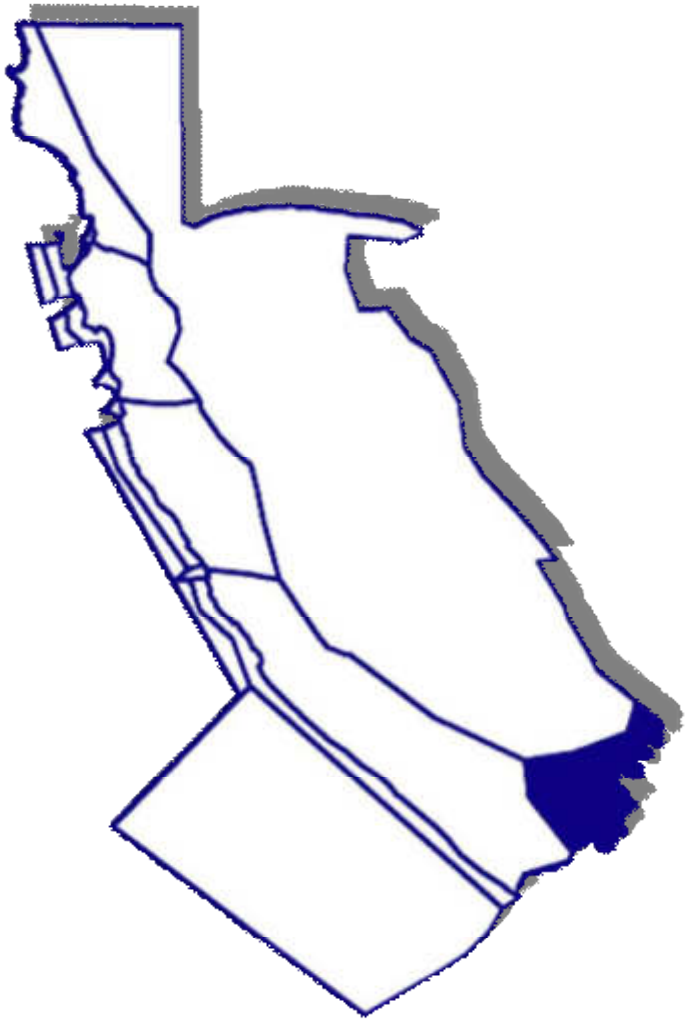

Environmental Management Programme Report for Namdeb's Mining Licence 42 (Orange River Mines) Update

February 2022

NAMDEB

A Namibia De Beers Partnership

Environmental Management Programme Report for Namdeb's Mining Licence 42 (Orange River Mines) Update for period 2022-2025

This updated report was compiled for Namdeb Diamond Corporation (Pty) Ltd by

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Acknowledgements

This report update is based on the 2018 EMPR and on information sourced and provided by Namdeb's Environmental Section.

February 2022

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Abbreviations and glossary

AA	Anglo American
ADT	Articulated Dump Truck
BP	Before Present
CITES	the Convention on International Trade in Endangered Species of Wild Fauna and Flora
DEA	Directorate of Environmental Affairs
DMS	Dense Medium Separation
EMP	Environmental Management Plan
EMPR	Environmental Management Programme Report
EMS	Environmental Management System
ESA	Early Stone Age
FRD	Fine residue disposal facility
HT	High Tension
IUCN	International Union for the Conservation of Nature (former World Conservation Union)
kV	kilovolt
LSA	Later Stone Age
MA1	Mining Area 1
MET	Ministry of Environment and Tourism
ML	Mining Licence
MME	Ministry of Mines and Energy
MSE	Middle Stone Age
MVA	Mega-volt ampere
MWh	Megawatt hour
Nemcom	Namdeb Executive Management Committee
SBP	Strategic Business Plan
SCM	Southern Coastal Mines
SME	Small and Medium Enterprises
SSSI	Site of Special Scientific Interest
Transvac	Industrial vacuum machine

Figure and tables

Chapter 1 Introduction

1.1 Introduction

Four Environmental Management Programme Reports (EMPRs) linked to Namdeb's licence areas form the backbone of Namdeb's Environmental Management System (EMS). The 1997 EMPR report updated in 2018 for ML42 (Orange River licence area) is being reviewed in this document for the purposes of the Environmental Clearance Certificate Renewal, for the period 2022-2025.

This report therefore does not repeat all the information contained in the previous reports, except for ease of reference, but focusses on environmental performance for the past period (2018-2021), as well as on proposed work for the ensuing period (2022-2025).

1.2 Description of activities

Three mines were active since 2018 in the Orange River Mines licence area – at Daberas (including material mined at Obib to be treated at the Daberas Treatment Plant), Obib mine and Sendelingsdrif. Daberas and Sendelingsdrif operate independently and have the full complement of all required infrastructure such as treatment plants, tailings storage facilities, roads, water abstraction points and pipelines, power lines and telecommunications as well as accompanying earth-moving fleet. The deposit at Obib was small (approximately 1.4 km x 0.6 km), compared to Sendelingsdrif (5 km x 2 km) and Daberas (3.6 km x 1.2 km), and only a portion of the Obib deposit was mined. However, some of the remaining deposits could be mined in future.

The deposits currently stripped and treated at Daberas and Obib are expected to reach their life of mine in 2021-2022. The life of Mine for Sendelingsdrif is 2024. Exploration has been ongoing for the period 2018 – 2021 at Arrisdrif. Extensive exploration is scheduled for the period 2022-2024, with the aim to extend the ML 42 life of mine beyond 2024.

Responsible closure concurrent with ongoing mining initiatives has been a significant theme over the past period, which resulted in the Integrated Closure Plan (ICP) and its various Strategies, namely the Biodiversity Action Plan (2021), Integrated Water Management Plan (2021), Waste Management Strategy (2021), Demolition and Landscaping Report (2021), Namdeb's Cultural Heritage Management Plan (2020) and the Biophysical Rehabilitation Pan for ML42. The directives in these documents have been integrated into this report.

Figure 1: The mine at Daberas in the Orange River valley (view towards the southwest and the Orange River

Figure 2: Benched slopes indicate where terraces have been excavated at Daberas (left). Mining operations at Sendelingsdrif (right) include backfilling the mine voids in the mine plan.

1.3 The lower Orange River environment

The Lower Orange River Valley not only harbours economically viable diamond deposits, but also supports rich and unique biodiversity, thanks to the diversity of geology, landforms and resulting habitats. The ancient terraces, rocky outcrops, and mountains support unique invertebrate, reptile and plant communities, while the permanently flowing Orange River attracts large numbers of mammals and birds and supports wetland biota, such as fish, amphibians and aquatic plants. These habitats are not necessarily affected by the mining activities. Four extremely range-restricted, threatened species (*Amphibolia obscura, Juttadinteria albata, Portulacaria pygmaea* and *Sarcocaulon multifidum*) are affected by mining operations.

Figure 3: Largely undisturbed, the mountain areas in ML42 support a rich and diverse flora with many unique plant species – here at Schakalsberge. These areas are presently not affected by mining.

1.3 The socio-economic environment

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

Orange River Mine's current Life of Mine is 2024, although exploration activities are expected to lead to an extension. Sendelingsdrif and Daberas mining activities are continuing, while an extensive drilling programme is scheduled for the Meso-terraces along the Orange River. Namdeb has been able to retain the staff complement at Namdeb and for the next three years, no social deployment is expected at ORM.

The Ministry of Environment, Forestry and Tourism's (MEFT) management plan for the Tsau//Khaeb (Sperrgebiet) National Park, updated and published in 2020, zoned all Orange River terraces as "managed resource use" , and adjoining areas as "Wildlife management, special use and "development and infrastructure". The new management plan also has the area zoned into Tourism Development Areas (TDAs), with goals and objectives for each of these areas. The Orange River valley has been

a conduit and habitation for early man for millennia. As a result, many terraces, including the diamond-bearing ones, contain archaeological sites with Early to Later Stone Age implements.

1.4 Environmental management to date

Namdeb's Environmental Section is responsible for environmental protection. Currently ten full-time staff are responsible for planning, performance reporting, assurance, impact monitoring and stakeholder engagement. One senior environmental officer and an environmental officer are solely dedicated to Orange River Mines (ML42). Environmental Performance Reports are submitted to the DEA every 6 months. All Namdeb's operations are ISO14001:2015 certified and follow De Beers' and Anglo American's corporate standards.

1.5 Environmental assessment

Key environmental aspects identified during the 2018 EMPR for the Orange River Mines licence area are the partial loss of an unique Orange River valley environmentally sensitive habitat (biodiversity and archaeology), implementation of rehabilitation measures at Daberas, concurrent rehabilitation at Sendelingsdrif and Obib, effectiveness of restoration measures at Sendelingsdrif and Obib and the rehabilitation of exploration activities. Currently in 2021, the focus is on integrated closure concurrent to mining, and preparing the area for its future land use, which will be nature based tourism (Sendelingsdrif and Obib) and mining based tourism (Daberas).

1.6 Environmental management plan

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

1.7 Annex

The annex summarises the authors' credentials, a list of biodiversity specialist studies, provides an impact register, reviewed literature, a list of legal and regulatory requirements and the Demolition and Landscape Report.

Chapter 2 Introduction

Four Environmental Management Programme Reports (EMPRs) linked to Namdeb's licence areas form the backbone of Namdeb's Environmental Management System (EMS). This report includes a review of the 2018 EMPR for ML42 - the progress of work for the period 2019-2021 as well as intended work for the period 2022-2025 (next ECC renewal period).

2.1 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. 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 2018 EMPR;
3) Description of expected activities for the next three-year period;
4) Review of the 2018 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 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 ORM. Namdeb also provided ORM plans for the period: 2022-2025.

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.

2.2 Locality, company, legal and statutory requirements

Namdeb Holdings holds five mining licences on land and offshore, four of which belong to Namdeb. Mining Licence 42 is the eastern-most land-based license, extending along the north-bank of the Orange River (Figure 4 overleaf).

The company is equally owned by the Government of the Republic of Namibia and De Beers Centenary. Namdeb Holdings owns Namdeb and De Beers Marine Namibia. Namdeb is lead 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.

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

The Ministry of Environment, Forestry and Tourism's park management plan (update 2020), zoned the areas in ML42 as managed resource protected area, special value, wildlife management, and development and infrastructure. The other legal instruments which the EMPR need to comply with are listed in the EMP. As part of the Namdeb environmental efforts, a register of permits is kept and renewed when required.

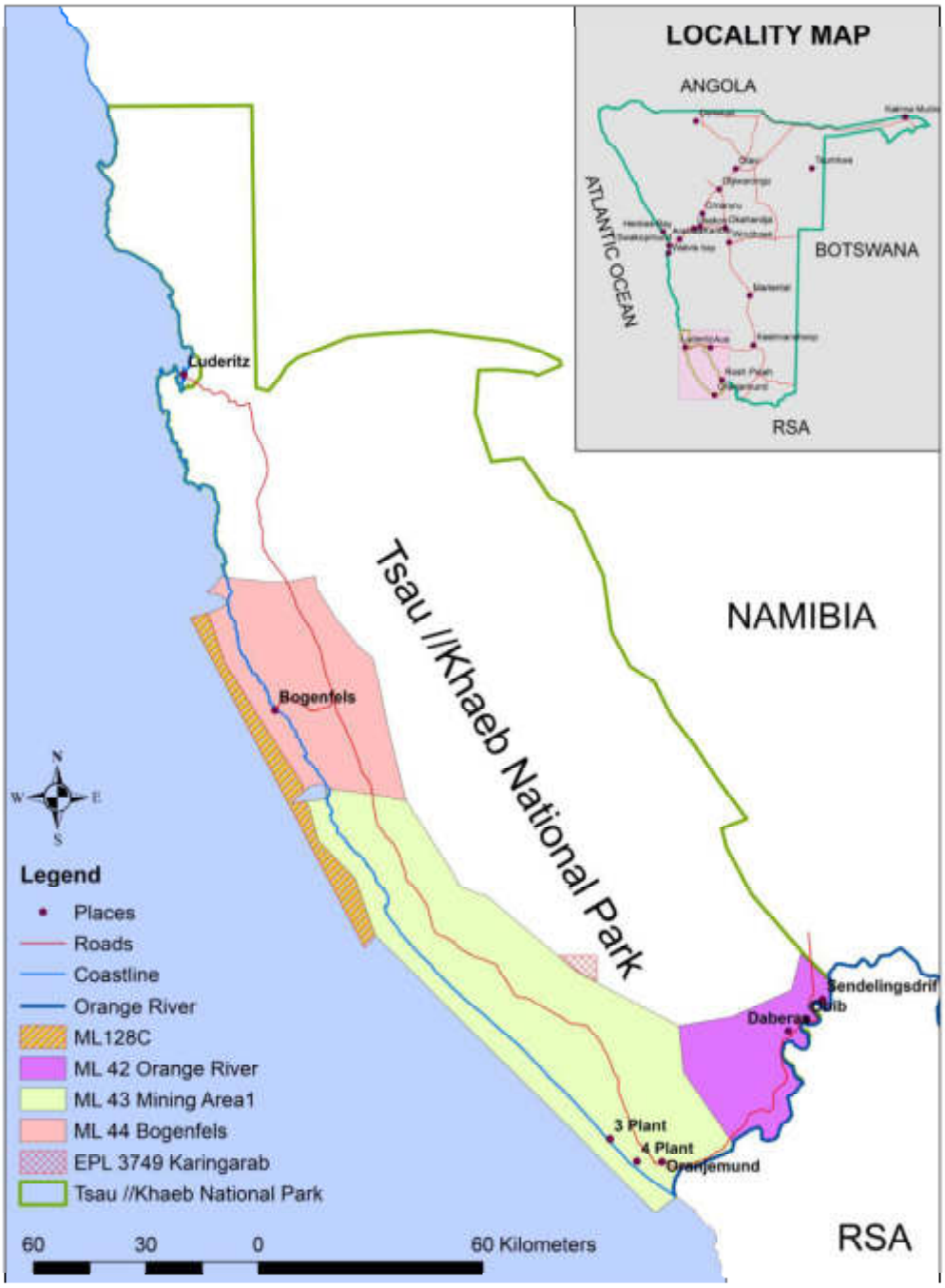


Figure 4:Location of ML42 licence area in Namibia and the Tsau//Khaeb (Sperrgebiet) National Park.

Chapter 3 Description of activities

Three mines are active in the Orange River Mines licence area – at Daberas, material mined at Obib and treated at the Daberas Treatment Plant and Sendelingsdrif. Sendelingsdrif and Daberas operate independently and have the full complement of all required infrastructure such as treatment plants, tailings storage facilities, roads, water abstraction points and pipelines, power lines and telecommunications as well as accompanying earth-moving fleet. Exploration is scheduled to investigate various deposits.

Namdeb mines diamond-bearing, tertiary terraces of the Orange River in the licence area ML42 (Orange River Mines). Exploration, mining and rehabilitation are the stages in the life mine cycle applicable to this license.

Following several phases of exploration on the Orange River terraces since the 1970's, full-scale mining of diamondiferous terraces in ML42 started at Auchas in 1989, then moved in 2002 to Daberas. Mining at Sendelingsdrif commenced in 2014 and at Obib in 2018. Those are the currently active mines (Figure 6). Exploration activities have occurred in 2018-2021 at Arisdrift, Daberas, and Sendelingsdrif. Further drilling is envisaged for 2022-2025 at Arrisdrif, Auchas, GP Pan (in ML43), Sendelingsdrif, Daberas and Auchas. The deposits currently stripped and treated at Daberas and Obib are expected to reach their life of mine end 2022. Full scale mining at Sendelingsdrif will continue for the next three-year period.

Figure 5: The mine site at Sendelingsdrif contains all components required for processing in a compact footprint.

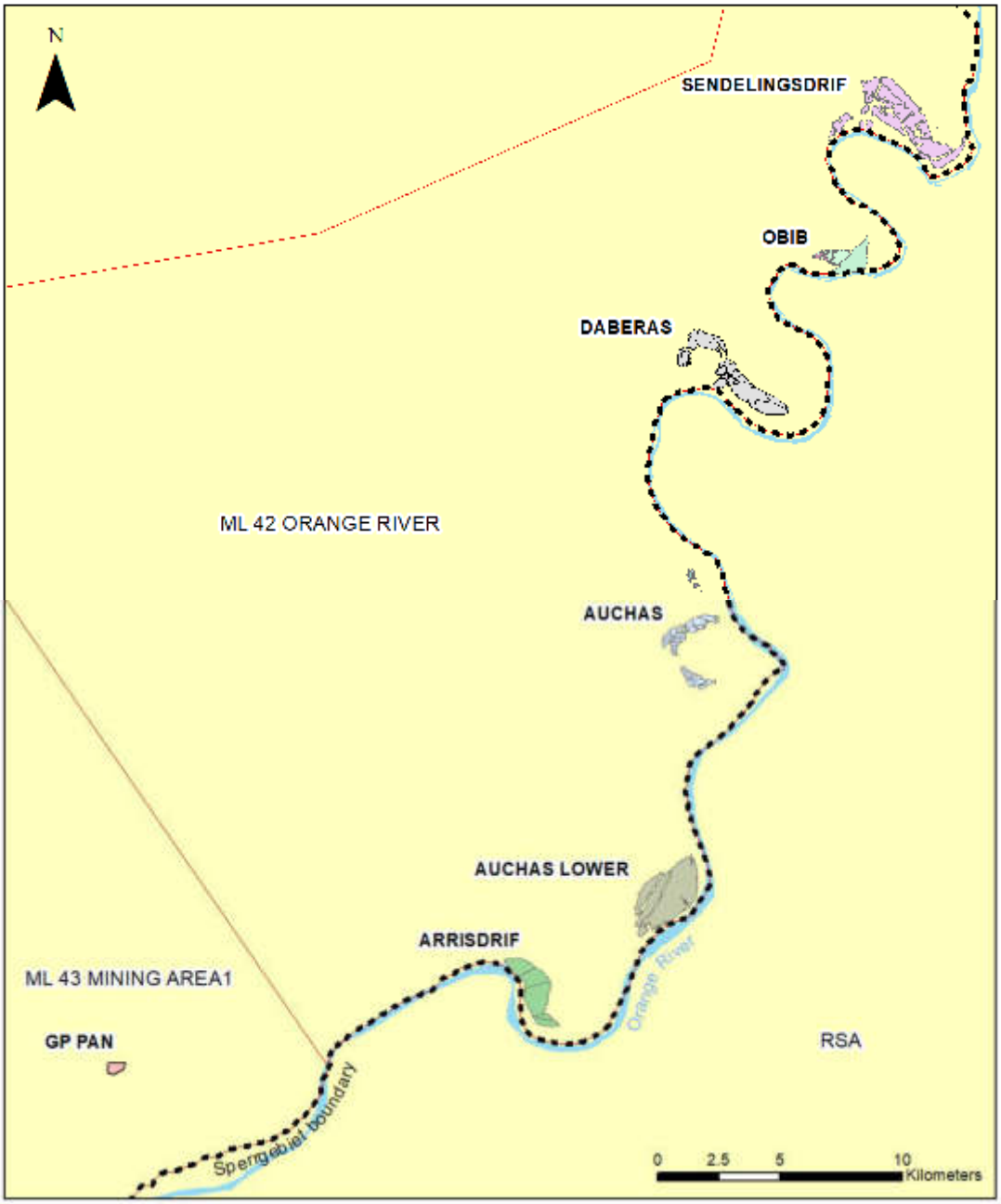


Figure 6: Overview of Orange River Mines and diamond deposits

3.1 Exploration

3.1.1 Arrisdrift

The Arrisdrift deposit is the western-most diamond-bearing terrace of possible economic importance on the north-bank of the Orange River (*Figure 6*).

3.1.1.1 2018-2021

Bulk sampling was conducted at sample pit ARD_15_04 (Figure 7), in 3 phases. The first phase was undertaken by Namdeb from 12/11/2018 – 04/01/2019, the second phase by contractors from 20/02/2020 – 15/03/2020 and the last phase by Namdeb from 02/09/2020 – 06/09/2020. A total of 166,536 tonnes of material was excavated. The campaign comprised 1x 390 excavator, 1x rock breaker, 1x PC200, 1x dozer, 1x grader, 1x water bowser, 1x front end loader, 2x rigid haul trucks (RHT), 1x articulated dump truck (ADT), 1x 30-seater bus and 2-3 light duty vehilces (LDV)s. The team size was 10, on average.

To store the excavated material, 4 stockpile areas were graded adjacent to the bulk sample pit. In addition, a parking lot at the tearoom container was graded to park the heavy machinery overnight.

A total of 12,169 tonnes of material was trammed/transported from Arrisdrif to Daberas treatment plant. The tramming of the stockpiled material was conducted in 2 phases by contractors. From 15/03/2020 – 25/03/2020 10 on-highway trucks were mobilised (2x 40 tonne Scania side tippers and 8x 22 tonne Powerstar tippers) which trammed the majority of the selected stockpile material to Daberas and from 02/09/2020 – 06/09/2020. A small portion remaining was trammed to Daberas (1x 20 tonne Scania).

The remaining 154,367 tonnes of excavated material are stockpiled at Arrisdrif awaiting tramming and treatment (Figure 7).

The exploration trench at Arrisdrif harbours one of the most diverse Miocene faunas in Africa and is thus a Site of Special Scientific Interest (Figure 8). This trench with the fossil finds will hence not be backfilled (Landscaping and Demolition Report 2021). It has however, been fenced and the landscape will be shaped to a natural appearance.

The waste on site was strictly handled and disposed of according to Namdeb's standard waste management procedures in the EMS and EMPR. Environmental monitoring on site consisted of the regular visit by an environmental control officer.

Figure 7:The existing stockpiles at Arrisdrift awaiting tramming and treatment

3.1.1.2 2022-2025

Namdeb envisages bulk sampling at the following three pits (*Figure 8*):

- Excavation of bulk sample ARD_15_01 (~50,000 tonnes). Tramming of approximately 50% of total volume excavated.
- Excavation of bulk sample ARD_15_02 (~150,000 tonnes). Tramming of approximately 50% of total volume excavated.
- Excavation of bulk sample ARD_15_03 (~170,000 tonnes). Tramming of approximately 50% of total volume excavated.
- Tramming of approximately 50% of total ~155,000 tonnes of ARD_15_04 (excavated in 2018-2020) bulk sample material to Daberas.

The following 4 activities mentioned above will not be conducted simultaneously; therefore, in total, the following assumptions are made:

- Maximum number of people not to exceed 30 at any specific point in time. The majority will comprise contractors, whereas Namdeb staff will comprise 1-2 geologists, 1-2 surveyors, 1-2 environmentalists, 1 mining engineer and 1 mining foreman.
- The following equipment is expected to be utilised: 1-2x excavator, 2-3x ADT and/or RHT, 1x rock breaker, 1-2x PC200s, 1x dozer, 1x grader, 1x front end loader, 1x water bowser, 1x fuel bowser, 1x jaw crusher, 1-2x scalpers, 8-10x on-highway trucks, 1x 30-seater bus and 2-4 LDVs. Minor changes in the fleet may occur.
- ~8,000 m of RC infill drilling (~150-200 boreholes).

The amount of drilling might be increased pending the results obtained from the abovementioned drilling. The number of additional meters cannot be quantified at this stage but is estimated not to exceed 12,000 m.

- In total, the following assumptions are made:
- Maximum number of people not to exceed 30 at any specific point in time. The majority will comprise contractors, whereas Namdeb staff will comprise 1-3x geologists, 1x surveyor and 1x environmental officer.
- The following equipment will be utilised: 1-2 x RC drill rigs, 1-2 support vehicles and 2-4 LDVs.

Water will be extracted from the Orange River and recycled if possible. Fuel trucks from Oranjemund will refuel the earthmoving machinery, but there will possibly also be some 5,000 litre of fuel stored on site. A septic tank will contain effluent.

Environmental and safety officers will inspect the site regularly and waste management will be done according to Namdeb's standard procedures as well as the recommendations of the Waste Management Strategy (2021). The fossil site at Arrisdrif is to be protected.

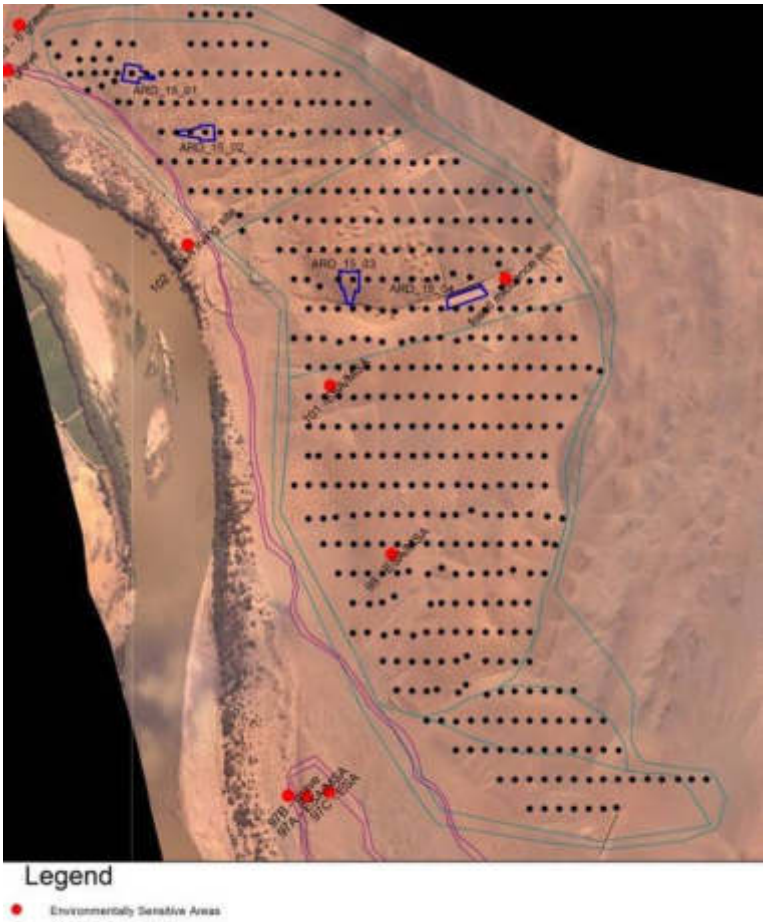


Figure 8: Locality of sampling sites and environmentally sensitive areas at Arrisdrift

3.2 Daberas Mine

Daberas Mine has been in operation since 2000 and is scheduled to close end 2022. The life of mine for Daberas will be extended as current exploration is rolled out. Nobody lives on the mine site and all employees commute daily from Oranjemund or Daberas Hostel.

3.1.2 Mining

The mining activities (Fig 9) that are being terminated at the end of 2022 have formed pits of up to 40m depth and they cover an extensive area.

The mine extracts alluvial diamonds in an open-cast dry-mining operation from ancient Orange River proto terraces of two economically viable deposits, referred to as the inlet (eastern portion) and outlet or hub (western portion). The road from Sendelingsdrif to Oranjemund separates these two deposits. Excavators, loaders and haul trucks are employed to extract the diamond-bearing gravel, following the standard sequence of overburden removal, waste stripping and ore mining. Cemented layers in the terraces are drilled and blasted. In some sections the remaining pockets of gravel in exposed bedrock are removed with manually operated industrial vacuum pumps (transvacs).

Overburden dumps surround the hub to the north, east and west, while dumps in the inlet area have been positioned in mined out areas or on the lower meso terraces towards the Orange River. The entire proto terrace has been mined to date (Fig. 9).

Figure 9: The mined northern part of the Daberas deposit.

***Table 1**. Volumes of material stripped, transported and treated at Daberas Mine: 2018-2020 and estimated for the remainder of 2021-2022*

Mining volumes (tons)	2018	2019	2020	2021	2022	2023	2024
Overburden stripped	154,000	4,000	11,000	206,000	639,000	0	0
Ore mined	3,448,000	360,000	1,444,000	3,537,528	0	0	0
Coarse tailings (oversize)	999.920	104,181	416,496	3,180,000	0	0	0
Wet fine tailings (-0.5mm)	125,511[1]	525,545	484,833	0	0	0	0

The Daberas Life of Mine is until end 2022 and, possibly spilling over into the first quarter of 2023, when the last stockpiled will be treated.

Table 1: The Orange River Mines fleet in 2021

	Earth-moving fleet, vehicles and equipment
8	55-t rigid frame trucks
1	Articulated dump truck (ADT)
9	Wheel loaders
3	CAT trucks
5	Excavators
4	Wheel dozers
1	Integrated tool carrier
3	Track dozer
2	Graders
3	Water tankers
1	Tractor hauler
1	Flood lights generator
4	Suction unit trailers
46	Light duty vehicles, heavy commercial vehicles and utility vehicles

Some small changes have been made to the fleet, but it has stayed more or less the same size and these resources are also being used for the exploration activities.

3.1.3 Exploration at Daberas

During May to June 2019, contractors performed 100m of RC exploration drilling at Daberas. One Rig with a crew of approximately 7 people and 2 LDVs was used.

Since there are only desktop studies available on the deposits in the Meso terraces, the following exploration activities on the Meso deposits are envisaged across the entire mining license, including Daberas:

- ~10,000 m of RC drilling (~150-200 boreholes)
- The amount of drilling might be increased pending the results obtained from the abovementioned drilling. The number of additional meters cannot be quantified at this stage but is estimated not to exceed 15,000 m.

In total, the following assumptions are made:

[1] Actual disposal January–July 2018.

- Maximum number of people not to exceed 15 at any specific point in time. The majority will comprise contractors, whereas Namdeb staff will comprise 1-3 geologists, 1 surveyor and 1 environmental officer.
- The following equipment will be utilised: 1-2x RC drill rigs, 1-2 support vehicles and 2-4 LDVs.

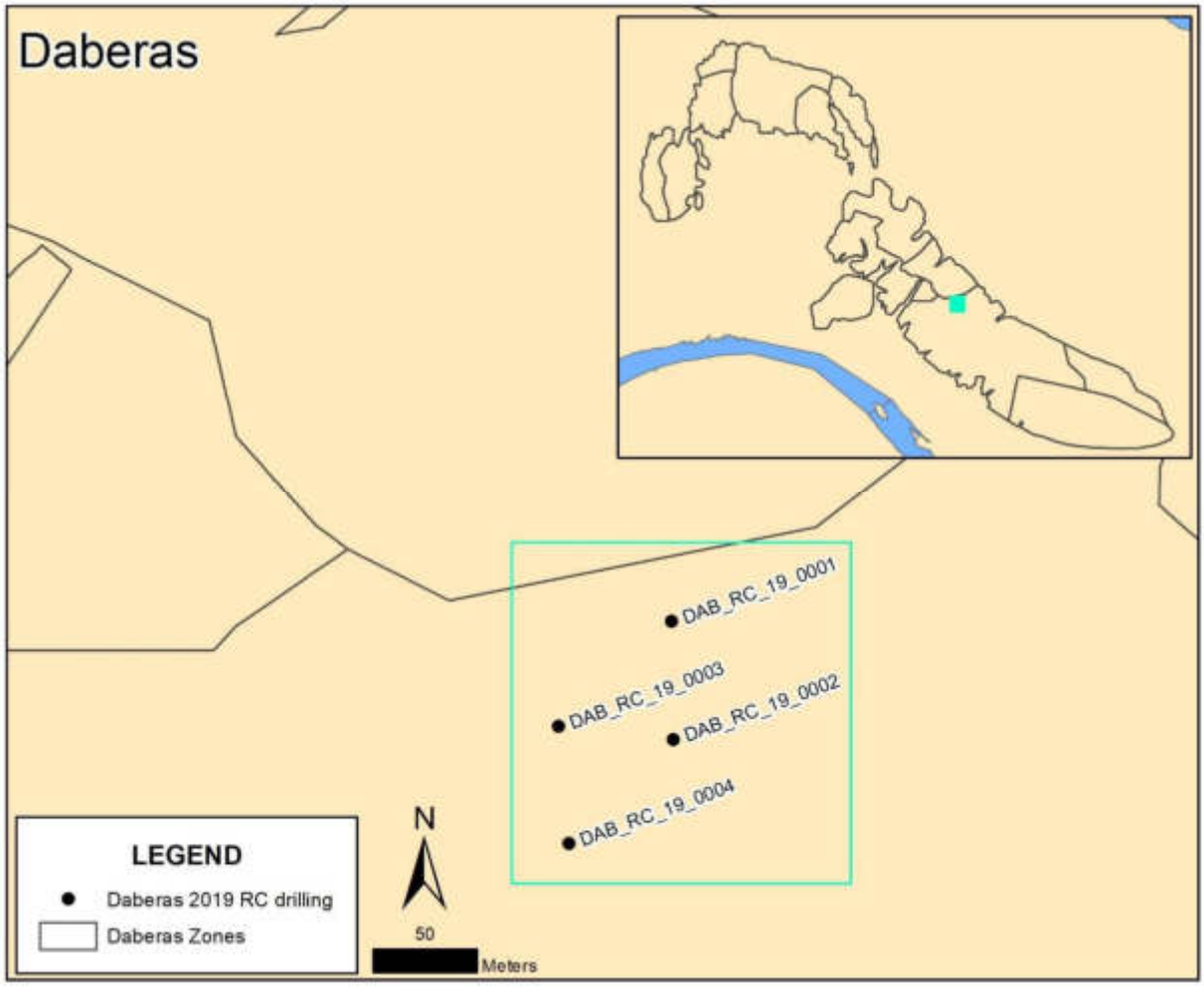


Figure 10: 2019 drilling at Daberas

3.2.2 Treatment of ore at Daberas

The main treatment plant is positioned at the north-eastern margin of the ore deposit. The plant consists of dry- and wet-screening sections and Dense Medium Separation (DMS), which process the mined material in several steps to a diamond concentrate, after which the concentrate is transported to the Red Area Complex in Mining Area 1. A new configuration of the treatment plant facilitated the treatment of lower grade material which extended the Life of Mine at Daberas until end 2022 This means less material is discarded as overburden and some stockpiles are now treated as well. The treatment plant has dry- and wet-screening components, scrubbing,

degrit and thickener sections. The degrit and thickener sections facilitate the recycling of water and reduce the fines disposal. The only chemical used during processing is a flocculant (Yangfloc) in the thickener which is a water-soluble organic polymer and Ferrosilicon (FeSi) in the DMS. FeSi is not a hazardous substance. Although it is not bio-degradable (Vargön Alloys 2012), it is not considered to harm aquatic organisms (Lillicrap 2011).

Mine waste generated at the processing plant is composed of oversize (+90mm from the trommel screen, +35mm after dry screening and +30mm after wet screening) and undersize (-3mm from dry and finally wet fines -0.5mm). The fines go to the Fine Residue Disposal (FRD) facility. The coarse residue fraction is also slightly wet to facilitate slumping and thus more gentle slopes during deposition on mined out bedrock area in Zone 2 to the south-west of the main treatment plant. In the past dry coarse tailings were deposited on the tailings dump north-east of the processing plant, but this tailings dump has been decommissioned. One large and two small fine residue disposal dams were constructed outside the deposit initially. Since 2010 fine residue is deposited in mined out pits in the outlet. The main fine residue disposal facility (FRD) is positioned to the north-west of the office block but is no longer in use. Some 900,000 tons (9.2 million m^3) of fine tailings have been stored here and the area covers 45.12ha (EnviroScience 2002). The Original EMPR contains a flow diagram of the Treatment Plant.

3.2.3 Water abstraction and use at Daberas

The water sources for Sendelingsdrif Treatment Plant (STP) and Daberas are the Orange River and recycled water from the in-pit sliming operation. Abstraction at both STP and Daberas from the river remain within the limits of the permit. As seen from the graph below the abstraction figures were low during the production stoppage (2020). An operational action plan to ensure water security from the river were also executed successfully. These included: the re-use of water from slimes facilities; the reduction of water leaks; and the monthly monitoring of water targets against actual usage. In 2020 a Water Management Plan was updated for Namdeb and more water saving measures initiated, including flow meters to monitor losses, installation of additional pumps to improve recycling, optimization of thickeners, optimisation of recycled water supply and abstraction, and monitoring of seepage.

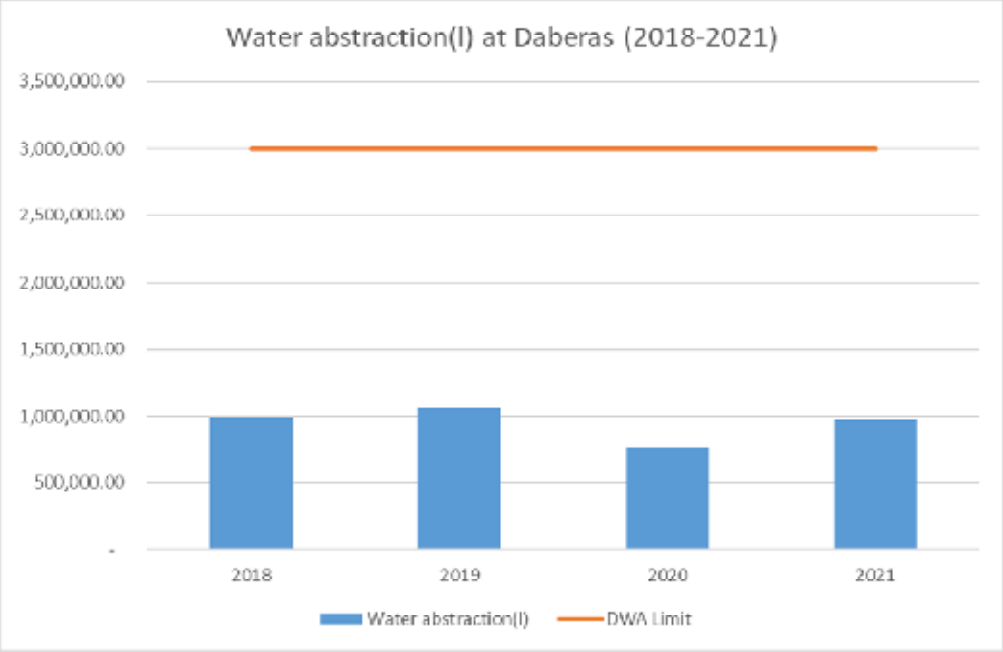


Figure 11: Water abstracted from the Orange River at Daberas Mine (2018-2021)

3.2.4 Infrastructure and services

Workshops, stores, water reservoir, septic tanks and maintenance areas adjoin the old main office block to the north and east. There are also some additional offices, workshops, stores and maintenance rooms near the main treatment plant.

A fuel depot farm, operated by Vivo Energy Namibia (VEN), is positioned south of the old main office block, consisting of 3 x 83m^3 diesel tanks and fuelling facilities.

A water truck brings potable water from Oranjemund (approximately 40m^3 per week for both Daberas and Sendelingsdrif) and a potable water plant at Daberas hostel generates an additional 60m^3 per month from raw water from the Orange River.

