

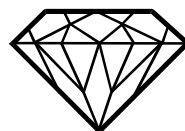
# ENVIRONMENTAL IMPACT ASSESSMENT AND ENVIRONMENTAL MANAGEMENT PLAN FOR ORANGE RIVER MINES LIFE OF MINE EXTENSION PROJECT



## FINAL SCOPING REPORT

Report No. CSIR/CAS/EMS/EXP/2010/0001/A

March 2011





## Summary

The Orange River Life of Mines Extension Project, situated in the Orange River Mining Licence Area 42 (ML42), was initiated to sustain carat production beyond 2012 when the current Daberas operation reaches end of life. The mined resource will be scalped and screened at Sendelingsdrif, and transferred to Daberas on an aerial ropeway for processing. This will extend the life of mining operations in ML 42 till at least 2020.

In order for the Directorate of Environmental Affairs (DEA) in the Namibian Ministry of Environment and Tourism (MET) to make an informed decision as to whether or not the project should receive an environmental clearance certificate and be allowed to proceed, it is essential that potentially significant environmental and social impacts (both negative and positive) are investigated and well understood. It is therefore necessary to conduct an Environmental Impact Assessment (EIA) process. CSIR has therefore been appointed by Namdeb to undertake the EIA for the proposed project, with Enviro Dynamics conducting the public participation component.

The findings of the EIA Scoping Phase are presented in this Final Scoping Report; the Draft Report was made available to Interested and Affected Parties (I&APs) for comment.

The purpose of the Scoping Report is to:

- Provide a description of the proposed project, including a sufficient level of detail to inform the Ministry of Environment and Tourism;
- Describe the local environment within which the project is proposed, to assist further in identifying issues and concerns;
- Provide an overview of the process being followed in the Scoping Phase, in particular the public participation process, as well as present the draft Plan of Study for EIA that would be followed in the subsequent EIA phase;
- Present the issues and concerns identified to date by specialists and stakeholders, together with an explanation of how these issues will be addressed through the EIA process.

I&APs (including organs of state) were invited to submit comments on an earlier Draft Scoping Report by 30 July 2010. The project description was subsequently updated, and I&APs were asked to comment on this in the period 15 December 2010 to 14 January 2011. After further revision of the project description, the period for comments was extended to 4 February 2011. Issues raised during the Scoping process are included in the Issues Trail (Appendix I) of this Final Scoping Report.

The following specialist studies will address issues identified in the Scoping Phase:

- Impacts on archaeology (Dieter Noli).
- Impacts on vegetation and restoration of ecological system (Coleen Mannheimer, Theo Wassenaar).
- Impacts on insects, small mammals and reptiles (Peter Cunningham, Telane Greyling, John Irish).
- Impact on groundwater and the functions of the Orange River (Pierre Botha, Stef de Wet).
- Local socio-economic impacts (Stephanie van Zyl, Carla Saayman)

All information on the EIA process, including I&AP inputs, are hosted on the CSIR project website: [http://www.csir.co.za/eia/namdeb\\_project.html](http://www.csir.co.za/eia/namdeb_project.html)

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## 1. Introduction

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Several terraces along the Orange River contain economically viable deposits of diamonds that are within ML42, Namdeb's Orange River Mining Licence Area. Namdeb started to mine the gravel deposits at Auchas in 1991, about 30 km east of Oranjemund. This was extended to Daberas in 1999 which is the largest resource in the ML42 area and located  $\pm 15$  km north east of Auchas. The current end of life of mine of the Daberas operation is estimated for the end of 2012. By exploiting other mineable resources such as Sendelingsdrif in ML42, the Orange River Life of Mine can be extended to 2020 and beyond.

Although the Environmental Management Programme Report (EMPR) for the Orange River Mining Licence Area covers the potential environmental impacts associated with mining activities along the Orange River in general terms, Namdeb's Environmental Policy commits the company to conduct the environmental impact assessment process on all operations.

This Final Scoping Report (FSR) is part of the first phase of an Environmental Impact Assessment (EIA) that determines environmental issues to be considered for a decision on whether the proposed Orange River Mines Life of Mines Extension Project at Sendelingsdrif should be authorised or not. It will also serve as a management tool for future mining of other resources such as Obib and Arrisdrif in ML42.

The project proponent, Namibian Diamond Corporation (Pty) Ltd (Namdeb) has appointed CSIR as the independent consultant for this EIA process. Enviro-Dynamics (Pty) Ltd are responsible for stakeholder engagement throughout the process.

This FSR describes key issues that have been identified, the process followed to date, and the process that will follow after the publication of this FSR. Stakeholders were asked to comment on the Draft of this document, and Section 1.3 provides information on this process of public review.

Sources for the information used in this report are listed in the Bibliography in Chapter 7.

### 1.1 Namdeb

Namdeb Diamond Corporation (Pty) Ltd (Namdeb), previously known as CDM (Pty) Ltd, has held mining and prospecting licences in the areas known as Diamond Area 1 (Sperrgebiet) and Diamond Area 2 since 1919. Namdeb is jointly and equally owned by the Government of the Republic of Namibia and De Beers Centenary. In the years since joint ownership took effect, Namdeb has continued to recover diamonds and generate employment for Namibian citizens. The revenue generated has played a central role in building the social and physical infrastructure of an independent Namibia.

It has a Board of Directors with a chairman proposed by De Beers Centenary and a deputy chairman proposed by the Government of the Republic of Namibia. The Namdeb board oversees the activities and decisions of the Management Committee that advises it on technical and management operations. Mine management is under the General Manager of Namdeb. Two Assistant General Managers and a number of departmental heads form the Executive Committee for Namdeb operations.

### 1.1.1 *Namdeb's environmental framework*<sup>1</sup>

Namdeb's approach towards environmental issues is to integrate these into its core business and, where necessary, develop appropriate policies and tools for implementation that will be embedded in its ISO 14001 management system. This provides a framework for management solutions that fit individual environmental, social and economic contexts in its operations. Sustainability management, performance and assurance are implemented primarily through the Environment, Community, Occupational Hygiene, Health and Safety (ECOHS) programme, the De Beers Best Practice Principles (BPPs) and its assurance programme which supports the ECOHS functions.

Namdeb's business philosophy and principles require that all its operations adhere to national safety legislation and work towards best practice safety standards such as OHSAS 18001. In 2007 Namdeb obtained OHSAS 18001 certification.

At every stage of the mining lifecycle, namely, the exploration, projects, operation and closure phases, environmental impacts of operations are planned for. Namdeb is sensitive to local needs, since it engages in stakeholder engagement as a part of the impact assessment process, as a requirement of Namdeb's ISO 14001 certification, and in its planning for closure processes. It therefore places particular emphasis on forging strategic partnerships with relevant Authorities, local communities and NGOs when it needs to find creative solutions to environmental challenges.

Namdeb commissioned external benchmarking during 2008 that included a review of its performance in comparison to the leading three mining companies that are listed on the Dow Jones Sustainability Index (DJSI). Its Environmental Policy was also reviewed and benchmarked by Conservation International (CI) against the same companies, the Global Reporting Initiative (GRI) and the International Finance Corporation's best practice standards. These recommended that targets for biodiversity conservation, water, energy and climate change be developed. In addition, a new biodiversity strategy was reviewed and developed with the Biodiversity Peer Group and Namdeb's conservation partners. Biodiversity is now a component of all baseline assessments of advanced exploration activities. Biodiversity issues that are identified during these assessments are then included in all Environmental Impact Assessments (EIAs) and environmental management plans. Namdeb finalised its Biodiversity Action Plan for land operations at the end of 2008.

