3. Project description

3.1 Existing situation

Namdeb started mining gravel deposits in the Orange River Mining Licence (ML42) area at Auchas, 30 km north east from Oranjemund, in 1991. Daberas is the largest resource in the ML42 area and located ±15km north east of Auchas. Mining operations were moved to Daberas in 1999 following the completed sampling campaign in 1995. The current end of life of mine of the Daberas operation is estimated for the middle of 2013. More deposits in the ML42 area are presently under investigation for future mining post Daberas, the most significant being the Sendelingsdrif (second largest deposit of the area) and Obib deposits (Figure 3.1). Sampling and planning of mining operations is undertaken individually for each of these deposits. An infield screening plant and a sampling treatment plant (OREX) were relocated to the area in 1996. The current Sendelingsdrif sampling programme is ISO 14001 certified.

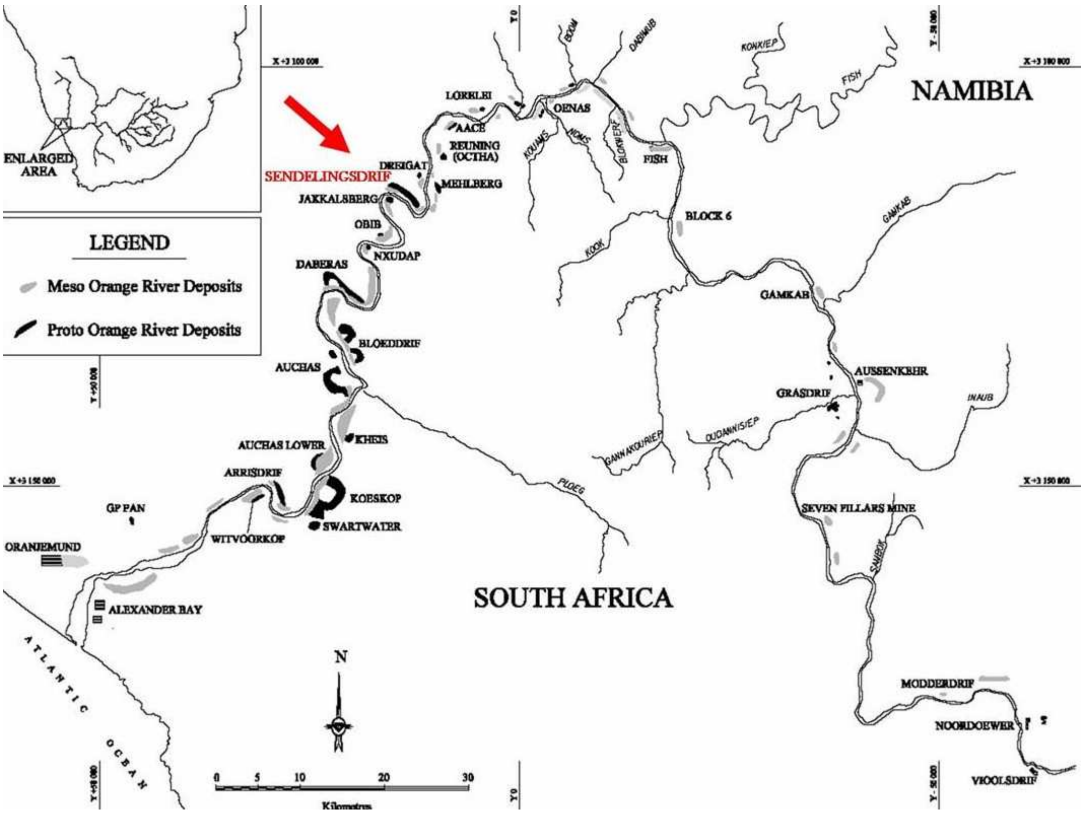

Figure 3.1 Gravel terrace deposits along the Orange River. Sendelingsdrif, like Auchas and Daberas, has a large Proto- deposit.
Source: Namdeb

Southern Namibia is one of the world's top 25 biodiversity hotspots; over 10 percent of plant species here are found only in the Sperrgebiet area. As the only permanent river in southern Namibia, the Orange River provides a favourable habitat for plants and animals. Some plant species are restricted to the lower Orange River valley, which makes the area environmentally highly sensitive. The Orange River licence area has been a protected area since 1908, with mining as its land use. The entire Sperrgebiet was proclaimed as a National Park on 1 December 2008. Its Land Use Plan is based on a compendium of information (Pallett, 1995) that was commissioned by Namdeb in 1993. The Plan outlines specific development guidelines for specific areas within the Sperrgebiet and for Rosh Pinah, Aus, Lüderitz and Oranjemund as development nodes and gateways. Since its vision statement includes the need to "enhance socio-economic values for the region and nation",

> "The land use management of the park will be pro-poor, so much that the formerly disadvantaged people should have the share of the cake from the park."

The Ministry of Environment and Tourism is in the process of developing a management plan for the Sperrgebiet National Park that will smooth the way for the issuing of tourism concessions. With such an emphasis on tourism, the Namibian Ministry of Environment and Tourism (MET) understandably wants the impacts of exploration and mining to be minimised and land to be rehabilitated to a condition that will not compromise the future end land use for the area.

3.2 Proposed operations at Sendelingsdrif

This EIA was initiated in the pre-feasibility phase of the Orange River Mines Life of Mine Extension project. Figure 3.2 illustrates how it fits into the high level planning for the new mine operation. Project implementation is envisaged to start during 2011. This EIA fits into the feasibility study.

