 2023 (Chamber of Mines 2023) collectively for 2024 thus far.

4.3.5 Health, safety, medical care and emergency response

Each section within ML 43 & ML 42 has a fully equipped government first aid and regulated box, with a trained first aiders for each section. There are 3 first aid rooms strategically placed at the 2 main Pants and at the main maintenance centre (Uubvlei). There is a paramedic available 24/7 at ML43 and a registered nurse at the Daberas hostel within ML 42 .

The Namdeb hospital is a primary medical care facility and offers emergency, out-patient, dental care and a surgical theatre, by outsourced medical practitioners.

Namdeb has an HIV/AIDS awareness and training programme. Occupational health amongst staff is monitored regularly for noise and dust exposure, with the occupational health section conducting medical fitness examinations.

Namdeb has an Emergency Management policy and procedure to cater for various emergency situations. Emergency response teams are available and conduct various drills and simulations. Namdeb has an contract with a specialised contractor handling potential oil and other hazardous substances spills.

Over the previous three years (2022-2024) Southern Coastal Mines reported five environmental incidents, namely two diesel spills, a sewage spill and two hydraulic spills. There were 43 minor environmental incidents related to wildlife, minor spills, waste, etc.

4.3.6 Education

Namdeb supports private pre-primary, primary and secondary schools in Oranjemund and maintains an Educational Assistance Scheme to subsidize school fees.

4.4 Land use

The park's tourism development plan (TDP) (MEFT 2020b) has included ML43 in the 'Oranjemund coastal / Orange River tourism development area'. The TDP recognises that mining will continue along the coast, thereby limiting tourism to some extent. Two concessions are envisaged: (1) the Oranjemund coast and mining concession and (2) the Orange River concession. The Orange River concession has been awarded to the OMDis Town Transform Agency who has started to further develop the tourism offering of the concession. The old hostels and the remains of the Portuguese shipwreck 'Bom Jesus' are listed as attractions within the high security area, while Baker's Bay, Chameis gate and the historic camel station at Buntfeldschuh are mentioned as attractions outside the mining area. Small groups are envisaged to be taken on guided one-day tours to the high security mining area, while Chameis, Baker's Bay, Buntfeldschuh and Bogenfels could be visited on one-day (or possibly overnight) bus tours. A daily convoy to Lüderitz is also envisaged.

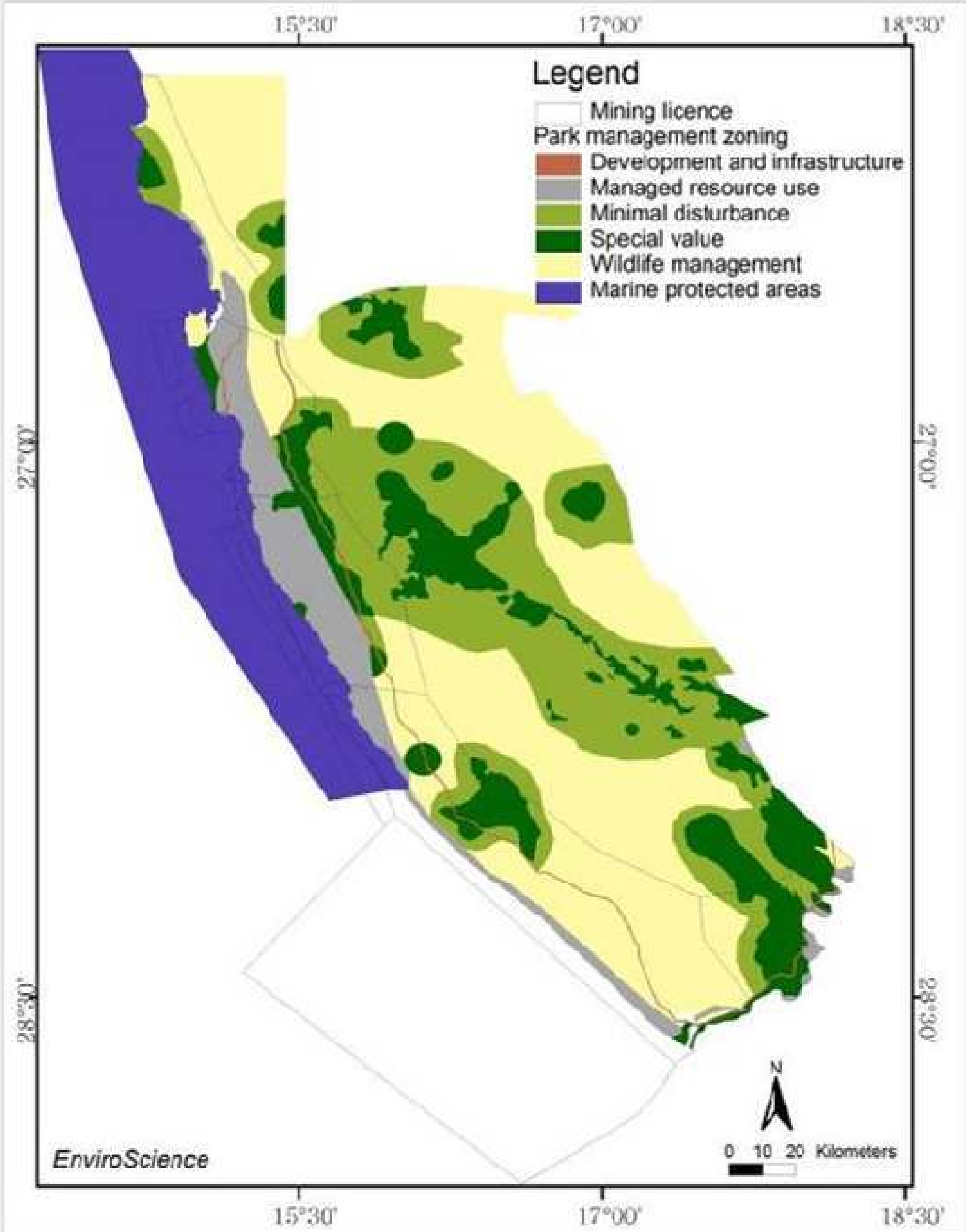

Figure 38. Zoning of the Tsau//Khaeb (Sperrgebiet) National Park and Namdeb mining licences (Ministry of Environment, Forestry and Tourism 2020a).

4.5 Cultural heritage

Over 300,000 years of occupation by people has left its mark in the licence area. Particularly the Orange River and the coast are rich in archaeological sites (Covinus 1983, Noli 1995). The earliest finds are from the Acheulian (lower Palaeolithic culture of the Early Stone Age) from about 1.5 Ma to 150,000 years ago. Hand-axes, flakes and cleavers from this period were found in calcrete cappings of ancient shorelines near the Orange River mouth where early men lived on the then 4 m higher beach.

Middle Stone Age (150,000 – 20,000 BP) artefacts were found in sand and on calcrete, with surface sites abundant in the Affenrücken and Kerbehuk area, where silcrete and ferricrete provided suitable rocks for tools (Corvinus 1983). The silcrete-capped Tafelberge in the Affenrücken-Chameis area have many workshop sites with clusters of flakes, points, blades and other artefacts. These were possibly manufactured when the wind-blown dune fields developed some 65,000 – 30,000 years ago (Corvinus 1983).

During Later Stone Age (20,000 – 500 or 300 years BP) many shell middens were found in the vicinity of the shore, usually as surface sites in the dunes.

Due to the possibility of artefacts being uncovered during mining a "chance find" procedure was formulated and implemented on all sites. Any artefacts discovered during exploration or mining are thereby reported. See examples below of chance finds discovered during mining activities (elephant tusks and coin relating to shipwreck finds and fossilised whale bones). Artefacts are indeed found from time to time, as the case in the fourth quarter of 2023, when Two ship anchors were unearthed at G123 and three elephant tusks at U60x. The National Heritage Council had been notified regarding the discoveries. The local curator who is employed by the Museum of Namibia provided input to ensure that the artefacts were correctly identified.

The most spectacular archaeological find was made in 2008, when mining operations, working behind sea walls and below sea level, uncovered an early 16th century shipwreck, the *Bom Jesus*, from the time of the first great sea-voyages of the early explorers. Several years of intensive research by a multi-disciplinary team revealed that the Portuguese ship was an armed trade vessel, a so-called Não, on its way from Lisbon via West Africa, likely Sao Tome, to Goa, India (Knabe & Noli 2012). The ship was laden with trade goods such as textiles, leather, copper and lead ingots, swords, and an array of metal ware, ivory and a huge treasure of Portuguese and Spanish gold and silver coins (Knabe & Noli 2012). Priceless specimens of nautical equipment and armoury of that time were also discovered during the excavation of the shipwreck.

Figure 39. Some artefacts uncovered as a result of the chance find procedure (Photo: Namdeb).

Of historic interest in the licence area are also relics of the first diamond processing plant near Oranjemund and more modern relics associated with the history of diamond mining in this area. This includes the hostels in the high security area (Affenrücken, Mittag and Uubvlei hostels), remarkable technical innovations at the time, such as an underwater tunnel for water intake at a former processing plant, mining equipment and typical dumps created by the various mining machinery. Currently still active infrastructure such as No.3 plant, Red Area Complex and Personnel Control Centre may become sites of great importance for future tourism (Namdeb CHMP 2020).

Figure 40. The excavation site of the shipwreck (left) and a reconstruction of the Portuguese Não (right, from Knabe & Noli 2012) which stranded probably around 1533.

Information on cultural heritage is included in Anglo-American's 'Social Way' as a cultural heritage management plan. Any archaeological sites uncovered during mining are reported under the 'chance find procedure'. Awareness and training in this procedure is included in the environmental inductions. This also includes immediate reporting to the National Monuments Council and Uubvlei Museum for finds related to the historic shipwreck. Namdeb currently supports additional studies on the shipwreck.

Namdeb has a Cultural Heritage Management Plan which addresses all aspects related to the protection, preservation and management of cultural heritage sites. This includes archaeological, historic and geologically important Sites of Special Scientific Interest, including many fossil sites (Namdeb CHMP 2020).