3.2.3.1 Linear infrastructure

The public road from Oranjemund to Rosh Pinah runs through the mine and a haul road links the hub to the main treatment plant near the inlet area. A network of haul and access roads used to cross the deposits, but many have been removed during the course of mining or are now covered by overburden.

Water for the treatment plant is abstracted from the Orange River and pumped to reservoirs through a pipeline and from the reservoir to the plant. Water from the river is also used for the fire hydrant and ablution facilities and for dust control on the roads and in the mine site.

Water abstracted at the Daberas hostel is purified for use at the hostel. This water is also trucked to Daberas for drinking water (potable water).

Water abstracted at the Daberas hostel is purified for use at the hostel. This water is also trucked to Daberas for drinking water (potable water).

Power is supplied by Eskom via the Bloeddrift substation (5 MVA) on the south bank of the Orange River and transmitted in a 22kV line to the mine.

Fibre optic cables link the mine sites to the power and telecommunications grid. All lines are above-ground and supported by wooden poles.

3.2.3.2 Waste management

Waste management on site includes the separation of waste into hazardous, industrial (scrap, tyres, plastics) and domestic, which will then be disposed following established procedures. The waste removal services are supplied by a contactor.

Wash bays for vehicles and machinery are equipped with oil-water separators. Waste oil and lubricants are stored in waste oil tanks in a dedicated area near the office or plant, collected by Vivo Energy when the storage reaches 80% capacity and transported to Walvis Bay for recycling.

Polluted soil is stockpiled at the remediation site near the office block for treatment. All raw sewage is collected in septic tanks which are regularly emptied into the trickling sewage treatment plant at the Daberas hostel.

Batteries and fluorescent tubes are temporarily stored and collected for recycling, once storage capacity has been reached. Domestic waste (soft refuse) is transported regularly to the managed landfill in Oranjemund. Tyres, rubber and piping is kept on site either for removal to Southern Coastal Mines (SCM) or until alternative disposal can be determined. Scrap metal is stored at the scrap yard either for removal to SCM and eventual recycling. Other non-hazardous waste (including domestic waste) is transported to Oranjemund for disposal at the landfill site.

With closure in mind, the Waste Management Strategy (2021) describes the domains in Daberas with significant waste and provides detailed goals and objectives for each. A summary of the strategy for Daberas is provided in Table 2 below.

The Waste Management Strategy also contains recommendations for pollution management at ML 42. The two sites with the highest pollution risk are the bio-remediation site and the waste oil storage areas. The bioremediation site is a potential risk to the groundwater and prevention measures are provided. Strict procedures are being prescribed in the strategy, including the use of containers, liners, leachate treatment. After closure, a groundwater pollution assessment should be carried out.

The storage of oils throughout the areas are also a potential contamination risk. Waste storage areas should be clearly labelled and bunded. Spillages should be prevented during transport and filling of tanks by using spill proof surfaces and by not overfilling tanks. They should be emptied on a regular basis. Regular emptying, cleaning and treating of oils as hazardous waste with the removal and remediation of contaminated soils is prescribed. All these measures have been included in the updated EMP and the risk assessment used to update the impact assessment of the EMPR (Chapter 74).

Table 2: Summary of waste management strategy for Daberas domains with significant waste (Waste Management Strategy, GPT, 2021)

Domain	Description		Recommendations
Domain 8 Office Buildings	Building waste and materials 80,000l waste oil tank	Waste will be demolition waste and structural steel.	• Identify landfill areas and compile demolition plan. • Specific protocols for the waste oil tank, including prior consultation, inspections and cleaning, removal of tank, materials and waste, assessment of polluted soils for removal and remediation, followed by an environmental conditions survey. Monitoring to reach desired contaminant levels, followed by site handover for filling of excavations and landscaping.
Domain 9: Fuel Station and Wash Bay	Fuel station and wash bay	Three bunded, above ground 83,000L tanks, concrete walls and working surfaces, pipelines and other fuel station related infrastructure. Waste is steel, concrete, rubble, waste fuel and possible contaminated materials.	• Notice to Minister of intended date of closure (Petroleum products regulations, 155 of 2000). • Identify landfill areas for concrete landfill • Preparation work to safely remove all fuel station related infrastructure • Safe disposal of fuels as hazardous or to recyclers • Removal of the tanks and other infrastructure • Demolition of remining concrete surfaces and bunding • Sorting of materials according to waste type • Removal and remediation of polluted soils • Obtain Certificate of Compliance • Conduct environmental conditions survey • Once desired contamination levels of reached, fill excavations and compact appropriately. • Possible asbestos and a pollution plume at the wash bay are of interest. Identify hazardous materials and treat such.
Domain 10: Bioremediation Site	Bioremediation site	Used for the temporary storage of contaminated soils. Such soils disposed of during closure will also be treated at this site.	• All preparation work required to safely close the site. • Removal of all contaminated soils, surveying of remaining soil to determine a rehabilitation strategy (removal for remediation or in-situ remediation). • Environmental conditions survey of desired contamination levels, filling and compaction.
Domain 11: Landfill and Scrapyard	Laydown areas	Areas used for the temporary storage of equipment and scrap. Waste consists of scrap with possibly contaminated materials.	• Compile register of all materials and sorting of materials • Scrap removal by contractor – optimise recycling • Clean the laydown area with visual assessment to identify possible contamination. Removal and remediate any contaminated soils.
Daberas scrap year (satellite Domain 8)	Scrap yard	Used for the sorting of scrap and waste. Contains scrap metals, with some hazardous waste, general waste, and tyres.	• Compile register of all materials and sorting of materials • Contamination investigation • Scrap removal by contractor – optimise recycling • Dispose of all waste according to Namdeb procedures • Clean the laydown area with visual assessment to identify possible contamination. Removal and remediate any contaminated soils. • Surface management.

3.1.4 Rehabilitation at Daberas

Daberas is almost at the end of its current Life of Mine, save for ongoing exploration work in the meso-terraces which might lead to mining activities in future. This means that rehabilitation is a priority at Daberas. By 2020, Daberas had a total disturbed area of 813 Ha, inclusive of the Daberas operation, hostel, scrap yard, pump house, old pump house, and the spill area close to the hostel. Of this area,the scrap yard (5Ha) has already been rehabilitated. It is planned to rehabilitate another 69 Ha, which consists of the terrain which has been identified as requiring rehabilitation according to the Namdeb Integrated Closure Plan (2021).

3.1.4.1 Closure criteria for Daberas

Daberas has a total of 28 Ha to be landscaped. The overall closure Criteria that are applicable to all the sites, are provided in the Demolition and Landscape Report (2021, Annex 5). The closure criteria that are specific to ML 42, are provided in Table 3 below.

Table 3. Closure criteria applicable in ML42

. **Component**	**Closure criteria**
Landscape	
Visual	• Dumps visible from access roads profiled (edges and crests of slopes rounded) • No dumps higher than surrounding topography (20 m above the surrounding) • No excavated trenches visible from the public road (M118) • Maximum slopes angle for reshaping of slopes is 20º
Substrate	• Surface blends in with natural environment in terms of texture and colour
Water	• Cover all exposed, artificial water bodies with oversize (± > 60 mm) 1 m above water level and cover with finer material (zones 10, 11 and 13) • Re-establish riparian belt in Zone 13

Following these criteria, the specific tasks to remove and restore the physical and natural landscape is described below.

3.1.4.2 Manmade features and earthworks rehabilitation

Table 4 below provides the specific tasks identified for rehabilitating manmade features and earthworks.

Table 4: Manmade features and earthworks rehabilitation tasks in Daberas (Demolition and Landscape Report, 2020)

Component	Description	Task
Mining pits (Domain 3)	• Zones 11 and 13, open water remaining in some pits	• Partly backfilling of Zone 13 to reconstruct riparian belt • Cover all exposed, artificial water bodies with overburden • Demonstrate stability of pit walls
Exposed bedrock	•	• No Rehabilitation
Meso stockpiles	• Stockpiles from meso sample	• Reshape to low rounded dumps
Tailings dump (Domain 7)	•	• Reshape sharp edges and crests and create channel
Overburden dumps (Domain 4)	• Most dumps throughout mining area to remain	• Dumps along public road to be reshaped
Fine residue disposal facilities1 (Domain 6)	• Zones 8 and 9 are used for fine residue disposal • Reeds have established on the initial, large fine residue dam and prevent dust and erosion. The fine residue disposal sites in mined out areas do not require rehabilitation.	• Where open water remains, cover all exposed, artificial water bodies with overburden 1m above water table • No rehabilitation of other fine residue disposal sites, if chemical stability can be demonstrated
Prospecting sites and trenches	• Throughout mining area and on meso deposit	• Steep walls secured with berms
Ramps and built-up areas	• Ramps near plants, workshops and fuel station	• Reshape (round edges and crests)
Small dumps, heaps and stockpiles	• Heaps of material are scattered throughout the mining area	• Levelled where visible from public road
Areas disturbed by infrastructure	• Sites of plants, workshops, offices and other accessory works, helipad	• Cover with suitable substrate; scarify only where heavily compacted, no plant growth-supporting substrate is available and rip-marks are not visible from tourism route
Access roads	• Access roads to inlet and hub as well as to water infrastructure turning off from the public road	• Scarified (and rip-marked erased), where necessary or covered with suitable material
Haul road	• A haul road runs along northern margin of the deposit	• Scarified (and rip-marks erased) and breached at two places to re-establish natural water flow

3.1.4.3 Landscape and biodiversity restoration

The post-mining landscape will be composed of mined out areas, overburden dumps, slimes (fine tailings) dams, (coarse) tailings dumps, stockpiles, exploration trenches and associated stockpiles and overburden dumps, as well as compacted areas associated with roads and areas where infrastructure was positioned.

Rehabilitation of the section of riparian belt that has been eliminated during mining of zone 13 is currently under review and backfill criteria will be determined in consultation with stakeholders. The haul road will be "breached" where natural drainage lines are currently blocked. Other landscape rehabilitation focuses on areas within view of future access routes.

A few sections of unmined terraces, environmentally sensitive areas within the mine which are currently fenced (significant archaeological sites and the succulent (*Juttadinteria albata*) population on dolomite outcrop) and sites identified of special scientific interest, such as the bedrock scour and channel in the pit and an exploration trench through the meso terrace deposit (Burke 2015) will remain.

Natural recovery of vegetation will be monitored in rehabilitated areas. Alien plant invasive at the mine site, if still present, will be eradicated and re-emergence monitored.

3.1.4.4 Cultural heritage to remain

Namdeb has a wealth of cultural heritage and according to the Cultural Heritage Management Plan (2020), sites to be remain at Daberas include:

- Two geological sites: an exposed channel in bedrock area in Zone 11 and a scour feature in Zone 13 (under water). The water management plan specifies that all artificial water bodies are covered up to 1 m above the water table with overburden material (Namdeb 2021 - Water Management strategy).
- The majority of the manmade landscape of fine residue disposal facilities, overburden dumps, tailings dumps, exposed bedrock and other areas disturbed by mining and associated infrastructure at Daberas is to remain. Only areas visible from the public road will be reshaped to some extent. However, some landscaping will take place where infrastructure is to be removed.

3.2 Sendelingsdrif Mine

Sendelingsdrif mine started operation in 2014 and has a projected life of mine until 2024 according to the current mine plan. Like at Daberas, all mine staff is accommodated either in Oranjemund or Daberas Hostel and employees commute daily.

The Sendelingsdrif deposit is one of the largest remaining, diamondiferous proto terraces on the Orange River. For this reason it is of tremendous economic but also environmental importance as it supports vegetation (and likely fauna) restricted to

Orange River terrace habitats. Unlike mining at Auchas and Daberas, progressive rehabilitation has therefore been integrated with the mine plan.

3.2.1 Mining

The deposit is mined in an open cast dry mining operation following the conventional sequence of overburden removal, waste stripping and ore mining using excavators, loaders and haul trucks. Two mining faces are open at one time which will allow mixing of material to obtain the required grades. Blasting is necessary where cemented layers are encountered. Bedrock cleaning with manually operated transvacs (industrial vacuum cleaners) will follow in some sections. Back dumping is incorporated in the mining design, to fulfil the requirement of concurrent rehabilitation.

The ore is transported to the Sendelingsdrif treatment plant which is within a maximum 3km range of all planned mining phases. A dump is currently created to the south of the deposit, just above the 100m flood-line to accommodate the material from the first mined out areas. The dump (capacity of 5 million tonnes) will remain, as well as the storm water berms created with overburden to the north and west of the deposit to protect the mine site from flooding.

Table 5 below presents the mining volumes for 2020, 2021 and estimated until 2024.

Table 5: Mining volumes at Sendelingsdrif Mine

Mining volumes (tons)	2020	2021	2022	2023	2024
Overburden stripped	530,778	645,070	827,000	108,000	139,000
Ore mined	2,638,097	2,418,700	2,440,000	2,809,000	2,233,425
Treated	2,638,097	2,236,700	2,440,000	2,809,000	2,233,425

Figure *12* shows geographically, the zones currently being mined at Sendelingsdrif. The blue zones indicate the extent of the deposit.

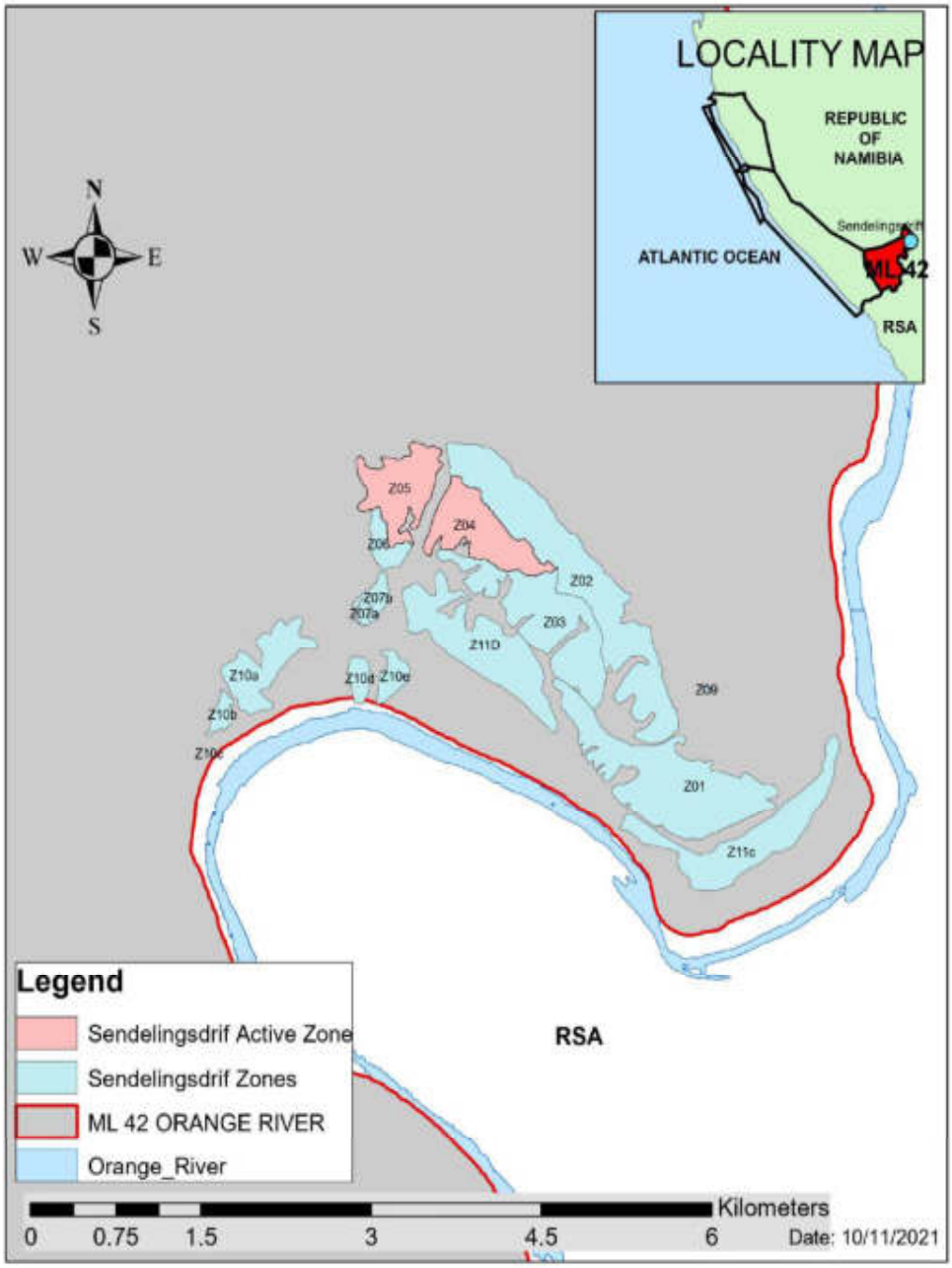


Figure 12: Sendelingsdrif active zones currently mined

3.2.2 Exploration targets at Sendelingsdrif

In 2019, 1,100 m of reverse circulation (RC) exploration drilling was conducted Sendelingsdrif in May and June, using contractors. One RC rig with a crew of approximately 7 2 LDVs was utilised. The planned drilling programme for the next three years, described for Daberas, covering the meso terraces, also involves Sendelingsdrif.

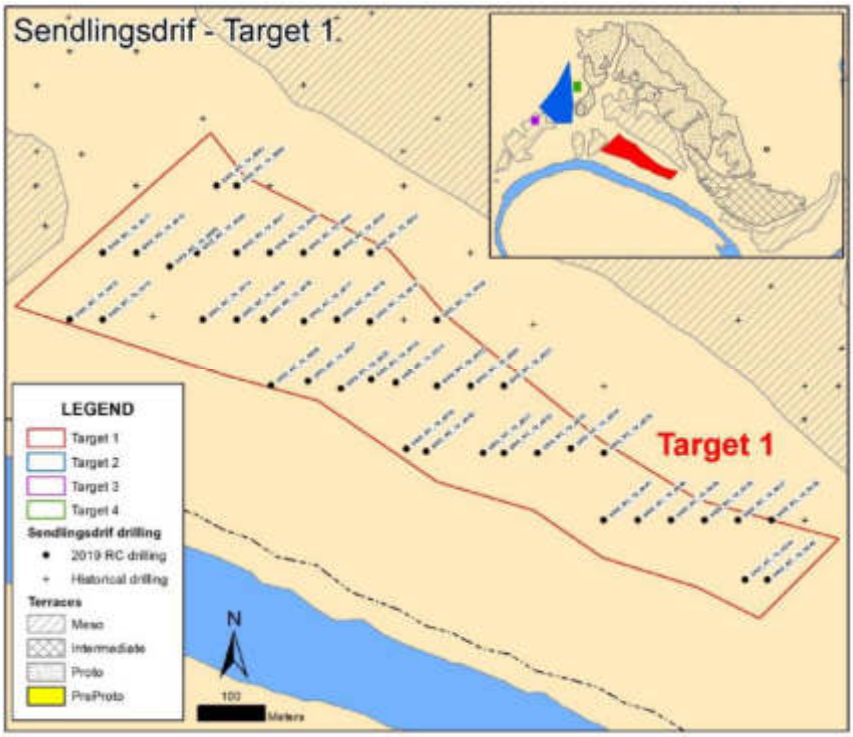


Figure 13: Exploration Target 1 at Sendelingsdrif

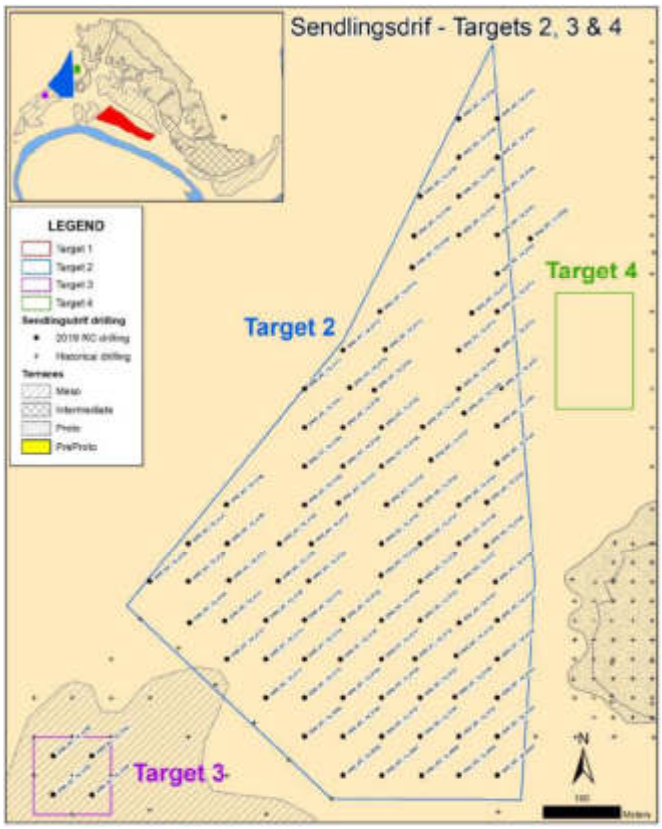


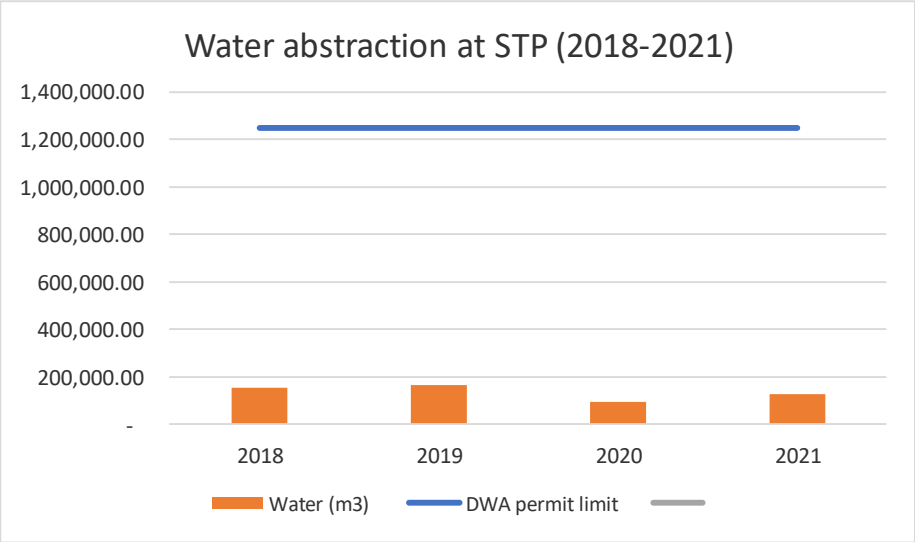
Figure 14: Exploration Target 2-4 at Sendelingsdrif

3.2.3 Treatment of ore

The main treatment plant is positioned to the north of the outline of the current viable diamond deposit. It consists of a dry screening process, a DMS (Dense Medium Separation) x-ray, and degrit sections. The 2018 EMPR contains a detailed description of these facilities. Tailings from these sections are returned to mined out zones, constituting the backfilling part of the progressive rehabilitation.

Process water is abstracted from the Orange River and pumped to a reservoir near the treatment plant. Since 2017 the plant has managed to recycle on average 90% of its water (through the process described above) reducing the need to extract river water, which is permitted up to 104,000m^3 monthly. The actual water consumption is approximately 8% of the total permitted volume (Table 6).

Table 6 Annual water abstraction at Sendelingsdrif Mine



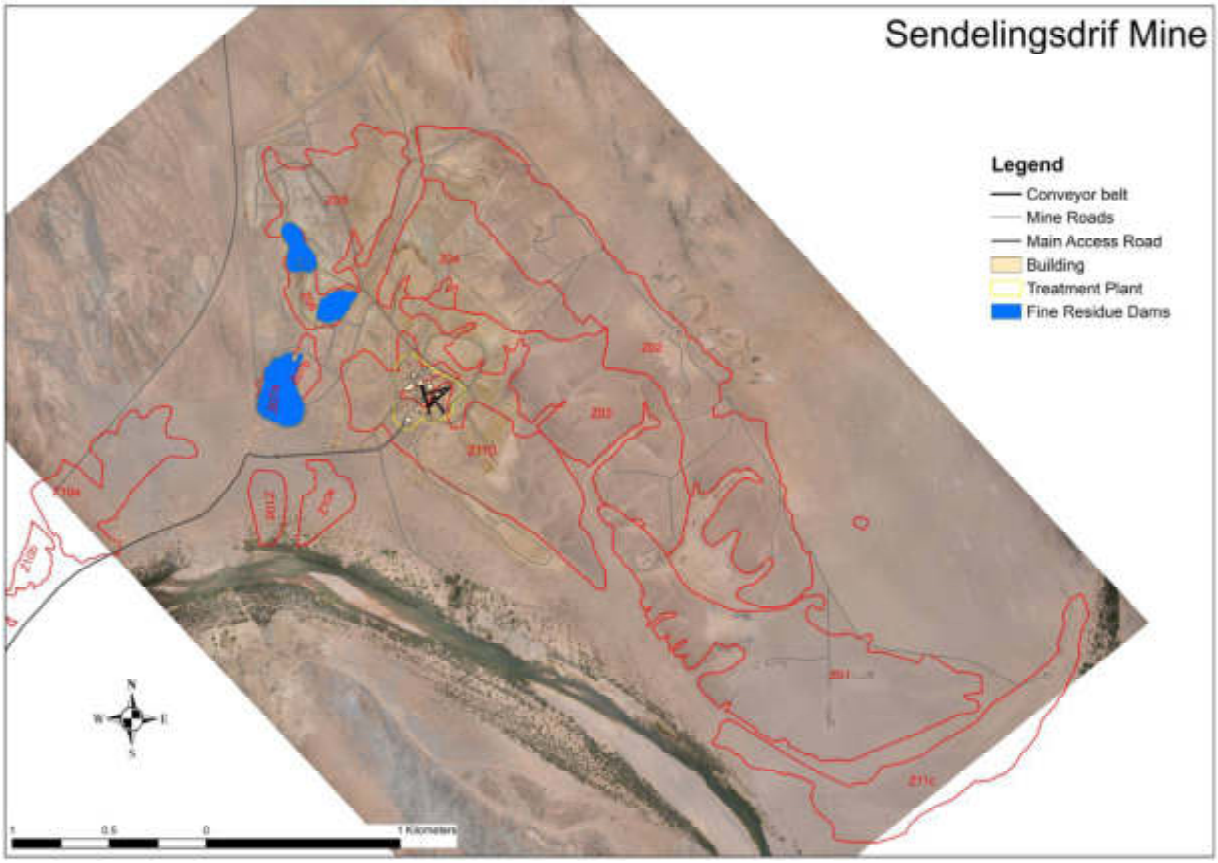


Figure 15: Locality of the treatment plant and fines residue disposal sites, as well as the conveyor belt and roads in relation to the mining zones at Sendelingsdrif (EMPR, 2018)

3.2.4 Infrastructure and services

- All the buildings are mobile containers, near the treatment plant. A (bio-filter trickling) sewage plant, pump station and reservoir are also positioned near the main plant. The main office block is established on a hill to the north-east of the treatment plant.
- Sendelingsdrif has a diesel fuelling facility with two 83m^3 tanks which is operated by Vivo Energy Namibia (VEN).
- Potable water is supplied by Namwater from Rosh Pinah, with a pipeline from the Orange River.
- The Oranjemund-Rosh Pinah main road to the west of the mine, an access road.
- A fine tailings line from the treatment plant to the in-pit tailings facility
- Fibre optic lines service the office block.
- Power supplied by Nampower via the Zincum substation (3 MVA) near Rosh Pinah and a 66kV overhead power along the public road to the main treatment plant.

Waste is separated into hazardous, industrial and domestic, which is disposed following established procedures. The waste removal services are supplied by a contactor – currently Rent-a-Drum.

Wash bays for vehicles and machinery are equipped with oil-water separators. Waste oil and lubricants are stored in waste oil tanks in a dedicated area near the office or plant, collected by Vivo Energy when the storage reaches 80% capacity and transported to Walvis Bay for recycling.

Polluted soil is stored on site in skips and transported to the remediation site at Daberas for treatment. All raw sewage is collected in septic tanks which are regularly emptied into the trickling sewage treatment plant at the Daberas hostel.

Batteries are temporarily stored and collected for recycling once storage capacity has been reached. Domestic waste (soft refuse) is transported regularly to the managed landfill in Oranjemund.

Metal scrap is stored at the Daberas scrap yard and collected by SA Metal when sufficient material has accumulated. Tyres, rubber, piping and other non-hazardous industrial waste are also kept there.

The waste Management Strategy prescribes similar interventions for the closure of the domains at Sendelingsdrif, but for this mine, closure is not planned within the next three-year period.

3.2.5 Rehabilitation at Sendelingsdrif

3.3.4.1 Infrastructure and pollution remediation

All infrastructure with no post-mining use will be removed at the closure of the mine. This includes all linear infrastructure such as power lines, fibre optic lines and all

pipelines serving only the mine. Remaining waste will be removed and polluted soil is treated to acceptable levels. This is not planned for the ensuing three-year period of active mining.

3.3.4.2 Landscape and biodiversity restoration

Backfilling has been incorporated in the mine plan and only some voids will remain open at mine closure. The initial main tailings dump (TD1) will remain and will have a height not exceeding 65 m amsl (maximum height 20m). The back-filled areas (in-pit tailings dumps) will not exceed 85m amsl and low-grade stockpiles will be lower than 65 m amsl. All dumps will be sloped to a 25°angle. No dumps or stockpiles will remain, other than the stormwater berm and the main tailings dump (TD1).

Zone 4N4 will remain open from mining and will be made safe with berms **(Figure 16)**.

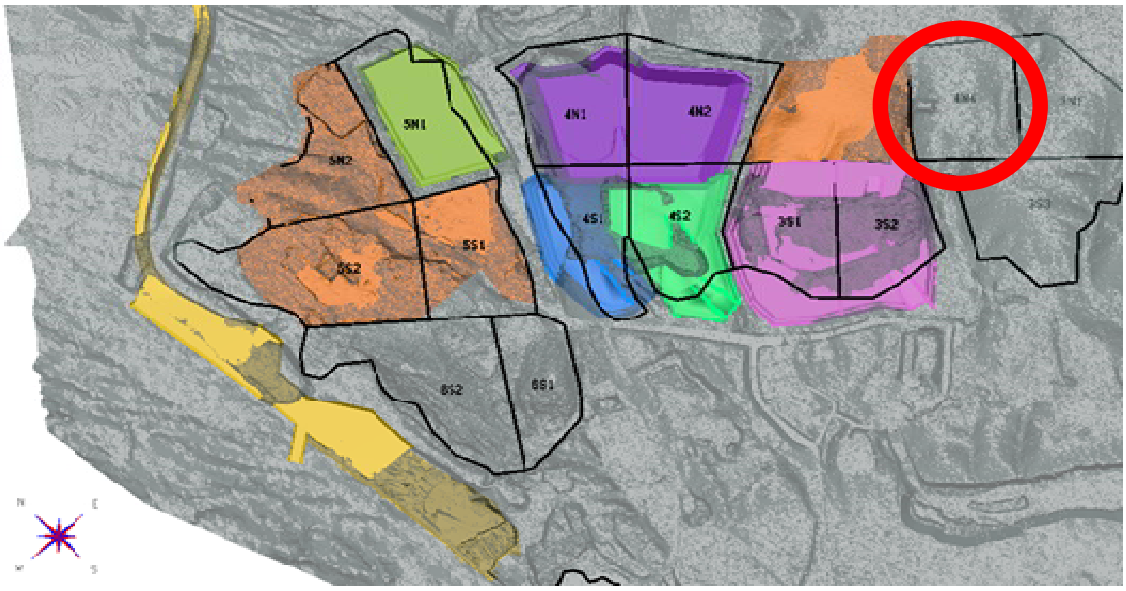


Figure 16: Zone 4N4 to remain open and made safe with berms

Table 7 lists the tasks to be undertaken to achieve the above goals.

Table 7: Manmade features and earthworks rehabilitation tasks at Sendelingsdrif (Demolition and Landscape Report, 2021)

Component	Description	Task
Mining area	Sample pits and remaining mined out voids	Rehabilitation of some sample pits and sloping of remaining voids
Mineral dumps	Progressive rehabilitation by backfilling the majority of mined out areas	Slopes at final voids to be rounded and sloped to no more than ±20 degree, if necessary
Tailings dumps	Coarse tailings from treatment plant	Reshape to 15° slope angle
Low-grade stockpiles	Low-grade stockpiles near plant	No rehabilitation required as they will be treated before closure

Component	Description	Task
Fine residue disposal facilities	Presently two mined out areas serves as fine residue disposal sites.	Geotechnical study required to determine technical and chemical stability

The site of the former sampling plant to the east of the mine will also be rehabilitated towards meeting the same closure criteria as the mine site. Only the experimental rehabilitation trials may remain.

The back-filled areas are planned to be re-vegetated and the Sendelingsdrif Ecological Restoration Programme (SENEREP) was initiated in partnership with the Gobabeb Research and Training Centre and the Millennium Seed Bank Project to meet the restoration goals. To date, Namdeb installed an office/laboratory, a greenhouse, a water tank, a weather station and a re-vegetating trial site. This infrastructure was removed once the vegetation trials was completed. The weather station is situated outside the Sendelingsdrif Whitehouse .

Three nurseries were constructed to house seedlings prior to revegetation.

Figure 17. Greenhouse, laboratory/office space and water tank (left) and the weather station (right) at the Sendelingsdrif restoration trial site before they were moved to the current position (Photos: Namdeb).

The 2020 operational performance indicators for SENEREP was to backfill 1.8M tons of material into mined out paddocks and to revegetate 0.6ha of reshaped areas. The operational planning actions were to track monthly tons backfilled against target; revegetate the available backfilled area, track it against the target; and to monitor revegetation success rate for plant species of conservation importance.

Due to the 3-month unplanned production stoppage the backfilled tonnes target for 2020 was almost achieved with 0.57ha revegetated.

However, at the end of 2020 a revegetation exercise was executed on an area revegetated in 2018 where the survival rate was very poor. In December 2020, about 589 plants were transplanted onto 3S1 (see **Error! Reference source not found.** below). Other activities for the reporting period included:

Figure 18: Revegetated site at Sendelingsdrif - 3S1 (Photo: Namdeb)

- Seed collection. Only a minimal amount of seeds were collected since most plants in the natural environment were dried out.
- Greenhouse maintenance. A third greenhouse was built to accommodate all plants. Alien vegetation was removed from the greenhouses and the shade netting was fixed. Broken pots were replaced with new ones. Please see figure 13 below.
- Vegetation monitoring was conducted on the control site (Sensitive Kopje, as well as on 4S1, 3S1 and 3S2). The plants in the greenhouses had a 97% survival rate. Almost all plants at 3S1 were found to be dead and therefore the area was replanted. Plants at 3S2 looked very good except for damage by baboons. They seem to mostly target *Juttadinteria albata* and more so if the plants are grouped together.
- About 800 seedlings were transferred from germination trays to pots/bags in the greenhouse.

3.2.5.1 Manmade landforms and cultural heritage sites to remain

The following features will remain:

- A pre-proto terrace outside the ore reserve and a terrace deposit intermediate between proto and meso
- Mined out areas are being back-filled
- The storm-water berm around the northern part of the mining area will be breached to re-establish natural water flow and it will be rounded in areas visible from the public road.
- The initial tailings dump to the south of the deposit, low-grade stockpiles and the fine residue disposal sites.

3.4 Obib

The Obib proto terraces are positioned between Daberas and Sendelingsdrif (*Figure 6:*). This resource at Obib extended the life-of-mine at Daberas mine for one year. The project was planned for 15 months, and started in the fourth quarter of 2018. Only a portion of the Obib deposit has been mined over the past three years, but will not be continued for the ensuing period. The mined deposit is however being treated at Daberas and this will

continue for the ensuing period. Some of the remaining proto-terrace deposits could be mined in future. The deposit has been extensively sampled and some areas have been disturbed by trenches, sampling plant and camp facilities.

Figure 19: Photo of the mining site at Obib

3.3 Obib Operation

The deposit at Obib was small (approximately 1.4 km x 0.6 km), compared to Sendelingsdrif (5 km x 2 km) and Daberas (3.6 km x 1.2 km), and only a portion of the Obib Proto deposit (red outline, below) was mined. However, some of the remaining proto-terrace deposits could be mined in future.

Figure 20:The deposit which was mined at Obib (red outline), and remaining Proto-Orange terraces.

The mine planned focussed on stripping the upper units (pedogenic and upper gravels). A low-grade stockpile was planned to be constructed from the stripped material along the south-eastern margin of the deposit. The exposed ore was scalped and transported to Daberas for processing in the existing treatment plant. The oversize was planned to be backfilled into mined-out area and covered by low-grade material once an initial cut was made.

The main equipment used on site were two mobile dry scalping screening plants, two excavators and two wheel loaders. Between four and five haul trucks moved the ore to Daberas. Office facilities constituted mobile containers and all operators resided at the Daberas hostel or in Oranjemund Town. Fuel and potable water were provided by trucks. Electricity was provided by a diesel generator.

Domestic waste was collected and regularly disposed at the Oranjemund landfill. Scrap, hazardous waste and other industrial waste were disposed with the Sendelingsdrif and Daberas waste streams. Mobile toilets were provided for staff and waste contained in a septic tank which were emptied regularly for disposal at the Daberas hostel sewage treatment plant.

Figure 21: Plant rescuing (left) and greenhouse facility (right)

Figure 22: Topsoil harvesting at Obib

3.4 Removal of redundant infrastructure

All infrastructure has been removed.

Figure 23: Before and after pictures of infrastructure removed at Obib

3.5 Profiling of landscapes (earthworks)

The mine plan envisaged to incorporate back-filling of mined out areas with oversize and covering the oversize with a portion of low-grade overburden. This was partially achieved due to technical challenges encountered by the mining team during operations resulting in not enough material available to backfill all the voids.

One remaining low-grade stockpile was envisaged with specifications of not higher than 10m and to be situated on a disturbed area on the Meso-Orange River terrace. This was partially achieved. Two low-grade stockpiles will remain, both are on disturbed area but are higher than 10m (Figure 25).

Below is a representation of what the end state will look like.