The Millennium Seed Bank Project researches the development of restoration techniques. Namdeb participates in it together with Namibia's Ministry of Agriculture, Water and Forestry and the Royal Botanic Gardens at Kew in London. Rehabilitation planning is co-ordinated with the Ministry of Environment and Tourism's planning for the future Sperrgebiet National Park, and ministry staff is directly involved in Namdeb's rehabilitation projects. Namdeb's rehabilitation plan was finalized at the end of October 2007. An inter-ministerial committee has been mandated by the Namibian Government to provide input to Namdeb's Strategic Business and Closure Plan.

Namdeb's Environmental Performance Reporting Application (EPRA) systematically captures environmental indicators on a regular basis via its intranet, which enables it to compare its environmental performance against stakeholder concerns.

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<sup>1</sup> *De Beers Family of Companies, Report to Society 2008*



### **1.1.2 Namdeb's market presence<sup>2</sup>**

The De Beers Family of Companies is involved across the breadth of the diamond value chain. This includes exploring for new deposits on four continents and mining in Botswana, Canada, Namibia and South Africa. It produces about 40% of world diamond production by value.

Namdeb, De Beers Marine Namibia (DBMN), NamGem and the Namibia Diamond Trading Company (NDTC) employ over 3 000 people. Namdeb is therefore one of the country's largest employers, and has partnerships in mining, technology, enterprise development and academic research. Diamonds account for more than 40% of Namibia's export revenue, 7% of fiscal revenue and more than 10% of GDP. All Namdeb diamonds mined at Namdeb's operation are sold to the NDTC for resale on the international diamond market.

NamGem is a wholly owned subsidiary of Namdeb, and has been cutting and polishing top quality gems supplied to it by the DTC International since 1999, employing over 120 people at Okahandja and transferring specialist cutting skills to Namibian citizens. NamGem's strategic partnership with Lazare Kaplan International has added momentum to the company's drive towards profitability and global competitiveness.

Namdeb is committed to sustainable development, especially in local communities. The Namdeb Social Fund is the country's leading corporate social responsibility fund, and has donated over N\$20 million to various beneficiaries since its inception in 1994. The Oshipe Development Fund is a wholly owned subsidiary of Namdeb, and promotes entrepreneurship and SME development through investment in commercially viable business in the country. Education received 36% of its donations, followed by health and welfare (16%), community development (12%), public affairs (12%) and small business development (11%).

## **1.2 The need for the proposed activity**

Namdeb is faced with challenges posed by a decline in the profile of carats and the need to prepare for lower production outputs. Its projected production plan indicates a significant decrease in onshore production from 2009, as resources near depletion. This will impact negatively on current levels of employment and overheads associated with maintaining the town of Oranjemund.

It currently holds seven diamond mining licences covering both land and sea areas on and adjacent to the southern coast of Namibia. The Orange River Mining Licence (ML42) is located along the north bank of the Orange River for about 50 kilometres inland from the Mining Area No.1 boundary. Mining commenced in this area at the Auchas deposit where production ceased in 1999; at present, mining is limited to Daberas.

To meet the Company's objective of acquiring maximum sustainability to 2020 when mining licences expire, Namdeb needs to add the deposit at Sendelingsdrif, about 20 km south of Rosh Pinah and 12 km north-east of Daberas (Figure 1.1) to the current mine plan. It represents the second largest deposit after Daberas and will extend the life of mine along the Orange River and enable Namdeb to fulfil its strategic goal of sustaining carat production from Orange River mines beyond 2012.

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<sup>2</sup> Namdeb Annual Review 2007

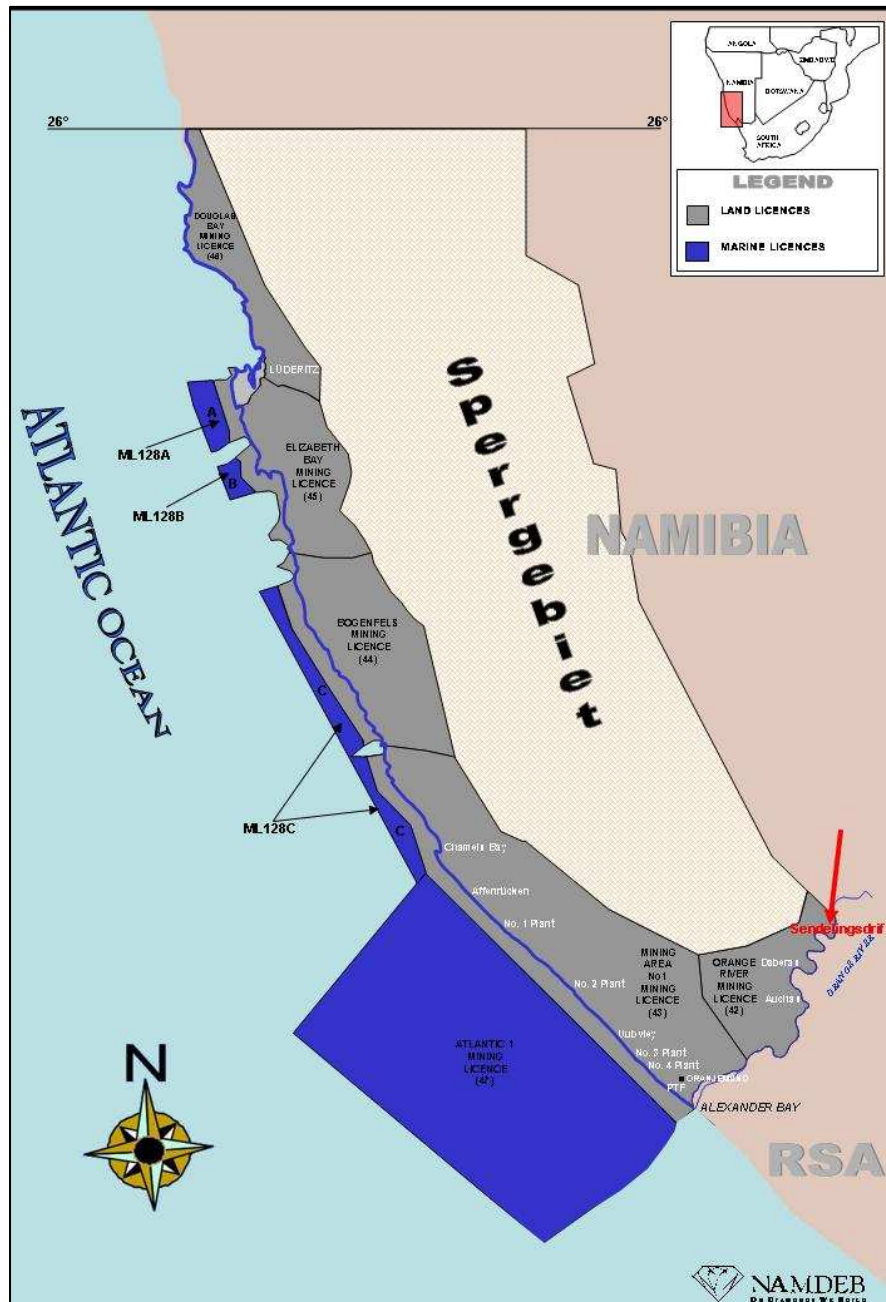


Figure 1.1: Location of Orange River Mining Licence (ML42) and Sendelingsdrif.