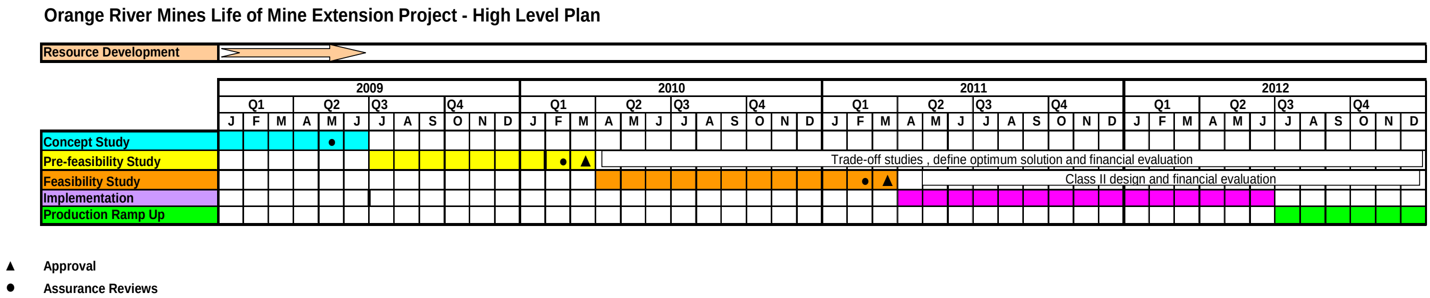

Figure 3.2 High Level Plan for Orange River Mines Life of Mine Extension Project.
Source: Namdeb

Sendelingsdrif deposit has been divided into seven zones, as illustrated in Figure 3.3. The resource consists of distinct gravel terraces of which the proto deposit is considered the most economically significant. The final mine plan will be dependent on the optimal business case for exploiting the Sendelingsdrif resource. Zone 1, most of Zone 2 and the Meso deposits are currently not in the mine plan since they are not profitable to mine. This may change in the future depending on available technology or the economic climate. Zones such as 6 and 7 contain scour environments and are also associated with moist conditions. This will have to be taken into account when planning the mining operations.

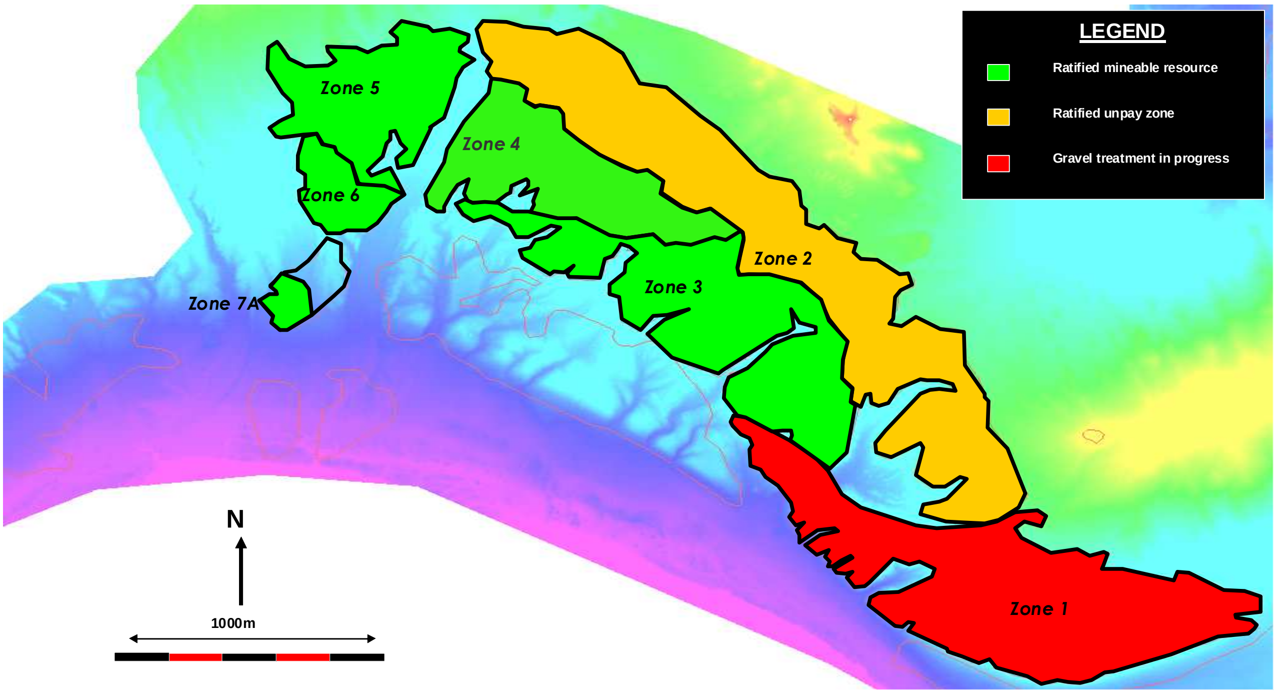

Figure 3.3 The seven zones that comprise mining operations at Sendelingsdrif.

3.3 Project Description and Project Alternatives

Treatment of the Sendelingsdrif deposit considers two options:

- Construction of a stand-alone treatment facility at Sendelingsdrif, or alternatively,
- Transporting the material from Sendelingsdrif to Daberas for treatment at Daberas.

The third option is a no-go-option.

Namdeb investigated various alternatives during the pre-feasibility study to find the optimal techno-economical solution for the exploitation of the Sendelingsdrif resource. The alternatives were evaluated with trade-off studies that considered plant location, product transfer, treatment solution options as well as various other aspects (see Table 3.1).

Table 3.1. Trade off studies included treatment solution options, plant location, product transfer and production rates. (OREX = Orange River Exploration Plant; DTP = Daberas Treatment Plant; MDMS = Mobile Dense Medium Separation Plant = Blue Plant. Yellow indicates plant location at Daberas and green indicates plant location at Sendelingsdrif).