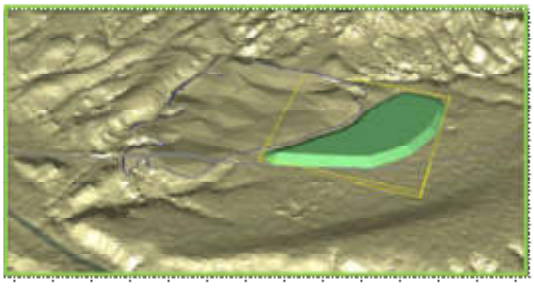


Figure 24: 3D view of the envisaged post-mining landscape with low grade stockpile (green – view from SSW to NNE)

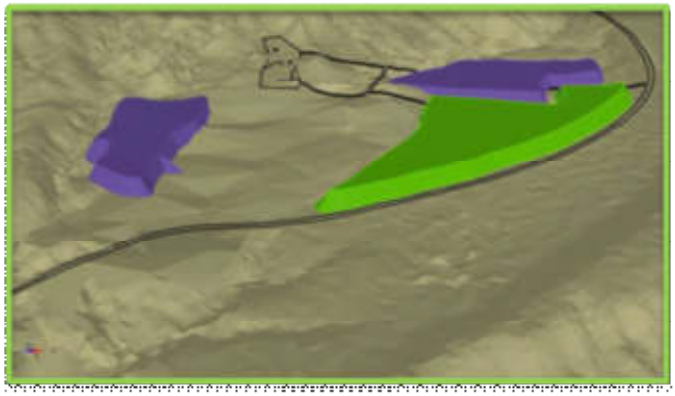


Figure 25: 3D view of the final landscape with x2 oversize stockpiles (purple) and low grade stockpile (green)

All stockpiles will be shaped to blend in with the natural environment including recreating the main drainage line between the deposits and rounding of slopes and sharp corners. All access roads will be rehabilitated.

3.6 Pollution clean-up

All waste management and fuel, oil and lubricant procedures for ORM were adopted and implemented at Obib (Figure 26Figure 27). All redundant waste and hydrocarbons were removed from site.

Figure 26: Waste management at Obib

Figure 27: Fuel, oil and lubricant management at Obib

3.4 Auchas Mine

Auchas Mine is positioned some 34km east of Oranjemund on the north-bank of the Orange River. The public road between Oranjemund and Rosh Pinah runs through the mine and separates the deposit.

Auchas Mine is not active presently, but there are still ore reserves remaining which are planned to be mined in future. Nevertheless the plant and supplementary infrastructure have been demolished, except for the office building which the Ministry of Environment, Forestry and Tourism agreed to take over.

Overburden dumps in view of the public road, the tailings dump and dumps visible from the river have been reshaped. The mining pit and other mined out areas and remaining dumps are left to recover naturally. It needs to be made safe with berms obstructing access.

Some of the excavated areas still to be mined are a safety risk and visible from the road and, and it has been stated in the Demolition and Landscape Report (2021), that these need to be mined and rehabilitated.

The fine residue disposal facility needs to be further investigated to demonstrate geotechnical and chemical stability (Namdeb 2021 - water strategy).Figure 28 below shows the remaining rehabilitation tasks for Auchas.

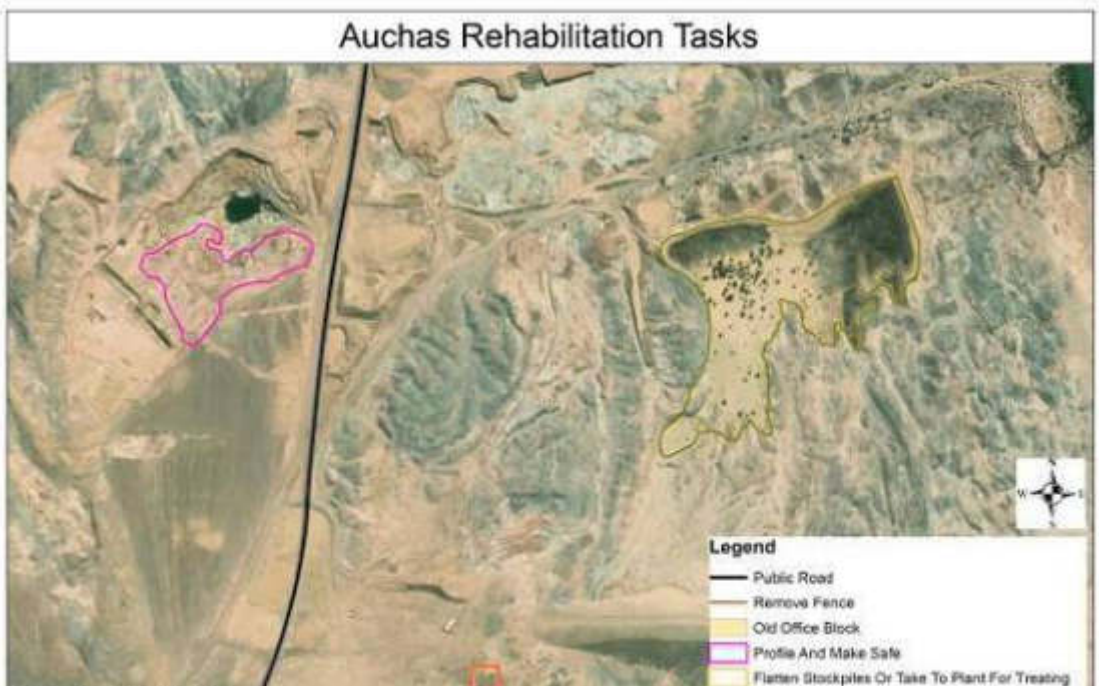


Figure 28: Remaining rehabilitation tasks at Auchas (Namdeb)

3.5 Rehabilitation monitoring

A number of pilot projects were undertaken in ML42 to develop appropriate methods for rehabilitation. Although these used areas disturbed by road works as test sites, e.g. borrow-pits, the methods developed are also applicable to most mining operations. In the process of these pilot projects all unused borrow-pits, road diversions and heaps and trenches remaining from sampling outside the mine sites were rehabilitated.

Figure 29: A redundant borrow-pit outside Oranjemund in ML42 before (top) and after rehabilitation (below) in 2008. Rehabilitation measures included re-shaping and re-vegetating selected parts of the rehabilitated area.

Chapter 4 The Lower Orange River Environment

The 2018 EMPR contains a comprehensive description of the environment of ML42 along the Lower Orange River. It harbours economically viable diamond deposits and supports rich and unique biodiversity, thanks to the diversity of geology, landforms and resulting habitats. The ancient terraces, rocky outcrops, and mountains support unique invertebrate, reptile and plant communities, while the permanently flowing Orange River attracts large numbers of mammals and birds and supports wetland biota, such as fish, amphibians and aquatic plants. These habitats are not necessarily affected by the mining activities. Four extremely range-restricted, threatened plant species (*Amphibolia obscura, Juttadinteria albata, Portulacaria pygmaea* and *Sarcocaulon multifidum*) are affected by mining operations.

Key features of the environment are listed in Table 8.

Table 8: Salient characteristics of the Lower Orange River

Feature	Characteristics (Summarised from EMPR, 2018)
Climate	• Average 51-54 mm Winter annual rainfall, 16-18 º C on average, but reaching up to 40ºC in summer, southerly and south-westerly winds prevail, with occasional bergwinds causing dust, regular fog
Biome	• Succulent Karoo
Geology and palaeontology	• Older, higher lying terraces (>40m above present river level), which yield the bulk of the economic deposits. Proto-Orange deposits. • Younger, lower lying terraces (<40m above present river level), which are some 2 to 5 million years old. Meso-Orange River deposits. Economic in localised areas only. • Deposits consist of a gravel and cobble layer within a sand, silt and clay matrix. Sand and more recent sheetwash rubble and colluvium cap the diamond-bearing layers. This "overburden" material, ranges between 0 and 20m in thickness. • Nine Nine geological / paleontological sites identified of particular importance, to be protected as Sites of Special Scientific Interest (SSSIs), such as the Arrisdrift trench, the pre-proto terrace at Sendelingsdrif and some spectacular erosion features in the Daberas and Auchas pits.
Landforms and soils	• Mining occurs in ancient Orange River terraces – adjoined by sandy and gravel plains, localised outcrops • Gullies in terraces provide habitat for vegetation • Mountain range at Daberas -their foothills and rock outcrops could be affected by mining • Drainage systems at Sendelingsdrift could pose a threat to mining operations • The poorly developed soils in the areas (regosols) have no agricultural potential • Some agricultural potential exists on the younger terraces
Flora and Vegetation	• Characterised mainly by leaf-succulent dwarf shrubs and grasses • Obib-Schakalsberge identified a centre of plant endemism

Feature	Characteristics (Summarised from EMPR, 2018)
	• All vegetation types classified as very high conservation importance, growing mostly on mountains, inselbergs, and rocky outcrops which are largely undisturbed by mining although several species of conservation concern occur on the terraces which are affected by mining. • Main concern - the red-listed and threatened succulent *Juttadinteria albata* with an estimated 47% of its distribution range and 39% of its entire population being eliminated by the mining at Sendelingsdrif and Daberas. Other red-list and protected plants on the terraces (e.g. *Cephalophyllum herrei, Pelargonium klinghardtense, Psammophora modesta*). Three threatened and vulnerable species affected by mining on the Obib terraces: *Amphibolia obscura, Portulacaria pygmaea* and *Sarcocaulon multifidum*. • Riparian woodlands are in a fairly pristine state. Although alien invasive species do occur and have spread into mining areas particularly in wet areas. • Lichens do occur on mountains and inselbrgs and may be indirectly affected by mining. • Orange River valley supports the most diverse wildlife in the Sperrgebiet • The Orange River licence area is a feature of conservation concern for insects with some possibly endemic to the Skilpadberg. • The Orange River valley is also of importance for reptiles with endemic species expected to occur and confirmed. • Vulnerable mammal species expected to occur/ spotted area brown hyena (*Hyaena brunnea*), cheetah (*Acinonyx jubatus*), African wild cat (*Felis silvestris*) and Cape fox (*Vulpes chama*). The brown hyena has been identified a flagship species. • The valley is rich in birdlife although none are known to be restricted to it.
Hydrology and aquatic environment	• Orange River ha largest catchment in southern Africa extending to the Lesotho highlands. It supports important aquatic ecosystems but is in an ecological unhealthy state. Some 5 species that are endemic, rare or vulnerable occur in this portion of the river. The Lower Orange River is in a better condition than upstream. • Water levels fluctuate throughout the year although largely regulated. Flood events are common after high rainfall. • Water quality issues include eutrophication, salinity, turbidity, heavy metals, water-borne pathogens and persistent organic pollutants in this stretch of the river. • Known groundwater sources exist at Daberas (uncovered by mining) and Sendelingsdrif (a spring).

Environmentally sensitive areas that have been identified over years of baseline studies and monitoring in ML 42 are shown below. These features are constantly being integrated with mine plans.

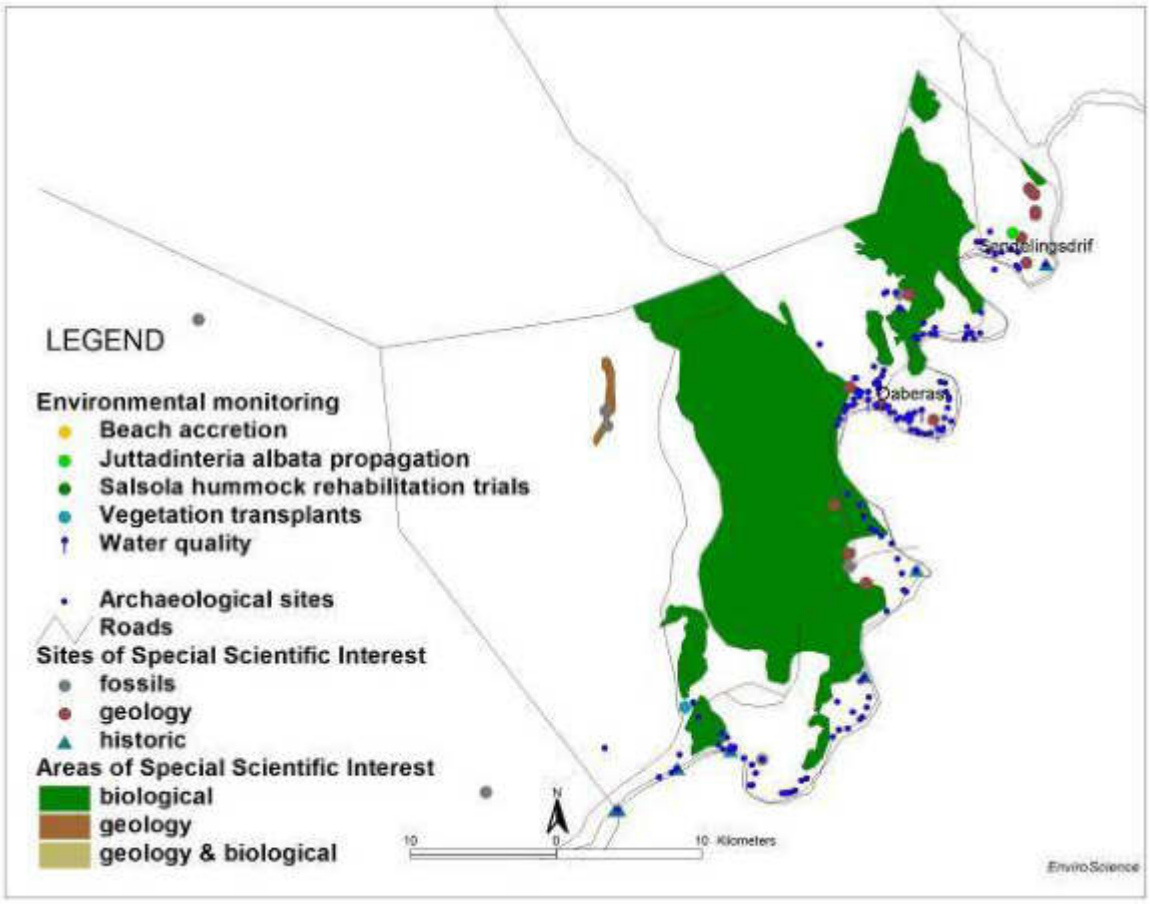


Figure 30: Environmentally sensitive areas in ML42

Chapter 5 The Socio-economic Environment

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

Orange River Mines employs currently 317 staff. The majority (268) is employed by Namdeb directly. The two mines at Daberas and Sendelingsdrif run a 4-shift pattern of two weeks on / two weeks off. Office-based personnel work 8 hours daily 5 days a week. Employees are transported regularly from Oranjemund to Daberas and Sendelingsdrift, coinciding with these shift patterns.

The Ministry of Environment and Tourism's management plan for the Tsau//Khaeb (Sperrgebiet) National Park zoned all Orange River terraces as "managed resource protected area" and the adjoining areas as "national park", "wilderness" and "strict nature reserve". The Orange River valley has been a conduit and habitation for early man for millennia. As a result, many terraces, including the diamond-bearing ones, contain archaeological sites with Early to Later Stone Age implements.

Initial growth projections for the mining industry in 2020 stood at 11.1%. However, the preliminary National Accounts, released by the Namibia Statistics Agency, show that the industry recorded a negative growth rate of 14.5%. This was a further contraction from the negative growth rate of 9.5% posted in 2019.

The demand for diamonds plummeted as a result of the pandemic. Reduced salaries and wages meant that consumers changed their spending patterns away from luxury goods to essential items. Sight holder sales were concluded with excess supply, creating an overflow in the diamond value chain. Rough diamond sales were also negatively impacted by frequent closures of major diamond cutting and polishing factories in India, and the major trading center in Belgium. This resulted in bottlenecks along the entire value chain, causing diamond mining operations to curtail production, including Debmarine Namibia.

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

Table 9 provides a summary of Namdeb's socio-ecnomic impact over the past three years.

Table 9: Socio economic impact of Namdeb over the past three years.

	2018	2019	2020
Highlights	• Wins "Gender is my agenda" award, and inter-safety competition • Five new mining faces at Southern Coastal operations • Orange River Mines exceed production targets	• Commencement of Sale of Elizabeth Bay • Commencement of property sale in Oranjemund, previously owned by Namdeb • Good production year	• Covid-19 Pandemic response • Sale of the Elizabeth Bay mine handed over to Sperrgebiet Diamond Diamond Mining (SDM). • Closure envisaged in business plan from closure in 2022 to 2038
Output	• 571,847carats	• 407,986 carats	• 322,376 carats
Employees	• Permanent 1533 • Temporary 42 • Contractors 726 • Expatriate 15 • Expenditure training and skills development N$ 7.91 million	• Permanent 1339 • Temporary 37 • Contractors 964 • Expatriate 10 • Expenditure training and skills development N$ 8.8 million •	• Permanent 1394 • Temporary 45 • Contractors 963 • Expatriate 10 • Expenditure training and skills development N$ 9.55 million •
Financial	• Total procurement spent N$ 2.71 billion • Total local procurement spent N$ 2.27 billion	• Total procurement spent N$ 2.132 billion • Total local procurement spent N$ 1.68 billion	• Total procurement spent N$ 1.84 billion • Total local procurement spent N$ 1.50 billion

5.1 HR resources matters

The workforce has remained stable since the previous EMPR submission, and as mentioned Namdeb is working towards a sustainable transition of the workforce from being employed by the company, to having access to diversified opportunities. It is expected, however, that the Life of Mine of Orange River Mines will be extended, with prolonged job opportunities.

All medical, disaster, health and safety and occupational health matters are being maintained, as per the 2018 EMPR. Privatisation of facilities is one of the strategies of sustainability strategy, as discussed in the next section.

Annual emergency preparedness and response simulations/drills was conducted for all bulk fuel and waste oil installations (Daberas and Sendelingsdrif).

Figure 31: An emergency preparedness drill at Sendelingsdrif (Photo: Namdeb)

Orange River Mines has moved from OHSAS 18001 to ISO 45001 for safety management and ISO 14001:2015 certification since 2018 for environmental management. Five lost time injuries were recorded during the period 2019-2021. Between 2018 and 2021 Orange River mines reported a total of 59 pollution, 22 natural resource wastage and 19 fauna and flora disturbance incidents. No occupational health cases have to date been reported at Namdeb.

5.2 Social transition

5.2.1 Sustainability strategy

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

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

Transfer refers to the transfer of municipal services to the OTC and the Namdeb properties to private ownership. The transfer of services was concluded in 2020. Property sales have been slow due to legal and administrative challenges. 197 residential property sales had been sold to date. Another 458 applications have been received and approved for sale. Some additional applications are still being processed. The Covid-19 pandemic situation has also slowed down this process.

Transition is the term assigned for the normalisation of the healthcare and education sectors in the town. It also includes the mobilization of the citizenry of the town. The, which is a primary school, was opened in Oranjemund in 2014 whilst the !Garibams public secondary school was opened in 2020 after the secondary classes of the Ambrosius Amutenya Public School and the Oranjemund Private School were combined an Namdeb donated the infrastructure of the school.

During 2019 it was agreed that a portion of the Namdeb owned Namdeb Private Hospital, the Old Male Ward, would be renovated for use as a clinic, since the existing public clinic in Oranjemund has become insufficient to cater for the growing medical needs since the opening of the town in 2017. With the advent the COVID-19 pandemic, it was however agreed for the facility to be converted into an isolation centre for Covid19 cases and has proven extremely valuable in fighting the pandemic. Discussions on availing another facility to be converted into a public health centre is continuing.

OMD 2030 is an independent citizen organisation and its objective is to grow the citizenry in their understanding of their role as citizens. It also focusses on tourism and SME Development.

Transform refers to the transformation of Oranjemund to become an economically diversified town. The OMDis Town Transform Agency (Pty) Ltd is a Section 21 (not-for-profit) company with the singular focus to diversify the economy of the town and was established in 2019. Initiatives are being developed and shared with potential business investors. The main objectives of OMDis are to support and grow existing SME's in Oranjemund, attract and develop new SME's to the town and attract investor to establish large industries with the ultimate aim of replacing mining as the only economic driver of the town. Opportunities include: agriculture with the local production of fresh produce, preparing the tourism industry to recover, opportunities in training and healthcare, investigation and training of citizens with regard to SME development.

5.3 Social Impact Assessment

Namdeb commissioned a closure Social Impact Assessment (SIA) in 2019 to determine the potential social and economic impacts on the direct and indirect communities of Namdeb operations as a whole during closure. The closure SIA was

finalized and signed off towards the end of 2021. The results from the closure SIA informed the social closure transition component in the Namdeb Integrated Closure Plan (NICP). With the extended Life of Mine, the impacts and risks with social consequences identified during the closure social impact assessment will be integrated into the Social Management Plan.

Since the mines being considered in ML42 do not involve social closure for the ensuing period, these impacts and resulting strategies are important for Namdeb, but not directly for ML42 currently.

5.4 Land use

The most recent update of the Park Management Plan has zoned the area as indicated in ***Figure 32***. The land use guidelines for each zone are as follows.

Table 10: Land use zones of the 2020 Tsau//Khaeb National Park Management Plan with abbreviated comments

Permitted Activities	Application in TKSNP
Special Value	
• Access to these zones is possible but must be determined according to their vulnerability to disturbance. • In cases where a Special Value Zone is deemed to be too vulnerable to disturbance, access must be limited to that which is necessary for management, monitoring and research actions only. Seasonal limits will imply temporal zoning as well as spatial. • Where visitation is possible, must be strictly controlled.	• The national guidelines allow controlled visitation, but there are localised sites within 'special value zones' which need to be excluded from visitation because of their vulnerability. • One such area is the Aurus Mountains' saddle and peak (viewpoint and high ridges near "Africa rock'). • There are more such sites, usually related to vulnerable plant species with an extremely limited distribution, such as *Conophytum halenbergense*, *Heliophila obibensis* and *Namibia cinerea*. • There are also temporary springs, archaeological and geologically important sites and fossil sites which need higher protection than the rest of this zone.
Minimal Disturbance	
• Management interventions should be limited to safety and security requirements, access control, research and monitoring, but could include restorative interventions where necessary. • Roads and all forms of infrastructure should be excluded with both management and visitor access limited	• The same as above applies also to this zone. • Note that not all historic and archaeological sites in this zone have been included in the map.

Permitted Activities	Application in TKSNP
Special Value	
to foot and/or horseback. • Access should be contained through the provision of walking/hiking trails with both management and visitors carrying all that is needed to sustain their visit, both into and out of the area.	
Wildlife Management	
• Levels of use must be carefully determined and closely monitored to ensure that they remain within limits of potential concerns. • Both consumptive and non-consumptive use hold potential negative impacts and must be strictly controlled. • The development and maintenance of infrastructure necessary to support and facilitate management interventions; such as roads, communication towers, anti-poaching facilities (outposts), and access control points may be accommodated in these zones. • Infrastructure to support and facilitate visitor access may also be accommodated and may overlap to some extent with management infrastructure, particularly access roads. • Such infrastructure may include small scale high-end tourism products such as luxury fly camps managed under concession agreements, picnic and small public camping areas, rest stops inclusive of ablution facilities (composting toilets) and small-scale food and beverage outlets. Visitor access may be guided but self-guided access may be the dominant form.	• Even in areas zoned for wildlife management extremely localised plant populations which require special protection exist (e.g. the park endemic *Polemanniopsis namibensis* occurs in this zone, has only been recorded at 3 sites in TKSNP and the populations are small).
Managed Resource Use	
• From a consumptive use perspective, the types of activities that may be permitted in this zone are primarily related to the harvesting of natural resources such as medicinal plants, wood and grass for construction purposes, fuel wood, food such as fruits	• Almost half of Namdeb's ML 43 and 44 and sections of ML42 - are now excluded from mining, based on MET/MME agreement through the policy on mining in protected areas. • One area allocated for a wind farm on the

Permitted Activities	Application in TKSNP
Special Value	
and honey, and grazing or browsing for livestock. • From a non-consumptive perspective and in consideration of the need to keep the levels of consumptive utilisation within limits of potential concern, these zones may retain their natural and cultural appeal to the extent that they are able to accommodate some tourism facilities and activities, and these may be strongly oriented towards the cultural features of the beneficiary communities. • Mining and exploration may also be permitted in this zone subject to the policy on mining and prospecting in protected areas in Namibia.	Greater Lüderitz peninsula is included. • Non-consumptive tourism is envisaged in the park, except for recreational angling. • No communities live inside the park and harvesting of natural resources is thus not applicable.
Development and Infrastructure	
• Where possible, these should be located in areas of least conservation importance and preferably on the periphery of the protected areas. • Their extent must be kept as small as possible and the developments and related activities within them must be planned and managed in accordance with the principles of Integrated Environmental Management. • They must be planned very carefully, and strict controls will need to be enforced. • Monitoring of aspects such as the levels of water use, the generation and treatment of both solid and liquid waste and other environmental impacts will need to be instituted.	• This includes all main access roads. • The gum tree grove and disturbed areas nearby at Hohenfels have also been zoned for development. • The largely disturbed area along the coast inside Namdeb's high security area in ML43 is zoned as 'managed resource use' but could also be considered for development as it has potential for renewable energy, • Particularly wind power generation, and also for aquaculture.

The Diamond Act, 1999 (Act 13 of 1999) is also being amended to allow for controlled tourism and restricted traversing rights for tourism concessions holders through Diamond Areas.

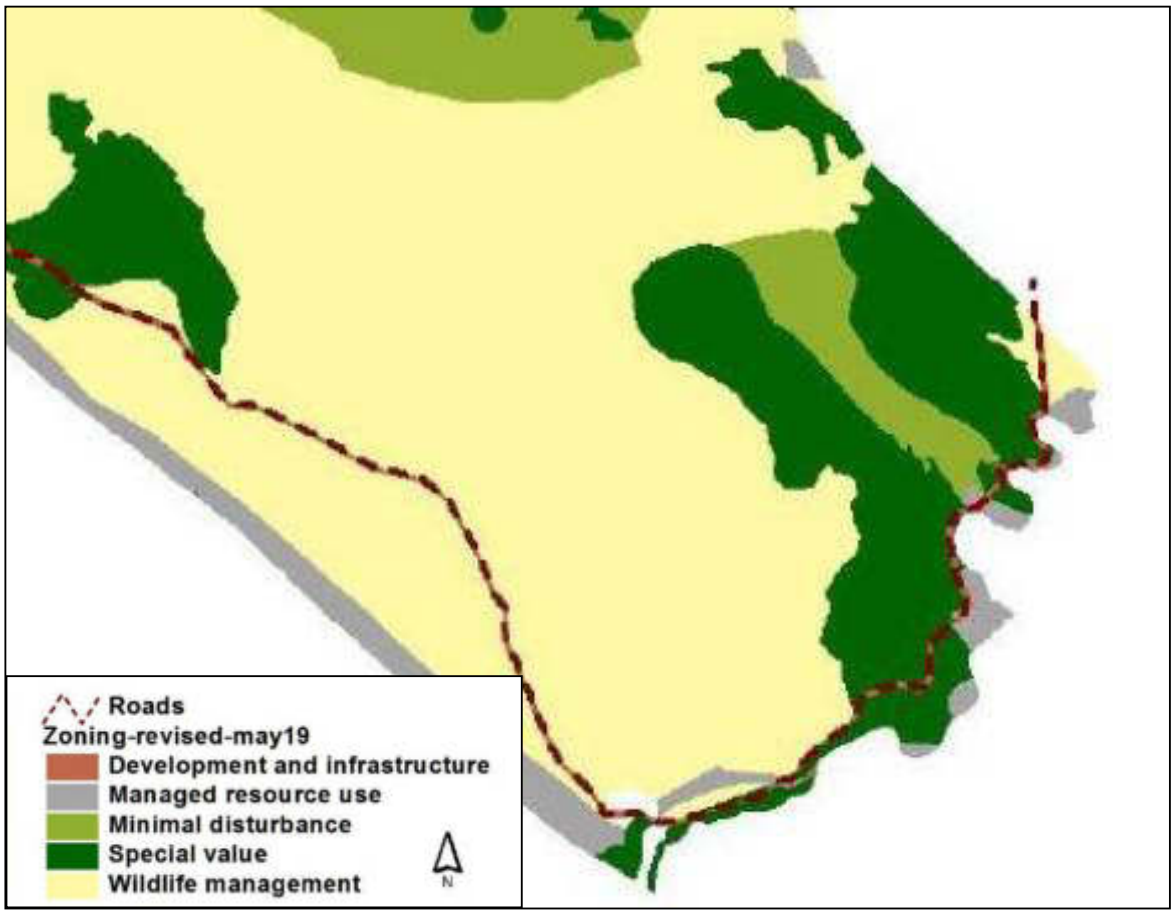


Figure 32: Zoning of the Tsau//Khaeb (Sperrgebiet) National Park in Mining Licence 42

The focus of the recent Management Plan is an appropriate strategy for the development of tourism. The plan supports the vision of:

"Promoting and developing sustainable, responsible tourism that enhances the quality of lives of host communities that conserves all tourism resources and attractions in the planning domain and ensures a high-quality visitor experience while optimising economic returns for government and tourism stakeholders".

Therefore, this plan also serves as a tourism development plan and sets out principles to make this a sustainable reality. Proposed tourism gateways have been determined for Oranjemund and Sendelingsdrif in the study area. Tourism development areas (TDAs) have been identified. In ML 42, the applicable TDA's are Oranjemund coastal/river TDA, Wilderness Area TDA, and Southern TDA.

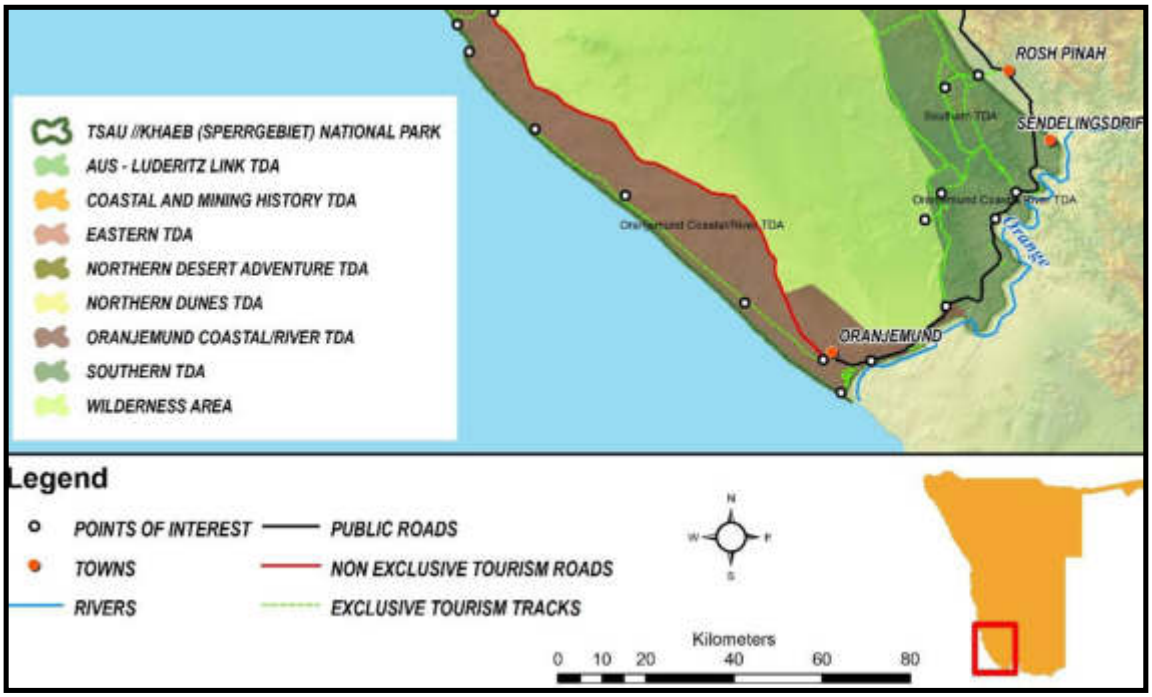


Figure 33: Tourism Development Areas along the Orange River (Tsau//Khaeb National Park Management Plan, 2020).

Concessions being considered for these TDAs are as follows:

Southern TDA
Red Dunes, Roter Kamm and Orange River – consession awarded to OMDis (Town Transform Agency.[2]

Oranjemund Coastal / Orange River TDA
Oranjemund Coast and Mining
Orange River Mouth

A key focus of Namdeb with closure in mind is currently and should remain to be, the preparation of the mines in ML42 for compatibility with the end land uses envisaged, particularly the tourism plans described above. It is clear from the Integrated Close Plan of Namdeb, that closure and rehabilitation efforts are geared toward this end.

[2] https://www.omdis.co/about/omdis/

5.5 Cultural heritage

The archaeological sites on the Orange River constitute a remarkable portion of all sites found in the Sperrgebiet and over 135 sites have been recorded so far (Noli 1995, 1997, 2010), with many more present (. Of interest are a cave and a potential living site with stone circles in the vicinity of Daberas, several sites with rock engravings (Noli 1995, 1997), a paved stone circle of unknown origin and some ESA/LSA artefacts at Sendelingsdrif which are worth conserving (Noli 2010).

While most sites are not directly impacted by mining and measures were implemented in the vicinity of mining operations to protect these, for example the graves and rock engravings at Daberas, this is not the case for most ESA/MSA sites which are located on the proto and meso terraces. Many of these artefacts have been destroyed during the course of mining the proto terraces at Auchas, Daberas and Sendelingsdrif. The ESA/MSA tools are more concentrated on the meso terraces which are now targeted for exploration and potential mining (Noli 1997).

Historic sites of importance in the Orange River Mining Licence area are the two German police stations at Sendelingsdrif and Hohenfels, some more recent stock posts and possibly a site of unknown origin at Arrisdrift (Noli 1995).

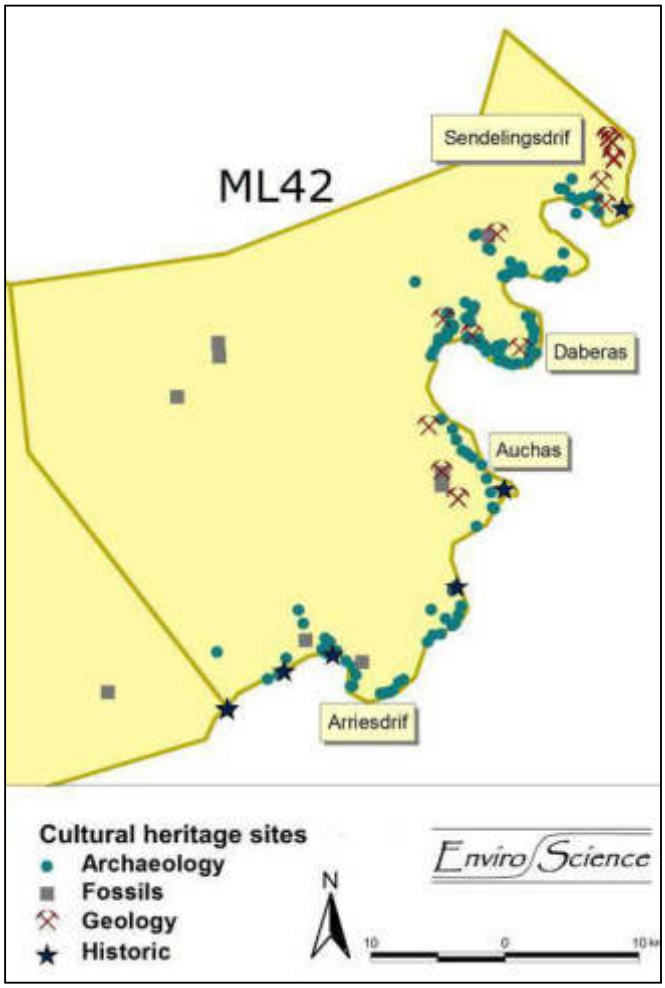


Figure 34:Cultural heritage sites identified in ML42

Chapter 6 Environmental management 2019-2021

Namdeb has a staff complement of ten for environmental management, of which two officers are is dedicated to ORM. The workings of the environmental management system at ORM and Namdeb as a whole have been reported on in the 2018 EMPR, and this system is still in place. This chapter reports on significant events and trends that have occurred for the reporting period, which include all stages of the mining life cycle. Environmental management includes ensuring ongoing monitoring of impacts and mitigation efforts of mining and exploration activities. Preparing for closure is an integrated effort with the overarching life cycle. For the past period, it involved inter alia, negotiations with stakeholders to get formal agreement of the proposed closure criteria and infrastructure to remain.

6.1 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.

All aspects described below apply to ML42, as well as Namdeb overall.

Figure 35: The main components of environmental management at Namdeb.

6.2 Planning

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

6.3 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.

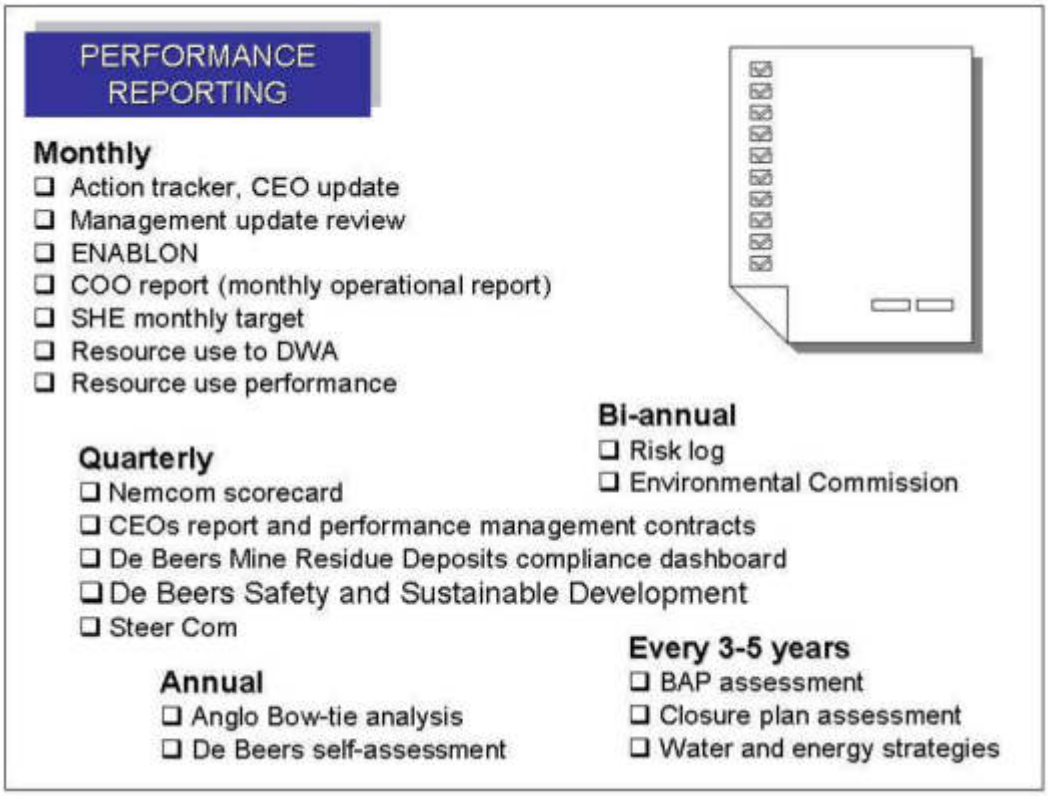


Figure 36: Elements of environmental performance reporting at Namdeb (BAP = Biodiversity Action Plan, CEO= Chief Executive Officer, COO= Chief Operational Officer, DWA= Department of Water Affairs, ENABLON= corporate reporting tool, SHE= Safety, Health and Environment).

ENABLON 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.

6.4 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 Forestry) and corporate head office.