4.6 Corporate social responsibility

Namdeb continues to collaborate with key stakeholders and focuses its community impact initiatives towards a sustainable Oranjemund as its doorstep community. Access to public healthcare and education continue to be key focus areas. In 2023 alone, over N$80 million was spent in the town of Oranjemund through various initiatives which include N$18 million for education and N$30 million for health. In addition, Namdeb supports the maintenance of sports facilities and public open spaces (i.e. parks) in Oranjemund. Namdeb further supports various youth empowerment initiatives (i.e. sports) in the wider //Kharas region.

The Omdis Town Transform Agency (pty) Ltd (OMDis), a Section 21 company funded by Namdeb, continues to drive socio-economic development through job creation, agriculture, tourism, infrastructure and enterprise development.

In addition, Namdeb also funds OMD 2030 (Pty) Ltd, an independent community organisation representing the town community which focuses on social transformation and community activation. Awareness raising and training in participation and project management of the citizens of Oranjemund are some of the organisations' functions.

4.7 Town transformation

The recently proclaimed town of Oranjemund needs to function independently from Namdeb in the long-term. The process of town transformation has been pursued for over a decade and the first crucial step – town proclamation – was achieved in 2011. On 21 October 2017, with a tarred public road now linking Oranjemund to the rest of Namibia, the town was officially opened, thus exempting visitors from the need to obtain a Restricted Area Permit to access the town or conduct business.

The transformation process has three key strategic focus areas:

1. Transfer: Transfer of municipal services, residential and commercial properties,

2. Transition: Transition of education, health and citizens, and

3. **Transform: Framework to diversify the economy beyond diamond mining (Oranjemund Town Council 2017, Synergy 2020)).**

The 'transform' strategy has a catalyst component, which through direct investment is proposed to stimulate economic activity and a donor component, which is meant to strengthen administration and economic diversification (Synergy 2020). The OMDis Town Transform Agency (OMDis) Section 21 (non-for-profit) Company was created with the sole mandate of the implementation of the 'transform' strategy together with other town stakeholders, including the OTC. Economic diversification focuses on tourism, agriculture, agro-processing and renewable energy as the sectors identified as having the best potential for the economic diversification of the town. OMDis is a in a partnership with Namdeb, Oranjemund Town Council and OMD 2030.

4.8 Infrastructure in Oranjemund

In 2015 it was indicated that the town's sewage infrastructure and waste disposal site is stretched to capacity (Aurecon, 2015). The design of a new waste disposal site is currently underway by Lithon Project Consultants.

Oranjemund has a private school offering grade 0-12 of excellent facilities. The hospital is a primary medical care facility and offers emergency, out-patient, dental care and a surgical theatre. All this infrastructure and services are currently funded by Namdeb. There is a government school and government clinic in Oranjemund.

Namdeb's annual expenditure on school, hospital, and economic diversification of Oranjemund's economy is approximately N$ 86 million annually.

It is clear that Namdeb is still significantly invested in Oranjemund, although much is done to change the situation. The table below provides a list of infrastructure in Oranjemund.

Table 9. Key infrastructure in Oranjemund owned by Namdeb vs. Government and Privately owned.

Infrastructure	Number / capacity	Comment
Houses	1013	
Houses converted to private enterprises	463	These are only Namdeb employees who bought their residential properties
Houses converted to private enteprises	262	Units sold to private businesses in town
Oranjemund Private Schools	2	Pre-primary and Primary
Oranjemund Government Schools	2	Pre-primary and Secondary
Private hospital	37 beds 2 operating theatres Digital x-ray machine Laboratory Mortuary	There is also a government primary health clinic.

Infrastructure	Number / capacity	Comment
	Incinerator	
Recreational facilities	Angling, badminton, bowling, boxing, cricket, golf, hockey, karate, netball, off-road, riding, rugby, soccer, snooker and darts, squash, shooting, tennis and volleyball	
Water supply	20,570 m3/day	10 boreholes and 1 well in alluvial aquifer
Water		Water consumption estimated 5 times Windhoek average
Sewerage	1 facility	
Electricity	Supplied by Eskom	
Solid waste disposal	1 facility	Construction of new general and hazardous waste disposal site completed 2024.

Chapter 5

Environmental management to date

Namdeb's Environmental Section is responsible for environmental management. Currently eleven full-time staff, inclusive of one intern are responsible for planning, performance reporting, assurance, impact monitoring and stakeholder engagement. One senior officer, with the assistance of two environmental officers, is solely dedicated to Southern Coastal Mines (Mining Area 1). All Namdeb's operations are ISO14001:2015 certified and follow De Beers' and Anglo American's corporate standards.

Environmental management at Namdeb, with the slogan "Mining for Good" encompasses an intricate set of components to address the challenges posed by profitably mining diamonds whilst ensuring environmental protection. For the purpose of this EMPR the headings in the diagram below structures this section. All aspects described below apply to ML43, as well as Namdeb overall.

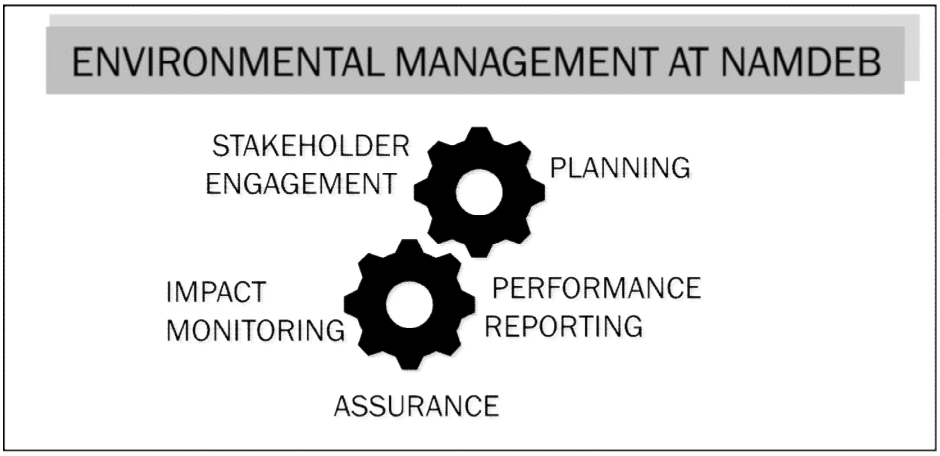

Figure 41. The main components of environmental management at Namdeb.

5.1 Planning

Environmental impact assessments undertaken by external environmental practitioners, internal risk and impact assessments undertaken by Namdeb environmental staff and specialist baseline studies are the tools used to inform projects at a planning stage at Namdeb.

5.2 Performance reporting

Corporate environmental management at Namdeb requires reporting at a multitude of levels internally to De Beers and Anglo-American peers, the Namdeb Executive Management Committee (NEMCOM scorecard), the OPSCO team and the Head Mineral Resources and Environment and externally to the authorities. The figure below provides a summary of the key performance reporting tools.

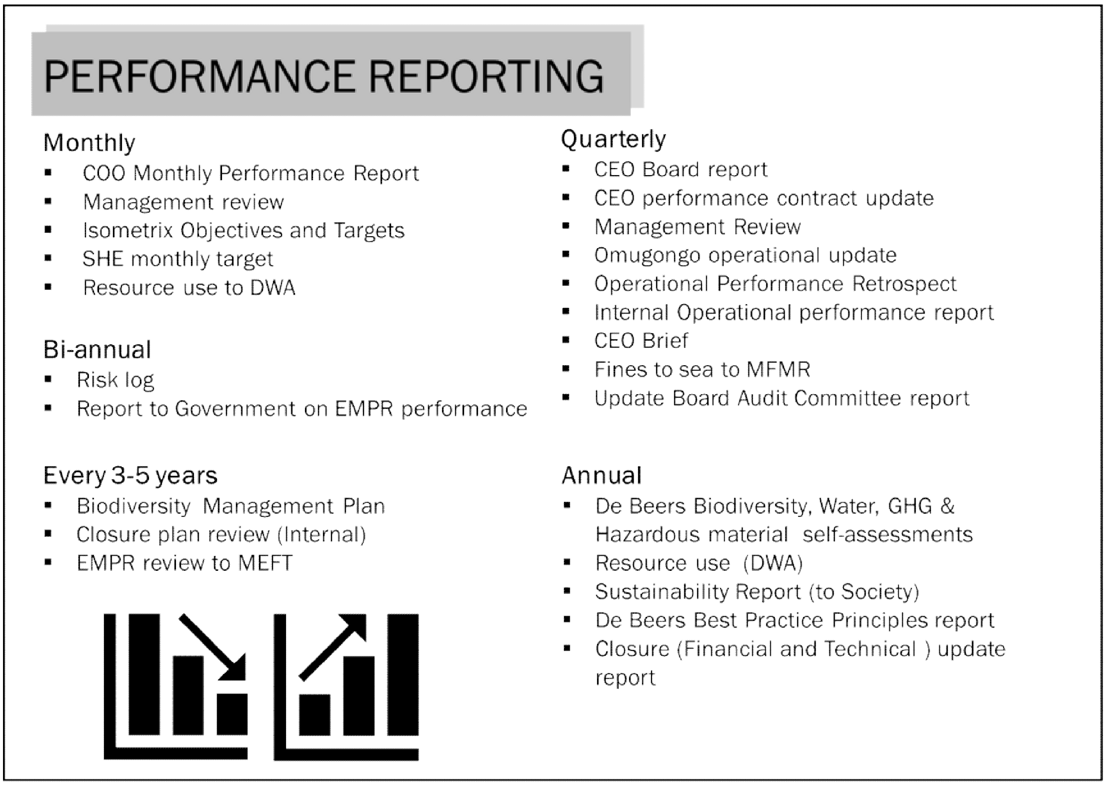

Figure 42. Elements of environmental performance reporting at Namdeb.

Isometrix is Anglo American's computerised environmental platform, which facilitates regular updates on-line and thus provides a real-time status of all Anglo-American/ De Beers operations.

5.3 Assurance

Environmental performance at Namdeb is certified by auditors, externally and internally and backed by compliance visits from the authorities (e.g. Department of Water Affairs) and corporate head office.