### 1.3 The purpose for the proposed activity

The ore deposit at Sendelingsdrif consists of ancient Orange River gravels, classified as an older, mostly Early to Middle Miocene-aged (19-17 million years ago) “Proto” suite and a younger, Plio-Pleistocene-aged (5-2 million years ago) “Meso” suite (Bluck, *et al*, 2007). The older and higher terrace is about 50 m – 70 m above the current level of the river, the lower terrace about 30 m – 40 m above the current level. The intention is that these be mined from the surface down to bedrock at selected sites, and for screened material to be transported to Daberas for further processing and recovery.

## 1.4 The purpose of the EIA process and this report

The purpose of the EIA process is to:

- Identify any interactions between the proposed activity and the environment;
- Consider which of these aspects, if any, are likely to have a significant impact on the environment; and
- Recommend measures that will enhance any positive impact and avoid any adverse negative impact, and if the latter cannot be avoided, to reduce its impact and ensure adequate protection during construction and operation of the proposed activity.

The Scoping Phase of the EIA refers to the process of determining the spatial and temporal boundaries for the EIA. In broad terms, this involves three important activities:

- Confirm the process to be followed and opportunities for stakeholder engagement;
- Clarify the project scope and alternatives to be covered; and
- Identify key issues to be addressed in the impact assessment phase and the approach to be followed in addressing these issues.

This is done through parallel processes of consulting with lead authorities that are associated with this EIA; with the public to ensure that local issues are well understood, and with the EIA specialist team to ensure that their scientific and professional expertise informs the identification of issues. The scoping process is supported by a review of relevant background literature on the local area. Through this comprehensive process, the environmental assessment can identify and focus on key issues requiring assessment and identify reasonable alternatives.

The primary objective of the Scoping Report is to present key stakeholders (including affected organs of state) with an overview of the project and key issues that require assessment in the EIA Phase; and allow the opportunity for the identification of additional issues that may require assessment.

## 1.5 Terms of Reference for the EIA

The principle objective is to prepare an environmental impact assessment and management plan for activities associated with the ORM LOM Extension project. All factors that may influence project implementation, including environmental and socio-economic aspects based on existing information, must be identified. The EIA/EMP must enable Namdeb to identify successfully high priorities for environmental decision making and integration of the EMPs into their Environmental Management System (EMS).

Namdeb have specified the following Terms of Reference in Tender Document E089-ND-2008:

- Establish legal and international environmental Best Practice and administrative requirements.
- Assist the Namdeb project team with environmental planning/guidelines, in order to derive, at the most, preferred options/solutions during the pre-feasibility/feasibility phases of the project.
- Conduct a scoping exercise with relevant Interested and Affected Parties (I&APs), government ministries and specialists. This should be done preferably during the pre-feasibility phase of the project.

- Identification of outstanding specialist studies required to address the impacts.
- Evaluate the socio-economic impact in relation to the ORM LOM Extension project.
- Draw up a detailed rehabilitation and closure plan for the project. The rehabilitation programme should include restoration ecology guidelines as well.
- Evaluate the environmental impact of all the activities associated with the ORM LOM Extension project on the environment and recommend mitigation actions.
- Produce an EMP that shall cover all aspects related to the project during the construction, operation and decommissioning of the mine. If timeframes are aligned, the EMPs from the hydrogeological study must be included in the EMPR. The EMP must include environmental monitoring plans for impacts as well as a rehabilitation and closure plan; it must be easily integrated with Namdeb's ISO 14001 EMS. The EMPR document should be reviewed by an independent reviewer prior to submission to the Directorate of Environmental Affairs – Ministry of Environment and Tourism (MET).
- Follow the EIA and EMP process through to Clearance Certificate approval from the Directorate of Environmental Affairs (MET) within the shortest time possible. The licence to operate should be obtained prior to the implementation phase of the project, preferably by September 2010.

Cognisance of the following must be taken:

- Namdeb's strategic Rehabilitation Plan for the land based operations.
- Existing information i.e. EMPR for ML42, Daberas EIAs, Sendelingsdrif EIA.
- Hydrogeological information for the area.
- De Beers Group Requirements.
- The use of Namibian specialists (e.g. socio-economic and restoration ecologist) for the project is recommended.
- The above terms of reference may change based on the additional or revised requirements following the Scoping phase, consultation with government and the De Beers Assurance Review for Project Gate Release/De Beers Board approvals.

## 1.6 Structure of this report

Chapter 1 of this Final Scoping Report presents the need for the project and the requirement for an EIA to be conducted. Chapter 2 outlines the relevant environmental legislation that applies to this project, and the approach and methods used in the EIA and public participation. Chapter 3 provides an overview of the proposed project. The affected environment of the Orange River Mining Area 42 is described in Chapter 4, in order to assist stakeholders in identifying potential impacts that could arise from the project. A summary of the issues identified to date from the Scoping process is provided in Chapter 5. Chapter 6 presents the plan of study for the subsequent EIA phase, listing the issues that are to be addressed in the specialist studies. Lastly, a Bibliography used in preparing this report is provided in Chapter 7.

Appendices at the end of this report provide more detail on previous environmental studies, the policy and statutory framework, newspaper advertisements regarding the EIA process, an issues trail with

responses to the issues from the EIA team, records of correspondence and notes from meetings with stakeholders, and comments received from I&APs.

## 1.7 Comment on the draft Scoping Report

As part of the EIA process all Interested and Affected Parties were invited to provide comment on an earlier Draft Scoping Report for the period 15 July 2010 to 30 July 2010. This Draft Scoping Report was revised with an updated project description that was sent out to stakeholders for comment in the period 15 December 2010 to 14 January 2011. After conclusion of this period, a further revision of the project description was sent to stakeholders in a new Background Information Document, and the comments period for this new project description was 2 February 2011 to 18 February 2011.

The address for comments was the following:

Carla Saayman  
P O Box 20837  
Windhoek  
Tel: 264 61 223336  
Fax: 264 61 307437  
E-mail: [carla@envirod.com](mailto:carla@envirod.com)

## 2. Description of the EIA process

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### 2.1 Statutory requirements

The statutory decision making framework for the proposed activity is defined by the Constitution of Namibia and relevant national policies and plans, proposed and promulgated statutes, international conventions and protocols, bilateral agreements such as the Minerals Agreement between CDM and the Namibian government (1994), and Namdeb's Safety, Health and Environmental Policy. Details on these are provided in Appendix A.

### 2.2 EIA procedure

This EIA is produced in accordance with the principles of integrated environmental management, the Environmental Assessment Policy of Namibia (1995), and the Environmental Management Act, 2007 (Act 7 of 2007), namely, to:

- Better inform decision makers and promote accountability for decisions taken;
- Strive for a high degree of public participation and involvement by all sectors of the Namibian community in the Environmental Assessment process;
- Take into account the environmental costs and benefits of proposed policies, programmes and projects, as well as secondary and cumulative environmental impacts of policies, programmes and projects;
- Incorporate internationally accepted norms and standards where appropriate to Namibia;
- Promote sustainable development in Namibia, and especially ensure that a reasonable attempt is made to minimise anticipated negative impacts and maximise the benefits of all developments;
- Be flexible and dynamic, thereby adapting as new issues, information and techniques become available.