Treatment Solution Options	OREX + DTP + MDMS	OREX + DTP + MDMS	OREX + DTP	OREX + DTP	OREX + MDMS	OREX + DTP	OREX + DTP + MDMS	MDMS
Plant Location	Daberas	Daberas	Daberas	Daberas	Sendelingsdrif	Sendelingsdrif	Sendelingsdrif	Sendelingsdrif
Rate (tph)	High tph	High tph	Low tph	Low tph	550 tph	1320 tph	770 tph	550 tph
Product transfer	Tramming	Aerial Ropeway	Tramming	Aerial Ropeway	At Sendelingsdrif	At Sendelingsdrif	At Sendelingsdrif	At Sendelingsdrif

All options assume conventional mining of the resource at Sendelingsdrif. The mining and treatment rates of the two options will differ due to the different capacities of the two treatment plants. The main difference between the two options is the concentration of the run-of-mine (ROM) material:

- For the **MDMS option** the material will be concentrated by the relocated MDMS plant at Sendelingsdrif.
- Transport to Daberas:
  - For the **aerial ropeway option** the screened material will be transported to Daberas with an aerial ropeway system for treatment through the DTP at Daberas;
  - For the **tramming option** the screened material will be transported to Daberas with on-highway trucks on a bitumen covered road for treatment through the DTP at Daberas.

For all options the concentrate will be transported by silo trucks from the respective treatment plants to the new Red Areas Complex (RAC) in Mining Area 1.

3.3.1 Option 1: Stand-Alone mine at Sendelingsdrif

3.3.1.1 Mining

The Sendelingsdrif resource is a near-surface deposit that can be exploited with conventional open pit mining methods (Figure 3.4). Essentially, diamond-bearing material is mined with heavy earthmoving machinery, such as hydraulic excavators, Rigid Frame Trucks (RTFs), bulldozers, front end loaders and graders. Contractors may also use Articulated Dump Trucks (ADTs). Ore retrieval will comprise of stripping; ore excavation; bedrock cleaning; drilling and blasting, stockpiling and hauling.

Figure 3.4 Sendelingsdrif will be exploited with conventional open pit mining methods.
Source: Namdeb

The bulk excavation of material will be undertaken with a 200-ton hydraulic backhoe excavator assisted occasionally by dozing and bedrock cleaning. Severely cemented portions of the deposit will require drilling (Figure 3.5) and blasting.

Figure 3.5 Drilling and blasting is sometimes required to break up hard cemented material
Source: Namdeb

Backfilling of mined-out areas will form part of rehabilitation of the area. Challenges with regard to progressive rehabilitation are anticipated. The resource is not mined progressively from one zone to the next; an average diamondiferous grade of material for treatment is considered. This will be positive for sustainability of the mine at Sendelingsdrif, but will lead to a setback time for backfilling. Backfilling will still take place during the mining operations, but not immediately.

The removal and stockpiling of a 30 cm layer of top soil for use during the rehabilitation process forms part of the investigation. Challenges exist in regard to the practicality of removing the layer of top soil and the replacement of this on top of the material. Also, some zones contain diamondiferous gravel material from top to bottom that makes it unavailable for topsoil material removal for use in rehabilitation.

In addition there will be a need to make provision for residue materials management i.e., storage areas for waste dumps, oversize dumps, low grade dumps and a safety berm between the Rosh Pinah road and the mining area. The total material to be moved/managed is approximately 47 million tons (Figure 3.6).

It is not practically possible to backfill all the material and in some areas dumps may remain. Remaining dumps will be profiled to fit in with the surrounding topography so that the future land use of nature based tourism or the visual acceptability of the area post mining is not compromised. Some of the waste material and residue will temporarily be used for storm water control and terracing, but is intended to also be eventually returned to mined-out areas.