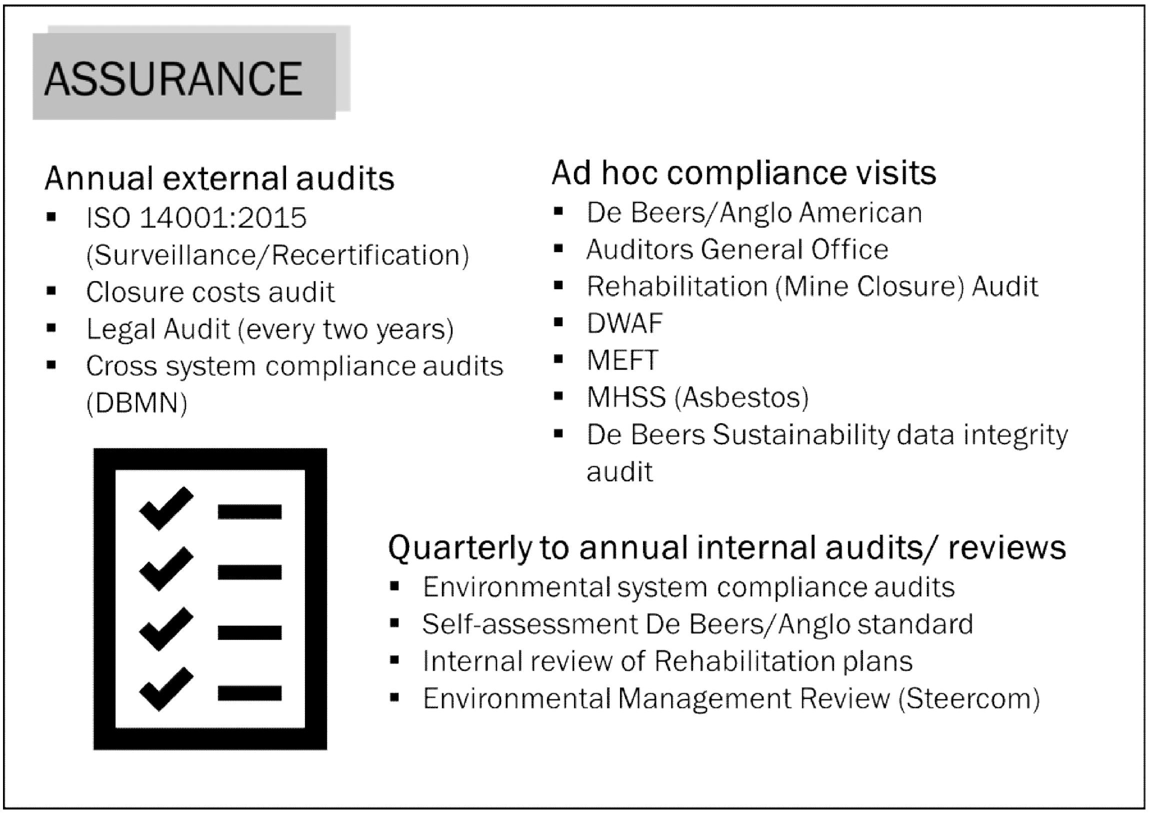

Figure 43. Environmental audits and certification at Namdeb

All Namdeb's operations are ISO14001:2015 certified. ML43 obtained its first certificate in 2000 and has maintained certification since then.

5.4 Impact monitoring

Monitoring of resource and material use, and environmental impacts go hand-in-hand. These are some of the critical functions of Namdeb's environmental section.

5.4.1 Resource use

Namdeb environmental staff regularly collate data on consumption of

- **Seawater and freshwater,**
- **Fuel,**

- Energy, and
- Selected chemicals used in processing.
- Electricity consumption of Oranjemund town is generally about one third of that of the mining operations in ML43.

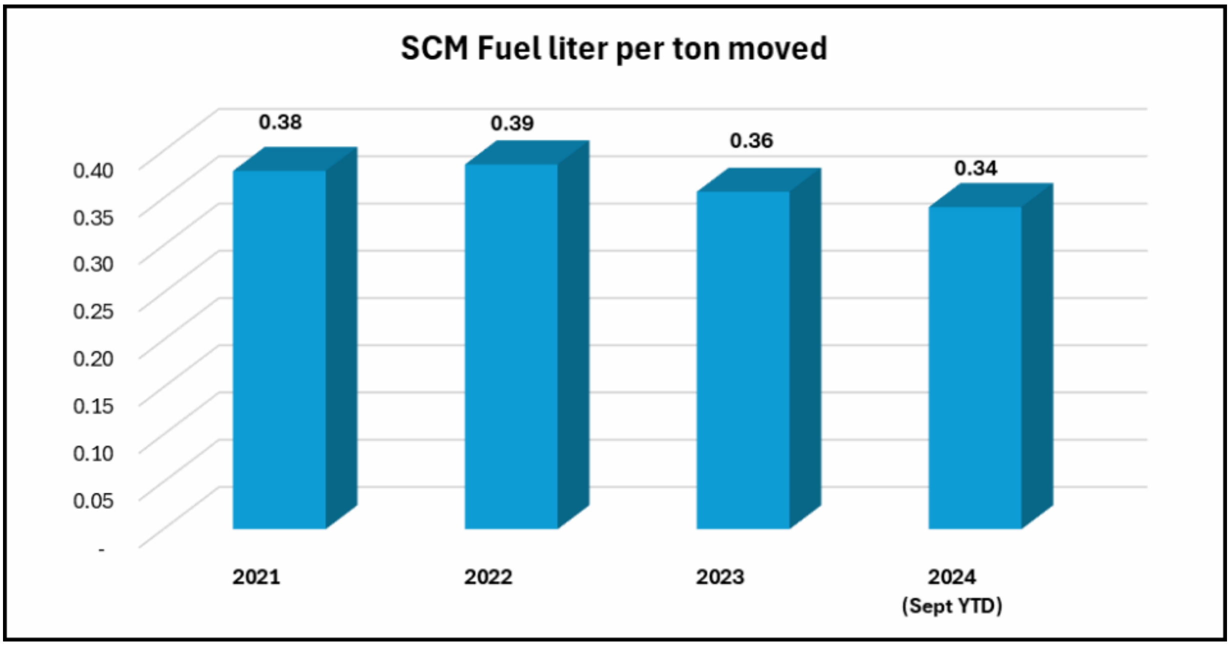

Figure 44. SCM Fuel Liter per ton moved

The above figure indicates how the efficiency of fuel consumption has improved since 2021. The graph indicates an improved fuel utilisation in 2023 (7.7% compare to 2022) and 2024 YTD as at September (5.56% compare to 2023). This is as a result of efficiency improvement on hauling distances, as well as an introduction of contractor stripping at the end of Q1 2023 with lower fuel consumption per ton to carry out the required additional stripping tons as per the mine plan.

5.4.2 Pollution monitoring

Regular pollution monitoring in Southern Coastal Mines (ML43) focuses on water quality, bioremediated sand, historical oil spill at W63, effluent from oil water separators and the sewage treatment plant. Asbestos disposal during demolition is monitored as well as staff's exposure to dust at regular intervals.

As part of the water disposal permit issued by Department of Water Affairs (DWA), sewage and oil water separator effluent samples are taken quarterly and sent for analysis. The results are forwarded to the Ministry of Agriculture, Water and Land Reform (MAWLR) on an annual basis.

5.4.3 Impacts on biodiversity

5.4.3.1 Marine

Namdeb places an emphasis on monitoring the potential impacts of its operations on biodiversity and has a marine programme in place since 1997 to monitor impacts on rocky shore, sandy beach and subtidal marine ecosystems. Sandy beach and rocky shore have been monitored since 2007 in SCM.

The first biological studies of beach macrofaunal communities in ML43 were those of McLachlan & De Ruyck (1993) and Clark & Nel (2002). McLachlan & De Ruyck (1993) comment that at the time of their survey, none of the MA1 beaches they sampled had been mined directly but emphasise that the extent to which they may have been affected by mining elsewhere was uncertain. The study of Clark & Nel (2002) was designed as a pre-mining 'baseline' survey for future operations associated with the Inshore Project. In 2007, the Environmental Management Plan for for ML43 recommended that a biological monitoring programme be implemented to monitor the impacts on biodiversity of sandy beaches and rocky shores. These habitats have been monitored annually ever since, with new sampling sites being added as and when necessary.

Recent successful monitoring of rocky shores, sandy beaches, *Tylos granulatus* and subtidal areas was conducted for 2023 in ML43. Recovery was noted at the impacted site (M93) of the beach communities.

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 test mining of the Purple, Bogenfels and Channel features in the offshore portions of ML43, ML44 and ML45, was undertaken in December 2015, and early 2018. A post-mining survey was undertaken in 2021 and following results strongly indicating evidence of significant recovery at Channel and Purple (ML43), it was recommended that repeat post-mining surveys (impact monitoring) take place every second year (Anchor Environmental, 2024)

A second post-mining survey was undertaken in 2023 by Anchor Environmental (2024) that aimed to assess impacts of the 2018 trial mining events on faunal communities at Bogenfels (ML44) and Purple (ML43). Baseline data was also collected from new sampling sites in the greater Northern Blocks area, where future mining is planned with the added objective to determine if any correlation between changes in coastal and offshore habitat composition exists as a result of coast accretion activities. The key results include:

- **Recovery of impacts at inter alia Purple are underway, but persistent dissimilarities were found between impact and control sites for sediment and particle size composition, benthic macrofaunal community structure and to a lesser degree, biological traits. The study however cautions, that univariate (single characteristic) indices used in the survey alone are not sufficient for** assessing impacts of mining rates of recovery, and that the monitoring should be followed up with multivariate (multiple characteristics) analysis.

- Narrow crawler lanes in the Purple region, seem to recover at a faster rate than those at Bogenfels with a much larger panel. These findings are however preliminary.
- Of the southernmost Northern Block sampling sites in ML43 have the lowest mean species richness, diversity and biomass and low mean abundance, which is the site located closest to the accretion activities at mining blocks U95-U105, despite them being moved 2km offshore from their proposed location.