The EIA process consists of the following steps, described further in sections 2.2.1 to 2.2.4:

1. Project inception workshop/site visit
  - Project registration with DEA/MET.
  - Background Information Document (BID) distributed
2. Scoping phase
  - Identification of Interested and Affected Parties (I&APs)
  - Announcement of EIA Process and Identification of Issues
  - Preparation of Scoping Report, with Public review
3. Impact assessment phase
  - Specialist studies undertaken.
  - EIA Report compiled.
4. Environmental Management Plan (EMP)

This process is illustrated in Figures 2.2 and 2.2 that follow.



## Orange River Life of Mine Extension Project Summary of Scoping Process

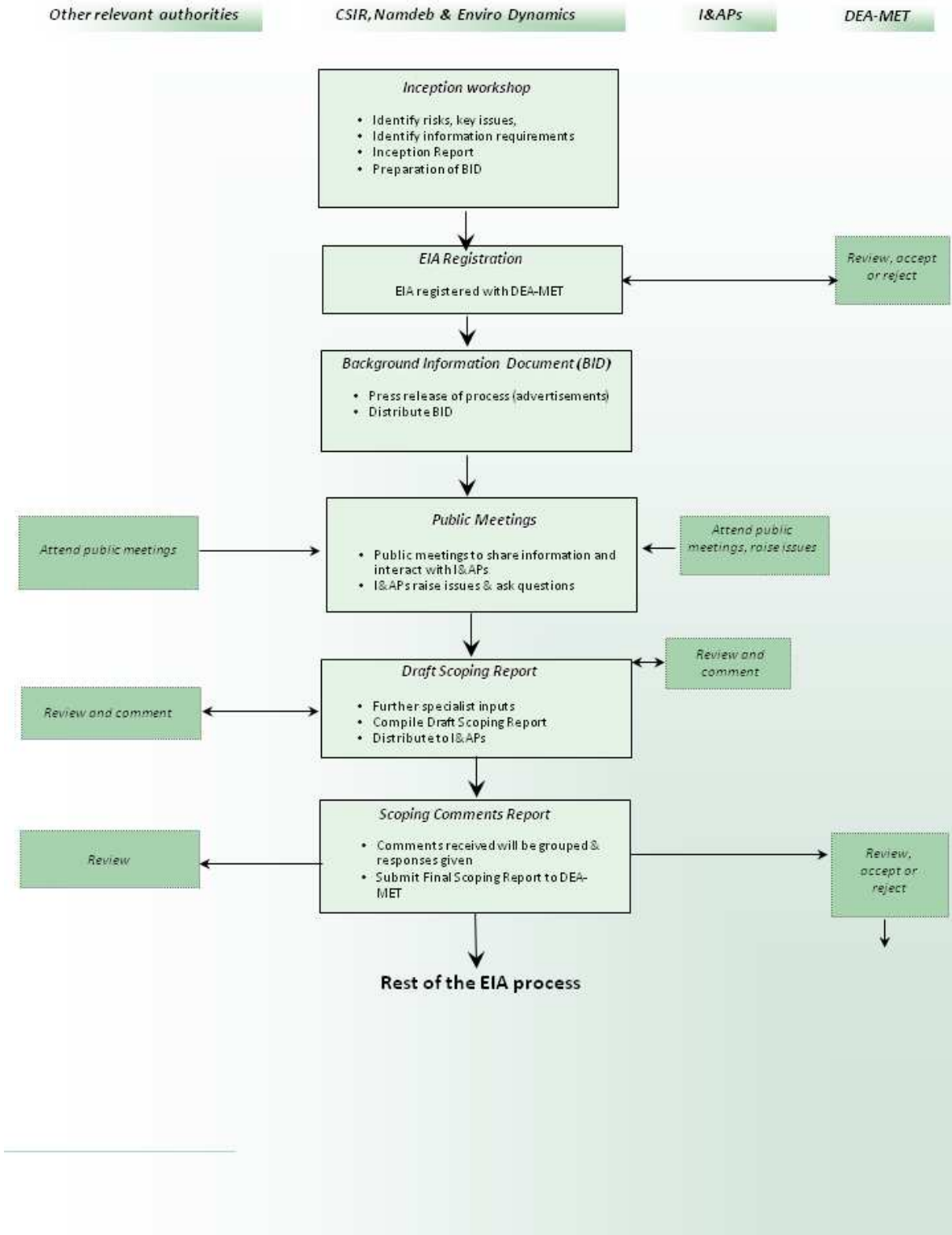


Figure 2.1 The EIA process: Scoping phase

## Orange River Life of Mine Extension Project Summary of EIA Process

Other relevant authorities

CSIR, Namdeb & Enviro Dynamics

I&APs

DEA-MET

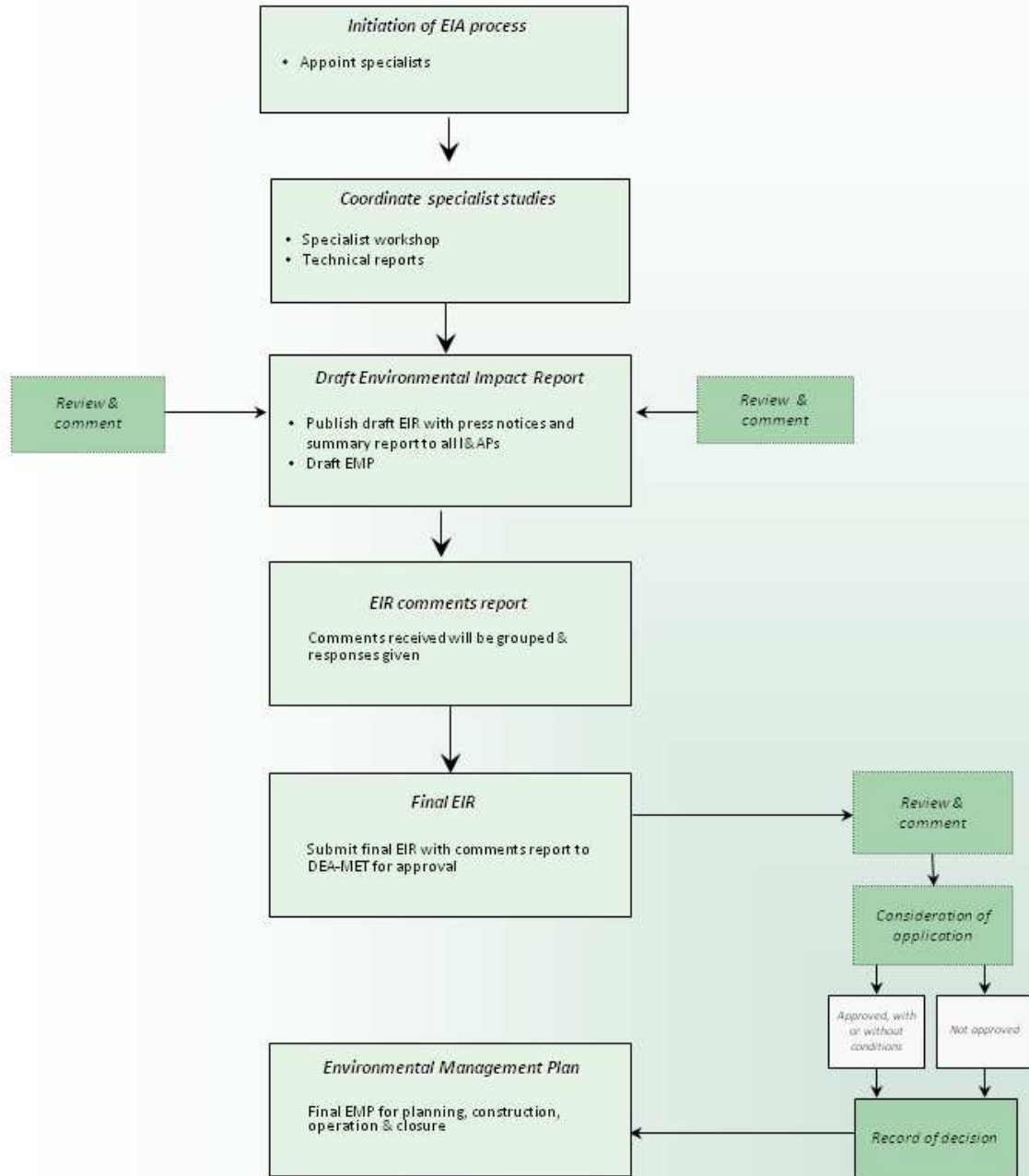


Figure 2.2 The EIA process: EIR and EMP phase

### 2.2.1 Project inception

The EIA process commenced when the project was registered with the Ministry for Environment and Tourism on 18 January 2010. A Background Information Document that described the proposed project was included with the letter of registration. A copy of the registration is provided in Appendix C. The project description that was the subject of a public participation process in April 2010 had proposed the transporting of mined material from Sendelingsdrif to Daberas for treatment at Daberas with the following options:

- With an aerial ropeway option the screened material is transported to Daberas with an aerial ropeway system for treatment through the direct treatment plant (DTP) at Daberas;
- With a tramping option the screened material is transported to Daberas with on-highway trucks on a bitumen covered road for treatment through the DTP at Daberas.

However, further technical studies by Namdeb show that this option is not feasible at this time. Namdeb is therefore proposing a new option that will entail the transfer of all current operations at Daberas to Sendelingsdrif, and this is the subject of this Scoping Report.

### 2.2.2 Scoping phase

The Scoping process is intended to provide sufficient information for the authorities to be assured about the scope of issues to be addressed in this EIA process, and to identify specialist studies to be included as part of the Environmental Impact Reporting Phase of the EIA, as well as the approach to these studies.

The objectives for this Scoping process are to:

- Identify and inform all stakeholders about the proposed development;
- Clarify the scope and nature of the proposed activities and the alternatives being considered;
- Conduct an open, participatory and transparent approach to facilitate the inclusion of stakeholder concerns in the decision-making process;
- Identify and document the key issues to be addressed in the forthcoming Environmental Impact Reporting Phase of the EIA;
- Ensure due consideration of alternative options in regard to the proposed development, including the “No development” option.

The following outcomes should follow the conclusion of the Scoping process:

- *Stakeholders* have been effectively identified and incorporated into the scoping process;
- *Alternatives* for achieving the objectives of the proposed activity have been given due consideration;
- *Closure* has been reached on the significant issues to be addressed;
- The *roles and responsibilities* of various stakeholders in the process have been clarified;
- All participants have *agreed* on the process to be followed;
- Adequate *terms of reference* for specialist investigations that are acceptable to all participants.

### 2.2.3 Tasks for the Scoping process

The Scoping process requires that certain tasks be undertaken. These tasks are described as follows:

- **Compile Background Information Document (BID)**

A Background Information Document (BID) was distributed to stakeholders on 2 February 2011. A copy is provided in Appendix D. As the name implies, it provided a description of the project, the EIA process, the project proponent and key issues identified for specialist studies. The BID is intended both to encourage interest in the project and provide adequate information for stakeholders to start identifying issues and possible concerns regarding the proposed activity.