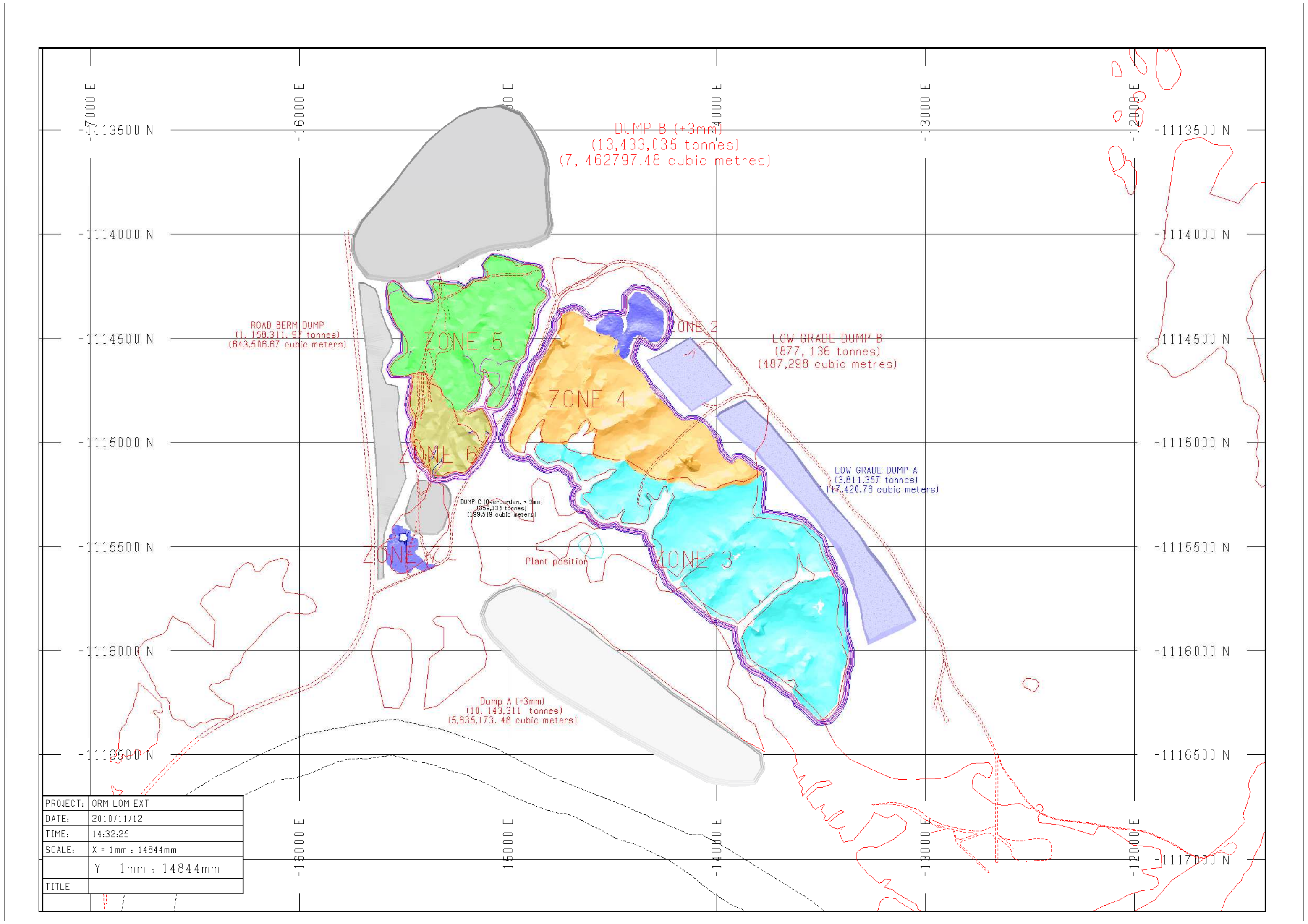

Figure 3.6 Anticipated residue management at Sendelingsdrif mine.
Source: Namdeb

A transvac gravel suction unit may be used to recover the final portion of the diamondiferous gravel on the bedrock after conventional mining has ceased (Figures 3.7 and 3.8).

Figure 3.7 Typical transvac suction units used at Orange River Mines.
Source: Namdeb

Figure 3.8 The footwall (bedrock) in some zones will be thoroughly cleaned using industrial vacuum units to ensure the recovery of all diamonds.
Source: Namdeb

3.3.1.2 Treatment

Various alternatives considered included new plants of various capacities as well as existing plants relocated to Sendelingsdrif. Relocation of the mobile DMS plant (MDMS) at Daberas to Sendelingsdrif proved to be the optimal solution in terms of a stand-alone operation at Sendelingsdrif.

Processing involves: dry screening; wet screening; degrit; Dense Medium Separation, X-ray recovery and residue disposal.

Treatment of the material through the MDMS plant at Sendelingsdrif

Gravel will be transported to the MDMS plant with mining trucks. There are two categories:

- Low grade material of <0.3cpt will not go to the treatment plant and this material will be stockpiled. This may be treated in the future if it becomes feasible to mine it again.
- Run of Mine (ROM) material will be fed to the MDMS and on average consists of ±40% +70mm boulders and ±20% fines <3mm.

The +90 mm material will be discharged onto the oversize stockpile while the product (-90 mm) will be conveyed to a dry sizing screen section. The product will be screened on a double deck screen removing the +60mm material (which will be conveyed to a residue stockpile), the -60mm +10mm fraction (which will be conveyed to the product stockpile/bin) and the -10mm material (which will be conveyed to a de-sanding screening plant). At the de-sanding screens, the -3mm material will be removed and conveyed onto the residue stockpile while the -10mm +3mm material will be conveyed onto the product stockpile.

The oversize and the residue stockpiles will be loaded by front end loader onto the mining trucks and dumped into mined-out areas as part of progressive rehabilitation. For the first ±5 years, insufficient mined-out areas will be available to back-fill into and subsequently temporary stockpiles will be created for backfill once the areas become available (see Figure 3.6). A conveyor may be considered for the building of a dump close to the plant.

The screened material will be fed from the product stockpile/bin into a front-end where the material will go through a wet scrubbing and size screening process (-30mm + 3mm), before going to the DMS section for final concentration.

The +30mm will be conveyed onto the residue stockpile with the -3mm reporting to the fine tailings disposal solution.

Final Concentration: Dense Media Separation

The +3 mm -25 mm product from wet screening will be further concentrated using a process called Dense Medium Separation (DMS). For this purpose a mixture of water and ferrosilicon at a density of approximately 2.65g/cm^3 and the feed material are mixed in a ratio of 6 to 1. This mixture is pumped to a 660 mm cyclone to separate the mixture into "sinks" and "floats". The sink product is washed to remove the ferrosilicon and then conveyed to the concentrate bin for later removal and transportation to the recovery plant, while the "floats" are discharged onto float screens to wash off the ferrosilicon. The washed float product is then conveyed to the tailings dump. Wash water from the DMS is pumped to a magnetic separator where 99.9% of the ferrosilicon will be recovered. The wash water is then pumped to a densifier and separated into overflow and underflow. The overflow reports to the dilute medium and the underflow to the correct medium sump. The final waste water may contain up to 0.05g/l ferrosilicon, which is not toxic.

Sporadic testing for density control is carried out in a laboratory; this requires a sample of about 500 g of DMS concentrate that is mixed with 5 litres of Bromoform, stirred and allowed to separate out. The float and sink fractions are weighed and the percentage float material calculated which enables a determination of the efficiency of the DMS process. While the sample is returned to the process, the Bromoform is drained from the float and sink fractions and returned for storage. Although very small quantities of Bromoform are thus introduced sporadically *via* the tested sample, the subsequent mixing of the sample with large volumes of material result in no measurable traces of Bromoform in the water.

The concentrate product from the DMS is stored in a bin for batched vacuum transfer into silo trucks for transport to the Red Areas Complex (RAC) in MA1 for final diamond recovery. The RAC still needs to be constructed, but it is accepted that the facility will be completed by the time that the project has been commissioned.

Fine Tailings Disposal

The MDMS option will require a fines residue disposal solution as it requires a wet process to deliver the concentrate. Separation of the waste water originating from the pre-DMS processes and that coming from the DMS process is being investigated. This may enable different fines residue disposal methods for the two streams to be implemented which may in turn benefit the project.

To date six different options for fine tailings disposal are considered, as described in Table 3.2.

Table 3.2 Various fine tailings disposal options under investigation for a stand-alone mine at Sendelingsdrif.