These results suggest that smothering related impacts on benthic macrofaunal communities from coastal accretion activities could extend beyond the 20m depth contour to at least 32m in this area. It also seems possible that differences in sediment particle size composition observed at sampling sites NB 2-6, indicate that this sediment could have originated from nearby coastal accretion activities, although further investigation is needed to confirm this.

Pond monitoring: Namdeb mined out areas to bedrock below sea level, which fill up with seawater when dewatering activities cease. This creates a series of marine ponds along the southern coastline, forming a unique habitat which attracts birdlife and, in some cases, supports fish populations. Maritz (2018 and 2020) provide valuable insight into the ecological value of the ponds. The 2020 study set out to establish whether they could function as a viable alternative habitat, instead of restoring them to their pre-mining state. The study confirmed that the ponds are indeed viable ecosystems. Although their saltmarsh and fish species have limited ranges, they support an impressively diverse avifauna. Their long-term viability, however, will become limited by rising salinity.

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

Accretion modelling based on volumes disposed in the sea, a quarterly shoreline survey and bi-annual bathymetric surveys take place, thereby providing the physical parameters of beach accretion.

Quarterly dam safety inspections are carried out by Jones and Wagener (2023), and Namdeb staff of various fine residue deposit (FRD) and course residue deposit (CRD) sites across Namdeb's ML areas. In ML43 there are five (5) CRD sites monitored. The 2023 report shows no major geotechnical concerns for these sites, besides some recommendations made to eliminate safety risk.

5.4.3.2 Terrestrial

Namdeb has been supporting the Brown Hyena Research Project since 1999. Some of the project's activities have generated important insights on brown hyena casualties, movements and behaviour in the National Park related to mining impacts.

On an *ad hoc* basis, wildlife sightings such as brown hyena are reported.

A quarterly monitoring programme to establish the impacts of road traffic and fences on wildlife (road impact study) was undertaken for three years to establish wildlife collision hotspots and manage traffic (Maritz 2014). More recent research on hyenas was done at the Baker's Bay seal colony, situated on the northernmost end of ML43, from 2020-2023 by Dr. Ingrid Wiesel and Marie Lemerle (Wiesel and Lemerle, 2023, aimed at establishing the parameters and conditions for sustainable brown hyena tourism sitings at this area.

One camera trap is set up temporarily at places where brown hyenas move in SCM. The camera captures information on large mammals and birds.

Figure 45. Wildlife captured on a camera trap at No 2 Plant, in Southern Coastal Mines (Photos: Namdeb).

5.4.4 Rehabilitation monitoring

Monitoring of restoration pilot sites, which are modelling different landscape rehabilitation tasks, has been on-going in SCM since 2007. The most recent restoration monitoring conducted in ML43 (Burke, 2023) natural plant recruitment at all sites in except for one. The 2022 proposed mechanism using a set of criteria to measure 'completion' has been further developed and now also been applied for two successive monitoring periods.

5.5 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 three regular, external channels for information exchange – the Marine Scientific Advisory Committee, the newly established Terrestrial Scientific Advisory Committee and the Namdeb Stakeholder Forum.

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 through regular newsletters, Oranjemund radio, "mine-wides" and presentations. Namdeb is represented on many working groups dealing with environmental matters affecting their licence areas. Namdeb has committed to maintaining on-going communication with key stakeholders on the progress of exploration (including marine exploration) and mining operations and rehabilitation in ML43.

Namdeb has a Stakeholder Engagement Plan which guides engagement, and a grievance mechanism for the lodging and redress of stakeholder complaints and concerns.

The public was invited to take part in this EMPR update process in the local press. Those who registered, as well as the stakeholders on Namdeb's standing database, were sent this draft EMPR for comments. Minor comments were received regarding terminologies related to birds and impacts on birds, and the changes were made in the document. Hyphen Namibia (potential Wind Park developer in the Tsau Khaseb National Park) enquired about potential interactions between their operations and Namdeb activities, the related risks which are considered to be low. This was communicated to Hyphen. No other communications were received in response to this engagement process.

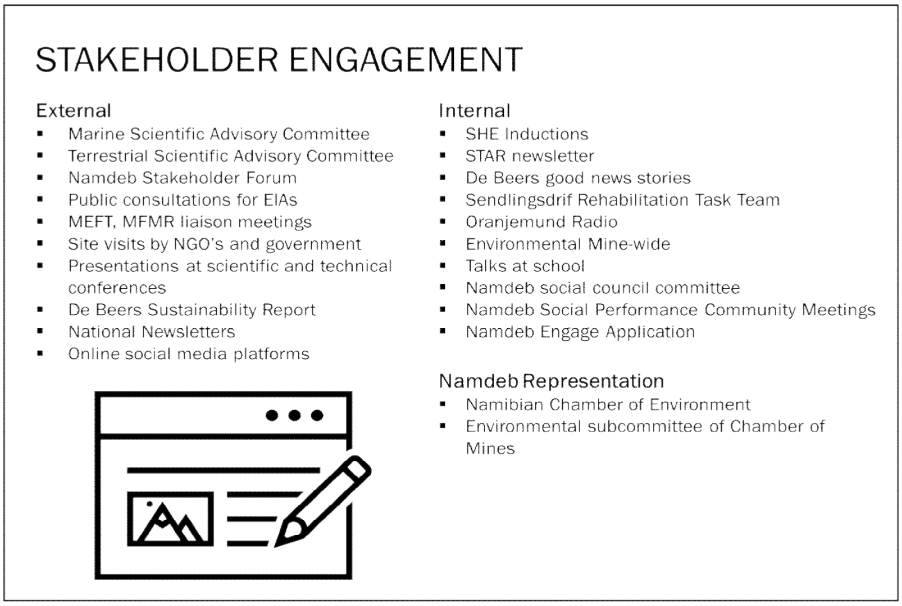

Figure 46. Stakeholder engagement, training and awareness in environmental matters at Namdeb (MEFT= Ministry of Environment, Forestry and Tourism, MFMR= Ministry of Fisheries and Marine Resources, NGO= non-governmental organisation, SHE= safety, health and environment).

Chapter 6

Environmental assessment

The environmental impact assessment followed a process using a risk assessment matrix prescribed by Anglo American. All activities resulting in "high" and "significant" impacts will be managed. These are compiled in an impact register. As this is an amendment to an existing EMPR, focus is on new operations and their impacts and prioritising previously identified impacts. Overall, no impacts were rated "high", but nineteen (19) were rated "significant".

Mining in ML43 focuses on accretion of the coastline with concomitant activities of overburden dump stripping and the creation of seawalls resulting in significant impacts on terrestrial and marine habitats and biota. Annual biological monitoring of the rocky shore, sandy natural and accreted beaches take place to assess and quantify the extent and duration, and consequently the significance of the impacts. The monitoring has shown that accretion and marine mining result in significant impacts on marine habitats and their associated biota. However, the magnitude and extent of the cumulative impacts of accretion, erosion of seawalls and tailings disposal on marine habitats and communities adjacent to the mining area have not yet been established with certainty.

6.1 Approach

Environmental risks at Namdeb are continuously reviewed and updated. Depending on the magnitude of the new disturbances to the environment, either following the formal environmental assessment process, prescribed in the Environmental Management Act or, in the case of minor changes to existing mining and exploration activities, internal assessments undertaken by Namdeb's environmental staff. During this EMPR review, to ensure that all environmental risks are covered, all relevant reports since the previous EMPRs were reviewed, discussed and re-assessed, where necessary. Following the initial risk assessment, follow-up reviews were conducted in 2015 (consolidation of EMPRs per ML area), 2018, and 2021, taking into account new activities, changes in baseline conditions and impacts. For this update, the same process was followed, with the emphasis on new and changed activities, processes, trends and technologies. The risk matrix has been updated accordingly.

Following an agreed level of assessment and assessment methodology, environmental risks are summarised in an impact matrix for each licence area for the natural and socio-economic environment (Table 11 and 12).

6.2 Assessment methodology

Namdeb follows Anglo American's corporate procedures, 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 Anglo 5x5 matrix includes the standard criteria 'extent', 'duration' and 'likelihood', which form part of all environmental impact assessment procedures. "Magnitude/severity" is described as 'receiving environment/ ecosystem context'. An overall significance rating is calculated from the ratings of these individual criteria by averaging the score of extent, duration and receiving environment and multiplying this with the score for likelihood (Table 9 and 10). Risks are assessed without management actions. During the assessment at Namdeb descriptive criteria were added for the assessment of visual and social impacts and for resource use, as these were inadequately catered for in the 5x5 matrix.

Table 10. Environmental assessment criteria from the Anglo American 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 11. Significance levels based on the Anglo American risk assessment matrix

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

This assessment process does not provide for assessing the reversibility of the potential impact. This has been added as an additional criterion in the impact register (Annex 3).

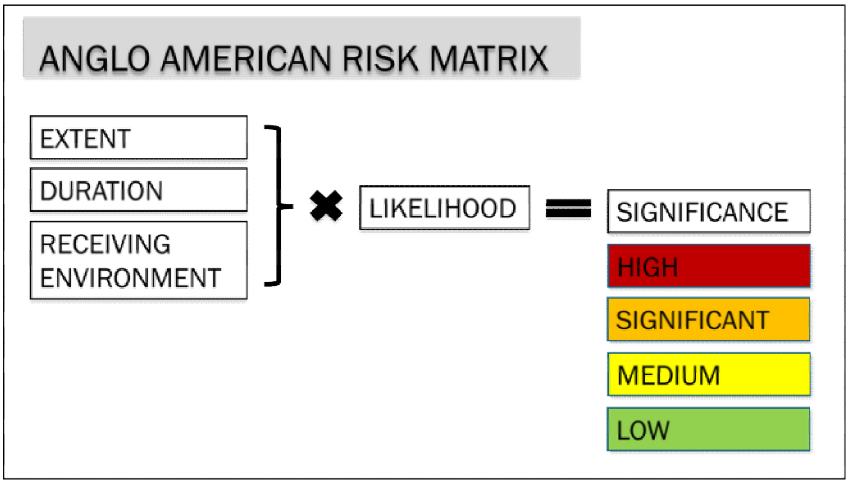

Figure 47. The algorithm used in the Anglo-American risk matrix

6.3 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 effective and presently applied. The current assessment assumes no management interventions.