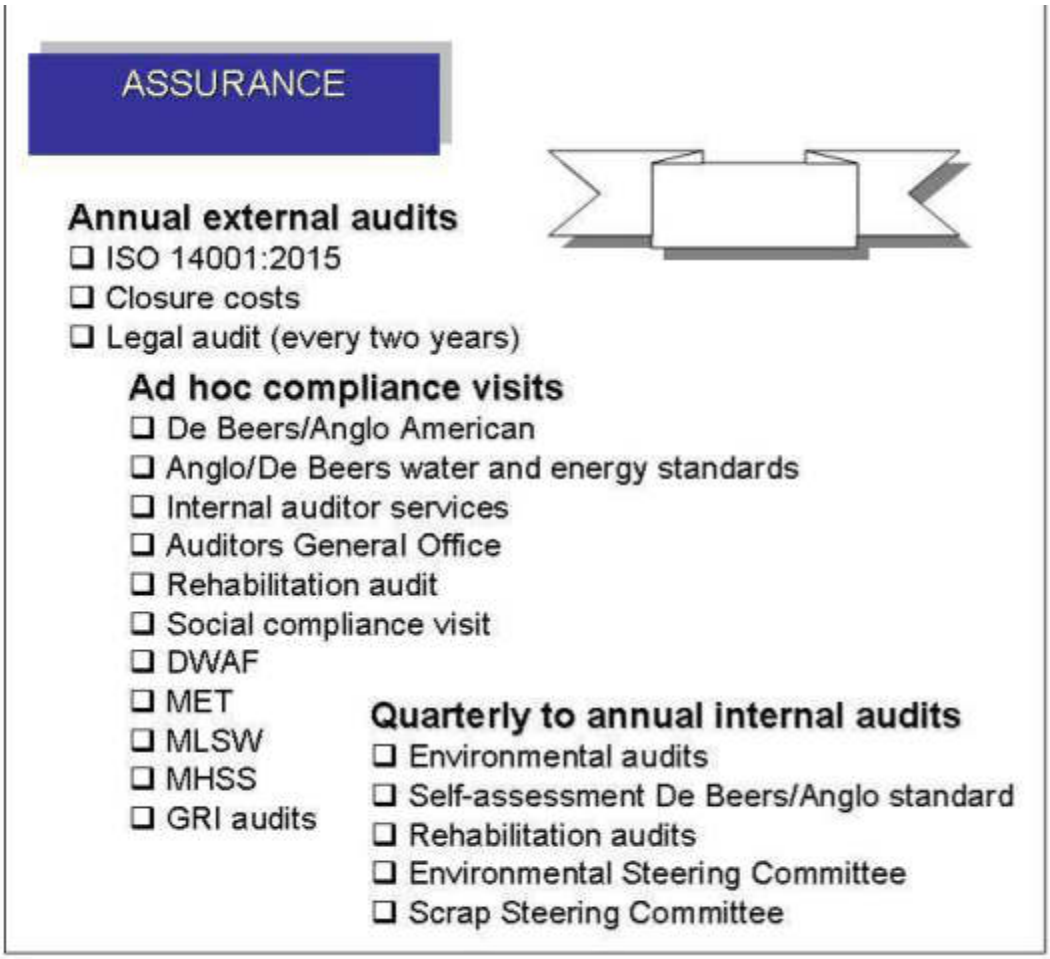


Figure 37: Environmental audits and certification at Namdeb (DWAF= Department of Water Affairs and Forestry, GRI= Global Reporting Initiative, MET= Ministry of Environment and Tourism, MLSW= Ministry of Labour, MHSS= Ministry of Health and Social Services).

All Namdeb's operations are ISO14001:2015 certified. Namdeb transitioned to the new ISO14001: 2015 standard in May 2018. The first certificate in ML42 was obtained for Daberas in 2000. The certificate for Sendelingsdrif was obtained in 2015 and both mines have maintained certification since then.

ENABLON 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's operations.

6.5 Impact monitoring

Namdeb environmental staff regularly collates data on consumption of

- ◊ Surface and underground water
- ◊ Fuel
- ◊ Energy and
- ◊ Selected chemicals used in processing.

These are interrelated with impacts during operation.

6.5.1 Resource use

Total average annual energy consumption for the previous reporting period (2015-2018) was 18,882,101 kWh. For 2019 and 2020, this figure was 17,305,000kWh. In 2019, the limit was exceeded, due to expansion in mining operations at Obib.

Electricity demands for ORM were above the monthly budgeted limits for nine months during 2020. Electricity saving initiatives are being investigated at ORM.

Recycling efforts at Daberas and Sendelingsdrift for 2019 and 2020, were under the target of 70%. The target was not met due to technical difficulties experienced during this period. In 2021, however, the target of over 80% was met (Katjirua, pers. Comm. Nove 2021). Water abstraction at Daberas and Sendelingsdrif remains well below the water abstraction permit limit.

6.5.2 Pollution monitoring

Regular pollution monitoring at Namdeb focuses on water quality in the Orange River, in monitoring boreholes and at all sewage treatment plants. Monitoring boreholes are drilled around the FRD facilities to monitor seepage. Staff's exposure to dust and noise is monitored, when needed.
As part of the water disposal permit issued by DWA, sewage and oil water separator effluent samples are taken regularly and sent for analysis. The results are forwarded to the Ministry of Agriculture and Land Reform (DWA) on an annual basis.

The water at the Sendelingsdrif inpit facility is surveyed on request. The last survey was in 2020.
Table 8. Pollution monitoring in Orange River Mines Licence Area.

Component	Monitoring points	Parameters	Frequency
Water quality	Orange River upstream and downstream of Daberas and Sendelingsdrif water intake All effluent water (raw sewage before and after chlorination) Water purification (before and after UV treatment) Washbay All boreholes	Microbiological and chemical analysis	Quarterly
Water quantity	Boreholes, zone 7 Daberas and Sendelingsdrif	Depth	Monthly
Air quality	Dust	Dust suppression measures	On a needs basis
Carbon emissions	Determined from diesel, oil and electricity consumption		Monthly
Noise	Noise level	PPE required in high noise areas	On a needs basis

6.5.3 Impacts on biodiversity and natural resources

Namdeb has supported the Namib Desert Brown Hyena project since 1999. Although the focus was initially on Lüderitz and surrounding, the project extended its activities also to the Orange River. The project has 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 to relevant data collection points.

6.5.4 Rehabilitation monitoring

Monitoring of restoration pilot sites has been on-going in Orange River Mines since 2007. Restoration trials at Sendelingsdrif are monitored once a year.

The Sendelingsdrif Rehabilitation Task Team (SRTT) coordinates the development of a comprehensive rehabilitation plan for Sendelingsdrif and facilitates the flow of information between planners and restoration experts. The SRTT also oversees rehabilitation of the Sendelingsdrif mine to its agreed end land-use status and facilitates meeting the Sendelingsdrif restoration goals. SRTT comprises the Environmental Section at Namdeb, restoration experts, mine planners and engineers involved with the Sendelingsdrif project.

To contain the final mining footprint, the waste rock dump at Sendelingsdrif is to remain above the 1:100 year flood-line, as per government directive, and controls were put in place to achieve this. This included the placing of drums to outline the permitted disposal area and daily site visits by the surveyor. A review of compliance to mine planning is undertaken monthly.

6.6 Stakeholder engagement

Effective environmental management cannot be achieved in isolation. Engaging stakeholders and creating awareness is therefore an important function of Namdeb's environmental staff. In addition to ad hoc public consultations related to impact assessments for specific projects, Namdeb has two regular, external fora for information exchange – the Marine Scientific Advisory Committee and the Namdeb Stakeholder Forum.

For the purposes of this report, Enviro Dynamics has publically invited stakeholders to gain access to these documents. Those who registered were added to the Namdeb stakeholder database. The documents were circulated for information and comment for a two-week period (24 February to 9 March 2022) and at the end of the period, no inputs were received.

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. Site specific environmental inductions are conducted for all new employees and refresher inductions are given to all employees annually. Contributions are also made to regular newsletters and presentations. Namdeb is represented on many working groups dealing with environmental matters affecting Namdeb's licence areas. Namdeb has committed to maintaining on-going communication with key stakeholders on the progress of exploration and mining operations in ML42.

Chapter 7 Environmental Assessment 2022-2024

Key environmental aspects, in the Orange River Mines licence area, as was the case when the 2018 EMPR was submitted, are the partial loss of a unique Orange River valley environmentally sensitive habitat (biodiversity and archaeology), appropriate closure of the large tailings facility at Daberas, implementation of rehabilitation measures at Daberas, concurrent rehabilitation at Sendelingsdrif and Obib, effectiveness of restoration measures at Sendelingsdrif and Obib and the sound management and rehabilitation of exploration activities. Aspects also include social closure and transition activities. These impacts now receive greater attention for this reporting period.

7.1 Approach

Environmental risks at Namdeb are continuously reviewed and updated for new projects, depending on magnitude of the new disturbances to the environment, following the formal environmental assessment process or, in the case of minor changes to existing mining and exploration activities, internal impact assessments are undertaken by Namdeb's environmental staff. The environmental risks summarised for the previous period are still valid but have been augmented with social impacts, as identified for the Social Impact Assessment (2019). The assessment methodology being used for Namdeb remains constant, as described below.

7.2 Assessment methodology

Namdeb is obliged to follow Anglo American's pre-scribed risk assessment. This matrix also underlies the assessment process for environmental aspects in the computerised EMS (IsoMetrix). 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. 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.

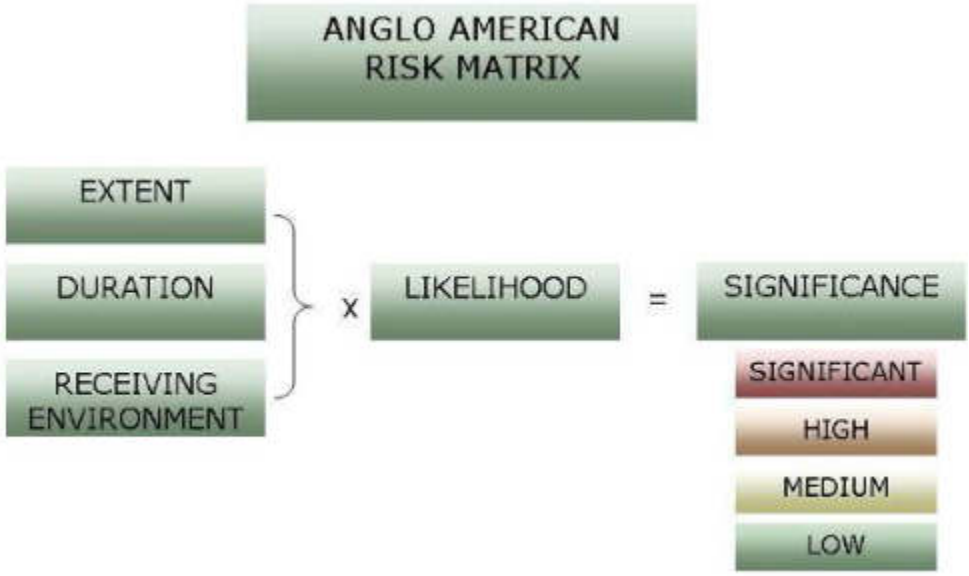


Figure 38: The algorithm used in the Anglo-American risk matrix.

Table 9. Environmental assessment criteria from Anglo 5x5 matrix.

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

Table 10. 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. An additional criterion has therefore been added in the impact register (Annex 2).

7.3 Environmental risks and their significance

Description of all high and significant impacts is provided in Annex 2. Mitigation measures are included in the Environmental Management Programme (EMP) for all high and significant impacts, and some medium and low impacts where mitigation is very effective and presently applied.

Table 11 shows the main negative impacts on the natural environment associated with exploration and mining activities in ML42.

The main environmental aspects in the Orange River Mining Licence Area are related to the

- ◊ Partial loss of Orange River terrace habitat with (1) some extremely range-restricted plant species, threatened with extinction – the only impact in all Namdeb's licence areas rated as 'high" (Table 9), and (2) stone age archaeological sites
- ◊ Appropriate closure of the large tailings facility at Daberas
- ◊ Visual impact of the remaining post-mining landscapes at Daberas, Obib and Sendelingsdrif
- ◊ Effectiveness of rehabilitation/restoration measures at Sendelingsdrif
- ◊ Rehabilitation of exploration areas.

The following assumptions have been made in the assessment:

- The environmental procedures already integrated with Namdeb's environmental management system, will be carried forward and implemented during the next phase of operations. For instance, no new areas will be opened up during any of the operations unless it has been specifically authorized to do so.
- Standard procedures for health, safety and waste management will be maintained.
- The current staff complemented for ORM will be retained by utilizing them in a diversified way, for instance the planned exploration programme for ORM. Therefore, the social impact assessment does not consider social closure issues.

- The impact assessment does not cover the positive impacts of mine closure and rehabilitation, i.e. the positive impact of re-vegetating an area or reshaping a mining pit. These impacts are accepted as positive but are considered mitigation measures of the initial negative impacts of the mine on the natural environment.

Table 11. Overall rating of negative environmental impacts associated with exploration and mining in Mining Licence 42 (Orange River Mines).

ML 42	Loss of flagship species	Habitat loss	Habitat change	Loss of biota	Effect on biota	Water quality	Soil quality	Air quality	Natural resources	Visual	Heritage
EXPLORATION											
Drilling and sampling pits in natural areas											
Drilling and sampling pits in disturbed areas											
MINING											
Overburden stripping, ore excavation and transport											
Dump and berm construction											
Fine tailings disposal											
Coarse tailings disposal											
Stockpiling of excavated and screened material in natural areas											
Stockpiling of excavated, screened material in disturbed areas											
Blasting											
Ferrosilicon losses with tailings											
Transport of ore from Obib and Arrisdrift to Daberas											
Freshwater usage											

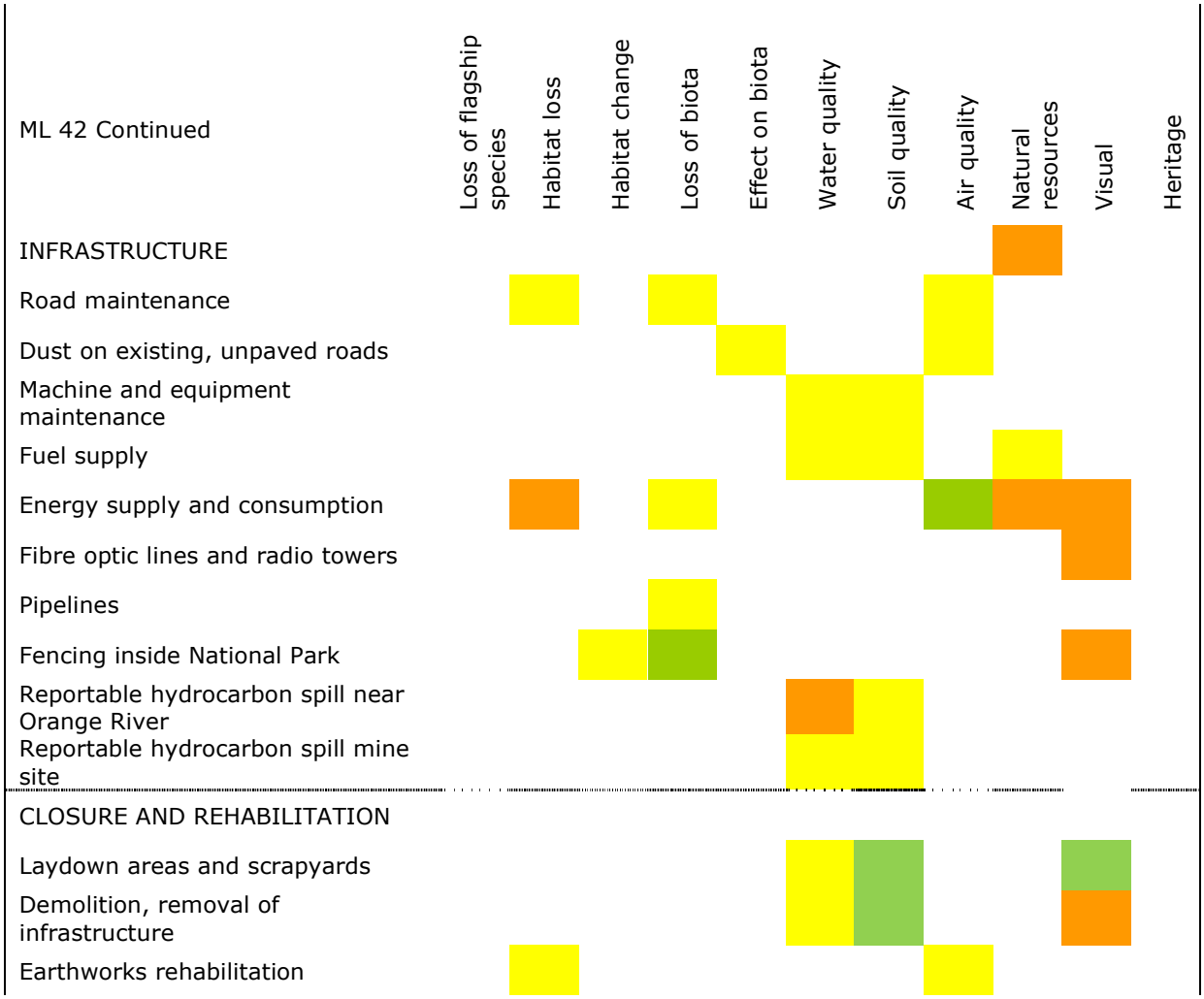

ML 42 Continued
Loss of flagship species
Habitat loss
Habitat change
Loss of biota
Effect on biota
Water quality
Soil quality
Air quality
Natural resources
Visual
Heritage
INFRASTRUCTURE
Road maintenance
Dust on existing, unpaved roads
Machine and equipment maintenance
Fuel supply
Energy supply and consumption
Fibre optic lines and radio towers
Pipelines
Fencing inside National Park
Reportable hydrocarbon spill near Orange River
Reportable hydrocarbon spill mine site
CLOSURE AND REHABILITATION
Laydown areas and scrapyards
Demolition, removal of infrastructure
Earthworks rehabilitation

Table 12. Overall rating of positive and negative socio-economic impacts associated with mining activities in ML42 (Orange River Mines) for the next three-year period.

SOCIO-ECONOMIC	Positive	Services	Social structure
Positive			
Contribution to Namibian economy	S		
Increased skills and employment	S		
Development of technology	S		
Improved scientific knowledge (geology, biodiversity and heritage)	S		
Community support and awareness	S		
Sustained employment	S		
Sustained social services	S		
Science and cultural heritage	L		
Negative			
In-migration			M
Labour migration system			M
Increased traffic on public road due to ore transport from Obib to Daberas		M	
Safety of product		M	

7.4 Cumulative effects and high significance impacts

7.4.1 External factors

The following are external factors of impacts on the biophysical and social environment beyond Namdeb's jurisdiction:

- The Orange River has the largest catchment of any river in southern Africa, and is impacted by water abstraction, industrial and agricultural pollution, wood clearing of riverbanks and a multitude of impoundments which have altered its natural flow regime.
- The current Covid-19 pandemic situation, the historic drought situation and other macro-economic factors have contributed to the current economic slump in Namibia.
- The Sperrgebiet and neighboring regions are being investigated for the development of hydrogen, wind and solar plants and associated infrastructure. These developments are potentially significant and if pursued, will change the entire economic, social and biophysical landscape of the Tsau //Khaeb National Park and the region.

7.4.2 Namdeb internal factors

Impact on *Juttadinteria albata*, *Amphibolia obscura* populations

Most ancient river terraces along the lower Orange River are diamond-bearing and are mined on both sides of the river in South Africa and Namibia. These terraces not only contain diamonds but also form a unique habitat which supports an assemblage of rare plants. In Namdeb's case the mining activities at Sendelingsdrif will eliminate a large part (39% of the world population) of the core, healthy population of the rare succulent *Juttadinteria albata*. Although a survey in 2004 supported by Namdeb established that these plants also grow in mountain habitat around the core population, the newly discovered subpopulations are smaller and not all in a healthy condition (Burke 2004b).

A large population of another rare succulent shrub, *Amphibolia obscura*, has been affected by mining the Obib deposit. Although the plant is not as range-restricted as *Juttadinteria albata*, the Obib terraces support one of the largest, known populations.

It is recommended that the impact of the current mining activities at Sendelingsdrif and the ceased activities at Obib be assessed by a specialist to determine the state of the population of the mentioned two species and that mitigation be identified accordingly.

Figure 39: Threatened, range-restricted species occur in ML42 (Orange River Mines) – Juttadinteria albata (top left), Sarcocaulon multifidum (top right), Amphibolia obscura (bottom left) and Portulacaria pygmaea (bottom right) These deserve particular attention when populations of these species are affected by mining (Photo's: 2018 EMPR)

Archaeological sites on Orange River terraces

Although archaeological open Stone Age sites are abundant on the Orange River terraces, and these sites are not protected by law and can be destroyed during *bona fide* mining, if all terraces are eventually mined, this would lead to the loss of an entire unstudied culture (Noli 2010). Although significant archaeological sites in the vicinity of mining operations have been protected, no witness sections for substantial archaeological ESA, MSA and LSA remains have been formally agreed and delineated on Orange River terraces.

Since the meso terraces are being targeted for exploration, it is recommended that an archaeological investigation be launched to identify sites for protection or relocation.

7.5 Shortcomings

7.5.1 Uncertainties

The previous impact assessment had identified some gaps in knowledge, and these are still relevant:

- ◊ The effect of dust on natural ecosystems and associated biota and
- ◊ Namdeb's contribution to the quality of the Orange River ecosystem.

Yet, these are not rated "high" or "significant" in the context of this EMPR and thus do not necessarily require further in-depth study. It is recommended that a monitoring programme be launched at dust affected habits with non-dust affected habitat sites are control. The Waste Management Strategy has recommended thorough cleaning up of sites that may affect the water quality downstream. This important recommendation is re-iterated here.

There is also a lack of baseline information on some biodiversity components such as invertebrates and soil biota.

Although efforts have been made to contribute to restoration, more understanding is required with regard to

- ◊ Natural recovery potential of all impacted habitats and vegetation types in response to different disturbances related to mining
- ◊ Effective restoration methods for all sensitive habitats affected by mining and
- ◊ Ecosystem function and services contributing to restoration (e.g. soil properties and processes and microclimatic parameters).

Namdeb is not necessarily responsible for closing all these gaps; particularly where practical considerations such as available expertise, identification and curating services in the case of biodiversity baseline information, suggest that results may not be available in the time frame required to manage the anticipated impacts.

Contributing to overarching programmes such as biodiversity monitoring undertaken by the Ministry of Environment and Tourism in the Tsau//Khaeb (Sperrgebiet) National Park would be an opportunity to help closing knowledge gaps.

Chapter 8 Environmental Management Plan 2022-2025

The Environmental Management Plan outlines overall environmental tasks, provides management actions for all high and significant impacts and describes rehabilitation activities and the required environmental monitoring during operation and at closure. This updated EMPR includes all the original management actions, as well as updated ones for the period 2022-2025.

Environmental management tasks are organised according to overall tasks which are necessary for the implementation of the EMP, then significance and finally rehabilitation and closure. 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. All policies and procedures directly referred to in this EMP are provided in Annex 4, while the full suite of standard policies and procedures related to environmental management and applicable to all licence areas is available on request. The management actions in this EMPR therefore focus on key aspects and prioritising environmental management tasks.

The management objectives are applicable to all management tasks in this EMP and are described below and therefore not repeated for each individual task. Impact descriptions are provided in the impact register in Annex 2. The management objectives for this EMP are described in Table 13.

Table 13: Namdeb Environmental Objectives and Key Performance Indicators

NAMDEB
A Namibia De Beers Partnership

MINEWIDE ENVIRONMENTAL OBJECTIVES AND KEY PERFORMANCE INDICATORS 2021

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



R.J. Jacob
Chief Operating Officer



The following legislation is directly applicable to the management actions 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.

Permits are constantly being updated and being reported on in the 6-monthly environmental monitoring reports.

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 all and particularly for 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, De Beers) and Namdeb internal reporting standards (PR-EV22, PR-EV-23) • Improve and maintain environmental data capture, storage and retrieval
I&APs	• Present relevant key features of updated EMPR at Namdeb regular stakeholder engagement (PR-EV-16)

HIGH ENVIRONMENTAL RISKS

Aspect	Mitigation and control measures	Legal
Mining		
Stripping of overburden and ore excavation at Sendelingsdrif	• Implement progressive rehabilitation by continuous backfilling • Regularly track backfilling progress • Foster plant rescue, temporary storage and development of propagation techniques for identified target species, including *Juttadinteria albata* • Implement restoration programme	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 14
Stripping of low grade and ore excavation at Obib	• Re-shape mined landscape to simulate natural environment and facilitate re-establishment of vegetation, complete all other closure tasks as set out in closure plan for Obib. • For detail, see measures under "rehabilitation and closure"	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 14, 18

SIGNIFICANT ENVIRONMENTAL RISKS

Aspect	Mitigation and control measures	Legal
Exploration		
Drilling, trenching and sample pits in natural areas	• Identify and demarcate all environmentally sensitive areas • Clearly demarcate with signs, where practical and prohibit access to all environmentally sensitive areas • 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 process (sampling and evaluation), 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 • Conduct an investigation of the archaeological sites to be protected/removed and implement the recommendations.	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 14, 15
Mining		
Riparian belt at Daberas	• Determine requirements for backfilling and re-establishment of riparian vegetation with key stakeholders.	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 14
Low-grade stockpile dump construction at Obib	• Place low-grade stockpile on disturbed area to the east of the area to be mined • Create low dump with rounded footprint and rounded slopes (guideline: slope angles 5-15º)	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 14, 18
Dump and berm construction	• Develop and maintain monitoring plan for vegetation regrowth to obtain indication of natural recovery potential • Further measures: see rehabilitation and closure	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 14
Fine residue disposal	• Dispose fines at Daberas and at Sendelingsdrif into mined out areas in consultation with Environmental Section • Continue ground- and surface water monitoring • Eradicate invasive alien plants at old and new fine residue disposal sites	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 14, 15
Coarse tailings disposal at Daberas	• Dispose coarse tailings in mined out areas and spread out as much as possible to cover bedrock areas	1, 2, 3, 4, 5

Stockpiling of excavated and screened material in natural areas	• Demarcate, where necessary and put up "off limit" signs for all environmentally sensitive areas near mining and exploration activities • Use disturbed areas for stockpiling, when available • Shape stockpiles to low, rounded "hills", if remaining in the area after mining ceases	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 14, 15
Services and infrastructure		
Freshwater (usage and pipelines)	• Maximise water recycling by monitoring and keeping up-to-date, easily retrievable records of freshwater use per plant site • Develop, support and implement all water-saving strategies • Monitor for leaks along pipelines and remedy instantly • Remove invasive aliens plants along water points and lines not within the 1:100 year flood-line	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 14, 15
Energy supply and consumption	• Dismantle power lines no longer in use • When constructing new power lines, bird distracting devices to be tested where bird flight paths cross power lines • Monitor bird mortalities as feasible on existing power lines in consultation with stakeholders. • Identify, introduce and encourage energy-saving measures, wherever possible	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 14, 15, 16
Fibre optic lines and radio towers	• Erect new radio towers or fibre optic lines only with agreement from the Environmental Section • Fibre optic lines and radio towers to be dismantled when no longer in use, unless identified for future land 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 • Replace fences used for safety measures with berms or other suitable types of barricades	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 14
Reportable hydrocarbon spills near Orange River	• Clean-up of spill as soon as possible following Namdeb policy PO-EV-07 and procedure PR-EV-07 • Monitor water quality up- and downstream of pollution source to establish whether mitigation is required	1, 7, 8, 15
Closure and rehabilitation		
Demolition, removal of infrastructure	• Use building rubble to fill voids where feasible according to the rehabilitation plan. Shape and cover with overburden. • Removal all scrap metal and other waste according to the demolition plan and waste management strategy.	

MEDIUM ENVIRONMENTAL RISKS

Aspect	Mitigation and control measures	Legal
Mining		
Blasting	• Secure blasting sites, no environmental measures required	1, 2
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 areas where oils and lubricants could be spilled • Remove polluted soil to closest remediation site • Use dedicated wash-bays for machine and vehicle cleaning	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 14, 15
Fuel supply	• Place bunding beneath fuel tanks • Use bunded areas for re-fuelling	1, 2, 3, 4, 5, 7, 8
Reportable hydrocarbon spill on mine site	• Follow procedure PR-EV-07	1, 2, 3, 4, 5, 7, 8, 9, 10, 11, 14, 15
Socio-economic		
In-migration and safety of product	• Make people aware of access restrictions and monitoring along public road • Ensure transparent and fair recruitment/ tender adjudication process	6
Archaeology	• Investigate significant archaeological sites on meso terraces where exploration is envisaged, for removal/conservation and implement any recommendations.	11
Closure and rehabilitation		
Laydown areas scrapyards, bioremediation sites and other waste disposal sites, infrastructure	• Implement the pollution remediation measures recommended in the waste management strategy including environmental conditions survey and implementation of prescribed remediation measures to achieve desired success levels.	
Earthworks rehabilitation	• Implement the measures prescribed to prevent further loss of habitat to prevent new areas from being disturbed. • Implement dust suppression where health of workers is at risk.	

LOW ENVIRONMENTAL RISKS		
Aspect	Mitigation and control measures	Legal
Mining		
Ferrosilicon losses with tailings	• Maximise Ferrosilicon recycling	1, 2, 3, 4, 5, 7, 8
Closure and rehabilitation	• Implement the remediation measures prescribed in the Waste Management Strategy until environmental conditions survey proves soils screen to levels consistent with the environment. • Removal all waste after demolition and clean up to achieve the end land use acceptable to stakeholders, according to the Closure Plan.	

In instances where impacts are unknown, but could potentially become significant, and where the effectiveness of management actions needs to be tracked, regular monitoring of appropriate environmental parameters is required.

ENVIRONMENTAL MONITORING DURING OPERATION			
Aspect	Parameter	Frequency	Comments
Freshwater			
Water quality	Up- and downstream of Daberas and Sendelingsdrif water intakes	Quarterly	
	Sewage effluent (raw, before chlorination and after treatment)	Quarterly	
	Water purification (before and after treatment)	Quarterly	
	Washbay (raw, after sediment filter and after carbon filter) at Sendelingsdrif	Quarterly	
Groundwater	Water quality in monitoring boreholes at Daberas and Sendelingsdrif	Quarterly	
	Water level in monitoring boreholes at Daberas and Sendelingsdrif	Monthly	
Biodiversity			
Restoration	Vegetation (plant species cover, richness, composition and structure) at pilot sites Target species survival Rehabilitated areas: vegetation at selected sites	Annually during vegetation season	
Invasive aliens	Emergence of invasive alien plants on mine site, at distance > 200m from Orange River bank and above the 1:100 year flood-line	Ad hoc	

The management tasks listed below are general guidelines with detailed task lists provided in the Integrated Closure Plan (ICP) and its various Strategies, namely the Biodiversity Action Plan (2021), Integrated Water Management Plan (2021), Waste Management Strategy (2021), Demolition and Landscaping Report (2021), Namdeb's Cultural Heritage Management Plan (2020) and more specifically the Biophysical Rehabilitation Pan for ML42.

The following structures are to be removed in ORM (Demolition and Landscaping Report, 2021):

Table 14: Infrastructure to be removed from east to west along the river.

Mine	**Description**
Daberas	
Office buildings (Domain 8)	Buildings and containers, foundations
Workshops, storage and shade parking	Open sheds, buildings and containers
Water supply infrastructure (Domain 10)	Water reservoirs and pump stations and foundations
Sewage plant	Biofilter trickling facility
Fuel station and wash bay (Domain 9)	Above-ground tanks and underground polluted water capture facility, oil separators, foundations
Explosives magazine (Domain 2)	Strengthened building and foundations
Bioremediation sites (Domain 11)	Concrete foundations
Treatment plant (Domain 5)	Processing plant, DMS, conveyors, recovery
Remaining B&E structures	Containers, buildings
Linear infrastructure (Domain 1)	Water and fine residue pipelines, power lines, fibre optic lines
Fences	Fences around some prospecting sites
Obib	
Gate (Domain 4)	Container
Sendelingsdrif	
Offices (Domain 7)	Containers
Workshops and storage	Open sheds, containers
Nursery	Open shed
Water supply infrastructure (Domain 9)	Water reservoirs and pump stations and foundations
Sewage plant	Biofilter trickling plant
Fuel station and wash bay (Domain 8)	Above-ground tanks and underground polluted water capture facility, oil separators, foundations
Treatment plant (Domain 4)	Processing plant, DMS, conveyors
Linear infrastructure (Domain 1)	Water and fines pipelines, power lines, fibre optic lines
Remaining ML42 (Satellite domain)	
Sendelingsdrif gate	Buildings and ablution facilities

The man-made features and earthworks rehabilitation tasks from east to west along the river are as follows (Demolition and Landscaping Report, 2021).

Table 15*: Man-made features and earthworks rehabilitation tasks from east to west along the river.*

Component	Description	Task
Arriesdrif		
	Exploration trench to remain	Clear demarcation of exploration trench with fossils Ensure landscape, except for exploration trench looks natural
Auchas		
Exposed bedrock	Mined out bedrock areas, north and south of the public road. Partially excavated areas north of the road (e.g. AM02) still contain viable deposits and may be mined in future.	Decision on mining, development of rehabilitation measures accordingly
Pit	Deep pit to remain	Secure with berms of 1.5 m height
Overburden dumps	Some overburden dumps along the public road and in sight of the road have been reshaped.	No further reshaping is scheduled.
Tailings dump	Tailings dump	Edges were reshaped to make a more rounded landform
Stockpiles	Some stockpiles are still remaining at the old plant site.	Reshape (to rounded low dumps)
Fine residue disposal facility	Reeds have established on the fine tailings dam and prevent dust and erosion.	Prove technical and chemical stability (include in study for Daberas)
Daberas		
Mining pits (Domain 3)	Zones 11 and 13, open water remaining in some pits	Partly backfilling of Zone 13 to reconstruct riparian belt Cover all exposed, artificial water bodies with overburden Demonstrate stability of pit walls
Exposed bedrock		No rehabilitation
Meso stockpiles	Stockpiles from meso sample	Reshape to low rounded dumps
Tailings dump (Domain 7)		Reshape sharp edges and crests and create channel

ENVIRONMENTAL MONITORING AT CLOSURE			
Aspect	Parameter	Frequency	Comments
Water			
	Water quality upstream and downstream of fine residue disposal facilities	Annually	Only, if risk of potential pollution remains
Restoration monitoring at Daberas and Sendelingsdrif			
Vegetation monitoring and landscape stability of restored areas	Vegetation (plant species cover, richness, composition and structure) and erosion on restored and naturally recovering areas at Sendelingsdrif.	Annually, during vegetation season	Monitoring for five years or until completion criteria are reached, if < 5 years
Restoration monitoring at Obib			
Vegetation monitoring and landscape stability of restored areas	Survival of target species Vegetation (plant species cover, richness, composition and structure) and erosion on restored and naturally recovering areas at Obib	Annually, during vegetation season	Monitoring for five years or until completion criteria are reached, if < 5 years
Invasive alien plants on mine site (excl. riparian habitats)	Re-emergence of invasive alien plants	Annually during vegetation season	Until no more alien plants emerge
Remediation	Hydrocarbon content of treated soil	Annually	Until remediated soil < 0.1% hydrocarbon content (TPH < 1000ppm).

Chapter 9 Annex

The annex summarises the author's credentials, presents all applicable legislation and provides a list of biodiversity specialist studies, an impact register, reviewed literature and Namdeb's environmental policies and procedures applicable to environmental management in ML42.

9.1 Annex 1. The environmental practitioner.

Antje Burke (Original EMPR compiler)

Academic qualifications

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

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

Stephanie van Zyl (EMPR update)

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

Stephanie has twenty-five years' experience in Environmental Management and Public Participation and Facilitation (Environmental and Social Assessment, Environmental Management Plans, Environmental Education, Environmental

Management Systems, Environmental Monitoring and Evaluation), Urban and Regional Development Planning, Socio-Economic Research, Land Use Planning, and Project Co-ordination.
She has been involved in or acted as the principal consultant for a number of large-scale environmental and social assessments in the following sectors:

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

9.2 Annex 2. Impact register

The impact register provides a description of significant and high impacts. All impacts rated "significant" (S) and "high" (H) require management. A description of these impacts is included below, management actions are outlined 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. Other, 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 all 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, infrastructure and services, marine contractors and socio-economic.