Option 1	Option 2	Option 3	Option 4	Option 5	Option 6
Slimes dam 2 Stage degrit section + thickener. Secondary cyclone overflows to thickener. Underflow pumped overland >2km to dam. Thickener overflow and slimes decant returned to plant water circuit.	In-pit sliming 2 Stage degrit section + thickener. Secondary cyclone overflows to thickener. Underflow pumped overland ~ 1.5km to mined out Z7 & Z6 pits. Thickener overflow and slimes decant returned to plant water circuit.	Slimes into river 2 Stage degrit section. Secondary cyclone overflow pumped to river to river @ -100µm particulates. Cyclone underflow solids dewatered and co-disposed.	Hi-G drying Single degrit section. Cyclone overflow pumped to river or process water circuit river @ -(40-75)µm particulates. Cyclone underflow solids dewatered and co-disposed.	Slimes Filtration 2 Stage degrit section + thickener. Secondary cyclone overflows to thickener. Thickener underflow pumped to belt filter. Thickener overflows and filter underflow returned to plant water circuit.	Slimes Centrifuging 2 Stage degrit section + thickener. Secondary cyclone overflows to thickener. Thickener underflow centrifuged. Thickener overflow returned to plant water circuit.

In-pit sliming will consider backfilling the fine tailings into the worked-out scours such as the ones at zones 6 & 7.

Filtration and other de-sliming technologies have the potential to reduce or even eliminate the slimes dam requirements by mechanical removal and co-disposal with the other tailings of the fines fraction. Some form of slimes containment will however always still be required to address periods when the de-sliming technology performs inefficiently.

Two potential areas for the disposal of fine tailings were already identified by Jones and Wagener during a previous study phase (Figure 3.9).

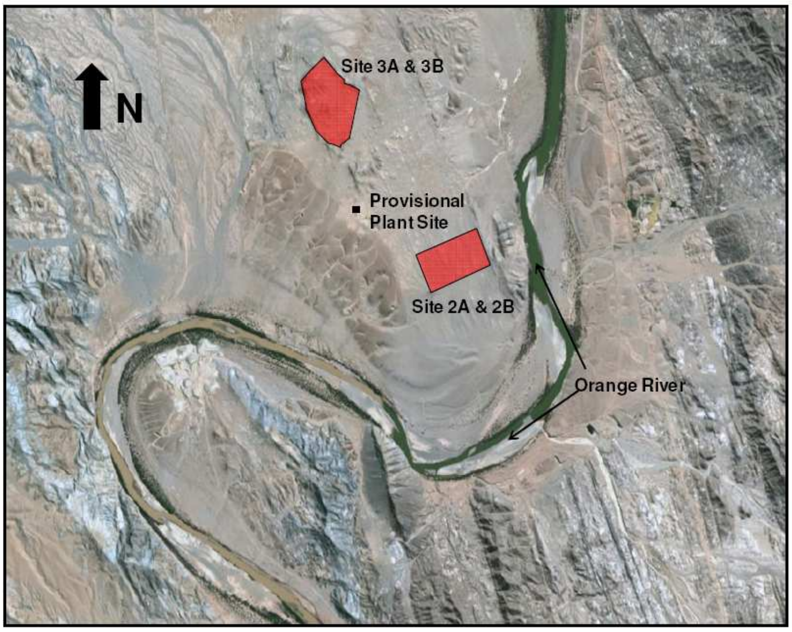

Figure 3.9 Two potential fine tailings disposal areas as indicated by Jones and Wagener.
Source: Namdeb

3.3.1.3 Services and Infrastructure

Because of the remoteness of the Sendelingsdrif resource in relation to existing infrastructure, establishing the operation at Sendelingsdrif is very expensive due to the cost of providing the required infrastructure on site. Its environmental classification as a future nature-based tourism area (visually acceptable area) also has to be borne in mind.

<u>Energy Supply</u>

Power will be needed for the stand-alone plant with its associated infrastructure at Sendelingsdrif.

Available power sources for the supply of electrical power to the Sendelingsdrif operation are:

- NamPower from Rosh Pinah
- Diesel generators

NamPower supply from Rosh Pinah
NamPower will need to construct a new substation at Rosh Pinah to meet the power requirements for a stand-alone mine at Sendelingsdrif. The redundant 66kV line between Rosh Pinah and Sendelingsdrif is currently disconnected at both ends. This line will require refurbishment as it has been in disuse for a number of years. A section of a new power line as well as substation(s) need to be constructed to connect the 66 kV line to the NamPower grid and the distribution network at Sendelingsdrif. The specific routes for these new sections of power line will depend on the final power supply solution agreed to between NamPower and Namdeb.

Diesel generators
An alternative for power supply to the Sendelingsdrif operation is a diesel power station that consists of five 725 kVA diesel generators (four running and one on rotational standby) with automatic synchronisation. For start-up four generators will be required to run, while only there generators will be required for normal running conditions. Power from the generators will be supplied at 525 V.

Water requirements

The addition of water to any process located at Sendelingsdrif will add significant infrastructural and OPEX costs as well as environmental complexities. Processes at Sendelingsdrif are therefore designed to operate with as little water as possible. For the MDMS option, allowance for water for maintenance purposes (roads, cleaning, etc.) and for domestic use has to be made. Trade-off studies for the supply of water to the Sendelingsdrif site will include river abstraction, borehole abstraction or alternatively trucking of water in from Oranjemund or the Sendelingsdrif control gate. The existing borehole close to the historic police station is a consideration for potable water consumption if water pump tests indicate sufficient borehole capacity.

In addition, a fines residue disposal site will be required. As previously mentioned, in-pit sliming into the bedrock-lined scours of zones 6 & 7 will be considered or alternatively a fine tailings disposal dam. The composition of the fines residue may however then not be only the -0.5mm fraction, but may also include the -3mm fraction. Other alternatives of screening of the fines will also be considered.

The option of releasing water containing controlled amounts of fines residue of acceptable quality into the Orange river will also be assessed as a matter of completeness for all possible fine tailings disposal options. Additional studies for this will consider potential impacts on river biota and the hydrology of the river to ensure enough data is gathered to aid the decision on the optimal techno-economical solution for fine tailings disposal at Sendelingsdrif.