Table 11 shows the main negative impacts on the natural environment associated with exploration and mining activities in ML43. 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 ten major 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 a nineteen (19) of the impacts were rated "significant".

Mining in ML43 focuses on accretion of the coastline with concomitant activities of overburden dump stripping and the creation of seawalls resulting in significant impacts on coastal and marine habitats and biota. Annual biological monitoring of the benthic biota of rocky shores, and invertebrate macrofauna of natural and accreted sandy beaches is undertaken to quantify and assess the extent, duration and consequently the significance of the impacts. Accretion modelling based on volumes disposed to sea, a quarterly shoreline survey and bi-annual bathymetric surveys are also conducted, thereby providing the physical parameters of beach accretion.

Positive impacts on the biophysical environment in Southern Coastal Mines are the removal of dumps for accretion and the habitat created by the ponds that support aquatic life.

Table 12. Overall rating of negative and positive environmental impacts associated with exploration and mining in Mining Licence 43 affecting the natural environment (S = significant, M = medium, L = low).

Negative impacts	Habitat loss	Habitat change	Loss of biota	Effect on biota	Water quality	Soil quality	Air quality	Natural resource use	Visual	Cultural heritage
Drilling, trenching and sampling pits in natural areas	S		S						S	
Drilling, trenching and sampling pits in disturbed areas		M								
Stripping of re-vegetated dumps	S		S	M			M			
Stripping and transport of material				M			M	S		
Bedrock cleaning		S								
Stripping of unmined areas	M	M	M							M
Seawalls and accretion	S	S	S	M	M					
Pond creation									M	

Negative impacts	Habitat loss	Habitat change	Loss of biota	Effect on biota	Water quality	Soil quality	Air quality	Natural resource use	Visual	Cultural heritage
Pumping for dewatering								S		
Dredging in pond and transport of material				L	M		L			
Fines disposal to sea		S			S					
Ferrosilicon losses with tailings					L					
Blasting for oversize visible from tourism route		M					M		M	
Blasting for oversize not visible from tourism route		M					M			
Blasting of bedrock during mining of accreted areas		M		S						
Infield screening	M		M							

Negative impacts	Habitat loss	Habitat change	Loss of biota	Effect on biota	Water quality	Soil quality	Air quality	Natural resource use	Visual	Cultural heritage
Geophysical surveying				M						
Seabed mining by marine contractors			S							
Oversize disposal to sea during marine exploration			S							
Oversize disposal to sea by marine contractors			S							
Discards disposal on land by marine contractors			M							
Fines disposal to sea by marine contractors					L					
Effect of marine mining and exploration on NIMPA and EBSA				M						
Upgrade of existing main road	S		S				L			

Negative impacts	Habitat loss	Habitat change	Loss of biota	Effect on biota	Water quality	Soil quality	Air quality	Natural resource use	Visual	Cultural heritage
Road maintenance in natural areas	S		S				L			
Dust on existing, unpaved roads				M			M			
Machine and equipment maintenance					M	M				
Fuel supply					M	M				
Energy supply and consumption	S		M				L	S	S	
Erection and dismantling of temporary powerlines			M							
Fibre optic lines and radio towers									S	
Pipelines			M							

Negative impacts	Habitat loss	Habitat change	Loss of biota	Effect on biota	Water quality	Soil quality	Air quality	Natural resource use	Visual	Cultural heritage
Fencing inside National Park		S	M						S	
Reportable hydrocarbon spill near water source					S	M				
Reportable hydrocarbon spill mine site					M	M				
Waste management			M							
Waste management on vessels					S					
Natural resource use by marine exploration and contractor mining								M		
Loss of equipment from vessel	L	L								
Air support to mining vessels				L						

Negative impacts	Habitat loss	Habitat change	Loss of biota	Effect on biota	Water quality	Soil quality	Air quality	Natural resource use	Visual	Cultural heritage
Positive impacts										
Stripping of non-revegetated dumps		S								
Pond creation		M								

Table 13. Positive and negative socio-economic impacts of mining operation in Namdeb's ML43 (Orange = significant, Light yellow = medium).

SOCIO-ECONOMIC	Natural resource use	Social structure	Socio-economic
Positive			
Contribution to the Namibian economy			[orange]
Increased skills and employment			[orange]
Development of technology			[orange]
Improved scientific knowledge (geology, biodiversity and heritage)			[orange]
Community support and awareness			[orange]
Sustained employment			[orange]
Sustained social services			[orange]
Negative			
In-migration	[light yellow]	[light yellow]	
Prolonged dependency on Namdeb			[light yellow]
Tourism activities in SCM			[light yellow]
Accommodation shortages			[orange]

Socio-economic impacts of mining activities in ML43 are largely positive, especially given the extended Life of Mine of ML43. These also include aspects related to the natural environment such as increased knowledge through long-term ecological monitoring and the uncovering of archaeological sites through mining. Negative impacts relate to in-migration and associated pressures on resources, including accommodation shortages in Oranjemund. Planned sustainability initiatives in Oranjemund such as a tourism concession in Southern Coastal Mines may have to be planned to complement continued mining.

6.4 Cumulative effects

6.4.1 External factors

6.4.1.1 Commercial fishing

Commercial fishing undoubtedly has an effect on fish populations. Of particular relevance to ML43 is the rock lobster industry. This makes it difficult to separate the impacts of mining on fish populations from those of commercial fishing and has resulted in a several-decade standing and still continuing debate between the mining and fishing sector.

The commercial rock lobster fishery in Namibia is centred around Lüderitz, with the most important southern fishing grounds located off Kerbehuk in ML43.

Of the total rock lobster fleet of ~25 vessels, between 10 and 15 large boats (20 m in length; D. Bester, MFMR, pers. comm.) many fish in the Kerbehuk area during the commercial season. Fishing is conducted with rectangular traps set in 10-40 m depth from wooden deck boats. In addition, these vessels may carry a fleet of small dinghies that under calm conditions may be deployed to fish in water as shallow as 7 m using ring-nets (Barkai & Bergh 1996). The fishery is managed by means of a commercial fishing season from November to April, a size limit of 65 mm carapace length, and an annually determined TAC that currently stands at 268 t (2016-17).

6.4.1.2 Climatic variations

Both marine and terrestrial environment are 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. It is currently still poorly understood which way these climatic changes will manifest themselves. However, 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 changes in storm patterns and wind regimes may have the opposite effect.

Natural recovery of vegetation on land will likely be hampered by increased aridity and thus less frequent conditions for successful establishment of plants.

Increased storm activity and deluges will impact on inshore exploration and survey, conventional shore-based mining and possible future mid-water mining. 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.

The opportunities presented by climate change are linked to responding to the risks identified. There is an opportunity to make a significant contribution by supporting global climate change adaptation efforts. The following are examples that are directly linked to operations and include:

- ◊ **Tracking consumption meticulously in the various plant operations,**
- ◊ **Changing shift patterns to reduce electricity use during peak tariff hours, and**
- ◊ **Accounting for solar energy utilisation of all remote security equipment.**
- ◊ **◊Installation of rooftop solar system to buildings and infrastructure**
- ◊ **Reviewing dewatering pipeline designs, and optimising these for reduced losses, in order to reduce electrical energy requirements for pumping.**

Namdeb has the ambition to become a carbon neutral operation by 2030, which will require an extensive programme to develop renewable energy solutions. The program will include:

- ◊ **Improved energy efficiency of operations (e.g. better plant utilisation, larger trucks).**
- ◊ **Improved utilisation of dewatering energy by using pumped water to transport overburden material.**
- ◊ **Introduction of solar energy where appropriate e.g. buildings, geysers, etc.**
- ◊ **Development of wind power solutions most likely in conjunction/in partnership with a major independent power producing company.**

6.4.1.3 External projects

Investigations of establishing wind farms as renewable energy sources are underway, and a separate environmental assessment has been undertaken for these. An Environmental Clearance Certificate has been issued. The environmental and social impacts of this wind farm, as well as of associated infrastructure, will be managed through the ESMP for the facility, by the operator, for the project, likely to be a separately entity to Namdeb.

6.4.2 Namdeb internal factors

In addition to the natural long-shore drift, there is sediment disposal from multiple sources along the southern Namibian coast, which in ML43 are purposely contributing to achieve accretion. Increased accretion is likely to increase the volume of sediment in the longshore drift through erosion of seawalls. This could potentially affect the Orange River mouth as well as the 'Orange Cone' EBSA and thereby become a trans-boundary issue.

Seafloor mining and sediment disposal often occurs repeatedly in the same areas. If a minimum of five years is allowed for natural recovery, sediments will be quickly re-distributed and seafloor mining is thus unlikely to be an issue in the ultra-shallow and shallow water areas.

6.4.3 Alternatives considered

There is no alternative to the overall mining principle of accretion mining because this is an existing and proven mining technique which Namdeb has employed for decades. However, there are various options regarding mining, once the seawall has been established.

These are

- **Dry bedrock mining with surface miner and**
- **Dry mining with conventional excavators and transvac vacuum suction cleaners (current mining process).**

There are also two options with regard to stripping:

- **Stripping with excavators and articulated dump trucks (current stripping process) and**
- **Wet stripping with dredge behind the seawall in a pond.**

All these scenarios have been assessed for their environmental impacts.

6.5 Shortcomings

6.5.1 Assumptions

The impact assessment presented here was based on the status of the information provided during September to October 2024. The mining environment changes continuously, and this assessment is thus a snap-shot in time. Any subsequent changes have not been assessed.

6.5.2 Uncertainties

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

- ◊ The effect of dust on natural ecosystems and associated biota,
- ◊ Effects of mobilised mining-related sediments on the offshore reefs, and
- ◊ Namdeb′s contribution to the health of the offshore marine ecosystem.
- ◊ Namdeb′s contribution to the health of the Orange River Mouth, although sediment generally moves in a northerly direction.
- ◊ Potential impacts of bedrock blasting on marine mammals

Namdeb should continue to gather more information to investigate the effects of sediments on the offshore reefs. Despite long-term marine monitoring, 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.