- **Identification of Interested and Affected Parties (I&APs)**

Key I&APs in and around Oranjemund had earlier been identified through reviewing and updating Enviro Dynamics' database for the Oranjemund area and the Karasburg Region, which includes relevant authorities and specific interest groups. The newspaper advertisements on 7 April 2010 that requested I&APs to register for the EIA of the earlier project description supplemented this database, which was updated regularly.

- **Announcement of EIA Process**

The EIA process was announced publicly through placement of newspaper adverts (Appendix E) on 7 April 2010 and distribution of notices to all I&APS in the database (Appendix F). The notices included the Background Information Document (BID) for the project description of April 2010. Advertisements requesting I&APs to register their interest in the project were placed in *The Express* (local newspaper), the *Republikein* and the *Namibian*, as detailed in Table 2.1.

- **Identification of issues and concerns**

A first round of public consultation in the Scoping process was held on 20-21 April 2010. Meetings were held with relevant Authorities on 1 June. Minutes of these meetings are provided in Appendix G, and a list of all stakeholders is in Appendix H.

Issues and concerns raised by I&APs for this earlier project description are integrated into an Issues and Response Trail (Appendix I) for the current project description, identified through:

- Written submissions in response to invitations to comment;
- Meetings with Authorities and general public.

In the Issues Trail, responses and clarification are provided where possible, or deferred to the Environmental Impact Report phase for resolution.

- **Preparation of Draft Scoping Report**

The Draft Scoping Report concludes the consultation process for the scope of the EIA.

- **Public review of Draft Scoping Report**

The Draft Scoping Report (DSR) for the project description of April 2010 was placed in the public domain for a review period of 14 days that ended on 31 July 2010. Printed copies of the report were made available at public libraries in Oranjemund and Rosh Pinah.

- Public review of Draft Scoping Report for revised project description**  
 The April 2010 project description was subsequently amended, and a revised Draft Scoping Report (DSR) was placed in the public domain in the period 15 December 2010 to 14 January 2011. The amended project description was emailed by Enviro Dynamics to all I&APs on the project database. After conclusion of this period, a further revision of the project description was sent to stakeholders in a new Background Information Document, and the comments period for this new project description was 2 February 2011 to 18 February 2011.
- Final Scoping Report**  
 This Final Scoping Report (FSR) will be submitted to the lead authority (MET) for their project file on the proposed activity.

Table 2-1 Media announcements at the commencement of the EIA process

Newspaper	Area of distribution	Language	Date placed
Namibian	Entire Namibia	English	7 April 2010
Die Republikein	Entire Namibia	Afrikaans paper; but placement in English	7 April 2010
The Express	Rosh Pinah town paper	English	12 April 2010
<b>Additional sources</b>			
Posters	Oranjemund & Rosh Pinah	English	± 1 week prior to meetings
Radio – live reads	Entire Namibia	National (English) Damara>Nama Oshiwambo Otjiherero Rukavango	Each broadcast on: 17 April 2010 @ 13h00 18 April 2010 @ 13h00 19 April 2010 @ 06h30 20 April 2010 @ 06h30
Email – invitations & reminders	Stakeholders	English	7 & 14 April 2010
Namdeb MineWide communication systems	All Namdeb Mine employees in the entire area & various residents & companies in Oranjemund	English	9 April 2010

## 2.2.4 Impact assessment phase

### 2.2.4.1 Finalise specialist terms of reference

This Scoping Report presents a Plan of Study for the EIA in chapter 6, which has Terms of Reference for the specialist studies.