Support and work facilities

The main infrastructural requirement is for the support of the mining fleet, e.g. earth moving vehicle (EMV) workshop, wash bay, lube facility, bulk fuel depot, etc. Power requirements at the site will be addressed through diesel generators or a bulk power line. To facilitate easier rehabilitation of the area to the nature-based requirement, all offices, ablution installations, etc. will be mobile units.

For the MDMS option i.e. stand-alone mine at Sendelingsdrif option, the support and work facilities requirement will increase slightly due to the additional personnel that will be required to run the MDMS and associated facilities. It is however anticipated that the additional requirements will not be substantial.

Accommodation

No significant changes to the current ORM complement is envisaged for the project since all mining activities will be kept the same and only moved over to Sendelingsdrif from the current Daberas mining operations. As such the accommodation requirements for the project will be virtually the same as for the current operation. This includes facilities and arrangements concerning housing, catering, medical facilities and recreation that currently apply at Daberas. A and B-band employees will be housed at Daberas hostel (Figure 3.10), while artisans, supervisory and supportive personnel will be housed in Oranjemund. Employees from Oranjemund will commute daily to Sendelingsdrif.

The MDMS option will require most employees to work at Sendelingsdrif which may warrant the investigation of the option of housing the personnel in Rosh Pinah. This will be traded off against the current accommodation arrangement at Daberas hostel or even the option of utilising existing accommodation in Oranjemund.

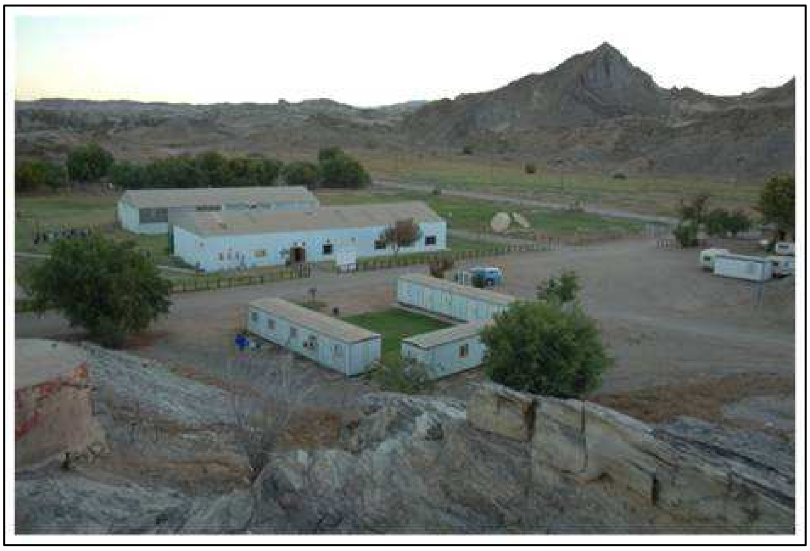

Figure 3.10 Accommodation will be provided for workers at the current Daberas hostel.
Source: Namdeb

Disposal of waste

All hazardous and non-hazardous waste will be separated and disposed of in accordance with Namdeb's internal policies and procedures.

- **Waste oil** will be stored temporarily on site and transported to Oranjemund town where it will be reused in the burners at Recovery inside Mining Area 1 or send for recycling.
- **Batteries** will be accumulated and temporarily stored at the Engineering workshops. From here they will be sent to Oranjemund for further disposal.
- **Unserviceable used tyres** will be dumped at the current Daberas scrap yard, while serviceable tyres will be re-treaded.
- **Hard scrap** will be accumulated at the point of generation and dumped in hard scrap containers. These will be emptied regularly in the current Daberas scrap yard. Contracted scrap merchants remove usable items regularly.
- **Domestic refuse** will be separated according to Namdeb's domestic waste separation procedure. Refuse will be accumulated at its point of generation and dumped into standard refuse containers lined with plastic bags and dumped into covered metal containers. These will be removed regularly to the designated refuse dump.
- **Sewage** will be generated at the office block and workshops on the mine and at the hostel.

3.3.2 Option 2: Plant located at Daberas

3.3.2.1 Mining

The mining process remains the same as described in the standalone option. Since approximately 40% of the material will be transported to Daberas for treatment the total waste material available that needs management is approximately 6 million tonnes, which includes the 30cm of topsoil.

The use of a dry scalping and screening plant for the aerial rope way or tramming options will ensure that all residue will be trammed back into the mined-out areas to facilitate the envisaged end-state of nature based tourism of the area. As with option 1, some of the waste material and residue will temporarily be used for storm water control and terracing, but is intended to also be eventually returned to mined-out areas. No mega fine tailings disposal dam is required in this option compared to the stand-alone option.

Overburden material removed will also be used for general earth works at the scalping and screening plant and for other infrastructural requirements.

3.3.2.2 Treatment

Treatment at Daberas is highly dependent on the method of transporting material between Sendelingsdrif and Daberas, and subsequently various product transfer options were evaluated. These included an overland conveyor, tramming via on-highway trucks, pumping, barging, a railway system and an aerial ropeway system. Of these alternatives, only the tramming and aerial ropeway options were regarded as technically practical solutions and were subsequently investigated further.

Treatment of the Sendelingsdrif resource will involve three processes:

- Initial dry, fixed infield screening close to the resource (average volume reduction of ±68%),
- Production of concentrate using dense media separation (DMS), and
- Recovery of diamonds at the Red Area Complex in MA1

Residue from the scalping and screening plant for these options will be trammed back into mined-out areas to facilitate the envisaged end-state of nature based tourism of the area. As with option 1, only the two mining zones containing scours are known to contain water close to bedrock. Dewatering of these pits will be required during mining of the basals. The same may be applicable for the meso deposits close to the river when it becomes mineable in the future.

Processing is the same as described for option 1 except that dry scalping and screening forms part of the process initially.