The effects of dust on the natural ecosystem and associated biota is not rated a ″high″ or ‶significant″ risk in the context of this EMPR. This may therefore not require further in-depth study.

Baseline information remains lacking in the following areas:

- ◊ 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).

Although some progress has been made, poorly understood in this area are presently

- ◊ **Effective restoration methods for all habitats requiring restoration, and**
- ◊ **Ecosystem function and services facilitating restoration (e.g. soil properties and processes, microclimatic parameters) and**
- ◊ **Time frames of natural recovery of the various man-made disturbances related to mining.**

Closing these knowledge gaps is not necessarily Namdeb′s sole responsibility and should take practicalities into account, such as available expertise, identification and curating services in the case of biodiversity baseline information, as results may not be available in the time frame required to manage the anticipated impacts.

Chapter

7 Environmental management plan

The Environmental Management Plan (EMP) outlines overall environmental tasks, provides management actions for all high and significant impacts, describes rehabilitation activities and the required monitoring during operation 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 and are not repeated for each task. Impact descriptions are provided in the impact register in Annex 3. All policies and procedures directly referred to in this EMP are provided in Annex 5, while the full suite of standard policies and procedures related to environmental management and applicable to all licence areas is included in Annex 6. The management objectives link directly to Namdeb's environmental policy.

The management objectives for this EMP are to:

◊ Protect the environment including pollution prevention and conserving natural habitats, flora and fauna and cultural heritage,
◊ Have no net loss of significant biodiversity,
◊ Avoid, substitute or reduce freshwater consumption and reduce carbon emissions from the 2004 baseline,
◊ Integrate waste management practices to reduce the generation of waste and the impact on the environment,
◊ Determine and evaluate fulfilment of the compliance obligations,
◊ Continually improve the effective implementation of the environmental management system,
◊ Enhance environmental performance,
◊ Complete internal audits and effectively implement corrective action for nonconformities identified,
◊ Effectively and expediently reporting incidents, complete investigations and implement controls,

◊ **Execute rehabilitation programs during mining operations and make provision for mine closure,**
◊ **Support environmental research and sustainable development initiatives that are relevant to our business,**
◊ **Create environmental awareness amongst our employees, suppliers, contractors and partners,**
◊ **Include the consideration of environmental issues in all business strategies and initiatives,**
◊ **Assess and, where practicable, reduce the environmental impact of the company's activities, products and services,**
◊ **Incorporate life-cycle considerations for significant procured goods and services and control and influence our suppliers and contractors,**
◊ **Consult and engage with interested parties on critical environmental matters of mutual concern,**
◊ **Make available suitable and adequate resources to achieve our environmental objectives, and**
◊ **Report on environmental performance publicly and provide assurance to shareholders.**

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 ENVIRONMENTAL 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 I (PR-EV-16)
Improved management of closure	◊ Allocate operational costs to monitor and demonstrate natural recovery of the seabed through pre- and post-mining benthic faunal and seabed surveys ◊ Provide sufficient funds for a post-closure environmental survey (seabed and/or benthic faunal survey) in the event that on closure or premature closure, the benthic monitoring programme has not been completed or has not been able to demonstrate sufficiently that natural recovery processes are occurring

SIGNIFICANT ENVIRONMENTAL RISKS

Aspect	Mitigation and control measures	Legal
Exploration		
Drilling in natural (previously undisturbed) areas	◊ **Clearly demarcate and put off limits all environmentally sensitive areas and environmental monitoring sites where these are near active sites** ◊ **Use already established tracks for access, and where new tracks are required agree on access routes with Environmental Section** ◊ **Keep footprint of disturbance to a minimum** ◊ **Implement waste management measures** ◊ **Place bunding, drip trays and/or liners in all areas where oils and lubricants could be spilled** ◊ **Remove polluted soil to closest remediation site** ◊ **Upon completion of exploration, close sampled areas (pits, trenches, drill holes), unless scheduled to be mined within the validity of the mining licence period for geological evaluation or identified as an SSSI** ◊ **Rehabilitate all drill sites after drilling, if not designated for future mining** ◊ **Rehabilitate all newly created access roads before relinquishment of the mining licence, unless identified and agreed with future land user to remain**	**1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 14, 15**

Mining		
Stripping of re-vegetated dumps	◊ Implement the SCM Restoration Plan.	1 ,2 ,3, 4, 5, 7, 8, 9, 10, 11, 14
Seawalls and accretion	◊ Establish maximum extent of additional sediment transported by the Benguela Current under different mining scenarios ◊ Continue marine monitoring programme and possibly adapt and extend to include maximum sediment impact area (at least 20 km beyond the current modelled area) ◊ Periodically calibrate and update current shoreline model ◊ Inform transboundary stakeholders that may be affected	12, 13, 15
Fines disposal to sea	◊ Keep easily retrievable records of volumes of fines disposal ◊ Include these in regular reporting	12, 13
Fuel consumption for stripping	◊ Express fuel consumption per tonnes processed, provide ambition according to industry standard and measure performance, aiming at continual improvement. ◊ Work towards adding other aspects with significant fuel consumption (e.g. transport), to fuel efficiency endeavours.	16
Energy demand for dewatering	◊ Save energy wherever possible ◊ Investigate renewable energy sources	16
Seabed mining by marine contractors	◊ Keep easily retrievable spatial record of contractor's mining activities and ensure they remain < 1 % of licence area within NIMPA areas	12, 13

Oversize disposal to sea during marine exploration	◊ **Keep easily retrievable, spatial record of activity** ◊ **Avoid disposal of tailings on reefs where practical**	**12, 13**
Oversize disposal to sea by marine contractors	◊ **Keep easily retrievable, spatial record of activity** ◊ **Avoid disposal of tailings on reefs where practical**	**12, 13**
Services and infrastructure		
Upgrade of main road, Road maintenance in natural areas	◊ **Source new borrow-pits and their access routes in consultation with Environmental Office to ensure avoidance of environmentally sensitive area** ◊ **Do internal Risk Assessment to assess need for external EIA for new roads and borrow pits.** ◊ **Rehabilitate borrow-pit when no longer in use or material is exhausted**	**1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 14**
Energy supply and consumption	◊ **Dismantle power lines no longer in use , unless identified for future use** ◊ **Test bird flight diverters on new power lines where bird flight paths cross power lines** ◊ **Introduce energy-saving measures wherever possible** ◊ **Encourage the use of renewable energy sources wherever possible**	**1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 14, 15, 16**
Fibre optic lines and radio towers	◊ **Erecting new radio towers or fibre optic lines require agreement from the Environmental Section in all areas** ◊ **Dismantle fibre optic lines and radio towers when no longer required, unless identified for future use**	**1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 14, 15**
Fencing	◊ **Erect new fences only where essential and no other means of barricading are feasible**	**1, 2, 3, 4, 5, 7, 8,**

	◊ Remove all fences, including high security fence, as soon as feasible ◊ Replace fences used for safety measures by berms or other suitable types of barricades	9, 10, 11, 14, 15
Reportable hydrocarbon spills near sea	◊ Clean-up of spill as soon as possible following Namdeb policy PO-EV-07 and procedure PR-EV-07	1, 7, 8, 15
Waste management on vessels	◊ Adopt standard waste management practices	12, 13, 14
Socio-economic		
Accommodation shortages	◊ Establish accommodation needs well in advance ◊ Support construction of required housing units	6

MEDIUM ENVIRONMENTAL RISKS		
Aspect	**Mitigation and control measures**	**Legal**
Exploration		
Drilling in disturbed areas	◊ Implement waste management measures ◊ Place bunding, drip trays and/or liners in all areas where oils and lubricants could be spilled ◊ Remove polluted soil to closest remediation site ◊ Upon completion of exploration, close sampled areas (pits, trenches, drill holes), unless scheduled to be mined within the validity of the mining licence period for geological evaluation or identified as a Site of Special Scientific Interest (SSSI) ◊ Rehabilitate all drill sites after drilling, if not designated for future mining ◊ Rehabilitate all newly created access roads before relinquishment of the mining licence, unless identified and agreed with future land user to remain	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 14, 15
Mining		
Overburden stripping in unmined[2] sand plains and transport of material	◊ Continue monitoring of pilot sites until completion criteria are reached to assess the necessity for a restoration plan/active restoration in SCM ◊ Establish extent of fossil 'Site of Special Scientific Interest' and demarcate 'out of bounds', where these are near active mining sites ◊ Look out for fossils and archaeological implements during mining and follow Chance Find procedure (PR-EV-25)	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 14
Pond creation	◊ Continue monitoring pond ecosystem	12, 13, 14
Blasting for oversize visible	◊ Follow safety procedures ◊ Apply dust suppression measures where this could also affect human health	1,2,6

[2] There are still some mining blocks in Southern Coastal Mines which present natural habitat and have never been mined.

from tourism route	◊ Backfill blasted area with minimum of 30 cm substrate over bedrock	
Blasting for oversize not visible from tourism route	◊ If feasible, select bedrock area below sealevel which would naturally rehabilitate faster ◊ Follow safety procedures ◊ Apply dust suppression measures where this could also affect human health	1,2,6
Blasting for breaking of bedrock	◊ Implement sound and/or vibration attenuating methods in keeping with industry standards, with consultation and guidance from a marine specialist.	
Infield screening	◊ Standard waste management and pollution control measures, following PO-EV-01, PO-EV-04, PO-EV-07 and PO-EV-08	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 14
Oversize disposal to sea by marine contractors	◊ Avoid disposal of tailings on reefs, where practical ◊ Keep easily retrievable, spatial record of activity	12, 13
Effects of marine mining on NIMPA and EBSA	◊ Ensure effective information exchange with scientists representing NIMPA and EBSA concerns ◊ Keep accurate records of areas mined within the NIMPA and ensure that they remain <1 % of MLA per annum	12, 13, 14, 15
Services and infrastructure		
Dust on existing, unpaved roads	◊ Apply dust suppression in areas where this could also affect human health	6
Machine and equipment maintenance	◊ Place bunding, drip trays and/or liners in all vehicle and machine maintenance areas ◊ Remove polluted soil to closest bioremediation site ◊ Use dedicated wash-bays for machine and vehicle cleaning	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 14
Fuel supply	◊ Place bunding beneath fuel tanks ◊ Use bunded areas for re-fuelling at fixed stations	1, 2, 3, 4,