9.2.1 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

9.2.2 Mining

Impact category	Description	Significance	Reversibility
	Overburden and low grade stripping, ore excavation and transport of material		
Loss of flagship species	Loss of species threatened with extinction: substantial portion of world population of succulent *Juttadinteria albata* and *Amphibolia obscura* is eliminated by mining	High	Low
Loss of habitat	Clearing of vegetation at mine site and through creation of access roads	Significant	Medium
Loss of biota	Clearing of vegetation at mine site and through creation of access roads	Significant	Medium

Dust impact on biota	Driving along unpaved roads and excavation of material at mine site deposits dust on vegetation and soil	Medium	High
Archaeology	Some Early and Middle Stone Age open sites on the Sendelingsdrif terraces will be eliminated by mining, but these are not unique and occur also elsewhere along the river.	Significant	None
Archaeology and fossils	Uncovering of archaeological and fossil sites	Medium positive	Not applicable
	Destruction of archaeological sites during stripping on meso-terraces	Significant	None
	Fine tailings disposal in tailings storage facilities		
Change in habitat	Natural vegetation cleared and replaced by wetland-type habitat	Significant	None
Change in water flow	Fine tailings disposal facility at Daberas is in a large drainage area	Significant	None
Loss of biota	Wildlife casualties occur occasionally in wet sections of tailings facility	Medium	Low
Visual	Large fine tailings disposal facility at Daberas next to public road	Significant	Medium
Dust impact on biota	The tailings facilities generate additional dust which is deposited on plants and soil in the vicinity	Medium	High
Water quality	Impact on Orange River through dam failure and effect of seepage from dam on groundwater	Low	None
	Coarse tailings disposal on tailings dump at Daberas		
Visual	Tailings dumps at Daberas are visible from public road	Significant	Medium
	Dump and berm construction		
Visual	Dumps and berms along public road at Dabaras and Sendelingsdrif detract from wilderness aspect in National Park	Significant	Medium
Change in water flow	Dumps and berms in drainage lines block water flow	Significant	Medium
Loss of habitat	Smothering of vegetation under dumps and berms	Significant	Low
Loss of biota	Elimination of vegetation and associated biota	Significant	Low
	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
	Closure and rehabilitation		
Visual	Loss of visual resources if demolished rubble, and scrap is not removed from the area	Significant	Low

9.2.3 Services and infrastructure

Impact category	Description	Significance	Reversibility
	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 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
Visual	Fences in national park detract from wilderness aspect	Significant	High
	Reportable hydrocarbon spills near Orange River		
Water quality	Large hydrocarbon spills from re-fuelling, maintenance and faulty equipment can pollute surface and groundwater	Significant	Medium

9.3 Annex 3. Literature

Added to EMPR Update (2021)

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9.4 Annex 4 Legal and regulatory requirements

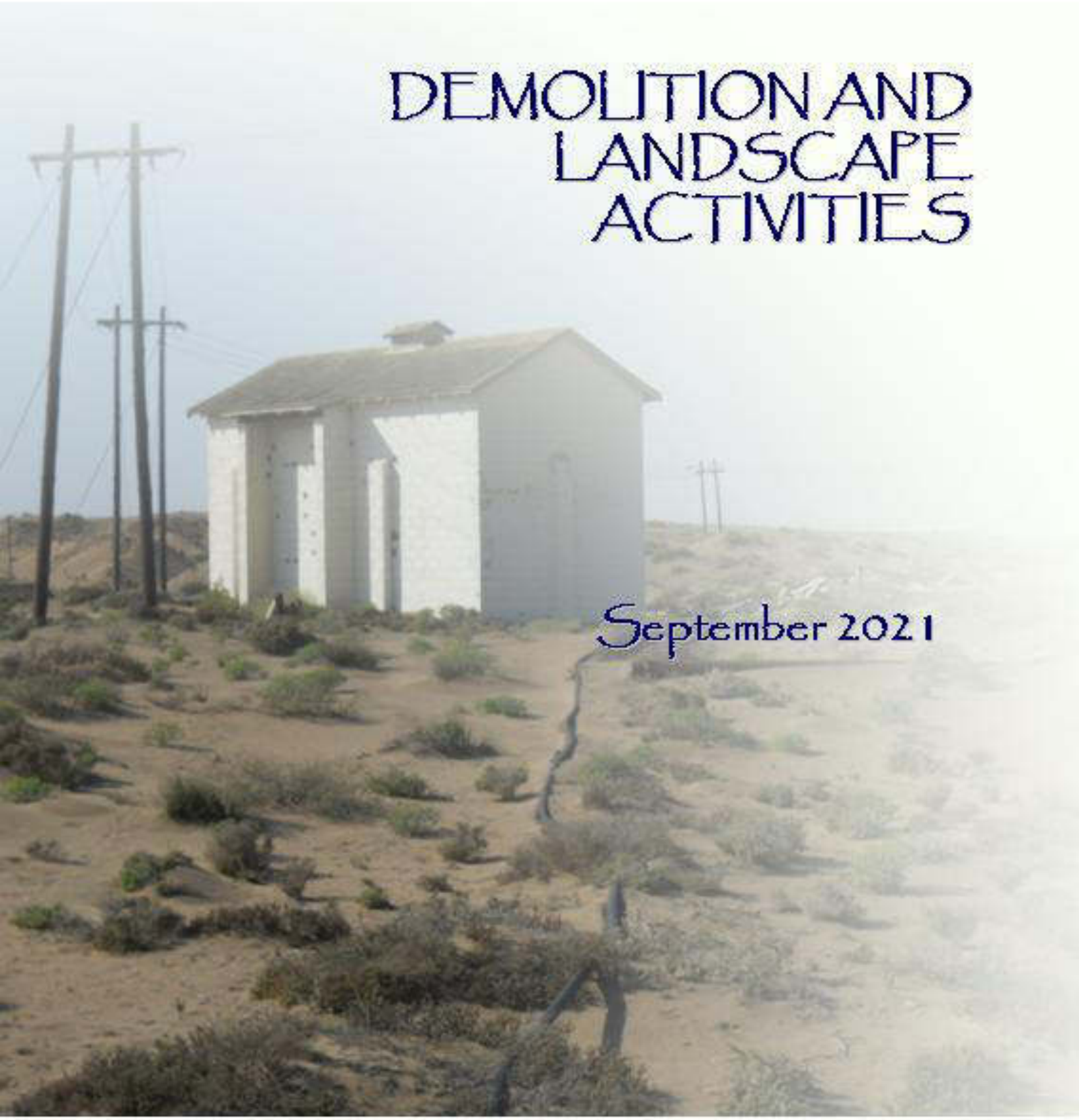
Legislation	Applicability
MINING LEGISLATION	
Mineral Act, 1992	Rehabilitation requirements, environmental status prior to mining/prospecting, pollution control measures, liability for pollution
Minerals (Prospecting and Mining) Amendment Act, 8 of 2008	Requirement of EMPR
Diamond Act 13 of 1999 and 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
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
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 Act, 54 of 1956	Permitting for industrial effluents
Water Resources Management Act, 11 of 2013 (not in force yet)	Protection, development and management of water resources; licencing water abstraction, 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; 18.1 Regulations relating to the exploitation of marine resources, GN 241 of 7 December 2001; 18.2 Regulations relating to Namibian Islands' Marine Protected Area, GN 316 of 31 December 2012	Protection of marine habitats and animals
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	
//Tsau Khaeb National Park Management Plan 2020	Delineation of the Park into zones, with land uses assigned to each for their management and protection
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, technical rules, GN 47 of 2016, economic rules, GN 46 of 2016	Electricity generation licences
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 with Endangered Species (CITES)	Internationally accepted list of plant and animals species under trade restrictions

9.5 Annex 5: Demolition and Landscape Report

DEMOLITION AND LANDSCAPE ACTIVITIES



September 2021

NAMDEB

A NAMIBIA DE BEERS PARTNERSHIP

Enviro Science

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Summary

1. **Introduction** – This report contributes to Namdeb's Integrated Closure Plan and describes demolition and landscaping (earthworks rehabilitation) tasks for Namdeb's ML42, ML43 and ML44.

2. **Objectives** – The vision for closure 'to hand over all licence areas in a condition that supports sustainable land uses agreed with the landowner' has guided rehabilitation at Namdeb for over a decade. This means in practice and by law that all structures will need to be demolished for which no future use is agreed upon with the regulator. Requirements for landscaping (earthworks rehabilitation) are less rigidly legislated and aspects such as natural recovery potential and processes of landscape and biodiversity recovery as well as visual impacts guide the level of intervention. These are difficult to quantify and are to some extent subjective.

3. **All Namdeb areas** – Closure criteria and tasks for demolition and earthworks rehabilitation which apply to all licence areas are listed and described. These typically include treatment plants and accessory infrastructure, workshops, stores, offices, accommodation as well as linear infrastructure related to power and water supply, communications and transport. Earthworks rehabilitation tasks include similar steps in terms of the process of rehabilitation, but are specific for each mine site.

4. **ML42** – Five mining sites in ML42 require rehabilitation. Some additional closure criteria apply as a public road traverses the mine sites at Auchas and Daberas. Infrastructure to remain includes the historic police stations at Sendelingsdrif and Hohenfels, sections of the original (then private) road between Oranjemund and Sendelingdrif and two buildings. All other structures will be removed. Cultural heritage sites and Sites of Special Scientific Interest such as the exploration trench with Miocene fossil at Arriesdrif are excluded from earthworks rehabilitation. Earthworks rehabilitation tasks at closure focus on safety of the mine sites, remediating pollution, re-establishing natural flow where necessary, re-establishing biodiversity at priority sites, and addressing visual aspects.

5. **ML43** – Additional closure criteria related to the shaping of dumps apply in ML43. Some infrastructure to remain has been agreed with the regulator (Affenrücken and Mittag Hostel and three buildings at Baker's Bay), but there are many more structures which need to be considered to support mining-based tourism after closure. 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, these need further investigation and agreement with the regulator.

6. **ML44** – Demolition and earthworks rehabilitation in ML44 is possibly required at a site north of Pomona where the subcontractor Sonnberg Diamante operated. There is infrastructure to be removed, pollution to be remediated and the requirements for earthworks rehabilitation need to be established.

However, the liability is currently disputed between Namdeb and the subcontractor.

7. **Gaps** – The need for earthworks rehabilitation is very subjective and this needs to be agreed with the regulator. Also infrastructure to remain needs to be formally agreed with the regulator. Rehabilitation tasks for Obib and Auchas need to be finalised.

8. **Stakeholder engagement** – Stakeholder engagement is required to agree on demolition and earthworks rehabilitation tasks at Namdeb. This will include internal and external stakeholders and should follow a step-by-step approach. Existing channels should be used as far as possible (e.g. the Lüderitz and Tsau//Khaeb (Sperrgebiet) National Park stakeholder fora), but a dedicated interaction related to closure overall is necessary. This should include the demolition and landscaping programs.

Figure 1. Elements of the post-mining landscape in Southern Coastal Mines: a pond, overburden dumps and tailings dump in the background (south of No.4 plant dump in 2014). The power lines will be removed before closure, but the landscape will largely remain.

Abbreviations

ADT	**iArticulated Dump Truck**
CHMP	Cultural Heritage Management Plan
CDM	Consolidated Diamond Mines
EMPR	Environmental Management Programme Report
EPL	Exclusive Prospecting Licence
ICP	Integrated Closure Plan
MEFT	Ministry of Environment, Forestry and Tourism
ML	Mining Licence
MME	Ministry of Mines and Energy
MHSS	Ministry of Health and Social Services
SSSI	Site of Special Scientific Interest

Figures and tables

Content

Chapter 1 Introduction

This report contributes to Namdeb's Integrated Closure Plan and describes demolition and landscaping (earthworks rehabilitation) tasks for Namdeb's ML42, ML43 and ML44.

This report is part of the information contributing to Namdeb's Integrated Closure Plan (ICP). Although written as a stand-alone document, it makes reference to several other reports which contain detail not repeated here. The overall principle in this series of reports towards the ICP is to limit repetition to what is necessary. This was meant to also include illustrations, but at Namdeb's request, many of these are now also included here.

Nonetheless, this report places demolition activities and landscape rehabilitation in the context of Namdeb's vision and overarching objectives for rehabilitation and closure, provides inventories and describes the demolition and landscaping tasks. The report is structured by first describing closure criteria and tasks applicable to all Namdeb licence areas and then by describing criteria and tasks specific to certain licence areas. Included are ML42, ML43 and ML44. The last chapters provide specifications for future mining and recommendations based on current gaps which are to be filled in future.

Chapter 2 Closure vision and objectives

The vision for closure 'to hand over all licence areas in a condition that supports sustainable land uses agreed with the landowner' has guided rehabilitation at Namdeb for over a decade.

This means in practice and by law that all structures will need to be demolished for which no future use is agreed upon with the regulator.

Requirements for landscaping (earthworks rehabilitation) are less rigidly legislated and aspects such as natural recovery potential and processes of the landscape and biodiversity recovery as well as visual impacts guide the level of intervention. These are difficult to quantify and are to some extent subjective.

2.1 Vision

Hand over all licence areas in a condition that supports sustainable land uses agreed with the landowner.

This vision has guided rehabilitation at Namdeb since 2007 (Namdeb 2018).

2.2 Closure objectives

Overall closure objectives with regard to landscape rehabilitation are:

- 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.

All four overall objectives directly apply to demolition and landscaping activities.

2.3 Principles and legal requirements

2.3.1 Demolition

In line with the vision and objectives for biophysical closure, all structures for which no future use is identified and agreed with the landowner need to be demolished (Minerals Act 1992). In Namdeb's case the landowner is the state and the Ministry of Environment, Forestry and Tourism (MEFT) is the executive arm of government in the Tsau//Khaeb (Sperrgebiet) National Park. This means all structures with no formal agreement with MEFT for future use need to be demolished.

2.3.2 Landscaping (earthworks rehabilitation)

Constructed landforms created by Namdeb include overburden, tailings and waste rock dumps, exposed bedrock, prospecting trenches, fine residue disposal facilities, pits, ponds, seawalls and accreted beaches as well as areas disturbed by infrastructure and roads.

Unlike demolition, which is strictly legislated, earthworks rehabilitation has no firm underlying legislation and is therefore subjective. The only legislation in Namibia to this effect (Minerals Act 1992) specifies that the licence holder "takes steps that may be necessary to remedy damage caused to the land surface or environment within the licence area" to the reasonable satisfaction of the Ministry of Mines and Energy. This leaves ample room for interpretation and agreement with the regulators and future land user is therefore more important than ever.

Landscape and biodiversity rehabilitation are interlinked and natural processes need to be considered in defining landscape rehabilitation tasks. This will be addressed in more detail in Southern Coastal Mines' restoration plan and has been investigated in ML42 and ML 44 at selected sites (Burke 2008 and 2014), but a few key observations are presented here.

Natural recovery takes place in almost all disturbed areas on land in Namdeb's coastal licence areas to some extent without intervention (Williamson 1994; van der Merwe 2005; Burke 2007, Burke 2014). Plant diversity can reach levels similar to those observed in undisturbed vegetation in the surrounding after about 30 years in the coastal areas, but vegetation cover does not reach densities comparable to the natural vegetation (Burke 2007); nor does natural recovery happen in all disturbed areas. Observations 13 years after a comprehensive survey of natural recovery in SCM show that it is unlikely that indigenous plant cover or species richness will eventually reach pre-mining conditions (Burke, pers. obs., August 2020). Yet, in accord with the principle of ecological restoration, the creation of a stable ecological system with lower plant cover and diversity is acceptable, even if it does not resemble pre-disturbance conditions (Burke 2001; Milton 2001; Clewell et al. 2005).

The time frame and conditions for the natural recovery processes described above only apply to the dynamic coastal environment. Natural recovery in inland areas takes much longer, for example along the Orange River. Where topsoil is not replaced or no sand is deposited on disturbed areas by wind action, limited natural regrowth is observed in the short- to medium-term (10-20 years) (Burke 2008b). In

both, coastal and inland areas, however, plant recruitment is usually associated with average to above-average rainfall seasons and hence happens infrequently.

Defining earthworks rehabilitation tasks in Namdeb's licence areas takes these natural processes of recovery into account. Landscaping and biodiversity restoration activities therefore focus on areas where natural recovery is very slow or does not take place at all.

Figure 2. The mining landscape at Daberas at the Orange River includes overburden and tailings dumps, exposed bedrock and a network of haul roads (photo 2013).

Chapter 3 Namdeb overall

Closure criteria and tasks for demolition and earthworks rehabilitation which apply to all licence areas are listed and described. These typically include treatment plants and accessory infrastructure, workshops, stores, offices, accommodation as well as linear infrastructure related to power and water supply, communications and transport. Earthworks rehabilitation tasks include similar steps in terms of process of rehabilitation, but are specific for each mine site.

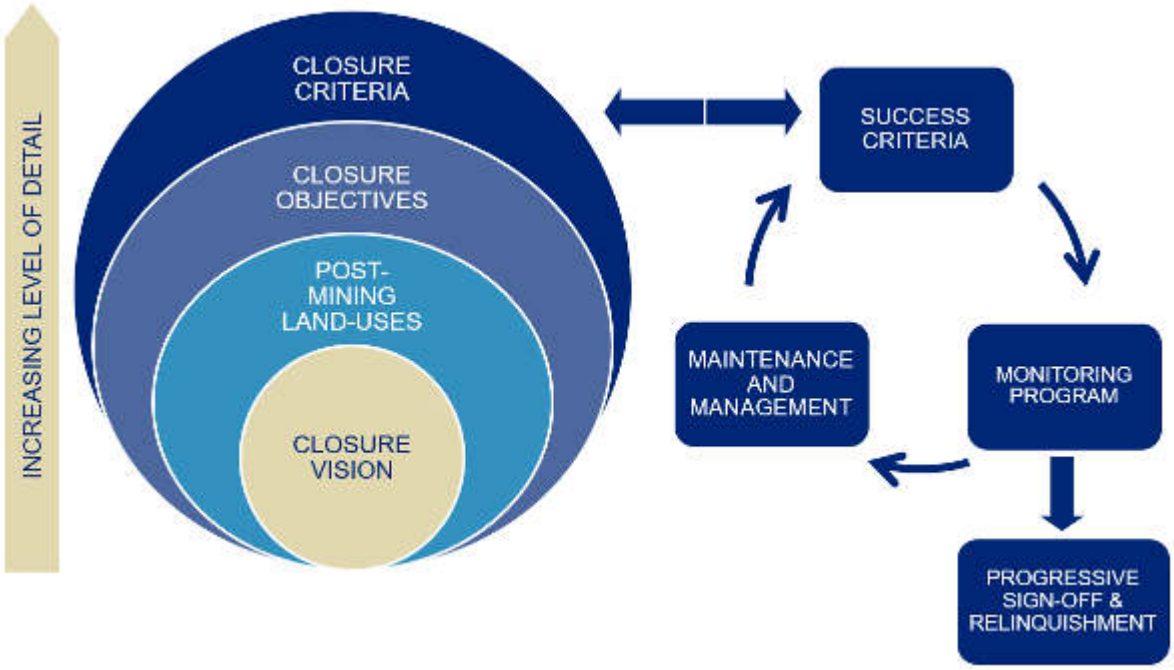


Figure 3. Components of closure and their linkages (Source: S & SD Group Guideline on rehabilitation 2019).

The closure vision and post-mining land use determine closure objectives. These are accompanied by respective closure criteria. In many instances success criteria leading towards closure criteria are developed and these are monitored. Depending on the level of attainment these either lead to maintenance and management and further monitoring, or to progressive sign-off and relinquishment (Figure 3)

Principles, closure criteria and tasks applicable in all licence areas are described below. These govern all tasks and are not repeated in the individual mining licences. Additional, site-specific principles and closure criteria are described in the relevant mining licences.

3.2 Closure criteria applicable in all licence areas

Closure criteria were developed to ensure a rehabilitation standard which meets the vision adopted for mine closure. The rehabilitation standard is guided by future land use. All zoning categories in the Tsau //Khaeb (Sperrgebiet) National Park apply in Namdeb's licence areas (Figure 4). However, with some minor exceptions, all areas directly disturbed by mining were zoned for 'managed resource use' (MEFT 2020). Mining-based tourism is envisaged to be the future land use in all areas disturbed directly by mining, except at Bogenfels (former pocket beaches site 11/12), Sendelingsdrif and Obib where nature-based tourism applies.

Ideally closure criteria need to be geared towards future land use, achievable, measurable and site-specific. Quantitative, legislated standards are usually available for water, air and soil quality, but closure criteria for landscape rehabilitation and biodiversity are more difficult to quantify. In this case closure criteria need to be drafted, tested, and refined based on monitoring of research trials and agreed with stakeholders (Nichols 2006).

Criteria to measure the success of rehabilitation are specific to the rehabilitation task, future land use and location. With regard to the components landscape and biodiversity, these are strongly dependent on the natural environment. Closure criteria for biodiversity are discussed in Namdeb's Biodiversity Action Plan and additional criteria for landscape, applicable to specific environments, are described in the respective mining licences in the chapters following below. These will be amalgamated in the biophysical chapter of Namdeb's Integrated Closure Plan.

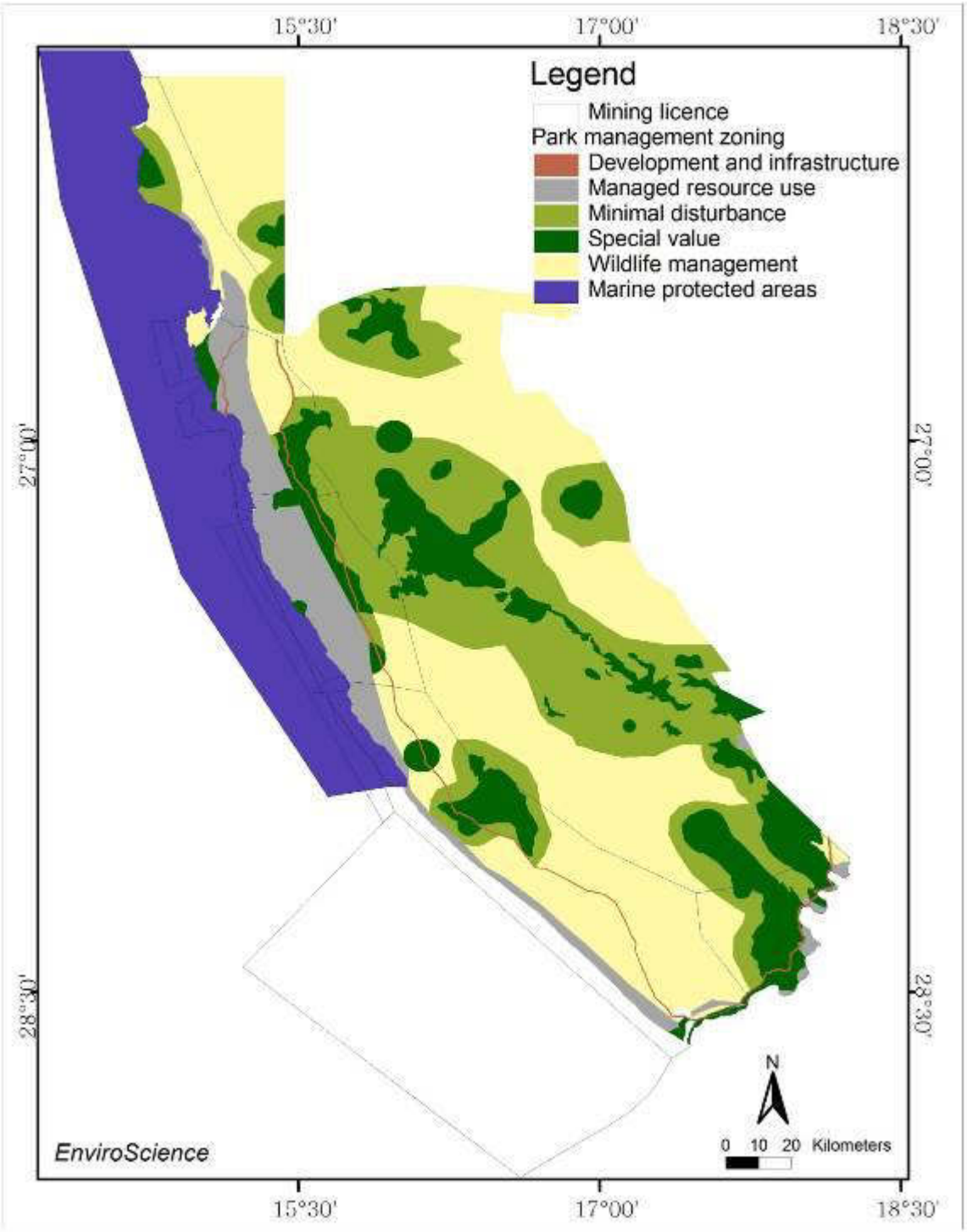


Figure 4. Namdeb licence areas and park management zoning (MEFT 2020).

Table 1. Closure criteria applicable in all Namdeb's mining licences.

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

	• Where reshaping is required, profiling to maximum of 15-20º slope angle • Reshaped slopes contoured
Substrate	• No excessive dust pollution (excessive = surface and vegetation in large areas (> 1000 m^2) covered in dust) • Substrate supports indigenous plant growth • Minimum of 10 cm growth medium (topsoil or other suitable substrate) on compacted or bedrock surfaces
Blocked drainage	• Natural flow re-established
Visual	• Post-mining landscape supports mining-based tourism • Small-scale disturbances (stockpiles, scrapes, small excavations, etc.) visible from access and tourism routes are levelled or filled in • Landform and surface of rehabilitated areas blend in with surrounding natural environment

3.3 Tasks applicable to all licence areas

Many tasks in the implementation of rehabilitation measures are the same in all Namdeb licence areas. These are listed below. Infrastructure demolition and earthworks rehabilitation tasks can be divided into three phases:

1. Pre-execution
2. Execution and
3. Post-execution.

While many tasks are the same across all Namdeb licence areas, the biophysical work breakdown structure for individual licence areas indicates which activities apply to which structures and manmade features. The listed tasks relate to demolition and earthworks rehabilitation only.

3.3.1 Infrastructure demolition

The table below lists all tasks applicable to the demolition of infrastructure in all Namdeb licence areas.

Table 2. Infrastructure demolition tasks in approximate chronological order.

Phase	Task	Details
Pre-execution	Clearance certificate from Ministry of Mines and Energy (MME) for security cleared Red Areas Demolition scope Approved asbestos removal plan Removal of radiation sources and x-ray machines Removal of surveillance equipment	

Phase	Task	Details
	Procurement process for the demolition contractor Security checks of contractors Preparation for removal of water lines, fine residue lines, pump stations and monitoring boreholes no longer required Salvage of remaining reusable items	
Execution	Site establishment	Offices and facilities Overall demarcation
	Verification of utility disconnections	Electricity Fuel Water
	Asbestos removal	Decontamination facility AIA air sample monitoring set up AIA inspections Transport to asbestos disposal site AIA clearance certificate
	Concrete removal	Pre-demolition survey Approve method Identify and demarcate suitable demolition waste disposal site nearby
	Pollution remediation	Investigation of contamination level Inventory of waste types and volume at waste site
	Steel removal	Determine collapse direction Demarcation of break-down, work and cleared areas Cut and pull, and cut further Determine and open enclosed structure for inspection Transport off site for sale
	Removal of non-concrete or non-steel structures and waste	Removal of loose debris such as plastic, wood and other Removal of non-concrete and non-steel structures
		Remove containers used for storage, office or workshops to be reused, or if not reusable cut up and dispose with demolition waste
	Concrete removal	Demolish concrete, brick buildings and structures Demolish floor and plinths Transport demolition waste to disposal site
	Pollution remediation	Remove polluted soil to bioremediation site Remove hazardous waste to

Phase	Task	Details
		hazmat disposal site Flush sewage line with clean water into septic tank Remove non-hazardous waste
	Compliance monitoring	In-progress surveys and ad-hoc compliance monitoring
	Landscape (as part of the demolition work)	Level heaps and other artificial features on the surface Identify compacted areas to be rehabilitated Scarify compacted areas (only where necessary) or cover with layer of sand from disturbed area nearby Erase tracks, machine marks and any signs of other manmade features
Post demolition	Sign-off	Site inspection against closure criteria by Namdeb rehabilitation coordinator Inspection and sign-off by MME & Ministry of Environment, Forestry and Tourism (MEFT)

3.3.2 Landscaping (earthworks rehabilitation)

Many steps in earthworks rehabilitation need to take place at all rehabilitation sites. These steps would be applicable to whatever scope of work is drafted for contractors in all Namdeb licence areas. There are also additional steps which are applicable to specific licence areas and these are listed and described in the chapters for the individual MLs. The table below lists all tasks applicable to earthworks rehabilitation in all Namdeb licence areas.

Table 3. Earthworks rehabilitation tasks in approximate chronological order.

Phase	Task	Details
Preparation	Pre-earthworks aerial survey Clearance from Namdeb mine planners Earthworks rehabilitation scope (data processing and design work) Procurement process Identify compacted areas to be rehabilitated Identify blocked natural flow Demarcate areas to be profiled	
	Site establishment	Offices and facilities Overall demarcation

Phase	Task	Details
Execution	Earthworks rehabilitation	Rehabilitate to earthworks specifications Profile slopes: to prevent erosion reshaping of dumps should aim at contouring rather than moving material vertically up and down slopes Backfill exposed bedrock with suitable material from disturbed areas to a minimum of 10 cm cover Scarify compacted areas or cover with suitable substrate from disturbed areas Re-establish natural drainage Erase tracks, machine marks and any signs of other manmade features
	Compliance monitoring	In-progress surveys and ad-hoc compliance monitoring
Post execution		Post-earthworks aerial survey
	Sign-off	Site inspection against closure criteria by Namdeb rehabilitation coordinator (EMS compliance) Inspection and sign-off by MME, MEFT and possibly MHSS

Chapter 4 ML 42

Five mining sites in ML42 require rehabilitation. Some additional closure criteria apply as a public road traverses the mine sites at Auchas and Daberas. Infrastructure to remain includes the historic police stations at Sendelingsdrif and Hohenfels, sections of the original (then private) road between Oranjemund and Sendelingdrif and two buildings. All other structures will be removed.

Cultural heritage sites and Sites of Special Scientific Interest such as the trench with Miocene fossil at Arriesdrif are excluded from earthworks rehabilitation. Earthworks rehabilitation tasks at closure focus on safety of the mine sites, remediating pollution, re-establishing natural flow where necessary, re-establishing biodiversity at priority sites and addressing visual aspects.

Five mining or prospecting sites are in ML42 which require rehabilitation. From west to east:

1. Arriesdrif
2. Auchas
3. Daberas
4. Obib and
5. Sendelingsdrif.

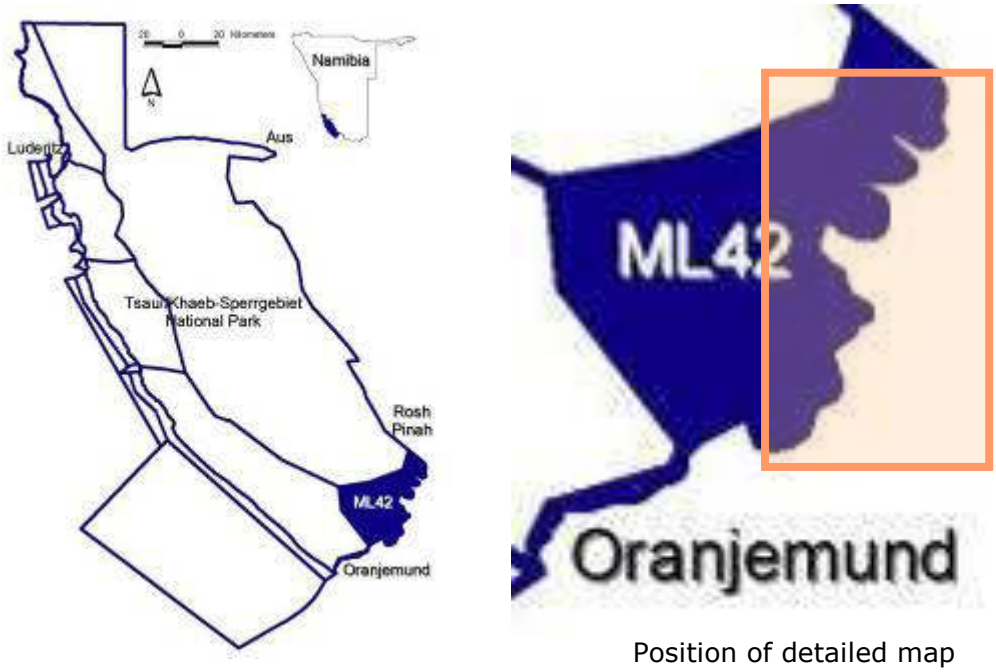


Figure 5. Position of ML42 in Namibia and position of detailed map of mine sites in Figure 6.

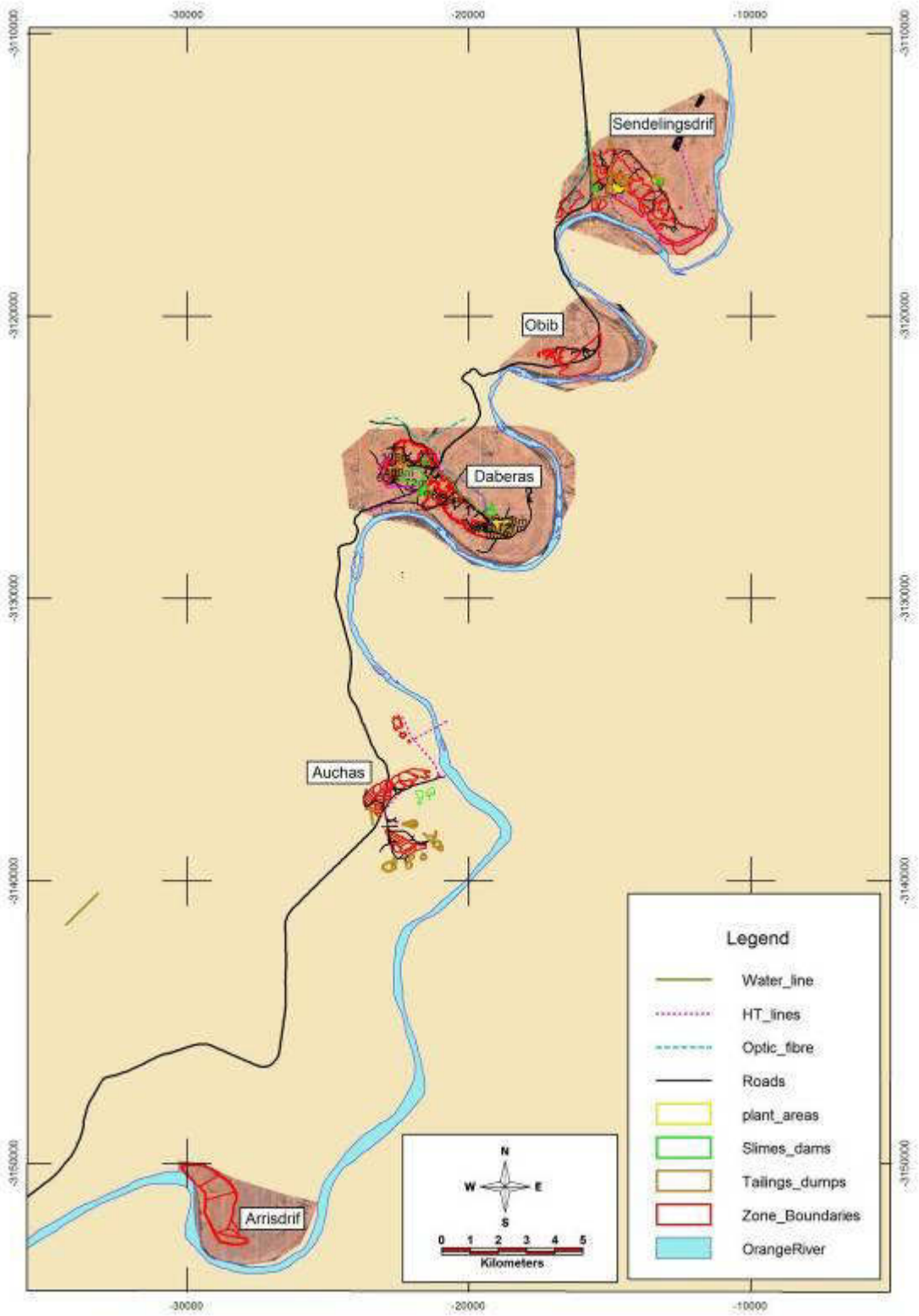


Figure 6. Position of mine sites in ML42 (map provided by Namdeb).

4.1 Additional closure criteria for ML42

All closure criteria introduced in chapter 3 apply in ML42. As a public road traverses the licence area some additional criteria related to visual aspects and safety need to be fulfilled. These are listed in the table below.

Table 4. Additional closure criteria applicable in ML42.

Component	Closure criteria
Landscape	
Visual	• Dumps visible from access roads profiled (edges and crests of slopes rounded) • No dumps higher than surrounding topography (20 m above the surrounding) • No excavated areas visible from the public road (M118) • Maximum slopes angle for reshaping of slopes is 20º
Substrate	• Surface blends in with natural environment in terms of texture and colour
Water	• Cover all exposed, artificial water bodies with oversize (± > 60 mm) 1 m above water level and cover with finer material • Re-establish riparian belt in Zone 13

4.2 Demolition

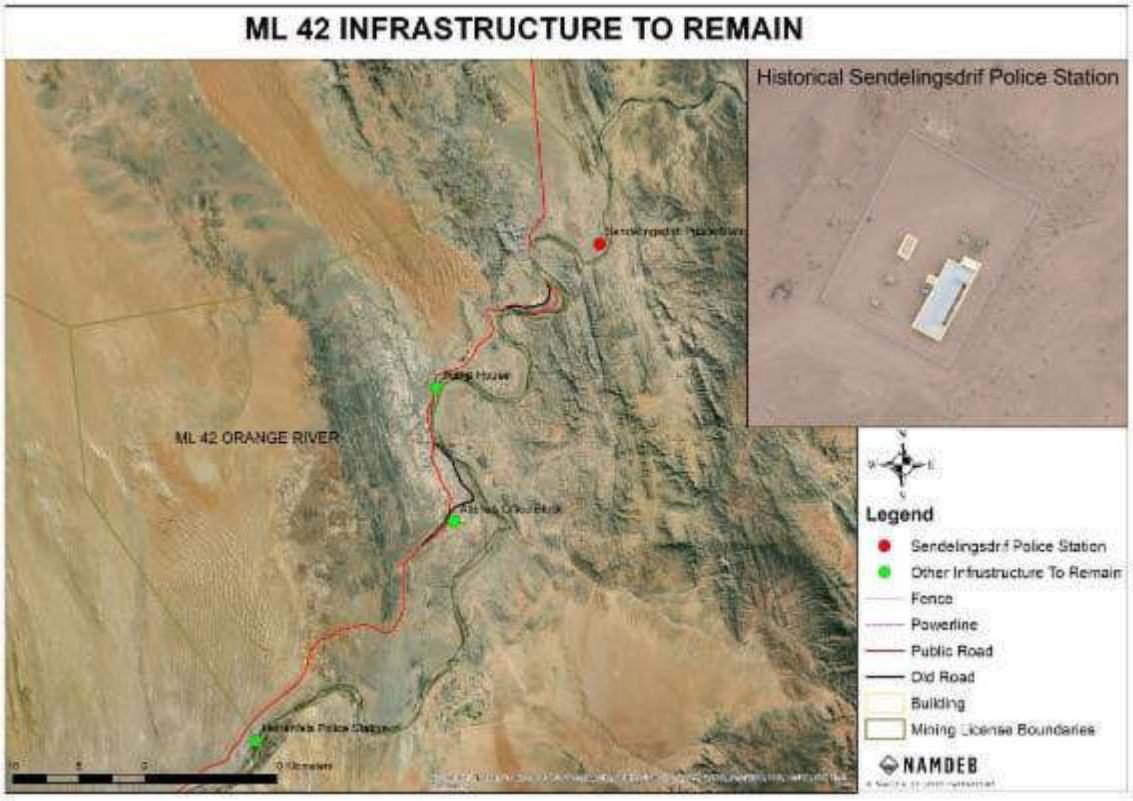
4.2.1 Infrastructure to remain

Five items have so far been identified not to be demolished:

1. Pump house (east of Daberas hostel)
2. Office block at Auchas
3. Historic police station at Sendelingsdrif
4. Ruins of historic police station at Hohenfels and
5. Sections of the old road alignment from the original Sendelingsdrif-Oranjemund private road

The historic police stations at Sendelingsdrif and Hohenfels have been identified as sites of cultural importance, but Sendelingsdrif is not listed as a site of importance in MEFT's cultural heritage register (Namdeb 2020a-CHMP).

The pump house near Daberas and the office block at Auchas were identified and agreed with MEFT to be used as an information centre or for a similar purpose.