<u>Dry scalping and screening of the mined material at Sendelingsdrif</u>

Gravel will be transported to the scalping and screening plant with mining trucks. There are two categories:

- Low grade material of <0.3cpt will not go to the treatment plant and this material will be stockpiled. This may be treated in the future if it becomes feasible to mine it again.
- Run of Mine (ROM) material to be fed to the scalping and screening plant on average consists of ±40% +70mm boulders and ±20% fines <3mm. For these options the remainder of the material will be transported *via* aerial ropeway or trucks to Daberas for treatment.

The scalping unit will screen out the +90 mm material which will be discharged onto the oversize stockpile while the product (-90 mm) will be conveyed to a dry sizing screen section. The product will be screened on a double deck screen removing the +60mm material (which will be conveyed to a residue stockpile), the -60mm +10mm fraction (which will be conveyed to the product stockpile) and the -10mm material (which will be conveyed to a de-sanding screening plant). At the de-sanding screens, the -3mm material will be removed and conveyed onto the residue stockpile while the -10mm +3mm material will be conveyed onto the product stockpile.

The oversize and the residue stockpiles will be loaded by front end loader onto the mining trucks and dumped into mined-out areas as part of progressive rehabilitation. For the first±2 years, insufficient mined-out areas will be available to back-fill into and subsequently temporary stockpiles will be created close to mining areas for backfill once the areas become available.

Depending on the transport option, the product stockpile will either be conveyed to the loading station of the aerial ropeway system or loaded onto trucks with a front end loader for transport to Daberas.

3.3.2.3 Transport of the screened material to Daberas

<u>Aerial Ropeway</u>

Although it is not used by Namdeb at present, aerial ropeways are used in various applications throughout the world and is regarded as proven technology. This option will enable Namdeb to transport of the screened product from Sendelingsdrif to Daberas*.*

The aerial rope way will have a total length of ±14.3 km and will consist of three sections with lengths 2.8 km, 7.8 km and 3.7 km, linked by two transfer stations. The system will have ±48 towers with an average span of 276 m, a minimum height of 10 metres and a maximum height of 18 m. It will have a loading station at Sendelingsdrif and an off-loading station at Daberas. The total power requirement of the system is estimated at ±1 MW.

A preliminary route for the aerial rope way is illustrated in Figure 3.11. This aerial ropeway will require authorisation as part of this EIA.

Figure 3.11 Route for aerial ropeway (*white line*) between Sendelingsdrif (top) and Daberas (bottom)
Source: Namdeb

The -70mm +3mm material will be conveyed by the aerial ropeway (Figure 3.12) for further wet screening and final treatment at Daberas.

Figure 3.12 Aerial ropeway will convey material to Daberas for further treatment.
Source: Namdeb

Tramming

Tramming with on-highway trucks on a newly constructed bitumen road is regarded considered as an alternative, to the aerial ropeway solution.

The option will require the re-alignment and profiling of the existing road between Sendelingsdrif and Daberas as well as the upgrading the surface of the road to a bitumen covered road. This is required to address various safety issues pertaining to dust, visibility, etc. of a 24/7 tramming operation.

Between 10 and 14 on-highway trucks per hour will be required to transport the screened material from Sendelingsdrif to the DTP for treatment. Since it will be a 24/7 operation and the road is also the only link in Namibia between Oranjemund and other towns open to the public, safety is of utmost importance. It is also anticipated that, although it is currently a private road, it will be proclaimed as a public road by the time that mining at Sendelingsdrif will start. Thus, the general public will be utilising the same road as the tramming trucks which will become a safety risk.

Trucks will be loaded with screened material by front end loader at Sendelingsdrif and will transport the material to the DTP at Daberas where it will off-load into a receiving bin from where the material will be conveyed into the DTP.

Treatment of the screened material through the DTP at Daberas

For the DTP options, the screened material will be transported to and treated through the existing DTP at Daberas.

At the DTP (Figure 3.13) the material will either be off-loaded in the aerial ropeway off-loading station or into the truck receiving bin and conveyed to the wet sizing screening unit that will separate it into three streams: -25 mm +3 mm, oversize (+25 mm) and undersize waste (-3 mm) . The -25 mm +3 mm material will be conveyed to the DMS plant for further processing. The +25 mm material discharges onto a tailings conveyor belt, while -3 mm fine tailings are collected in pans under the screens from where it is pumped to the Degrit plant.

Figure 3.13 The direct treatment plan (DTP) at Daberas, where wet screening separates the material into three further streams.
Source: Namdeb

The purpose of the Degrit plant is to reduce the volume of material discharge into the slimes dam and recycling of water to the plant. This is achieved through a system of centrifugal cyclones that generate three streams: –3 mm +0.5 mm material, –0.5 mm +0.045 mm material and water with – 0.045 mm solids. The –3mm +0.5 mm stream is conveyed to the tailings, -0.5 mm +0.045 mm underflow reports to the slimes dam and the –0.045 mm particles and water overflow gravitate to the plant's process water reservoir.

Namdeb has also commissioned a hydrogeological study to investigate the feasibility of inpit sliming instead of sliming into the current slimes dam at Daberas. Results so far have indicated that this is an option and can be done with the necessary management interventions. Namdeb already received permission from the Department of Water Affairs for this activity.

Final Concentration: Dense Media Separation

The +3 mm -25 mm product from wet screening will be further concentrated using a process called Dense Medium Separation (DMS). For this purpose a mixture of water and ferrosilicon at a density of approximately 2.65g/cm^3 and the feed material are mixed in a ratio of 6 to 1, This mixture is pumped to a 660 mm cyclone to separate the mixture into "sinks" and "floats". (The DTP cyclone has a slightly higher capacity than that of the MDMS due to a barrel extension fitted to the DTP cyclone.) The sink product is washed to remove the ferrosilicon and then conveyed to the x-ray recovery plant, while the "floats" are discharged onto float screens to wash off the ferrosilicon. The washed float product is then conveyed to the tailings dump. Wash water from the DMS is pumped to a magnetic separator where 99.9% of the ferrosilicon will be recovered. The wash water is then pumped to a densifier and separated into overflow and underflow. The overflow reports to the dilute medium and the underflow to the correct medium sump. The final waste water may contain up to 0.05g/l ferrosilicon, which is not toxic.