		5, 7, 8
Pipelines	◊ **Follow PR-EV-18 in emergencies**	
Reportable hydrocarbon spill on mine site	◊ **Follow procedure PR-EV-07**	**1, 2, 3, 4, 5, 7, 8**
Waste management	◊ **Follow procedure PR-WM-01 to PR-WM-06 and PR-EV-07**	**1, 2, 3, 4, 5, 7, 8,**
Natural resource use by marine exploration and contractor mining	◊ **Introduce energy-saving measures wherever possible** ◊ **Encourage the use of renewable energy sources wherever possible**	**16**
Socio-economic		
In-migration	◊ **Recruit new personnel according to clearly specified and widely publicised procedure**	**4, 5, 6**
Prolonged dependency on Namdeb	◊ **Encourage sustainability initiatives in Oranjemund**	**4, 6**
Tourism activities in SCM	◊ **Develop tourism activities in SCM parallel to mining activities, in collaboration with MME, the Namibian police and Namdeb Security** ◊ **Aim at an agreement with stakeholders regarding an access agreement for visitors into the mining licence area.**	**4, 6**

LOW ENVIRONMENTAL RISKS		
Aspect	**Mitigation and control measures**	**Legal**
Exploration		
Marine seismic surveys	◊ Develop a procedure to minimise impacts to marine mammals during geophysical surveys. This would include: ◊ Appoint Onboard Marine Mammal Observers (MMOs) to conduct visual scans for the presence of cetaceans around the survey vessel prior to initiation of any acoustic impulses, ensure compliance with mitigation measures during seismic geophysical surveying and reduce the chances of the vessel colliding with a marine mammal ◊ Limit pre-survey scans to 15 minutes prior to the start of survey equipment ◊ "Soft starts" to be carried out for any equipment of source levels greater than 210 dB re 1 μPa at 1m over a period of 20 minutes to give adequate time for marine mammals to leave the vicinity ◊ Terminate the survey if any marine mammals show affected behaviour within 500 m of the survey vessel or equipment until the mammal has vacated the area ◊ Undertake geophysical surveying largely between December and May, thereby avoiding the main migration period of baleen whales from their southern feeding grounds into low latitude waters. During the transition periods in June and November, surveying would be possible with stricter mitigation measures. As no seasonal patterns of abundance are known for odontocetes occupying the proposed exploration area, a precautionary approach to avoiding impacts throughout the year is recommended ◊ Ensure that PAM (passive acoustic monitoring), which detects marine mammals through their vocalisations, is incorporated into any surveying taking place between June and November	12

Mining		
Ferrosilicon losses with tailings	◊ **Maximise Ferrosilicon recycling**	**1, 2, 3, 4, 5, 7, 8**
Dredging in pond	◊ **No management actions**	**12**
Services and infrastructure		
Loss of equipment from marine vessel	◊ **All lost equipment to be accurately recorded in a hazards database, and reported to maritime authorities** ◊ **Make every effort to recover/remove lost equipment**	**12, 13**

ENVIRONMENTAL MONITORING DURING OPERATION		
Aspect	**Parameter**	**Frequency**
Freshwater		
Water quality	**Sewage effluent (raw, before and after treatment)** **Potable water (after treatment)** **Effluent from oil water separators**	**Quarterly**
Bioremediation	**Bioremediated sand and soil**	
Biodiversity		
Marine ecosystems	**Macrofauna and -flora and physical parameters on rocky shore, sandy beach habitats; subtidal habitats only when offshore mining takes place**	**Annually**
Restoration	**Vegetation (plant species cover, richness, composition and structure) at monitoring sites**	**Annually during vegetation season**
Invasive aliens	**Emergence of invasive alien plants on mine sites**	**Minimum: annually**

The management tasks listed below are transferred from an update of the demolition and landscaping programmes and waste strategy for Southern Coastal Mines in 2020 ("post closure use" assumes agreement with the authorities).

REHABILITATION AND CLOSURE		
Aspect	**Rehabilitation tasks**	**Comments**
Land use and Infrastructure		
Land use, buildings and plant structures	◊ **Consult with stakeholders, including authorities, to improve a draft master plan for post mining land-use in ML 43.** ◊ **Identify and assess possible post mining land uses for SCM.** ◊ **Following the mast plan, develop a schedule for the specific rehabilitation tasks to follow below in this rehabilitation and closure table.** ◊ **All buildings and plants to be demolished, except those identified for post closure use according to the land use master plan.**	
Landfills for demolition waste	◊ **Mined out and disturbed areas in the vicinity of plant sites to be identified for disposal of non-hazardous demolition waste**	
Service infrastructure	◊ **All service infrastructure to be demolished, unless identified for post closure use; this includes HT lines, substations and transformers, fibre optic, water, slimes, fuel and sewage lines and their supplementary structures, as well as radio masts, reservoirs, pump stations and fences** ◊ **The demolition process separates asbestos, polluted material and steel, and these items are handled and disposed separately**	

	Demolition process as for buildings and plants	
Gravel roads and tracks	◊ All roads and tracks without post-closure usage inside high security area within 250-300 m off access routes (i.e. haul road and East-cliff road) to be rehabilitated ◊ Rehabilitation means surface lightly covered with sand or overburden material, when available nearby, and scarified only where necessary ◊ If scarified, then rip-marks to be erased	
Pollution remediation		
Asbestos	◊ Asbestos disposed at asbestos landfill near Uubvlei ◊ Capacity of landfill for asbestos pipes to be assessed and extended, if necessary	
Polluted soil	◊ Disposal and treatment in bioremediation site near Uubvlei	
Waste	◊ Hazardous and all other waste removed off site	
Tyres and vulcanised rubber	◊ Stored at Uubvlei rubber and heavy plastics yard ◊ Final clearing to be identified through sustainability initiatives such as recycling or reuse	In the meantime separate tyres and plastic to lower fire risk.
Landscape rehabilitation		
Dumps along access routes	◊ Confirm earthworks rehabilitation tasks with regulator and other key stakeholders ◊ Rehabilitate all dumps identified (profiling means rounding of corners and straight lines and decreasing steep slopes)	Focus on making landscape visually acceptable along future tourism routes,

		considering mining-based tourism as post-mining land use.
Compacted areas	◊ Cover in sand or overburden material, if available nearby, or scarify, where necessary, and erase rip-marks	
Borrow-pits	◊ Identify borrow-pits requiring rehabilitation along access routes, profile, and where necessary, scarify	
Trenches	◊ All exploration trenches to be made safe	
SSSI's	◊ Demarcated "out of bounds" and secured, where necessary	
Biodiversity restoration		
Facilitating vegetation re-establishment	Implement the assisted natural revegetation intervention where vegetated dumps are to be stripped	
Invasive alien plant control	◊ All infestations identified, eradicated and re-emergence managed	
Natural regrowth	◊ Monitoring of vegetation re-establishment on disturbed and rehabilitated surfaces to demonstrate natural recovery in representative sites	
Ponds	◊ Monitoring to demonstrate re-colonising fauna	
Aftercare	See "Environmental monitoring at closure"	

ENVIRONMENTAL MONITORING AT CLOSURE			
Aspect	**Parameter**	**Frequency**	**Comments**
Marine monitoring			
Physical parameters	◊ Shoreline (measurements and modelling) ◊ Particle size distribution ◊ Beach slope ◊ Wave height and frequency ◊ Effluent line crossing ◊ Water table depth	**Annually**	
Biological parameters	◊ Rocky shore ecosystems ◊ Sandy beach ecosystems ◊ Benthic ecosystem when offshore mining takes place	**Annually**	**Monitoring for five years or until completion criteria are reached, if < 5 years**
Restoration monitoring			
Natural regrowth and landscape stability of restored areas	**Vegetation (plant species cover, richness, composition and structure) and erosion**	**Annually, during vegetation season**	**Monitoring for five years or until completion criteria are reached, if < 5 years**
Invasive alien plants	**Re-emergence of invasive alien plants and eradication**	**Annually during vegetation season**	**Until no more alien plants emerge, up to 5 years after last rehabilitation task completed**

Bioremediation	**Hydrocarbon content of treated soil**	**Annually**	**Until remediated soil < 0.1% (1000 ppm or mg/kg) hydrocarbon content**
Asbestos landfill	**Survey, demarcate and sign-post (once-off) and monitor**		

Chapter

8 Annex

The annex summarises the authors′ credentials, presents all applicable legislation, and provides an impact register, a list of reviewed literature and Namdeb′s environmental policies and procedures applicable to environmental management in ML43 and Namdeb overall.

8.1 Annex 1. The environmental practitioners

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 over 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 over 30 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.

Stephanie van Zyl

Academic qualifications

1992: B Hon Town and Regional Planning University of Pretoria

1999: M Environmental Managmenet University of the Orange Free State

Relevant Experience:

Thirty years′ 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 principal consultant for a number of large-scale environmental and social assessments in the following sectors: 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.