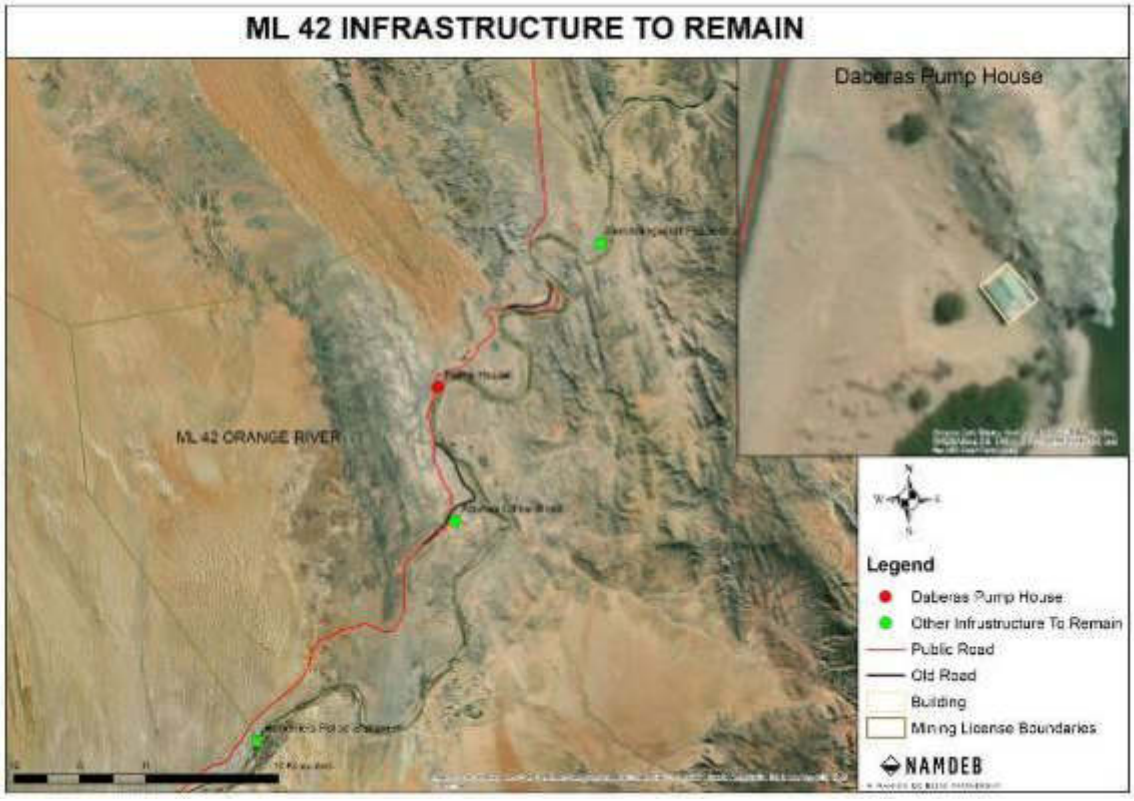
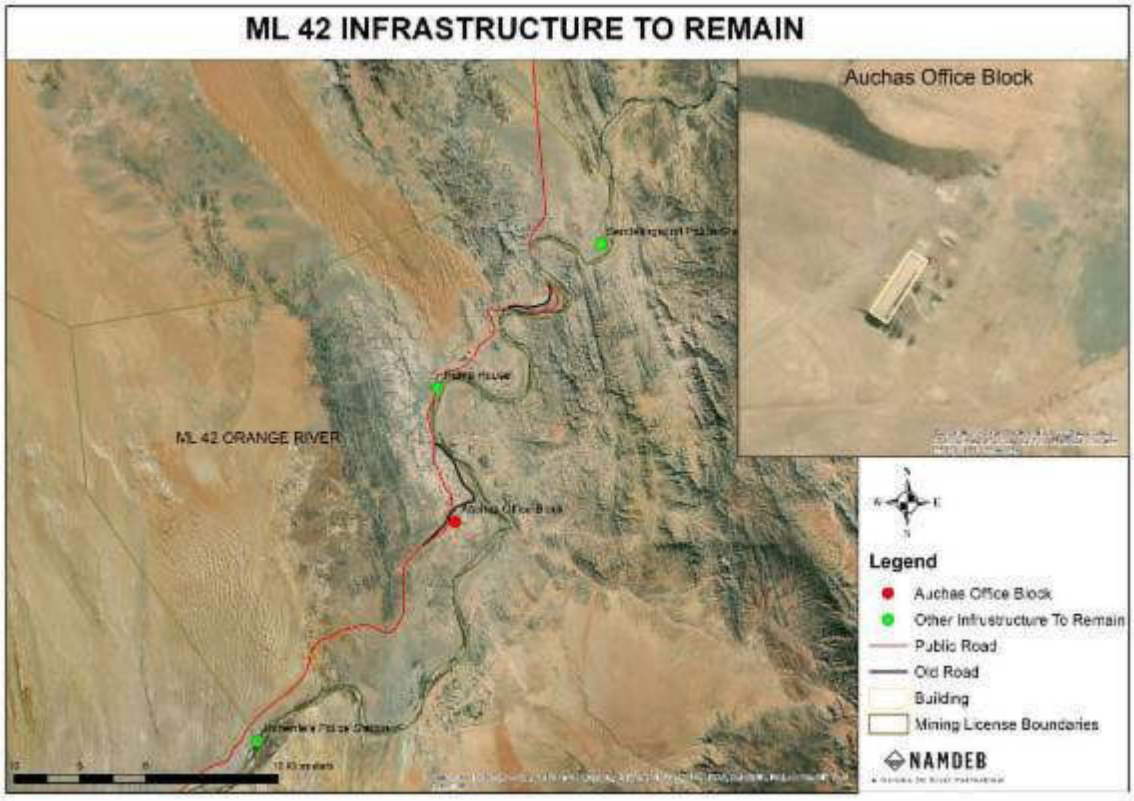


Figure 7. Overview and detail of infrastructure to remain in ML42 at Sendelingsdrif and Daberas.



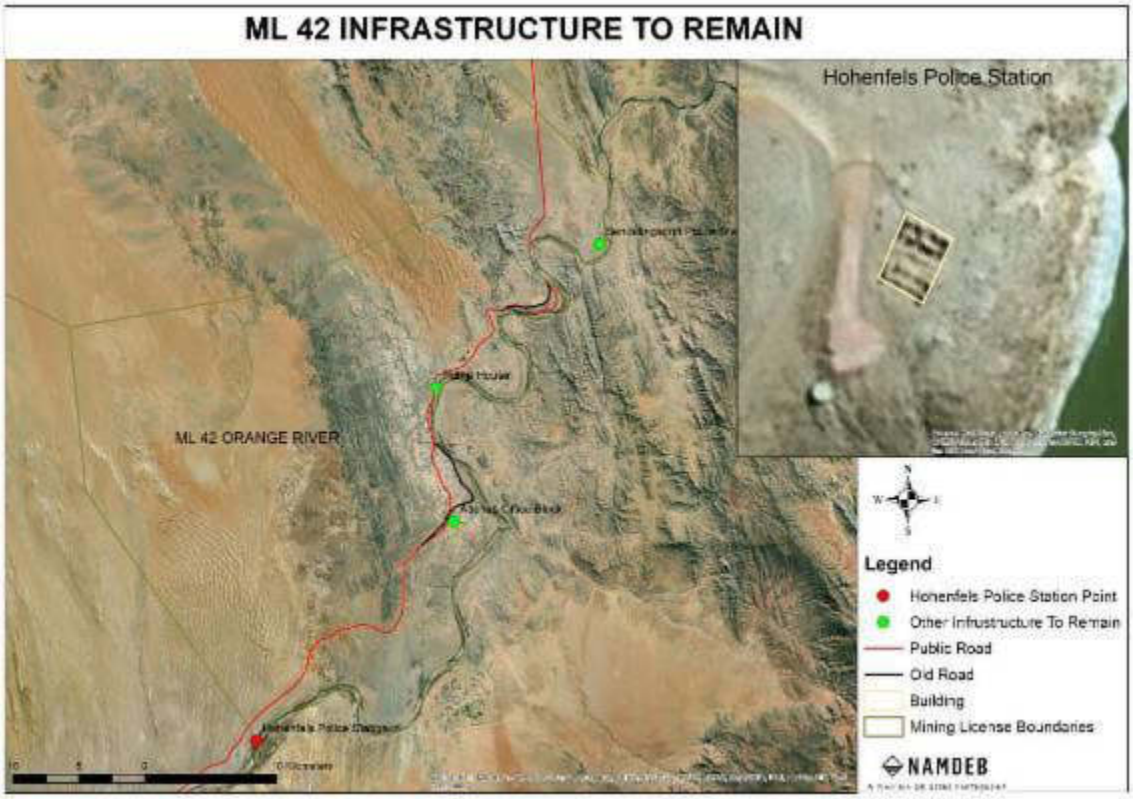


Figure 8. Overview and detail of infrastructure to remain in ML42 at Auchas and Hohenfels.

4.2.2 Infrastructure inventory and tasks

The table below lists the infrastructure in ML42 according to the different mine sites and domains (ECC 2020). Some restructuring of these domains may now be necessary, particularly with regard to earthworks rehabilitation. All these structures will need to be demolished or removed elsewhere when the respective mine sites are closed. There are no structures at Arriesdrif or Auchas to be removed.

Table 5. Infrastructure to be removed in ML42 from west to east along the Orange River.

Mine	Description
Daberas	
Office buildings (Domain 8)	Buildings and containers, foundations
Workshops, storage and shade parking	Open sheds, buildings and containers
Water supply infrastructure (Domain 10)	Water reservoirs and pump stations and foundations
Sewage plant	Biofilter trickling facility
Fuel station and wash bay (Domain 9)	Above-ground tanks and underground polluted water capture facility, oil separators, foundations
Explosives magazine (Domain 2)	Strengthened building and foundations
Bioremediation sites (Domain 11)	Concrete foundations
Treatment plant (Domain 5)	Processing plant, DMS, conveyors, recovery
Remaining B&E structures	Containers, buildings
Linear infrastructure (Domain 1)	Water and fine residue pipelines, power lines, fibre optic lines
Fences	Fences around some prospecting sites
Obib	
Gate (Domain 4)	Container
Sendelingsdrif	
Offices (Domain 7)	Containers
Workshops and storage	Open sheds, containers
Nursery	Open shed
Water supply infrastructure (Domain 9)	Water reservoirs and pump stations and foundations
Sewage plant	Biofilter trickling plant
Fuel station and wash bay (Domain 8)	Above-ground tanks and underground polluted water capture facility, oil separators, foundations
Treatment plant (Domain 4)	Processing plant, DMS, conveyors
Linear infrastructure (Domain 1)	Water and fines pipelines, power lines, fibre optic lines
Remaining ML42 (Satellite domain)	
Sendelingsdrif gate	Buildings and ablution facilities

Mine	Description
Daberas hostel (Domain 1)	Buildings and ablution facilities
Irrigation farm (Domain 3)	Buildings
Sendelingsrif gate (Domain 6)	Buildings and ablution facilities
Swartkop (Domain 7)	Buildings and ablution facilities
OREX screening plant	Sampling treatment plant, (now at MDTP, but included in ML42 costs)

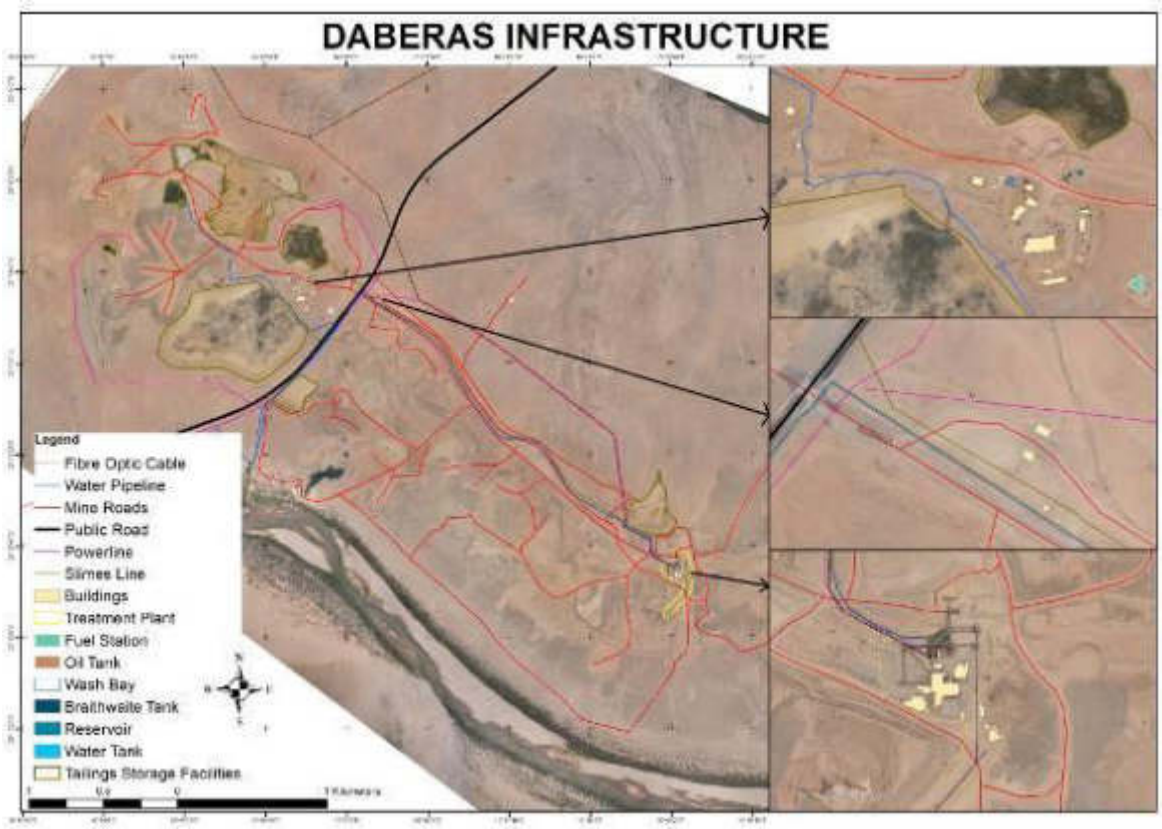


Figure 9. Current infrastructure at Daberas Mine.

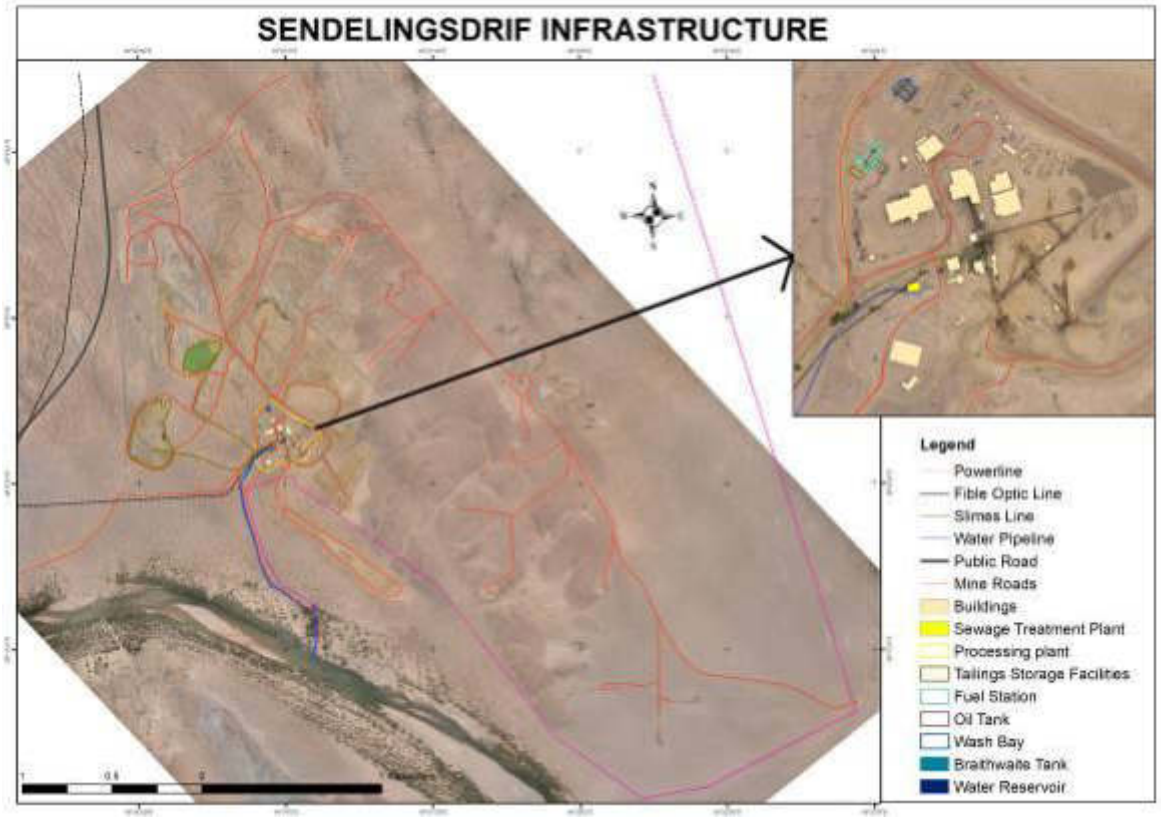


Figure 10. Current infrastructure at Sendelingsdrif Mine.

4.3 Earthworks rehabilitation

4.3.1 Manmade landforms and cultural heritage sites to remain

Mining along the Orange River integrated landscape rehabilitation in the mining process by "leaving areas that have been mined in a state that allows for recolonisation of areas within a reasonable period of time, wherever this is practically possible, and rehabilitate, where necessary, according to BATNET principle (Best Available Technology Not Entailing Excessive Costs)" (Namdeb EMPR 1997). In practice this means that the surrounding landscape was used to guide the construction of manmade features such as tailings and overburden dumps, wherever possible. Therefore most of the mining areas will remain as they are at closure and rehabilitation will focus on human and wildlife safety, pollution remediation, re-establishment of natural drainage and visual aspects along routes frequented by people. Sites of Special Scientific Interest within these mining landscapes are described below.

4.3.1.1 Cultural heritage sites

The Orange River valley has an abundance of archaeological, paleontological and geologically important sites. These cultural heritage sites will be respected and are excluded from earthworks rehabilitation. They are described in the sections below according to locality. More detail on these sites is included in Namdeb's Cultural Heritage Management Plan (Namdeb 2020).

4.3.1.2 Arriesdrif

The exploration trench at Arriesdrif harbours one of the most diverse Miocene faunas in Africa and is thus a Site of Special Scientific Interest. This trench with the fossil finds will hence not be backfilled.

4.3.1.3 Auchas

Several fossil finds of significance were made during the mining operations at Auchas which included fossil trees and more examples of Miocene fauna. There is also a spectacular geological feature, a push slope and waterfall, in the Auchas pit.

The Auchas pit, overburden dumps, mined out areas and fine residue disposal facility are to remain. The berms around the pit need to be inspected and completed where necessary. Whether or not the excavated area north of the road (AM02) can remain needs to be determined and rehabilitation measures developed accordingly.

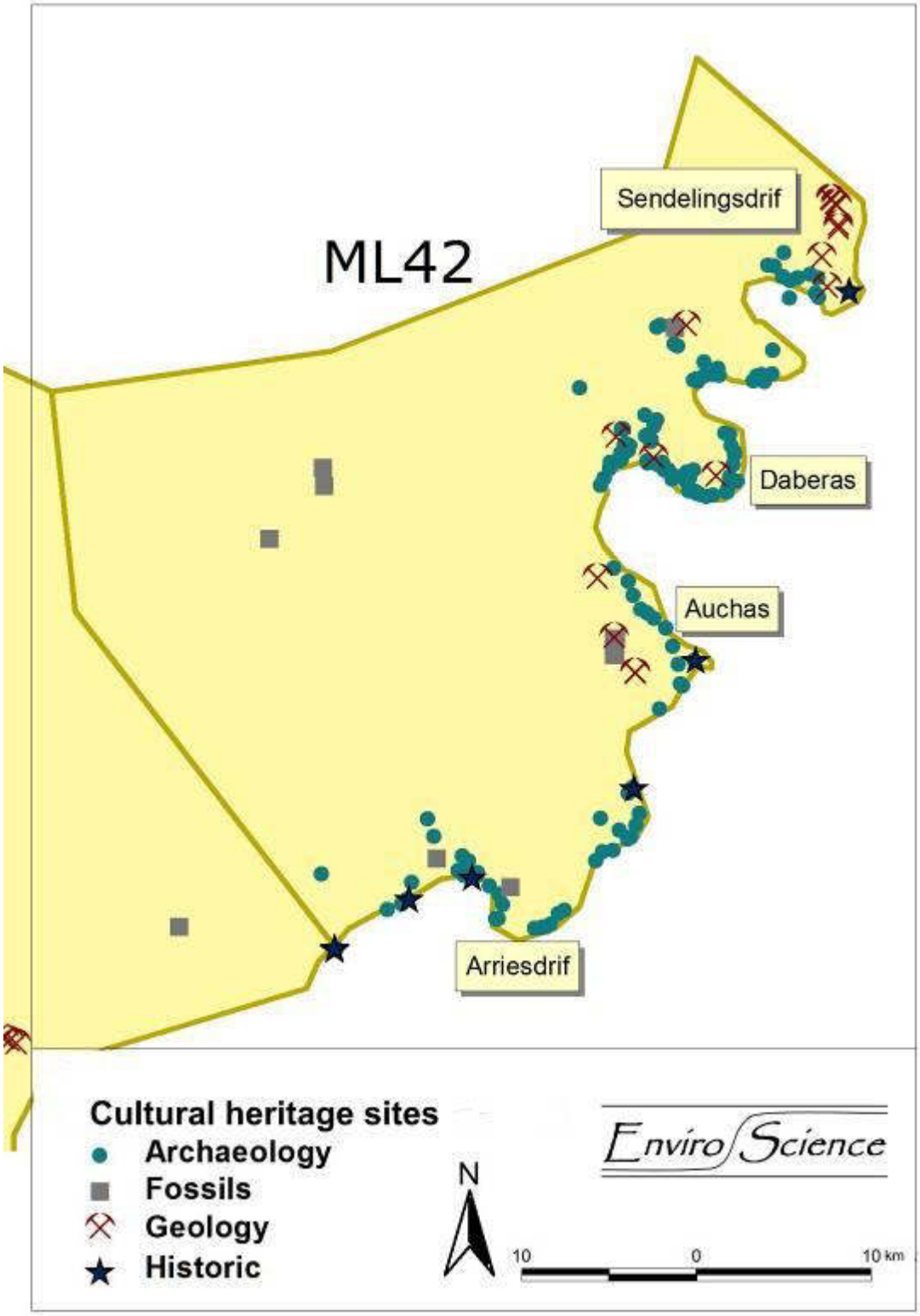


Figure 11. Cultural heritage sites in ML42.

4.3.1.4 Daberas

Two geological sites worth preserving were identified at Daberas: an exposed channel in bedrock area in Zone 11 and a scour feature in Zone 13. The scour feature in Zone 13 will be under water and the water management plan specifies that all artificial water bodies are covered up to 1 m above the water table with overburden material (Namdeb 2021 - water strategy).

The majority of the manmade landscape of fine residue disposal facilities, overburden dumps, tailings dumps, exposed bedrock and other areas disturbed by mining and associated infrastructure at Daberas is to remain, as per approved rehabilitation plan of 2008. Only areas visible from the public road will be reshaped to some extent. However, some landscaping will take place where infrastructure is to be removed.

The Environmental Clearance for mining at Daberas stipulates that the riparian belt of Zone 13 is to be re-constructed.

4.3.1.5 Obib

A low-grade stockpile constructed on the meso deposit was scheduled to remain for the present. For this reason it was constructed low and has been shaped to fit in with the surrounding landscape. It is not visible from the public road.

Mining at Obib has been temporarily stopped as adjustments to the mine plan are required. This will also affect rehabilitation. The rehabilitation plan for this site will need to be revised once Namdeb has decided how to proceed with mining at Obib.

4.3.1.6 Sendelingsdrif

A pre-proto terrace outside the ore reserve and a terrace deposit intermediate between proto and meso will be preserved at Sendelingsdrif.

Mining at Sendelingsdrif incorporated progressive rehabilitation and the mined out areas are being back-filled. The storm-water berm around the northern part of the mining area will remain, but will be breached to re-establish natural water flow and it will be rounded in areas visible from the public road. Also the initial tailings dump to the south of the deposit, low-grade stockpiles and the fine residue disposal sites will remain.

4.3.2 Earthworks rehabilitation inventory and tasks

The table below lists and describes all manmade features in ML42 which require rehabilitation.

Table 6. Manmade features and earthworks rehabilitation tasks in ML42 from west to east along the Orange River.

Component	Description	Task
Arriesdrif		
	Exploration trench to remain	Clear demarcation of exploration trench with fossils Ensure landscape, except for exploration trench looks natural
Auchas		
Exposed bedrock	Mined out bedrock areas, north and south of the public road. Partially excavated areas north of the road (e.g. AM02) still contain viable deposits and may be mined in future.	Decision on mining, development of rehabilitation measures accordingly
Pit	Deep pit to remain	Secure with berms of 1.5 m height
Overburden dumps	Some overburden dumps along the public road and in sight of the road have been reshaped.	No further reshaping is scheduled.
Tailings dump	Tailings dump	Edges were reshaped to make a more rounded landform
Stockpiles	Some stockpiles are still remaining at the old plant site.	Reshape (to rounded low dumps)
Fine residue disposal facility	Reeds have established on the fine tailings dam and prevent dust and erosion.	Prove technical and chemical stability (include in study for Daberas)
Daberas		
Mining pits (Domain 3)	Zones 11 and 13, open water remaining in some pits	• Partly backfilling of Zone 13 to reconstruct riparian belt • Cover all exposed, artificial water bodies with overburden • Demonstrate stability of pit walls
Exposed bedrock		No rehabilitation
Meso stockpiles	Stockpiles from meso sample	Reshape to low rounded dumps
Tailings dump (Domain 7)		Reshape sharp edges and crests and create channel

Component	Description	Task
Overburden dumps (Domain 4)	Most dumps throughout mining area to remain	Dumps along public road to be reshaped
Fine residue disposal facilities[1] (Domain 6)	Zones 8 and 9[2] are used for fine residue disposal Reeds have established on the initial, large fine residue dam and prevent dust and erosion. The fine residue disposal sites in mined out areas do not require rehabilitation.	• Where open water remains, cover all exposed, artificial water bodies with overburden 1m above water table • No rehabilitation of other fine residue disposal sites, if chemical stability can be demonstrated
Prospecting sites and trenches	Throughout mining area and on meso deposit	Steep walls secured with berms
Ramps and built-up areas	Ramps near plants, workshops and fuel station	Reshape (round edges and crests)
Small dumps, heaps and stockpiles	Heaps of material are scattered throughout the mining area	Levelled where visible from public road
Areas disturbed by infrastructure	Sites of plants, workshops, offices and other accessory works, helipad	Cover with suitable substrate; scarify only where heavily compacted, no plant growth-supporting substrate is available and rip-marks are not visible from tourism route
Access roads	Access roads to inlet and hub as well as to water infrastructure turning off from the public road	Scarified (and rip-marked erased), where necessary or covered with suitable material
Haul road	A haul road runs along northern margin of the deposit	Scarified (and rip-marks erased) and breached at two places to re-establish natural water flow
Obib		
Low-grade stockpile (Domain 3)	Low dumps constructed on meso with gentle slopes and not visible from public road	No rehabilitation necessary
Sendelingsdrif		

[1] Rounding the benched steps on the side of the large fine tailings facility facing the public road, was initially included as a rehabilitation measure, but has since been omitted for practical reasons.
[2] Although Zone 10 is used for fine tailings disposal, an open water body remains.

Component	Description	Task
Storm-water berm (Domain 10)	Berm around northern margin of mining area to protect the mining area from surface runoff	Breached to re-establish natural flow conditions, berm crests rounded
Mining area (Domain 2)	Sample pits and remaining mined out voids	Rehabilitation of some sample pits and sloping of remaining voids
Mineral dumps (Domain 3)	Progressive rehabilitation by backfilling the majority of mined out areas	Slopes at final voids to be rounded and sloped to no more than ±20 degree, if necessary
Tailings dumps (Domain 6)	Coarse tailings from treatment plant	Reshape to 15º slope angle
Low-grade stockpiles (Domain 3)	Low-grade stockpiles near plant	No rehabilitation required
Fine residue disposal facilities (Domain 5)	Presently two mined out areas serves as fine residue disposal sites.	Geotechnical study required to determine technical and chemical stability
Remaining ML42		
Daberas scrap yard (Domain 12)	Scrap disposal site near Daberas Hostel for entire ML42	Clean-up and levelling, contamination testing

The tasks are the same as for Namdeb overall, except for reshaping of dumps. Slopes do not necessarily have to be reshaped to 15º angle, as steeper slopes occur naturally in the surrounding area. However, for stability purposes a maximum of a 20 º slope angle should be aimed for. The focus of reshaping landforms is on rounding sharp edges and corners and removing straight lines as far as possible. Artificial water bodies need to be covered with oversize according to the water management plan.

4.3.2.1 Auchas

Some excavated areas near the road still retain diamonds and were therefore not rehabilitated. They are visible from the road, pose a safety risk and need to be mined and rehabilitated. The pit at Auchas will remain but made safe with berms obstructing access. The fine residue disposal facility needs to be further investigated to demonstrate geotechnical and chemical stability (Namdeb 2021 - water strategy).

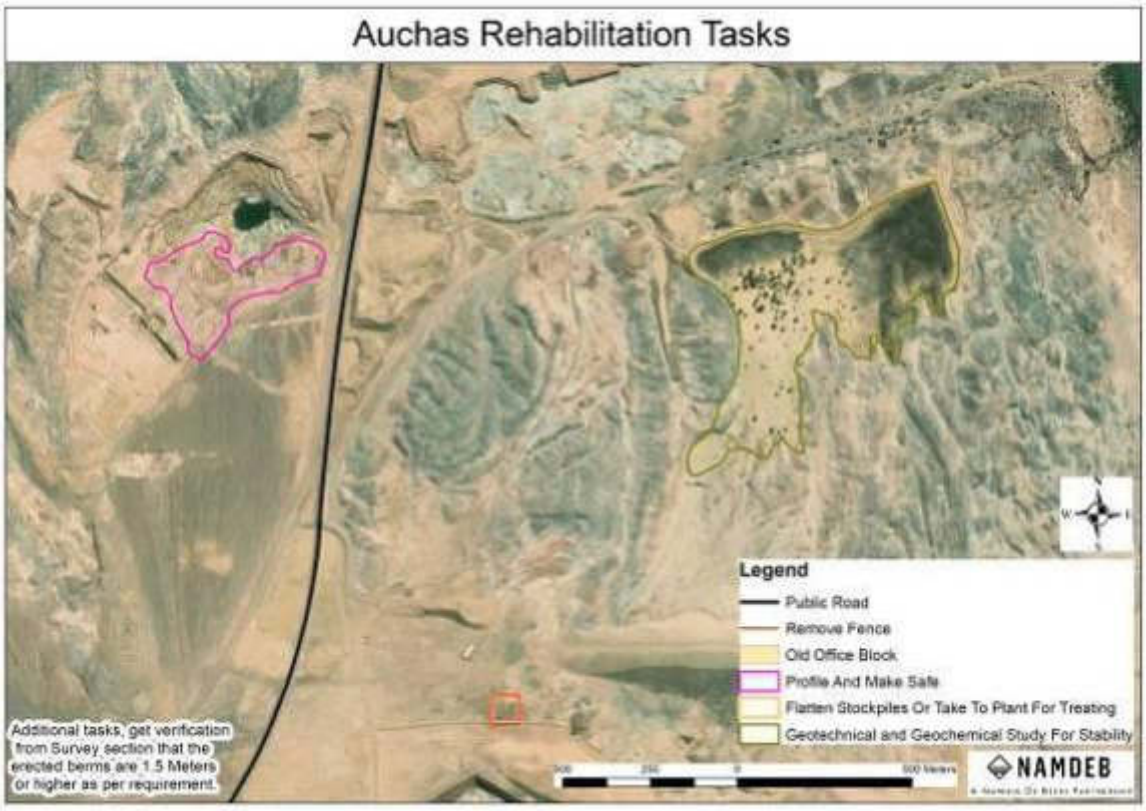


Figure 12. Remaining landscaping tasks at Auchas (Map provided by Namdeb March 2021).

4.3.2.2Daberas

The pits are used for fine residue disposal during operation and will be backfilled where exposed water remains at closure. The water table at Zone 10 is exposed through mining and needs to be backfilled. The pit near the Orange River (Zone 13) needs to be backfilled along its southern margin to reconstruct the riparian belt (Namdeb EMPR 2018). Some overburden dumps and the tailings dump which are visible from the public road will be reshaped.

The fine residue disposal facilities require no rehabilitation, if chemical stability can be demonstrated.

Small dumps and heaps visible from the public road will be levelled. All areas where infrastructure is to be demolished will be levelled and made tidy. Suitable substrate such as topsoil or sand will be applied on compacted surfaces and roads where feasible. To re-establish natural water flow, the haul road along the northern side of the deposit will be reached at two places.

The map shows the earthworks rehabilitation tasks at Daberas in a spatial context (Figure 13).

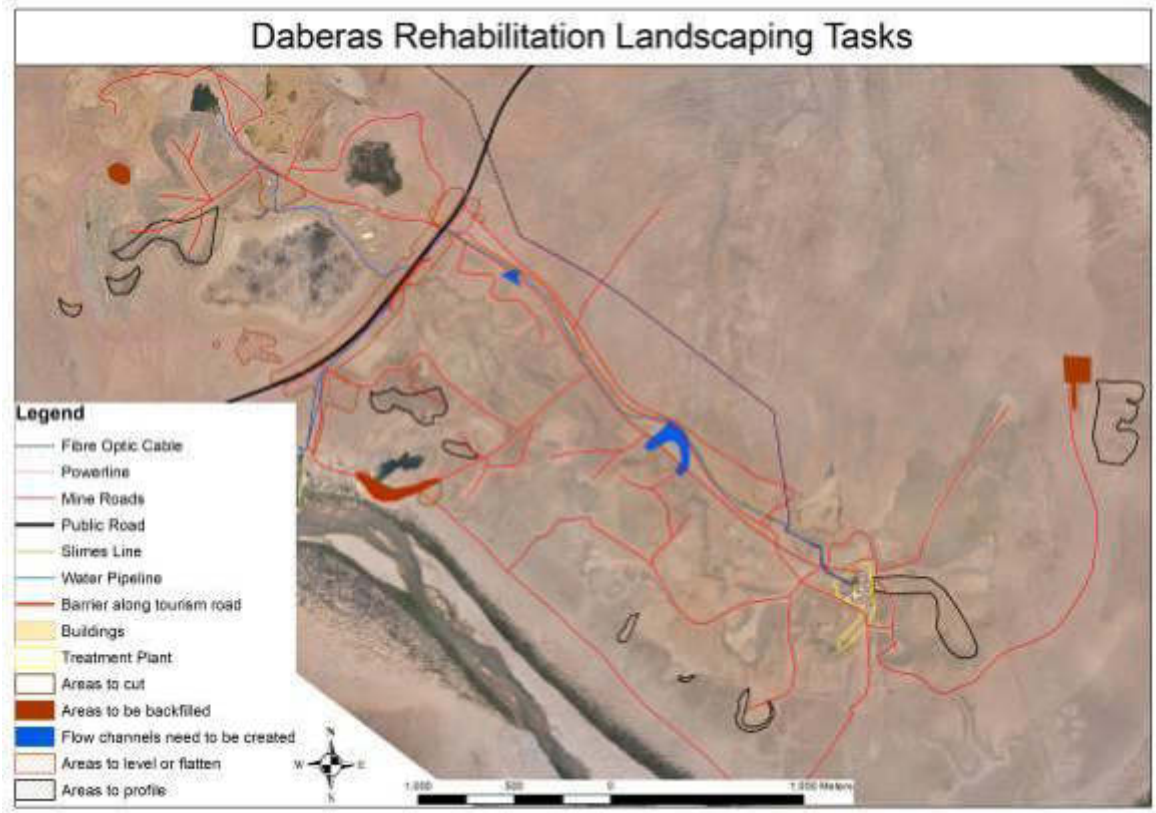


Figure 13. Overview of earthworks rehabilitation tasks at Daberas (map provided by Namdeb, January 2021).

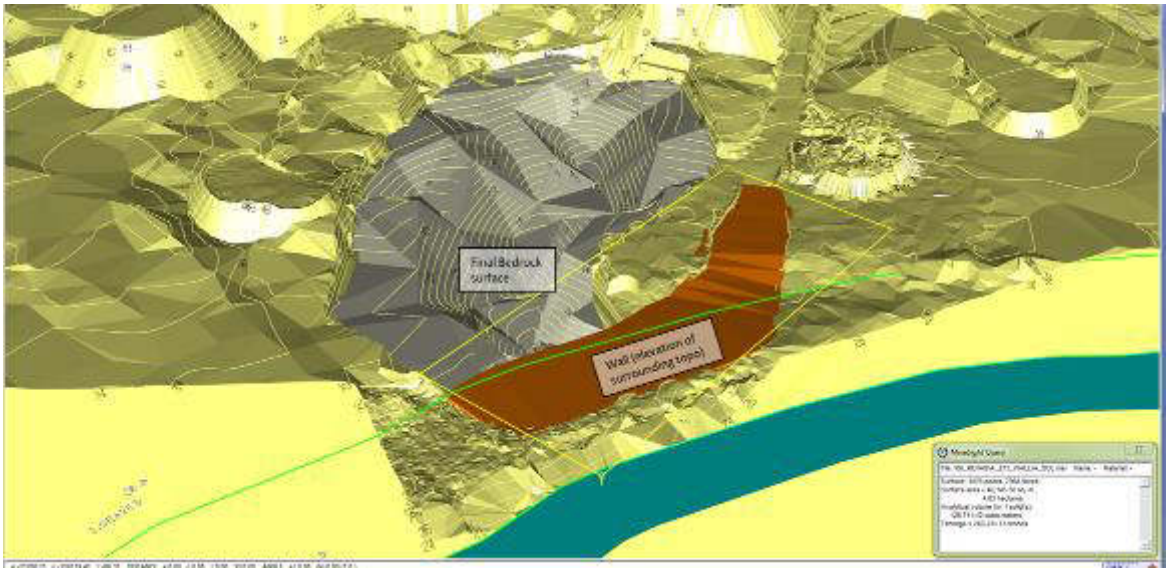


Figure 14. Backfilling task at Zone 13 to re-establish the riparian belt (Namdeb minesight, November 2019).