Sporadic testing for density control is carried out in a laboratory; this requires a sample of about 500g of DMS concentrate that is mixed with 5 litres of Bromoform, stirred and allowed to separate out. The float and sink fractions are weighed and the percentage float material calculated which enables a determination of the efficiency of the DMS process. While the sample is returned to the process, the Bromoform is drained from the float and sink fractions and returned for storage. Although very small quantities of Bromoform are thus introduced sporadically *via* the tested sample, the subsequent mixing of the sample with large volumes of material result in no measurable traces of Bromoform in the water.

Fine Tailings Disposal

A hydrogeological study was completed for the potential to conduct inpit sliming or fine tailings disposal into a mined-out area. Namdeb acquired the permit for this activity. Should the material be transported and treated at Daberas, the fine tailings from the DTP will be discharged into this area.

3.3.2.4 Services and infrastructure

Major differences for services and infrastructure can be ascribed to less infrastructure that is required at Sendelingsdrif for this option i.e. no fine tailings containment areas are necessary since the process is dry, less buildings/offices, less infrastructure for water requirements since a dry process will be used. Fewer personnel will be required to work on the Sendelingsdrif site since the operations will centre on mining and the servicing of the mining fleet. Except for the dry infield screening treatment personnel, less human resources are needed since the rest of the treatment process does not take place at Sendelingsdrif but at Daberas. Accommodation will still remain the same as for option 1. The construction of a fibre optic line will be the same as for option 1.

Energy Supply

Power will be needed for the Scalping and Screening plant with its associated infrastructure, the aerial ropeway system and the treatment plants at Daberas.

Available power sources for the supply of electrical power to the Sendelingsdrif operation are:

- NamPower from Rosh Pinah
- Diesel generators

NamPower supply from Rosh Pinah
There are two options for supply of power to Sendelingsdrif from the national grid, namely,

- *Via* the existing redundant 66kV line; this line is currently disconnected at both ends and will require refurbishment as it has been in disuse for a number of years. Sections of new power lines as well as substation(s) will, however, have to be constructed to connect the 66 kV line to the NamPower grid and the distribution network at Sendelingsdrif. The specific routes for these new sections of power line will depend on the final power supply solution agreed to between NamPower and Namdeb.

- *Via* a newly constructed 33 kV power line. This route will also depend on the final power supply solution agreed between NamPower and Namdeb. Its most likely route is from the NamPower Lorelei substation north east of Rosh Pinah along the shortest route to Sendelingsdrif.

With Eskom's Nightsave tariff structure, sufficient power is currently available to Daberas for operations. When the scalping and screening operation at Sendelingsdrif starts, the power requirement for the treatment plants at Daberas will be reduced and some capacity may therefore become available for use by the aerial ropeway system, if required. A new section of power line will still be required to connect the current distribution network at Daberas with the aerial ropeway.

Diesel generators

One option for power supply to the Sendelingsdrif operation is a diesel power station that consists of five 725 kVA diesel generators (four running and one on rotational standby) with automatic synchronisation. For start-up four generators will be required to run, while only there generators will be required for normal running conditions. Power from the generators will be supplied at 525 V.

A small distribution substation with adequately sized transformers has been provided for to supply power to the plant and the ropeway as well as other infrastructure loads as illustrated in Figure 3.14.

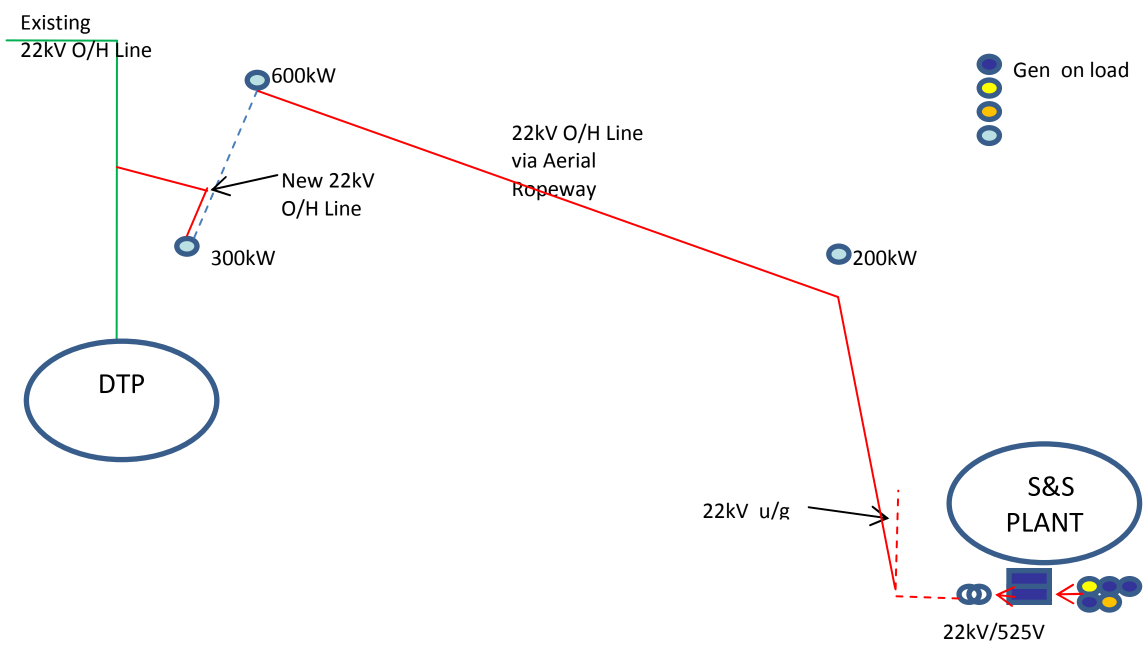

Figure 3.14 Base case for supply of power to ORM LOM EX
Source: Namdeb

3.3.2.5 Option 3: No Project Alternative/No Go Option

The project does not go ahead.