8.2 Annex 2. Legislation and statutory requirements

Legislation	Applicability
MINING LEGISLATION	
Mineral Act, 1992	Rehabilitation requirements, environmental status prior to mining/prospecting, pollution control measures, liability for pollution
Minerals (Prospecting and Mining) Amendment Act, 8 of 2008	Requirement of EMPR
Diamond Act 13 of 1999 and regulations, GN 84 of 31 March 2000	Permits for handling diamonds
Environmental clause of Namdeb's Minerals Agreement	Requirement of EMPR
ENVIRONMENTAL LEGISLATION	
Environmental Management and Assessment Act 7 of 2007; List of activities that may not be undertaken without Environmental Clearance Certificate, GN 29 of 2012; Environmental Impact Assessment Regulations, GN 30 of 2012	Requirements for and process of environmental assessments
Draft Regulations for Strategic Environmental Assessment (SEA) and Environmental Impact Assessment (EIA), 2008 and Draft procedures and guidelines for	Contents of strategic environmental assessments, Environmental Impact Assessments and Environmental Management Plans

Environmental Impact Assessment (EIA) and Environmental Management Plan (EMP), 2008	
Namibian Constitution Section 95(l)	Use of natural resources, protection of environment, biodiversity and ecosystems
Hazardous Substances Ordinance, 14 of 1974	Declaration and handling of hazardous substances
Labour Act 6 of 1992, Regulations relating to the health and safety of employees at work, GN 156, GG 1617 of 1 August 1997	Protection of employees from hazardous substances, incl. asbestos
Atmospheric Pollution Prevention Ordinance, 11 of 1976, prohibition of the import of ozone depleting substances, GN 281, 31 December 2010	Permitting of fuel burning appliances, prohibition of ozone-depleting substances Dust management
Atomic Energy and Radiation Protection Act, 5 of 2005; 1A.1 Radiation Protection and Waste Disposal Regulations, GN 221 of 18 November 2011	Handling, transport and disposal of radioactive substances
Road Traffic and Transport Act, 22 of 1999 and regulations GN53 of 2001	Transportation of dangerous goods
Water Resources Management Act, 11 of 2013	Protection, development and management of water resources; licencing water abstraction, licencing of wastewater and effluent disposal, protection of groundwater, water pollution control, obstruction of watercourses, control and use of wetlands
Soil Conservation Act, 76 of 1969	Prevention of soil erosion, no

	regulations, not enforced
Forest Act, 12 of 2001	Protected trees, permit for mining in forested areas and cutting of trees and shrubs within 100m from river, stream or watercourse
Nature Conservation Ordinance, 4 of 1975	Protected species
National Heritage Act, 27 of 2004	Heritage site protection
MARINE LEGISLATION	
Marine Resources Act, 27 of 2000; Regulations relating to the exploitation of marine resources, GN 241 of 7 December 2001; Regulations relating to Namibian Islands′ Marine Protected Area, GN 316, 31 December 2012	Protection of marine habitats, fauna and flora
Marine Traffic Act 2	No abandoning of ships
Prevention and Combating of Pollution of the Sea by Oil Act, 6 of 1981	Liability, combating and prevention of oil pollution
Wreck and Salvage Act, 5 of 2004	Procedures related to salvage of ships, aircraft and life, preventing damage to marine life
Namibian Ports Authority Act 2 of 1994	Establishment of Namibian Ports Authority and management of ports and lighthouses, protection of the environment in its jurisdiction
Territorial Sea and Exclusive Economic Zone of Namibia Act 3 of 1990	Definition territorial sea and exclusive economic zone

POLICIES AND OTHER	
National Policy on Coastal Management 2012	**Protect, maintain and restore health and biological diversity of ocean and coastal ecosystems**
Explosives Act, 26 of 1956	**Import, storage and transport of explosives**
Fire Brigade Services Act, 5 of 2006 and regulations 2010	**Maintenance of fire brigade services**
Petroleum Products and Energy Act, 13 of 1990; 5H.1 Petroleum Products Regulations, 2000 and Notice of Application of Specifications and Standards, GN 54 of 2016	**Distribution and price control**
Red data lists	**Plant and animals species classified as vulnerable, threatened or endangered**
Oranjemund town business registration regulations, 2013	
Oranjemund town noise control regulations, 2013	**Noise control in Oranjemund town**
Electricity Act 4 of 2007	**Environmental Impact Assessment for electricity installations**
Electricity Regulations: Administrative, GN 13 of 16 February 2011	
Electricity Control Board: Namibian electricity safety code, GN 200 of 12 October 2011, Electricity Control Board: Namibian Electricity Safety Code, Amendment, GN 234 of 2012,	**Electricity generation licences**

technical rules, GN 47 of 2016, economic rules, GN 46 of 2016	
INTERNATIONAL CONVENTIONS AND PROTOCOLS	
Convention on Biological Diversity, 1992	Protection of biodiversity
United Nations Framework Convention on Climate Change, 1992 13.1 Kyoto Protocol, 1997	No legislation promulgated yet to meet proposed guidelines
Montreal Protocol on substances that deplete the ozone layer, 1987; Amendments 1990 and 1992, Vienna Convention for the protection of the ozone layer 1985	Prohibition of ozone depleting substances
Ramsar Convention on Wetlands of International Importance especially as Waterfowl Habitat, 1971	Protection of declared wetlands
Law of the Sea Convention, 1982 (United Nations)	Territorial sea limits up to 12 nautical miles, innocent passage through territorial sea, exclusive economic zone, conservation and management of living resources, protection of marine environment
Protocol on Shared Watercourse Systems in the SADC Region	Coordinated and environmentally sound development of shared water resources, basin management committees
International Convention for the Prevention of Pollution from Ships (MARPOL 73/78)	Regulations for prevention of pollution by oil, noxious liquid substances, harmful substances, sewage and garbage
Convention on International Trade	Internationally accepted list of plant and animals species under trade

with Endangered Species (CITES)	restrictions

8.3 Annex 3. 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 EMPR, 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 exploration, mining and services and infrastructure.

8.3.1 Exploration

Impact category	Description	Significance	Reversibility
	Exploration drilling, trenching and sample pits in natural areas		
Loss of habitat and biota	Clearing of vegetation and creation of access roads	Significant	Medium
Visual	Cleared areas do not fit into natural surroundings	Significant	High

8.3.2 Mining

Impact category	Description	Significance	Reversibility
	Stripping of re-vegetated dumps		
Loss of habitat	Stripping of re-vegetated overburden dumps sets back the process of natural re-vegetation to the beginning and leaves little substrate to facilitate natural regrowth of vegetation.	Significant	High
Loss of biota	Clearing naturally regrown vegetation and associated biota on overburden dumps results in loss of sources of re-colonisation and protected and endemic species.	Significant	Medium
	Stripping and transport of material		
Dust impact on biota	Driving along unpaved roads and excavation of material at mine site deposits dust on vegetation and soil	Medium	High
Natural resource use	Transport by truck requires large amounts of fuel.	Significant	Medium
	Seawalls and accretion		
Change in marine habitat	Physical change in surf-zone habitat, increase in surf-zone turbidity compromising water quality; potential effects on dynamics of Orange River mouth	Significant	Medium

Impact category	Description	Significance	Reversibility
Loss of marine habitat	**Smothering/loss of rocky intertidal/subtidal habitats, reduction in diversity, changes in community composition**	**Medium**	**Low**
Loss of marine biota	**Loss of invertebrate macrofauna due to burial by seawall sediments, disturbance or loss of Tylos**	**Significant**	**Medium**
Effects on biota	**Cascade effects of turbidity on higher order consumer (shore birds, surfzone fish); loss or deterioration of habitat affecting the rock lobster stocks**	**Medium**	**High**
Water quality	**Increased turbidity due to erosion of seawalls**	**Mediu m**	**Low**
	Fines disposal to sea		
Change of marine habitat		**Significant**	**Medium**
Water quality		**Significant**	**Medium**
	Stockpiling of excavated and screened material in natural areas		
Loss of habitat and biota	**Stockpiles in natural areas eliminate vegetation and associated biota**	**Significant**	**Medium**
Visual	**Stockpiles do not fit into natural surroundings**	**Medium**	**High**
	Seabed mining by marine contractors		

Impact category	Description	Significance	Reversibility
Loss of marine biota	Disturbance and loss of biota in mined sediments	Significant	High
	Oversize disposal to sea during marine exploration and by marine contractors		
Loss of marine biota	Smothering of reef biota by tailings, change in community composition	Significant	High
	Dewatering and transport		
Resource use	Energy demand for dewatering and fuel consumption for transport	Significant	High

8.3.3 Services and infrastructure

Impact category	Description	Significance	Reversibility
	Road maintenance and construction in natural areas		
Loss of habitat and biota	Establishment of new borrow-pits and re-alignment of main road in undisturbed areas eliminates vegetation and associated biota	Significant	Medium
	Energy supply and consumption		
Loss of habitat	Power lines and their maintenance tracks through the Sperrgebiet National Park eliminate vegetation and associated biota.	Significant	Medium

Loss of biota	**Bird fatalities through power lines could affect red data species such as Ludwig's bustard and flamingos**	**Medium**	**High**
Visual	**Power lines through SNP detract from wilderness aspect**	**Significant**	**High**
Resource use	**Namdeb consumes a moderate portion of electricity available in Namibia (> 10%)**	**Significant**	**High**
	Fibre optic lines and radio towers throughout the Tsau//Khaeb (Sperrgebiet) National Park		
Visual	**Fibre optic lines and radio towers throughout the Sperrgebiet National Park are highly visible and detract from wilderness aspect**	**Significant**	**High**
	Fencing inside national park		
Loss of biota	**Wildlife incidents through animals running into fence**	**Medium**	**High**
Change in habitat	**Disruption of migration routes through high security fence**	**Significant**	**High**
Visual	**Fences in national park detract from wilderness aspect**	**Significant**	**High**
	Reportable hydrocarbon spills near water source		
Water quality	**Large hydrocarbon spills from re-fuelling, maintenance and faulty equipment can pollute surface and groundwater**	**Significant**	**Medium**
	Waste management on vessels		

Water quality	**Pollution of coastal waters through spilled hydrocarbons and litter**	**Significant**	**High**

8.4 Annex 4. Literature

8.4.1 References cited in text (2018 EMPR and subsequent updates)

Anchor Environmental Services (2022) Namdeb's Envrionmental Management progamme. Programme in the midwater License Area:2021 Benthic Sampling Campaign.

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8.5 Annex 5. Namdeb environmental policies and procedures referenced in this EMP

PO-EV-01 archaeology

PO-EV-04 fauna and flora

PO-EV-07 policy and procedure

PO-EV-08 rehabilitation

PR-EV-18 emergency

PR-EV-15 awareness

PR-EV-16 communication

PR-EV-22 audit

PR-EV-23 management review

PR-EV-25 chance find

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