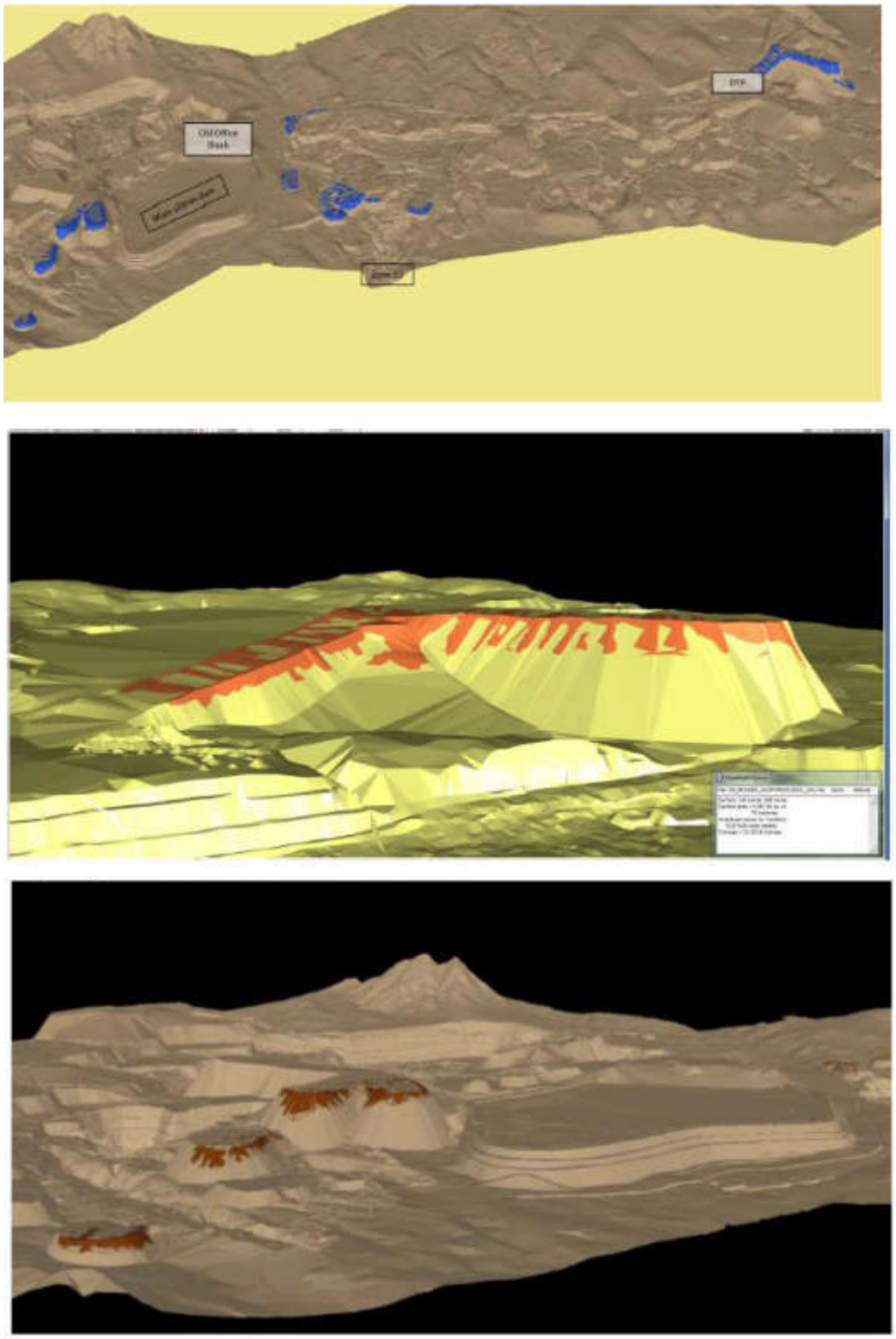


Figure 15. Illustrated earthworks rehabilitation tasks at Daberas: overview of dump profiling (top), reshaping of tailings dump (centre) and profiling of dumps near hub (bottom) (Namdeb minesight, November 2019).

4.3.2.2 Obib

An update of Obib's rehabilitation plan is required as the initial mine plan could not be followed due to geological challenges.

4.3.2.3 Sendelingsdrif

Earthworks rehabilitation at Sendelingsdrif at closure is concerned with making the site safe, remediating pollution, re-establishing biodiversity on backfilled areas and re-establishing natural water flow. The remaining voids will be sloped to no more than 20 degree where necessary, and the storm water berm will be breached and the berm crest rounded. The fate of the fine residue disposal sites will have to be determined based on a geotechnical study. The initial tailings dump will remain.

Figure 16. Features remaining at closure at Sendelingsdrif (the black outline is the tailings dump).

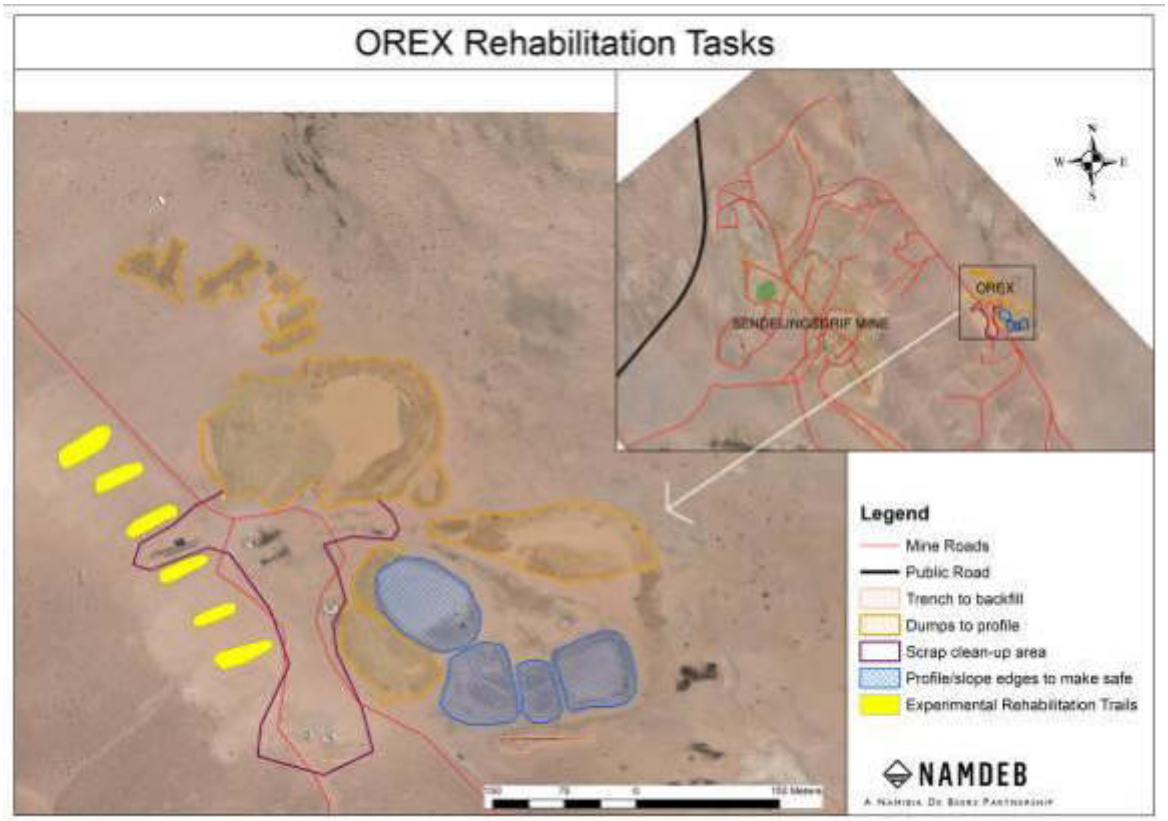


Figure 17. Rehabilitation at the OREX sampling plant site (Namdeb, April 2021).

The site of the former sampling plant to the east of the mine will also be rehabilitated towards meeting the same closure criteria as the mine site. Only the experimental rehabilitation trials may remain.

4.4 Opportunities

Historic buildings in ML42 will not be demolished. These are the German police stations at Sendelingsdrif and Hohenfels.

Also some more recent infrastructure is not to be demolished and to be used by the Ministry of Environment, Forestry and Tourism as facilities. These are the 'pump huis' and the office block at Auchas.

Where mining unearthed artefacts of cultural importance, these areas are not to be backfilled or otherwise rehabilitated. This applies to the exploration trench at Arriesdrif, a pre-proto terrace outside the ore reserve and a terrace deposit intermediate between proto and meso at Sendelingsdrif and the Zone 11 channel at Daberas.

The majority of the mine-made landscape at Auchas and Daberas will remain and demonstrate the mining activities at these sites.

Part of the steep mud-walls near the Orange River in Zone 13 have bird nesting sites. These are to remain open if permission is granted to an amendment to the ECC commitments to re-construct the riparian belt in Zone 13.

Backfilling the artificial open water body at Zone 13 may have to be re-considered, if this pond is used for recreational purposes.

Chapter 5 ML43

Additional closure criteria related to the shaping of dumps apply in ML43. Some infrastructure to remain has been agreed with the regulator (Affenrücken and Mittag Hostel and three buildings at Baker's Bay), but there are many more structures which need to be considered to support mining-based tourism after closure.

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 these need further investigation and agreement with the regulator.

Rehabilitation in ML43 is largely taking place in Southern Coastal Mines.

5.1 Additional closure criteria for ML43

Some additional closure criteria for earthworks rehabilitation apply in ML43. The topography in the disturbed area in ML43 is rather uniform and a few dumps show signs of erosion. Hence, where reshaping of dumps is required, the final landform should have gentle slopes. Initially a distinction in maximum slope angle was made between slopes facing the wind and those in the lee. Yet for practical reasons and because reshaping of dumps is limited to few areas, the slope angle of 15 º should be aimed at all around.

Material from some tailings dumps has been removed for accretion. If these dumps are to remain, slopes around the excavated areas need some profiling.

Table 7. Additional closure criteria for earthworks rehabilitation in ML43.

Component	Closure criteria
Landscape	
Steep slopes of dumps[3]	Rehabilitated slopes have a maximum of 15º slope angle
Tailings dumps used for accretion	Partly removed tailings dumps are stable and blend in with surrounding landscape

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

5.2 Demolition

5.2.1 Infrastructure to 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 are the only structures presently that have been agreed with MEFT to remain. A formal agreement exists for the three more modern structures (Affenrücken and Mittag Hostel and three buildings at Baker's Bay) (Namdeb 2008). Chameis gate is mentioned as a potential tourism site in MEFT's tourism development plan (MEFT 2020b).

However, to illustrate Namdeb's mining history and provide sufficient points of interest for the planned mining-based tourism in future, many more structures, machinery and evidence of the past mining operations are required. The Cultural Heritage Management Plan provides a list of items that should be considered to remain. Some examples are 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 (Namdeb 2020a - CHMP). The items to remain need to be agreed with stakeholders and a formal agreement with the regulator is required to preserve these items.

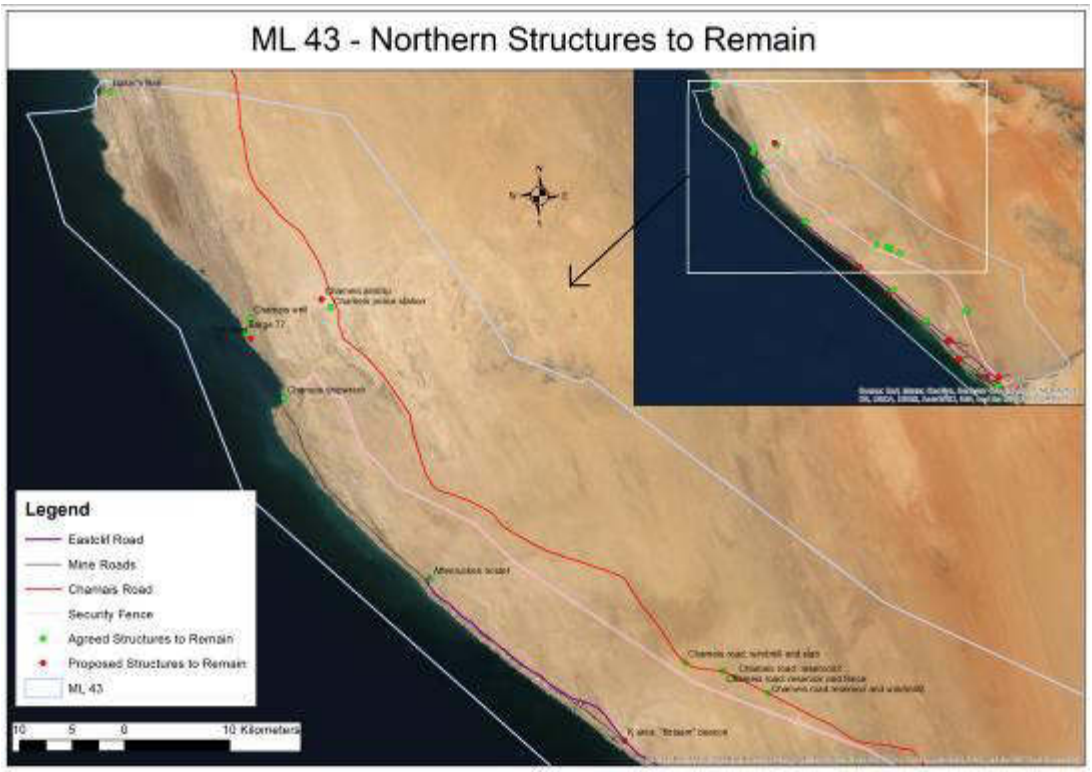


Figure 18. Map of infrastructure to remain in northern ML43.

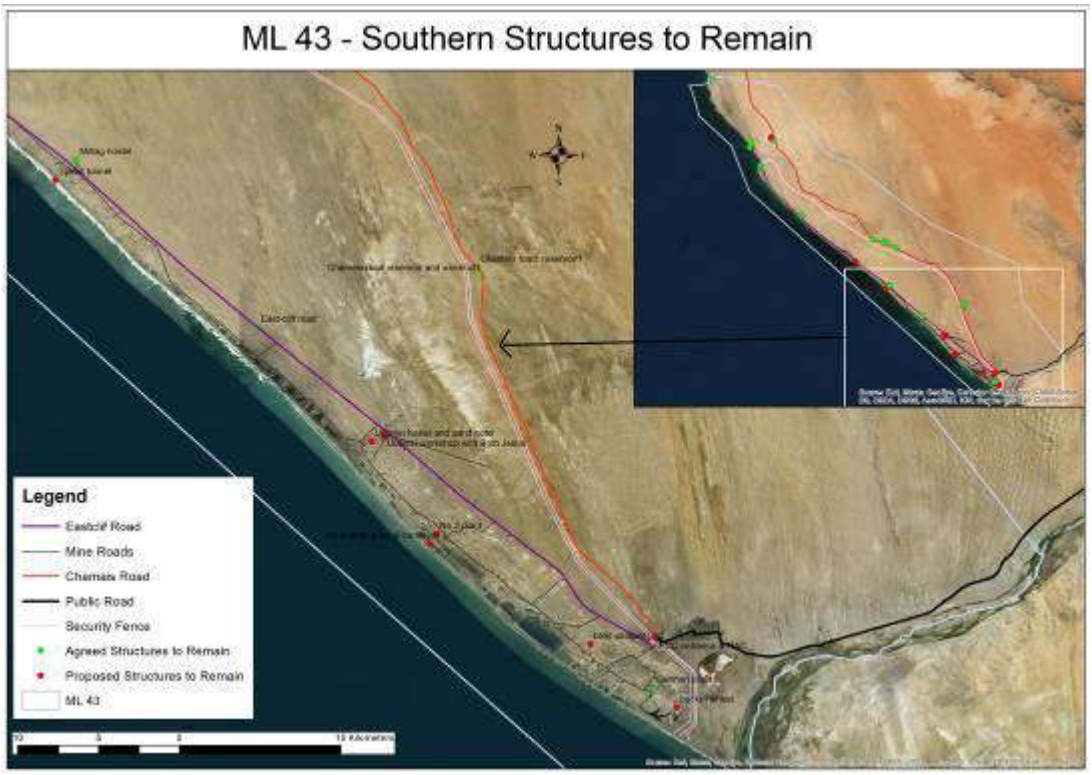


Figure 19. Map of infrastructure to remain in southern ML43.

5.2.2 Infrastructure inventory and tasks

The table below indicates the structures presently located in ML43 from north to south and throughout the area.

Table 8. Infrastructure in ML43 to be demolished from north to south.

Component	Description
Buildings	
Baker's Bay (Satellite Domain 13)	Buildings, water reservoir and concrete foundations
Fort Reef (Satellite Domain 12)	Buildings, water reservoir and concrete foundations
Chameis gate (Satellite Domain 11)	Buildings and fuelling point
Buildings, plants and accessory works	
No.2 plant workshop (Satellite Domain 6)	Remaining workshop
Marine Dredging Treatment Plant (Satellite Domain 3)	Remaining plant and accessory works
Uubvlei hostel (Uubvlei Domain 1)	Hostel complex with all associated infrastructure such as sewage disposal facilities, water and electricity supply
Uubvlei workshops (Uubvlei Domain 2)	• Workshops for Namdeb's large earth-moving fleet • Currently storage facility for historic 16th century shipwreck 'Bom Jesus'
Uubvlei fuel station (Uubvlei Domain 2)	Diesel and petrol tanks
Uubvlei tyre yard (Satellite Domain 5)	Tyre disposal site
Waste management control area (Uubvlei Domain 4)	Tyre yard, industrial waste and asbestos waste site
Domestic waste disposal site	Domestic waste
Mooi Meisies (Satellite Domain 4)	Workshops, storage yard, offices and laboratory
Namdeb main HT substation (Satellite Domain 9)	Substation for electricity received from Eskom
No.3 plant	Processing plant with all components of ore treatment for diamond extraction
No.4 plant	Remains of processing plant
No.4 plant production centre	Offices

Component	Description
No.4 plant fuel station	Diesel and petrol tanks
50G infrastructure (Satellite Domain 5)	Mostly demolished, only a few buildings remain
Southern Areas Sampling Plant (Satellite Domain 7)	SASP plant for geological samples
Personnel Control Centre (PCC)	Gateway with x-ray facilities, offices and storage facilities
Red Area Complex	Recovery, x-ray facilities next to PCC
Geological Sampling Recovery	Geological laboratory, integrated with PCC
Transport section and helipad	Offices and workshops next to PCC
Freight Yard	Office and yard next to PCC
Scrap disposal yard	Exit gate for processed scrap metal for re-sale and weigh bridge north of PCC
Waste oil facility	Storage tanks for waste oil near PCC
Oyster farm (Satellite Domain 10)	Trial site for oyster production in ponds
Accessory works throughout the area	
Power substations and transformers (Satellite Domain 9)	37G, 38G, 11G substations and 103 link station
Radio masts (Satellite Domain 14)	Eight radio masts
Concrete foundations and open sheds	Along haul road, at former plant and building sites
Water troph	East-cliff road
Manholes, inspection and valve chambers	Along water supply routes
Reservoirs and pump stations (Satellite Domain 14)	Along water supply routes
Linear infrastructure throughout the area (Overarching Domain 1)	
Roads and tracks	14 m wide haul roads, single tracks, (tar road to Affenrücken to remain)
Diesel fuel line	From PCC to Uubvlei with t-offs to No.3 and No.4 plants
Fibre optic lines	From PCC to Chameis and from there to Lüderitz
Power lines	Permanent lines to Uubvlei, No.3 and No.4 plant, temporary lines to active mining sites
Water, sewage and fines pipelines	• Sections of (non-asbestos) water pipeline to Affenrücken, underground water pipeline to Uubvlei, t-offs to waste management facility, No.3 plant and No.4 plant • Fines pipelines near all treatment plants
Security fence	Fence (double to triple in sections) around high security area

Component	Description
Mobile equipment	
OREX screening plant	Sampling treatment plant, now at MDTP
WIFS (Satellite Domain 7)	Wet Infield screening plant
DIFS (Satellite Domain 7)	Dry infield screening plant
Bucket wheel	Bucket wheel in ED area

The tasks associated with demolition are those described for Namdeb overall. The only difference in ML43 is that there is a substantially larger amount of infrastructure to demolish and dispose off, particularly with regard to hazardous waste (for example radioactive x-ray facilities and asbestos) and tyres.

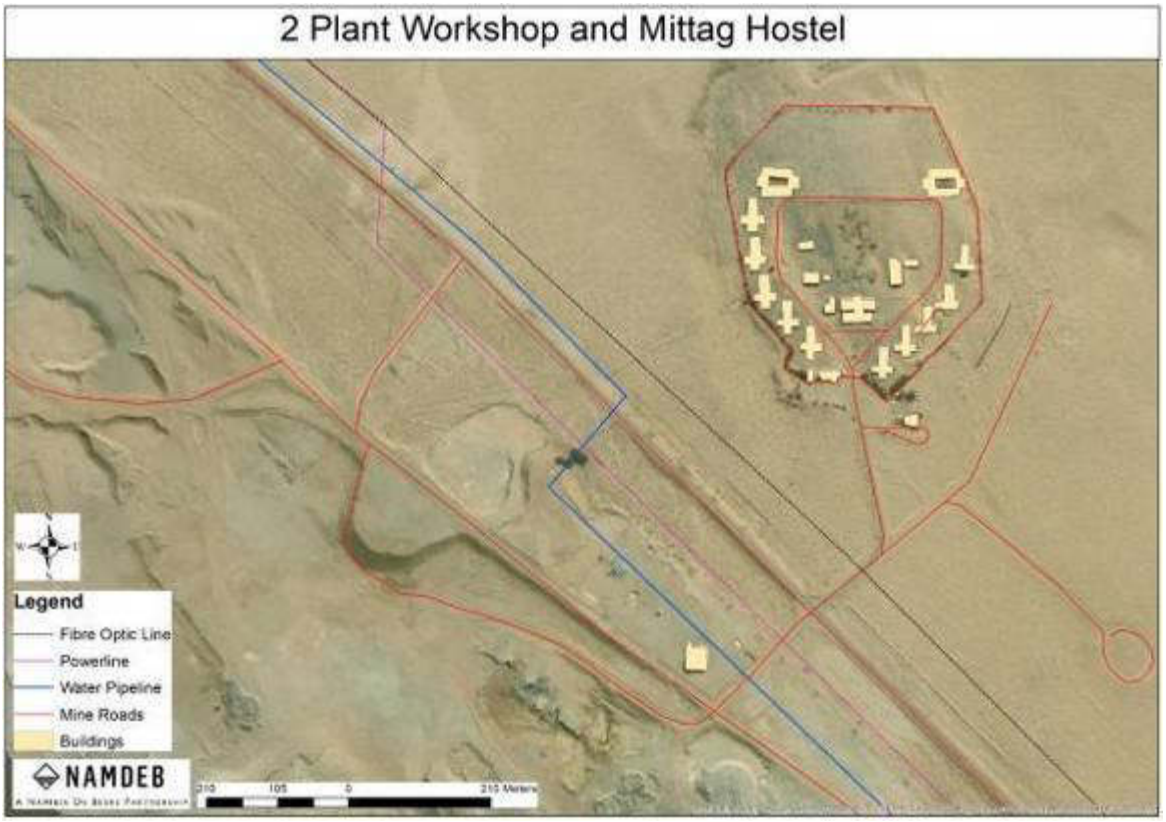


Figure 20. Infrastructure at No2. plant site (map compiled by Namdeb, February 2021).

Figure 21. Infrastructure at Marine Dredging Trial Plant site, Uublvei hostel and Uubvlei security complex (map compiled by Namdeb, February 2021).

Figure 22. Infrastructure at Uubvlei workshops (map compiled by Namdeb, February 2021). Note that the path of the fuel line from the East-cliff road to the fuel station is only approximate, as it does not traverse a workshop.

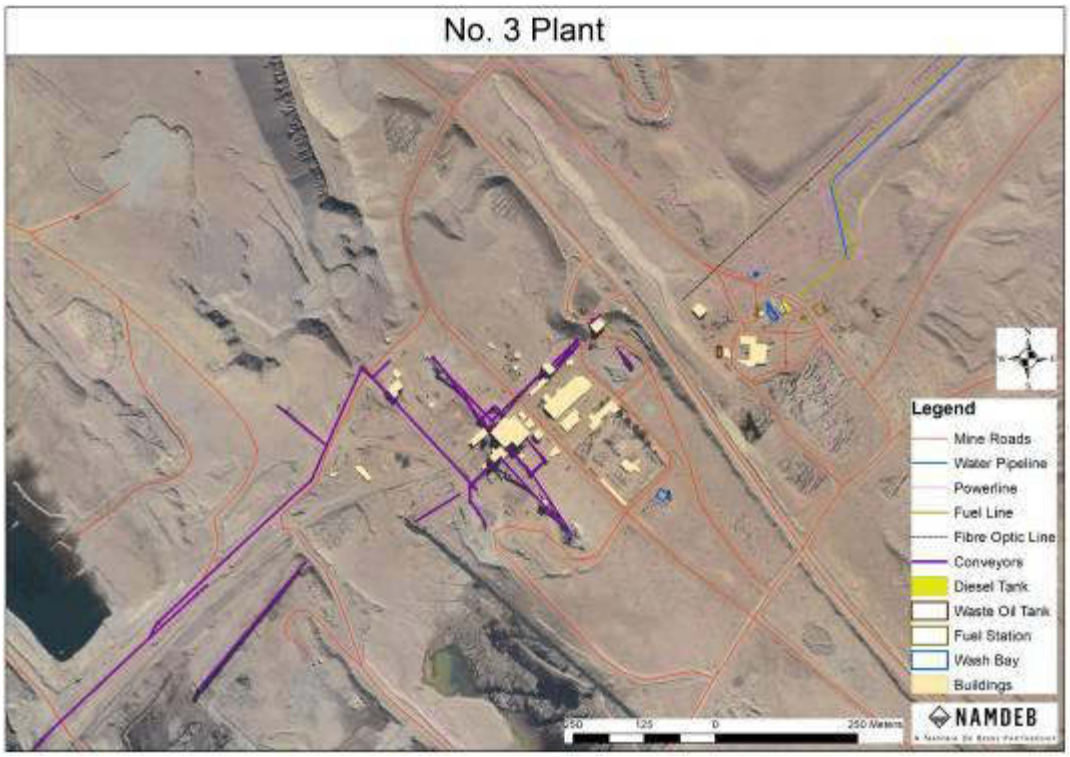


Figure 23. Infrastructure at No.3 plant (map compiled by Namdeb, February 2021).

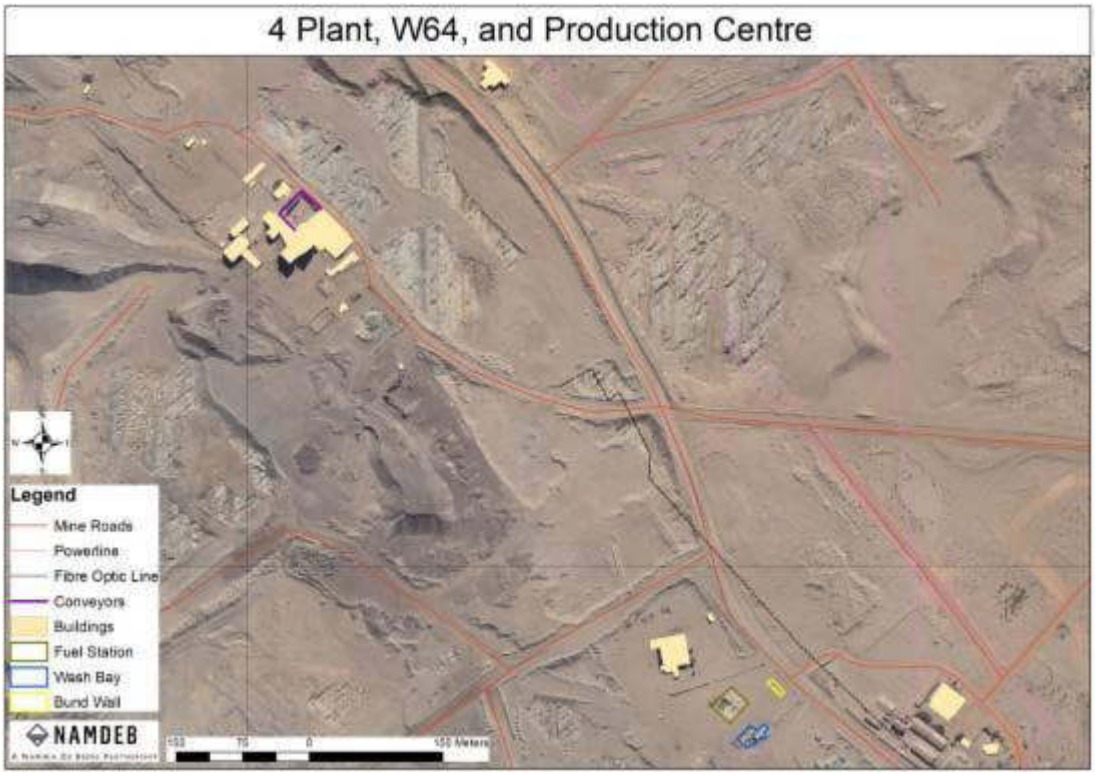


Figure 24. Infrastructure at No.4 plant (map compiled by Namdeb, February 2021).

Figure 25. Infrastructure at 50 G (map compiled by Namdeb, February 2021).

Figure 26. Infrastructure at Southern Areas Sampling Plant (SASP) (map compiled by Namdeb, February 2021).

5.3 Landscaping (earthworks rehabilitation)

Various proposals for landscaping tasks in Namdeb's Southern Coastal Mines (SCM) have been made and refined in subsequent revisions of Namdeb's rehabilitation plan. Considering that neither major erosion takes place – only few dumps show indications of erosion – nor is plant regrowth completely hampered on the manmade landforms (with few localised exceptions), earthworks rehabilitation is therefore guided mainly by visual aspects.

Visual aspects are extremely subjective and the views range from leaving all signs of mining completely untouched to backfilling mined out areas, reshaping of dumps and erasing all signs of human intervention to attempt to restore pre-mining conditions.

In an area that has been mined for over 100 years, with very little consideration for rehabilitation, the latter is impractical and would also not meet a vision for mining-based tourism as a future land use. An intermediate level of intervention therefore must be developed which is likely to gain the regulator's and stakeholders' approval.

The rehabilitation plan of 2008 proposed that rehabilitation in SCM should be restricted to a 500-600 m wide corridor along the future tourism route. However, even within this corridor, not all areas need to be rehabilitated and this was refined in further revisions of the rehabilitation plan.

5.3.1 Manmade landforms to remain

5.3.1.1 Sites of Special Scientific Interest

Areas identified as Sites of Special Scientific Interest (SSSI) for geological and historic reasons are excluded from earthworks rehabilitation. 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).

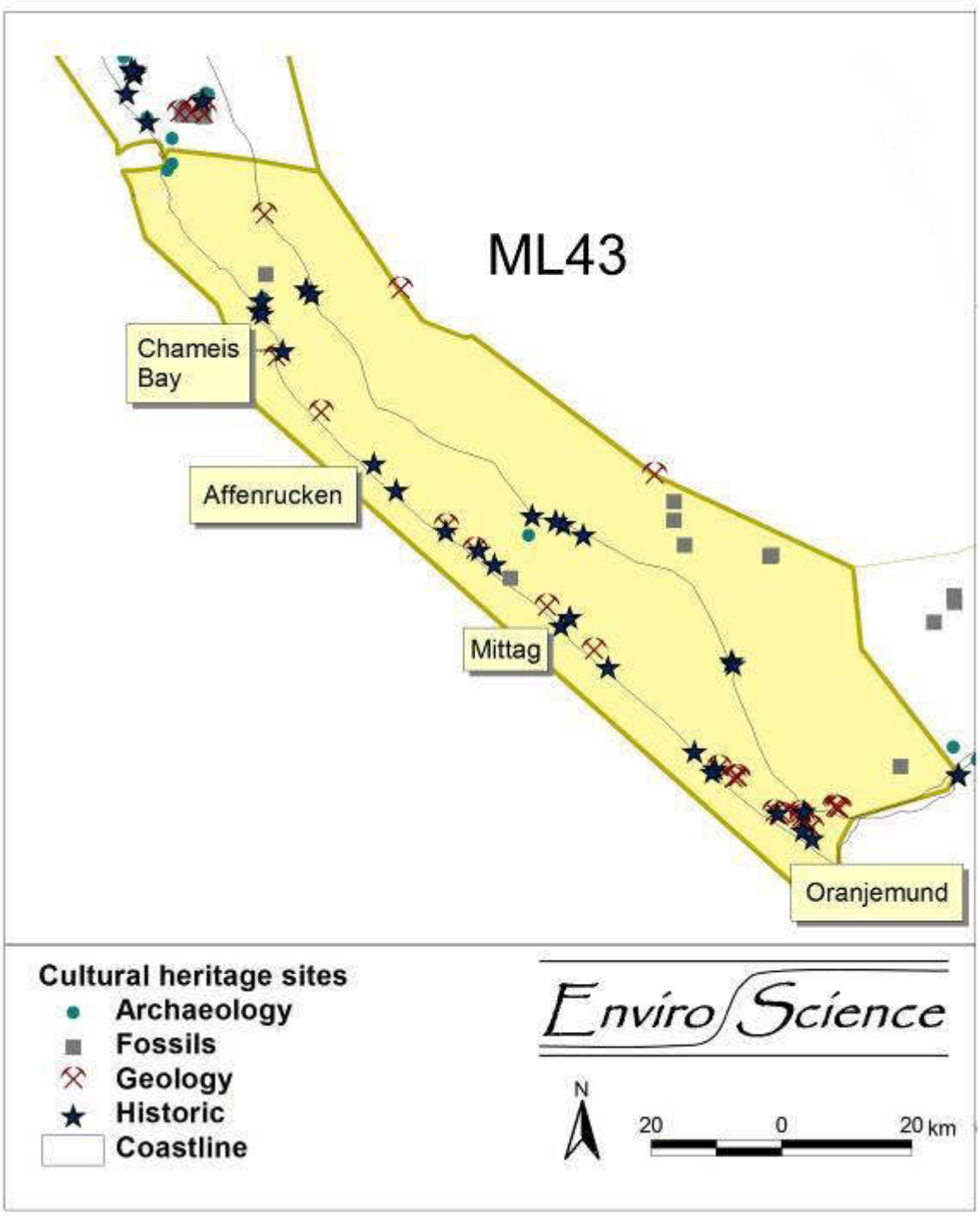


Figure 27. Cultural heritages site, which include Sites of Special Scientific Interest (geology, fossils, historic) in ML43.

5.3.1.2 Natural processes

Another aspect to consider is the natural reworking of landforms. This takes place rapidly in the beach-mined stretch due to the coastline gradually regaining its pre-mining state and thereby filling in many of the manmade ponds. As investigated by comparison of satellite imagery in 2013 during a 3-year time span, natural rehabilitation of bedrock areas is expected to take place within 200-500 m from the current shoreline (Burke 2013).

Moreover, the ponds currently support a diverse mix of marine and coastal wildlife. If it can be demonstrated that these ponds maintain functioning ecosystems, there is no reason to intervene. Recent studies indicate that the ponds indeed present a functioning ecosystem, but that their life span as an ecosystem supporting different life forms is limited due to increasing salinity with age (Maritz 2020).

5.3.1.3 Refining earthworks rehabilitation tasks

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.

This refinement process followed a set of criteria. This and the rationale for removing the majority of areas initially scheduled for reshaping, is described in detail in Southern Coastal Mines' restoration plan (EnviroScience 2021).

5.3.2 Earthworks rehabilitation inventory and tasks

Taking SSSIs' and natural processes into account, the current revision of earthworks rehabilitation tasks in the corridor along the future tourism route has reduced the tasks to few interventions. The table below lists and describes all manmade features in ML43 which may or may not require rehabilitation.

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 9. Manmade features and earthworks rehabilitation tasks in ML43, which are all in Southern Coastal Mines.

Component	Description	Task
Mining landscape (Overarching domains 2 and 3)		
Beach-mined stretch	Seawalls, cross-walls and ponds	Likely no rehabilitation
Exposed bedrock	Mined out bedrock areas	Likely no rehabilitation
Overburden dumps	These form the largest element of the manmade landscape in SCM. Dump shapes vary according to the machinery used to construct the dumps. Bucket wheel, ADT's and bowl-scraper created distinct dump shapes.	Optional: old dumps disturbed by removal of material to be reshaped, emerging waste to be removed and dumps reshaped; other dumps require no rehabilitation
Tailings dumps (Overarching Domain 4)	There are 5 large tailings dumps along the shoreline, No.3 and No.4 plant dumps are scheduled to be used for accretion. There are also two tailings dumps in the inland area.	Dumps used for accretion to be reshaped; inland tailings dumps to be left to recover naturally
Small heaps, stockpiles and excavations	Heaps of excavated material and small excavations are scattered in various places all along the haul road.	Levelled and /or filled in to create a neat appearance along the tourism route, where required
Waste rock dumps and boulder piles	Waste rock and boulders were deposited in some areas along the haul road.	Rehabilitation of those visible along the tourism route required
Stockpiles	There are stockpiles of material at the various processing and infield screening plants. Likely not all of these are eventually treated.	If not used, to be reshaped to low, rounded dumps or used for backfilling, if excavated areas are nearby
Prospecting sites and trenches	Systematic and localised prospecting has left a network of sampling trenches across the mining area.	Most to remain as sites of special scientific interest or cultural heritage (e.g. mega-trench sampling programme); unsafe sites to be identified and appropriately sign-posted
Borrow-pits	Borrow-pits are found along the East-cliff road and there are also some bedrock borrow-pits along the haul road.	Field investigation of sites identified in August 2020 is required to determine rehabilitation tasks.
Areas disturbed by	All areas where infrastructure	To be rehabilitated by

Component	Description	Task
infrastructure	has been built and will be demolished are disturbed by these activities. This can result in compacted areas and/or areas covered with unsuitable substrate to facilitate natural re-vegetation. This is not only limited to SCM, but also includes structures outside the mining area such as Baker's Bay, radio masts, helipad and others.	levelling, scarifying where necessary, or application of topsoil/suitable substrate to promote plant growth and final removal of all machine-made furrows and tracks
Roads and tracks	The tarred East-cliff road and the haul will remain, but they block natural flow in several drainage areas in the northern part of SCM. The same applies to the haul road north of No.2 plant.	Natural water flow to be re-established; roads and tracks with no future use branching off haul road and East-cliff road are to be rehabilitated for 300 m off the future tourism route.

Earthworks rehabilitation tasks are the same as for all Namdeb licence areas, with one addition: where reshaping of slopes is scheduled, the slope angle needs to be reduced to a maximum of 15º. Earthworks rehabilitation tasks in SCM relate to visual aspects and are therefore subjective.

A survey of initially identified steep slopes scheduled to be re-profiled, was undertaken in August 2020 by the consultant and Namdeb staff (Namdeb 2021 – SCM restoration plan). The objective of this field survey was to identify those slopes that showed regrowth of vegetation in order to exclude these from rehabilitation and to identify areas along the future tourism route which may pose a safety risk or a visual impact. Little agreement could be reached on visual aspects among the survey team, demonstrating the different views people have on visual aspects. There was agreement only on some items among the field survey team. The 'steep slope survey' identified therefore areas agreed upon (Table 10) and areas that need further investigation and stakeholder engagement (Table 11).