#### **2.2.4.2 Prepare draft specialist studies**

Specialists will conduct their specialist studies to address issues and concerns and other requirements that emerge from the Scoping process. The potential risks and associated impacts of various environmental factors of the proposed new mine operation will be assessed in the EIA for both construction and operations. If unacceptable changes are determined, modifications to the project design or mitigating measures shall be investigated for optimised solutions, so that the impacts on the environment are reduced to acceptable levels.

#### **2.2.4.3 Draft EIA Report**

A draft EIA Report will be compiled on the basis of the specialist studies. In broad terms this report will include the following structure:

- Introduction
- Approach and methodology for the EIA
- Legal and Planning framework
- Description of project and alternatives
- Description of affected biophysical and socio-economic environments
- Impact assessment (addressing public issues and concerns)
- Recommended management actions
- Conclusions
- Supporting information.

#### **2.2.4.4 Draft specialist studies, EIA Report and EMPs in the public domain**

The draft specialist studies, EIA Report and EMP will be placed in the public domain for review.

A Comments and Response Trail will be formulated to detail how the comments raised by I&APs have been addressed in the EIA Report. The Comments and Response Trail will be included in a Final EIA Report along with an outline of the process implemented, database of I&APs and record of proceedings for the EIA phase of the Project.

#### **2.2.4.5 Draft Environmental Management Plan (EMP)**

In parallel to the drafting of the EIA Report, a stand-alone EMP Report (EMP) will be compiled for the construction and operation phases. The EMP Report will be practical and effective, based on the environmental management philosophy of the ISO 14001 Environmental Management Systems standard and will thus be structured to define an environmental policy, planning, implementation and operation, checking and corrective action and management review (see Figure 2.3).



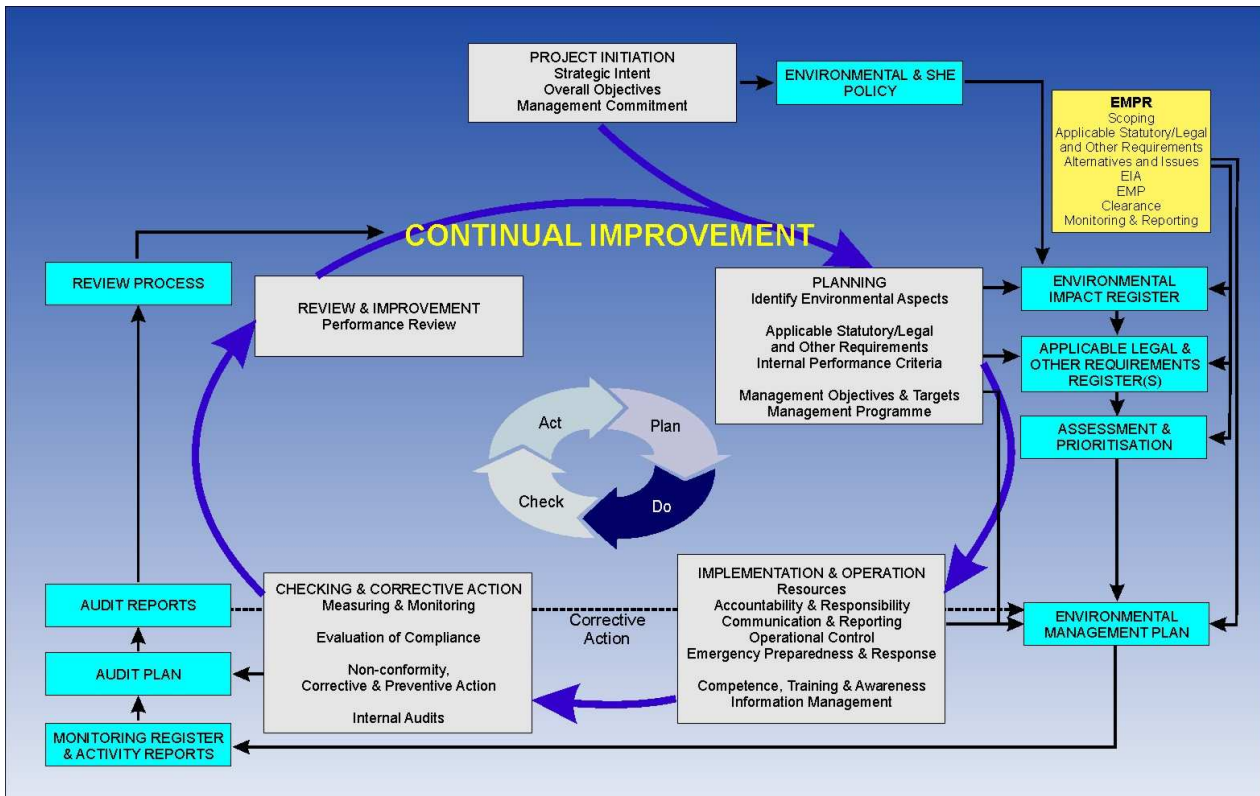


Figure 2.3 Namdeb's ISO 14001 process for Environmental Management Systems

### 2.2.5 Public participation programme (stakeholder engagement)

The public participation programme (PPP) is an integral part of the EIA process, and continues throughout this process. By its very nature, it is a dynamic process where different societal needs, values and interests must be recognised and managed. This requires that public participation provide the opportunity for participation in an open and transparent manner. The fact that Interested and Affected Parties (I&APs) do not always agree is acknowledged and accommodated in the process.

The objectives of the public participation process are to:

- Build credibility through instilling confidence in the integrity and independence of the team conducting the EIA.
- Educate the stakeholders on the process to be undertaken and opportunities for their involvement.
- Empower stakeholders through establishing an agreed framework according to which the process will be conducted. This requires accessible, fair, transparent and constructive participation at every stage of the process.
- Inform stakeholders on the proposed project and associated issues, impacts and mitigation, using the most effective manner to disseminate information.