Table 10. Areas agreed with Namdeb to require intervention based on 'steep slope' survey from south to north in SCM.

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

Item	Description	Intervention
	surrounding area	area

Table 11. 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

The areas to be rehabilitated are shown in overview below (Figure 28) and some examples in more detail in Figure 29 and 30).

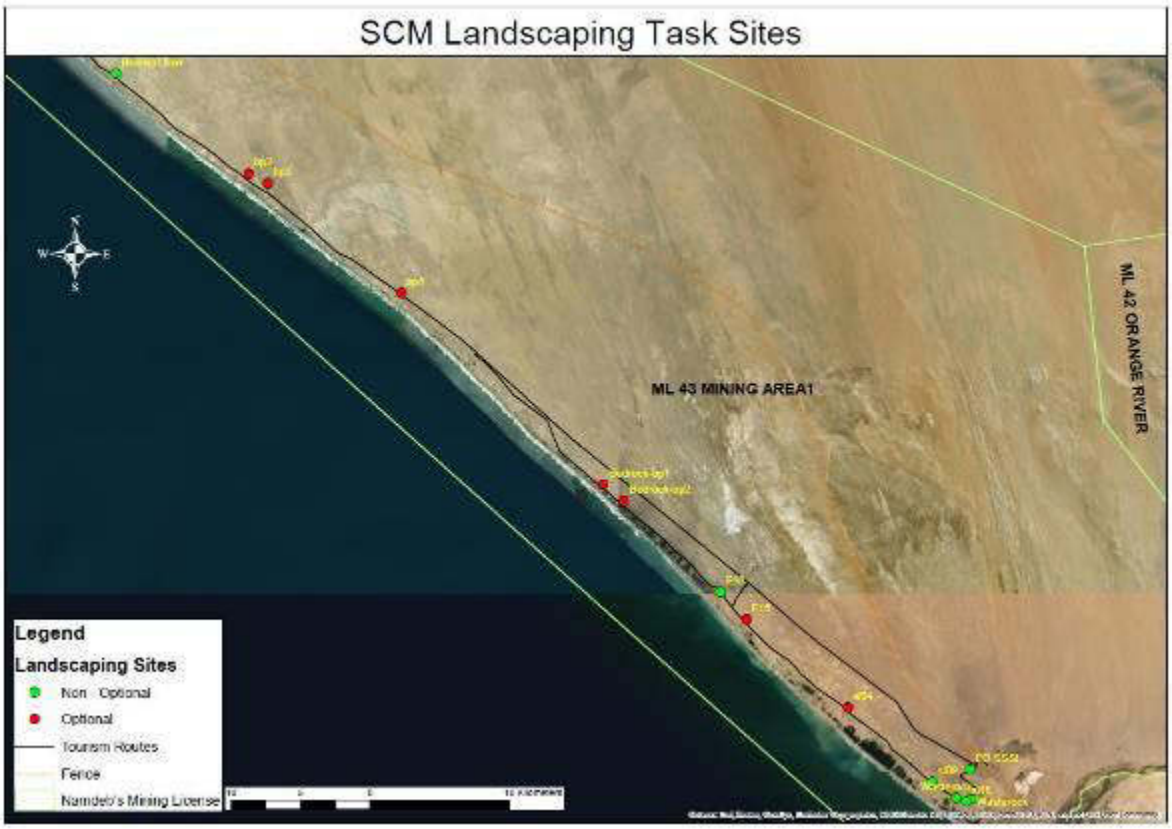


Figure 28. Earthworks rehabilitation sites in Southern Coastal Mines (map provided by Namdeb, December 2020).

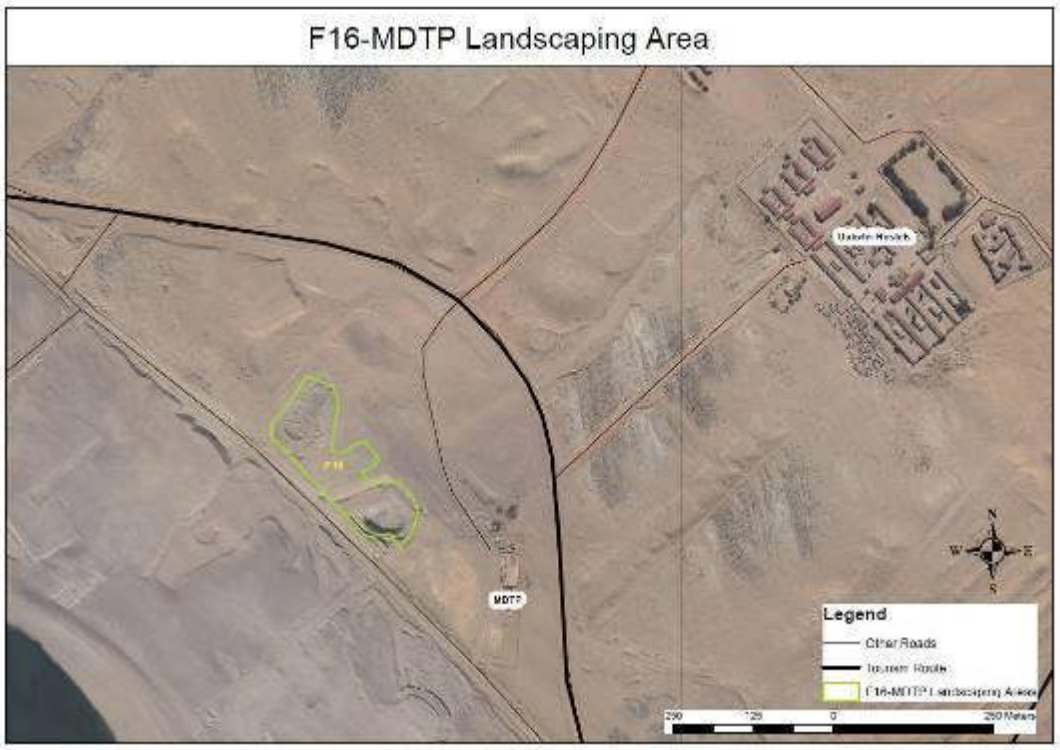


Figure 29. Landscaping tasks at the former Marine Dredging Trial Plant west of Uubvlei (map provided by Namdeb, November 2020).

Figure 30. Landscaping tasks in the southern part of Southern Coastal Mines (map provided by Namdeb, November 2020.

5.4 Guidelines for progressive rehabilitation in Southern Coastal Mines

- 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. The 500 m distance was determined in a study of satellite images in 2013 which showed that this was how far natural re-establishment of the coastline took place. This is a guidelines based on an average. How far inland the coastline establishes finally is dependent on local conditions and needs to be reviewed regularly (Burke 2013).

- Future mining activities in the vicinity of scheduled landscape rehabilitation should incorporate rehabilitation requirements at this 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 15º 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 15º 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.

5.5 Opportunities

Three buildings at Baker's Bay are proposed to remain to be used by MEFT staff. In SCM various structures are proposed to remain to illustrate Namdeb's industrial history. Namdeb's Cultural Heritage Management Plan contains a complete list of proposed structures. These include old and modern processing plants, hostels, entrance gateway to high security area as well as examples of (now) historic stripping machinery and dump types (Namdeb 2020a - CHMP).

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.

Chapter 6 ML44

Demolition and earthworks rehabilitation in ML44 is possibly required at a site north of Pomona where the subcontractor Sonnberg Diamante operated. There is infrastructure to be removed, pollution to be remediated and some earthworks rehabilitation is needed. However, the liability for this rehabilitation is currently disputed between Namdeb and the subcontractor.

6.1 Additional closure criteria for ML44

No additional closure criteria apply in ML44.

6.2 Demolition

6.2.1 Infrastructure to remain

The largest historic mining 'ghost' towns in the Sperrgebiet are situated in ML44. These are Bogenfels village and Pomona. In addition to these, there are numerous historic sites scattered throughout the mining licence, all related to mining endeavours and law enforcement in historic times. The star-studded map below (Figure 34) highlights this point. All historic structures are to remain which is aligned with MEFT's plans for cultural heritage preservation in the Tsau//Khaeb (Sperrgebiet) National Park and entrenched in Namdeb's Cultural Heritage Management Plan (Namdeb 2020a - CHMP). Roads and tracks to remain still need to be formally agreed with MEFT. The same applies to the fibre optic lines.

6.2.2 Infrastructure inventory and tasks

The table below indicates the structures potentially scheduled for demolition located in ML44. The site at Sonnberg near Pomona was mined by contractors who are also responsible for rehabilitating the areas they disturbed. However, the company folded and the rehabilitation liability is currently disputed.

Table 12. Infrastructure potentially to be demolished in ML44.

Component	Description
Sonnberg treatment plant (Domain 3)	Processing plant and associated infrastructure and concrete foundations
Sonnberg contractors camp (Domain 5)	Containers, water reservoir, ablutions and concrete foundations
Bogenfels satellite and accommodation buildings (Domain 6)	Containers, water reservoir, ablutions and concrete foundations
Linear infrastructure (Domain 1)	Roads, tracks and fibre optic lines

All modern infrastructure at the contractor camp and plant site will be removed. There are some brick/concrete and steel structures (labelled 'unknown structures' on the map) which may have been at this site before the contractor established the camp. These could possibly be historic but require further investigation before including these in the demolition schedule.

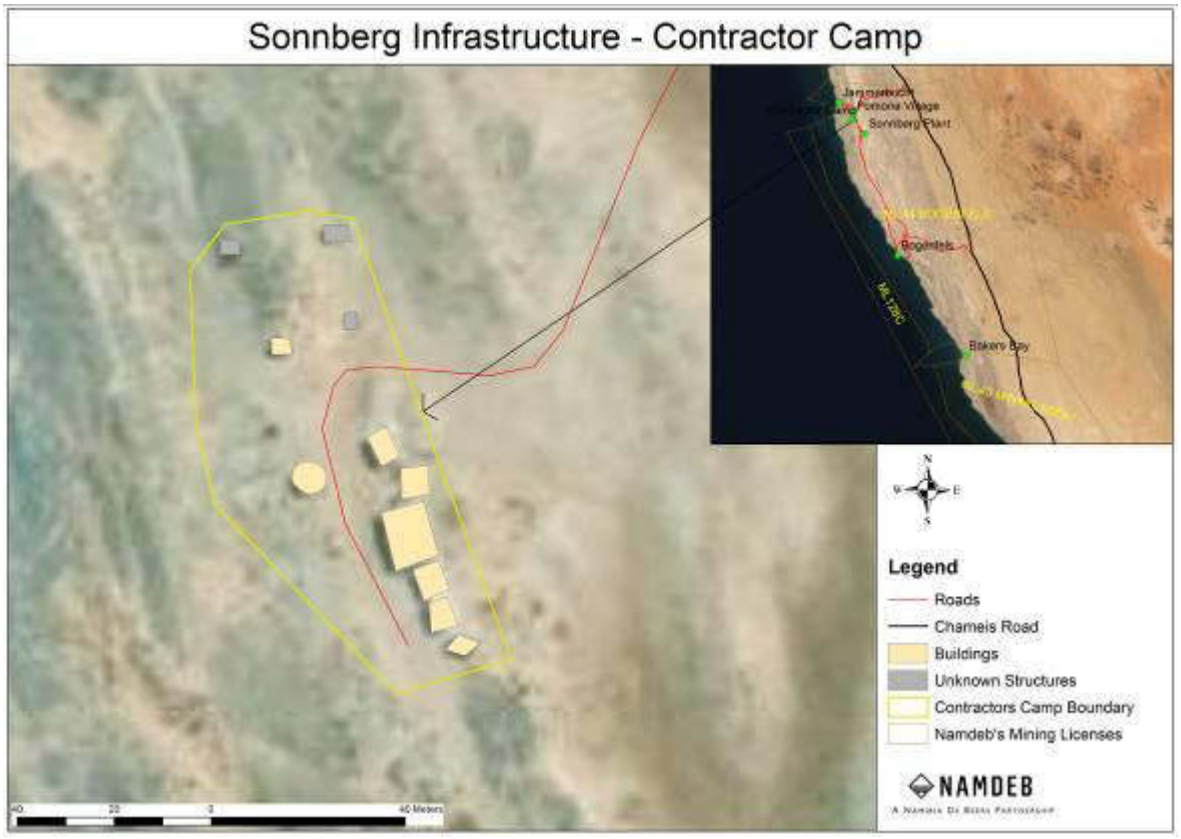


Figure 31. Buildings and unknown structures at Sonnberg's contractor camp (map: Namdeb, April 2021).

A variety of rehabilitation tasks applies at the Sonnberg treatment plant area. This includes removal of containers, caravans, machinery, tyres, scrap metal and other

industrial waste. There is also oil in drums to be removed. Uncertainty exists with regard to the rehabilitation of concrete foundations of the fuel station and plant area. There are no disposal sites nearer than Oranjemund if these are demolished and as they reach up to 1.5 m above ground, covering these with sand will also be difficult. This is an issue to be discussed with key stakeholders.

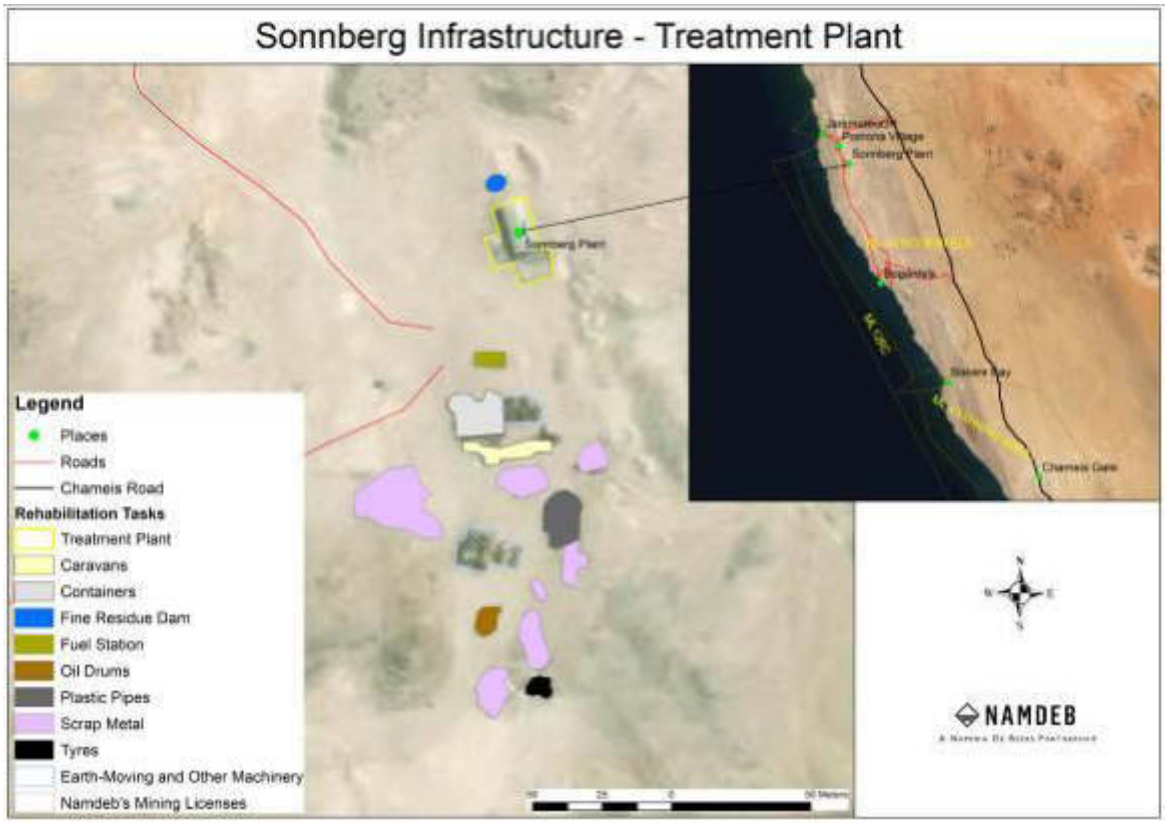


Figure 32. Buildings at Sonnberg's contractor camp (map: Namdeb, April 2021).


Figure 33 Scrap metal at the Sonnberg Diamante treatment plant area (Photo: J. Moongo, Namdeb).

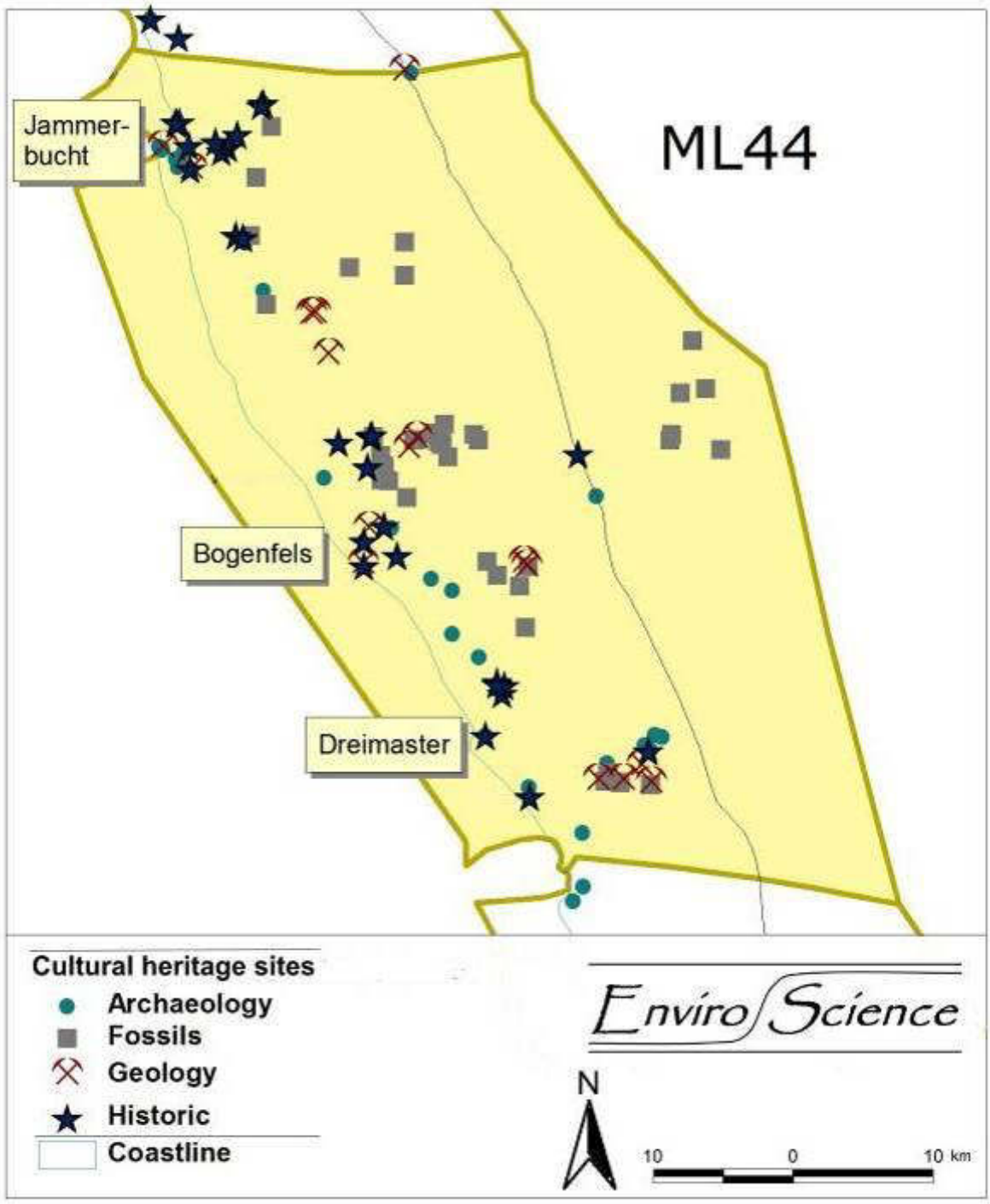


Figure 34. Cultural heritage sites in ML44.

6.3 Landscaping (earthworks rehabilitation)

6.3.1 Manmade landforms to remain

The manmade mining landscape around Bogenfels and Pomona and areas in between are historic and will therefore remain. The artificial and more recently created pond at the pocket beaches site 11/12 (Bogenfels) needs agreement with the authorities, if it is to remain. Key stakeholders have been consulted and agreed to this, but this still has to be formalised.

6.3.2 Earthworks rehabilitation inventory and tasks

There are some tailings dumps at the Sonnberg contactor site near Pomona, but most of these have been shaped and show reasonable plant cover. Only one area on the dumps needs some landscaping. There are also some small heaps and areas disturbed by infrastructure that require levelling. Because of the small areas and the disturbance machinery would create, these tasks can be accomplished manually with a small work force.

Table 13. Earthworks rehabilitation tasks in ML44.

Component	Description	Task
Sonnberg mineral dumps (Domain 4)	Three tailings dumps in Sonnberg area, small heaps and area disturbed by infrastructure	Some manual levelling of small dumps and top of some
Bogenfels mining area (Domain 2)	Pond at site 11/12	Regulator's approval on pond to remain

Figure 35. Most of the tailings dumps at the Sonnberg contractor plant site show reasonable plant cover (Photo: J. Moongo, Namdeb).

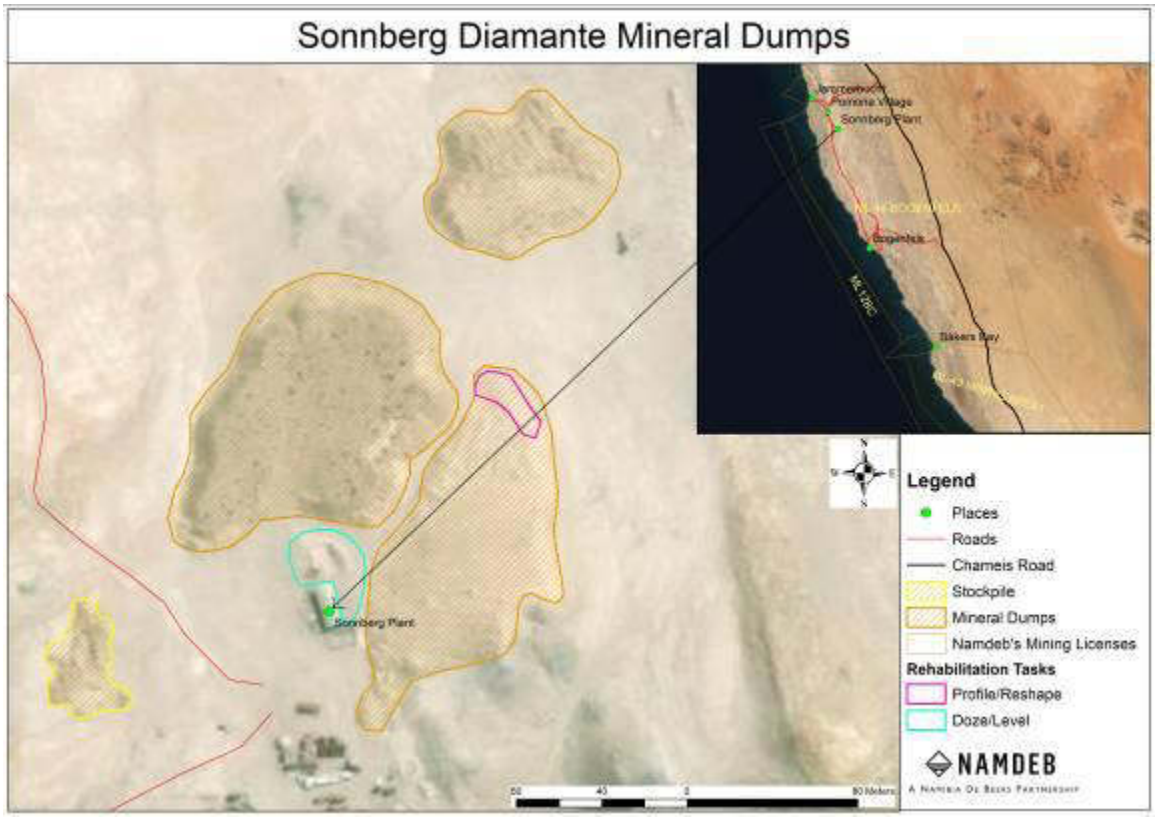


Figure 36. Earthworks rehabilitation tasks at the Sonnberg Diamante treatment plant area (Photo: J. Moongo, Namdeb).

6.4 Opportunities

The majority of remnants of the early diamond history is in ML44. The two early 20th century mining settlements Pomona and Bogenfels are in this licence area. These are key points of tremendous interest for mining-based tourism.

The spectacular natural rock arch, the 'Bogenfels' is also situated in this ML and is another point of interest for tourism.

Figure 37. The old clinic at Bogenfels (now Pink House) has been maintained by Namdeb and serves as welcome short-term accommodation to Namdeb staff and researchers who work in this area.

Chapter 7 Gaps to be filled in future

The need for earthworks rehabilitation is very subjective and this needs to be agreed with the regulator. Also infrastructure to remain needs to be formally agreed with the regulator. Rehabilitation tasks for Obib and Auchas need to be finalised.

7.1 Subjectivity of earthworks rehabilitation tasks

The subjective assessment of earthworks rehabilitation in Namdeb's licence areas needs to be addressed. This can only be achieved by stakeholder engagement which must include the regulator and should ideally be based on site visits. While this applies to all mining areas, those where minimal intervention is planned are of greatest importance, namely Southern Coastal Mines, Daberas and Auchas.

Also specific features where rehabilitation measures are controversial, such as the pond to be left at Bogenfels, need to be backed by signed agreements with the regulator.

7.2 Infrastructure to remain

Formal agreements with the regulator are required for infrastructure to remain in all licence areas. This should also include a review of the currently existing agreement.

This is particularly important in Southern Coastal Mines where many structures of importance for industrial history, including some modern structures, may inadvertently be included in Namdeb's demolition program.

7.3 Future mining in partially mined areas

Decisions need to be made within a reasonable time frame as to the future of mining at remaining reserves at Auchas and Obib.

Both these areas will require some rehabilitation, but appropriate measures should be based on the mine plans for these areas. However, as the question of mining at Auchas exceeds two decades now, a contingency rehabilitation plan should be developed. The same will apply to Obib, if decisions on mining are not reached within the foreseeable future (maximum three years).

Chapter 8 Stakeholder engagement

Stakeholder engagement is required to agree on demolition and earthworks rehabilitation tasks at Namdeb. This will include internal and external stakeholders and should follow a step-by-step approach. Existing channels should be used as far as possible (e.g. the Lüderitz and Tsau//Khaeb (Sperrgebiet) National Park stakeholder fora), but a dedicated interaction related to closure overall is necessary. This should include the demolition and landscaping programs.

The demolition and landscaping programs need to be agreed with the regulator(s). This needs to be approached step-by-step:

1. Internal agreement within Namdeb regarding rehabilitation tasks.
2. Agreement with De Beers and Anglo-American peers.
3. Agreement with key stakeholders and regulators.

8.1 Stakeholder groups

- Namdeb staff
- Group corporate peers such as Anglo American and De Beers
- Service providers and contractors
- Regulators and other government officials
- Conservation agencies and initiatives
- Tour operators

Namdeb staff is a stakeholder group on three levels of involvement:

1. to endorse the demolition and landscaping programs,
2. to provide input and
3. to manage the demolition and landscaping programs.

Service providers and contractors will need to be aware of certain activities and know about rehabilitated sites. Regulators and other government officials must to be informed of the rehabilitation programs and agree to the proposed tasks. MEFT and MME staff represent the regulator and need to be involved in identifying tasks and setting closure criteria.

8.2 External stakeholder engagement

The objectives of external stakeholder engagement will be three-fold:

1. To obtain acceptance of Namdeb's demolition and landscaping program by authorities and landholders
2. To involve key stakeholders in the development of actions that need to continue beyond mine closure
3. To identify the right partners for implementation of actions outside the company's level of responsibility and expertise.

8.2.1 When is the right time?

Stakeholder engagement should commence once the company has reached consensus on a broad vision and strategic objectives and has developed proposals for dealing with various rehabilitation tasks. Perhaps not all aspects need to be developed in design-level detail, but proposal for rehabilitation need to be realistic, technically feasible and affordable. Where solutions to rehabilitation tasks have not yet been found, the process of obtaining solutions must be presented. Examples of the type of actions considered are always good and should be presented. Stakeholders will then better understand the concept and consequences of the proposed activity.

8.2.2 Means of communication

Initially the aim of stakeholder engagement will be to present the rehabilitation program and gauge the response by regulators, key stakeholders and the public. During all interactions, stakeholder input will need to be recorded, screened for relevance, and if necessary, incorporated in a revision of the demolition and landscaping report. The initial discussions should also be used to determine the best means of further involvement of certain stakeholder groups.

Ways of communication will differ between stakeholder groups, but targeting certain groups in one-to-one interactions is preferred to addressing all groups in one meeting at once. Existing avenues for information exchange should be utilised as much as possible, rather than embarking on a separate communication activity. For example the Namdeb stakeholder forum and the Tsau//Khaeb (Sperrgebiet) park management committee would be sensible avenues. Internal communication can be achieved through regular company briefs and inclusion at company events.

Progress reporting on rehabilitation aspects should be combined with reporting to stakeholders on a regular basis. While the Namdeb stakeholder forum in Lüderitz is currently active, waning interest by stakeholders and the exclusive nature of the stakeholder engagement (attendance by invitation) may not be a sufficient mechanism for publicising Namdeb's efforts in sound environmental management.

A regular brief in the form of a newsletter (distributed by email) and regular updates on Namdeb's website will reach a far wider audience and thus help to inform the public about Namdeb's activities.

8.2.3 What to present and discuss

Effective stakeholder engagement needs to be well planned to manage expectations. Adequate time needs to be spent on explaining the background, principles, concept and process. This should also include a clear explanation of where and how stakeholders can influence the process.

The content to be discussed needs to be tailored to the level of expertise of the relevant stakeholder group. Facilitators and translators are recommended to be involved where language barriers are expected. Once an adequate level of confidence in the demolition and landscaping programs is achieved, it should be available to the public (e.g. on Namdeb's website and/or other web-based platforms, e.g. the Environmental Information System of Namibia).

8.2.4 How to begin

The first step in stakeholder engagement will be presenting the demolition and landscaping programs to government officials. These are staff of the Ministry of Environment, Forestry and Tourism and Mines and Energy. Ideally these interactions should include head office and regional staff and be accompanied by site visits. It is likely that these interactions identify other opportunities and the next steps can follow from there.

This should form part of the stakeholder engagement related to Namdeb's Integrated Closure Plan.

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Annex 1. Dust management plan.

A dust management plan is required at closure following the Atmospheric Pollution Prevention Ordinance 11 of 1976.

The nature of dust

At Namdeb dust is actively generated during construction, loading, hauling and driving on unpaved roads. Dust is also generated where fine materials are exposed for longer periods, which may be the case for Namdeb's fine tailings disposal facilities, if these have no adequate plant cover. However, dust is also a natural component of this environment and this needs to be taken into account when assessing its impact and developing management actions.

The treatment of ore at Namdeb does not require chemicals but is largely a mechanical process of crushing, scrubbing and sorting the material according to size classes. Although the composition of dust may be different from natural dust in the environment, no chemicals are present in noticeable amounts that do not occur in the natural environment.

Dust control areas during operation

Based on the definition in the Atmospheric Pollution Ordinance of 1976 any area where more than 20,000 m^3 of dust are deposited requires the implementation of dust suppression measures.

An automated dust monitoring system (SCADA) is installed at the Sendelingsdrif plant site which provides information to the managers on dust exposure levels. Management actions are implemented when exposure levels exceed legal limits.

However, as quantities of dust have not been measured at Namdeb overall, all loading and hauling activities related to mining are considered dust control areas. Also fine tailings disposal sites are considered potential dust control areas.

Table 14. Present dust control areas at Namdeb.

Area	Description	Control measures
ML42		
Sendelingsdrif mine site	Excavation, loading and transport of ore, as well as backfilling and rehabilitation generate dust.	Wetting of haul roads, sprinkler system at the plant area, automated dust monitoring system
Sendelingsdrif haul and access roads	Trucks transporting ore and vehicles related to supplementary services create dust on haul and access roads.	Wetting of haul and access roads

Area	Description	Control measures
Sendelingsdrif fine tailings disposal facilities	Wet fine tailings do not generate dust during operation, but as these are left to dry out, they may generate dust once dry during windy conditions.	To be determined based on study of geotechnical and chemical stability
Daberas mine site	Excavation, loading and transport of ore generate dust.	Wetting of haul roads
Daberas haul and access roads	Trucks transporting ore and vehicles related to supplementary services create dust on haul and access roads.	Wetting of haul and access roads
Daberas fine tailings disposal facility	The large fine tailings disposal facility at Daberas has been left to dry out for many years. Reeds have established on part of the area and keep the soil in place, thereby suppressing dust.	To be determined based on study of geotechnical and chemical stability
Auchas fine tailings disposal facility	Indigenous vegetation has established on the fine tailings disposal facility.	To be determined based on study of geotechnical and chemical stability
ML43		
Mine sites	Excavation, loading and transport of ore generate dust,	Wetting of haul roads
Haul and access roads	Trucks transporting ore and vehicles related to supplementary services create dust on haul and access roads.	Wetting of haul and access roads
Sources of accretion material	The stripping of overburden and tailings dumps for accretion material generates dust.	Wetting of haul roads
Oranjemund – Chameis road	Vehicle traffic generates dust on this unpaved road.	Traffic volume is low and no measures are applied.
ML44		
Mine sites	No active operations generating dust	
Gravel roads	Vehicle traffic generates dust on unpaved roads between Chameis and Rotkop and the road to Bogenfels.	Traffic volume very low presently and no measures are applied.

Dust control at Namdeb during operations is mainly related to mitigate potential negative effects on human health. The dust control areas are therefore regularly monitored by safety and health officers.

Dust control at closure

Once active mining has stopped and rehabilitation has been completed, manmade features potentially generating dust at quantities that may require control measures are the fine tailings deposit facilities at Orange River Mines (ML42) and possibly dumps with limited vegetation cover and exposed fine material at the surface.

As plant cover has established on both inactive tailings facilities at Auchas and Daberas, dust was not considered a significant impact requiring management at these facilities during operation. However, the geotechnical and chemical stability of the fine tailings disposal facilities to be left at closure will need to be investigated. At the same time potential dust pollution also needs to be considered. Plant cover is linked to the geotechnical and chemical stability of the dams. The vegetation may change and eventually die, if the facilities dry up entirely and dust could then become a problem.

Re-vegetating of the mined out landscape is planned at Sendelingsdrif and selected areas at Obib, but the majority of the mining landscape at Daberas, Auchas and Obib will be left to recover naturally. Depending on the progress of natural recovery, this may leave some sources of dust where dumps with an appreciable amount of fine material near the surface are to remain and take too long to establish an adequate plant cover naturally. This is presently not known and vegetation monitoring at Daberas should include this aspect. This would expose potential problem areas.

At closure no dust control areas are anticipated in ML43 and ML44 because of the nature of the material which will be left exposed (sand and rocks), the dynamic coastal environment, where sand movement is a natural force, and the fact that fines are deposited in the sea.

Table 15. Potential dust control areas at closure at Namdeb.

Area	Description	Control measures
ML42		
Sendelingsdrif fine tailings disposal facilities	Wet fine tailings do not generate dust during operation, but as these are left to dry out, they may generate dust once dry in windy conditions.	To be determined based on study of geotechnical and chemical stability
Daberas fine tailings disposal facility	The large fine tailings disposal facility at Daberas has been left to dry out for many years. Reeds have established on part of the area and keep the soil in place thereby suppressing dust.	To be determined based on study of geotechnical and chemical stability
Auchas fine tailings disposal facility	Indigenous vegetation has established on the fine tailings display facility.	To be determined based on study of geotechnical and chemical stability

Measures towards informed closure

In order to make informed decisions about the need for dust management at closure a dust monitoring program with focus on closure aspects should be implemented at Orange River Mines.

This program should establish dust buckets at strategic locations and these should be monitored regularly and become part of environmental monitoring. The placement of the buckets should ensure coverage of all potential dust sources at closure as well as adequate control sites which measure the natural level of dust at each site.

A more detailed dust management plan for closure can then be developed based on the dust monitoring, vegetation monitoring and the geotechnical investigations related to the fine tailings disposal facilities.

Annex 2. Soil management plan.

Soil management is required where topsoil is stored for rehabilitation. Topsoil contains seeds, nutrients and microorganism which are beneficial in facilitating the regrowth of vegetation (Strohmayer 2005; Sheoran et al. 2010). However, it is important to treat topsoil correctly to maximise the benefits from this intervention. Stored topsoil looses its viability with time and if compacted. That is if topsoil is piled high, the topsoil in deeper layers may become anaerobic and so looses its fertility (Harris et al. 1989).

At Namdeb some topsoil was saved and stored for rehabilitation at Obib at Orange River Mines, but storing topsoil at other mine sites was considered impractical as the topsoil forms part of the ore. Should salvaging topsoil be implemented in future, the following guidelines apply:

Planning

- If at all possible, plan topsoil stripping and movement so that stripped topsoil can be immediately applied to rehabilitated areas.
- If this is not possible, identify topsoil storage area, outside of areas to be mined, but ideally in disturbed areas. Avoid disturbing natural areas for topsoil storage. No topsoil storage should take place in environmentally sensitive areas. Also keep in mind natural processes, e.g. do not place stockpile in wind corridors or drainage areas.

Stripping topsoil

- Attempt to strip the first 10-20 cm of the soil, taking care not to strip deeper than 30 cm. Ensure topsoil is not mixed with subsoil.
- Store topsoil in flat dumps, ideally not more than 1 m high. However, if already disturbed areas are in short supply and storage in natural areas has to be considered, the disadvantage of higher stockpiles has to be assessed against disturbing a larger natural area. At Sendelingsdrif for example, minimum disturbance of a natural area is more important than keeping the 1 m height restriction.
- Should there be several topsoil storing events with more than 1 month between interventions, keep topsoil dumps from different times separate and mark with their date of stripping.

Applying topsoil

- Use the oldest topsoil first for rehabilitation.
- If topsoil is in short supply, identify priority areas for topsoil application where it is likely that topsoil application will most effective or where it is most necessary (e.g. exclude erosion-prone areas or areas with large voids like rock and boulder slopes).
- Apply topsoil on rehabilitated areas at approximate 10 cm depth.

- ◊ Minimise machinery movement on the applied topsoil to prevent soil compaction.
- ◊ Depending on natural conditions in the surrounding and availability of suitable materials – which are not to be sourced from undisturbed, natural areas – consider placing scattered stones, rocks or wood to reduce wind erosion.
- ◊ Implement re-vegetation measures where required.