### 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.

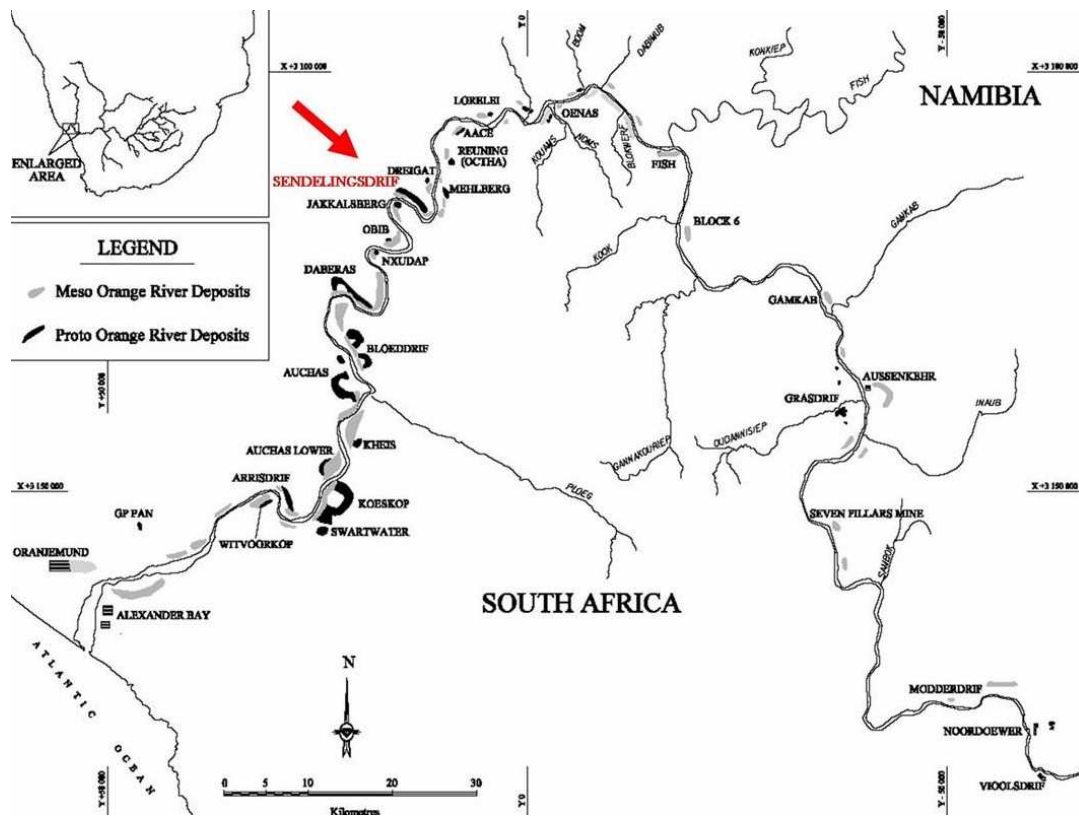


Figure 3.1 Gravel terrace deposits along the Orange River. Sendelingsdrif, like Auchas and Daberas, has a large Proto- deposit.

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",

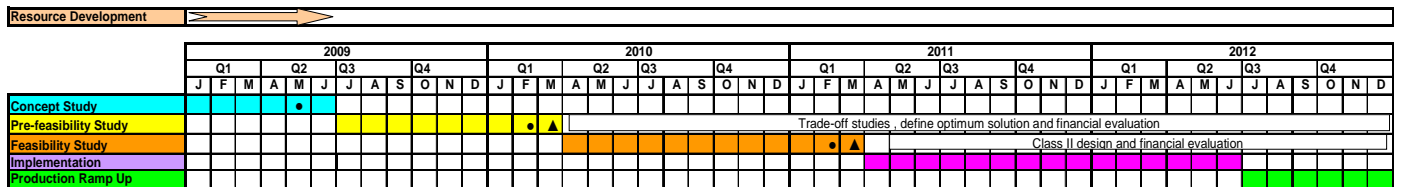
"The land use management of the park will be pro-poor, so much that the formerly disadvantaged people should have the share of the cake from the park."

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.

Orange River Mines Life of Mine Extension Project - High Level Plan



- ▲ Approval
- Assurance Reviews

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.

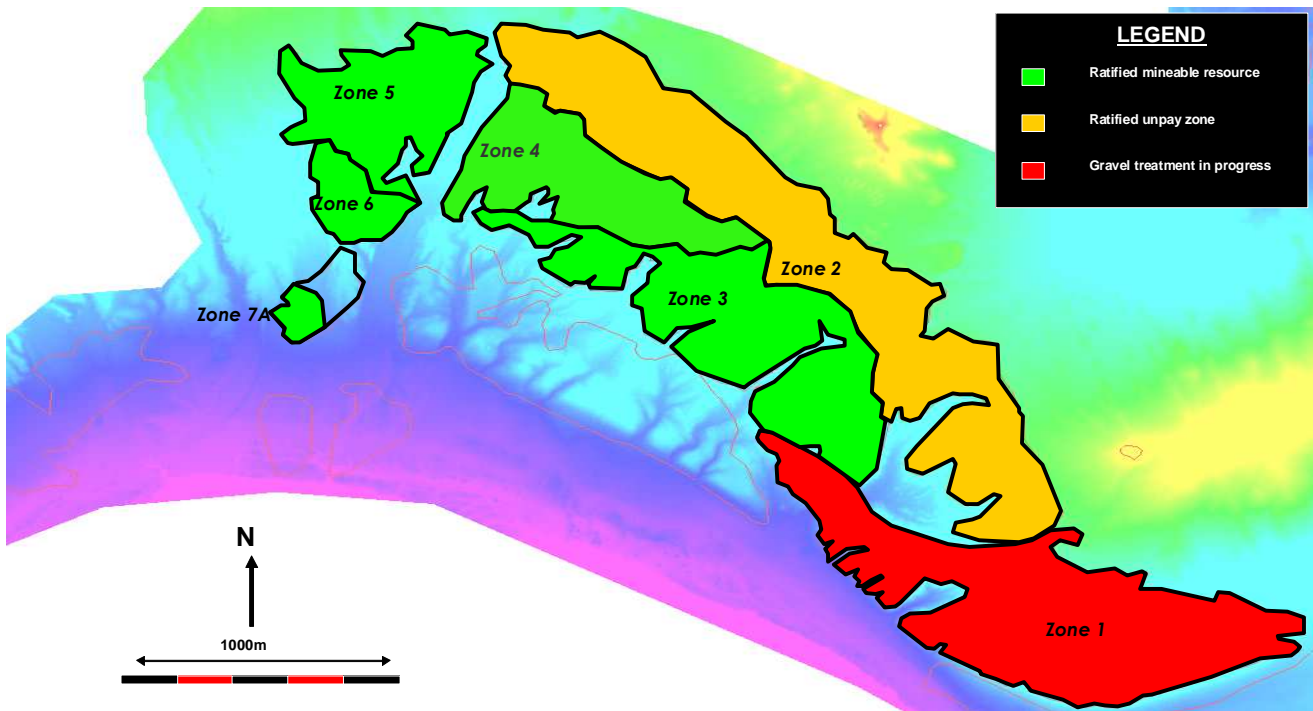


Figure 3.3 The seven zones that comprise mining operations at Sendelingsdrif.

### 3.3 Project Description and Project Alternatives

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	Sendelings drif	Sendelings drif	Sendelings drif	Sendelings drif
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 Sendelings drif	At Sendelings drif	At Sendelings drif	At Sendelings drif

All options assume conventional mining of the resource at Sendelingsdrif; these are:

- The No Project (“No Go”) option.
- For treatment of the Sendelingsdrif deposit, two options are available, described in 3.3.1 and 3.3.2 below; their mining and treatment rates will differ due to the different capacities of the treatment plants:

- Transporting the material from Sendelingsdrif to Daberas for treatment at Daberas:
  - With an aerial ropeway option the screened material is transported to Daberas with an aerial ropeway system for treatment through the direct treatment plant (DTP) at Daberas;
  - With a tramming option the screened material is transported to Daberas with on-highway trucks on a bitumen covered road for treatment through the DTP at Daberas.
- Construction of a stand-alone treatment facility at Sendelingsdrif. The material will be concentrated by a mobile dense media separation (MDMS) plant relocated to Sendelingsdrif.

The main difference between the two options is the concentration of the run-of-mine (ROM) material. For both options, the concentrate is transported by silo trucks from the treatment plants to the new Red Areas Complex (RAC) in Mining Area 1.

### **3.3.1 Transport of material from Sendelingsdrif for treatment at Daberas**

A public participation process was conducted for this option in April 2010, and specialist studies were commissioned to assess its environmental impact. However, further technical studies have shown that this option is not feasible at this time. Namdeb is therefore proposing a new option that will result in the transfer of all current operations at Daberas to Sendelingsdrif, as explained in 3.3.2 that follows.

### **3.3.2 Stand-Alone mine at Sendelingsdrif**

Further details on how Namdeb proposes to mine and treat the resource at Sendelingsdrif are provided below, as well as the services and infrastructure that will be required for such a stand-alone treatment facility.

#### **3.3.2.1 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. However, there will be challenges with regard to progressive rehabilitation, associated with the mine schedule that will maximize the life of mine and overall resource recovery. This will be achieved by the mining of both high and low grade deposits in a specific year to “average out” the resource performance, rather than first mining the high grade deposits with high returns at the beginning of operation. This will result in a marginal business at the end of life of the mine. The effect on progressive rehabilitation will be negative, as mining will be done sporadically from different zones, resulting in substantial delays between the start of mining and sufficient mined-out areas being available for back-filling to start. In other words, for the first number of years a lot of smaller mined-out areas will be created that will not yet be suited for back-filling because more mining will be done there at a later stage.

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.

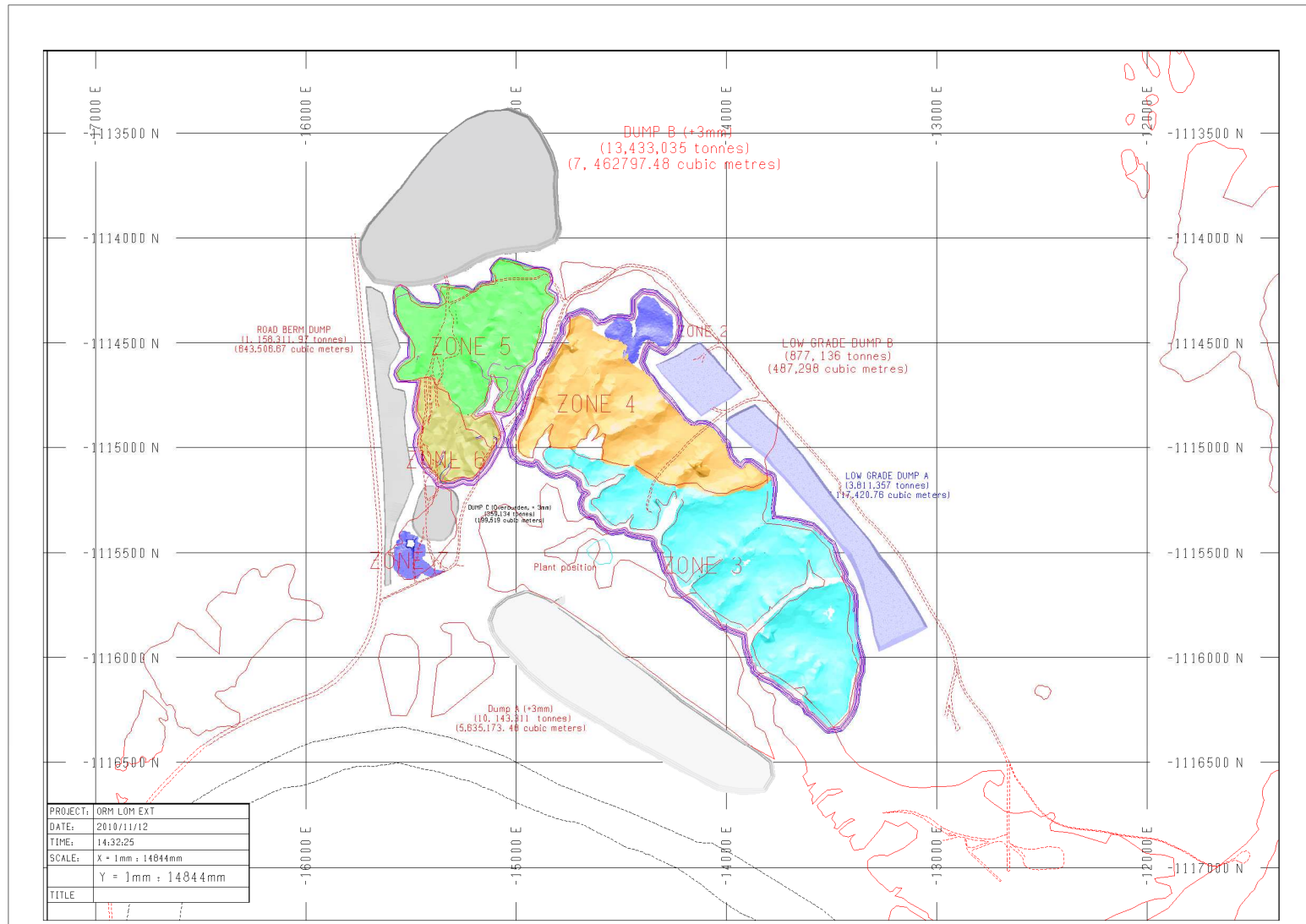


Figure 3.6 Anticipated residue management at Sendelingsdrif mine.

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*

### 3.3.2.2 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  $\pm 40\%$  +70mm boulders and  $\pm 20\%$  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  $\pm 5$  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  $2.65\text{g/cm}^3$  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 five 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
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.	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).

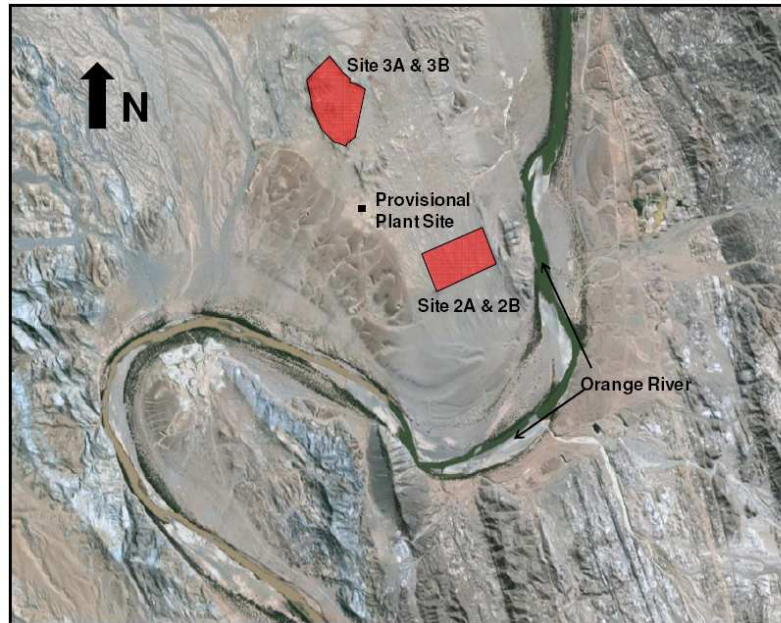


Figure 3.9 Two potential fine tailings disposal areas as indicated by Jones and Wagener.

Source: Namdeb

### 3.3.2.3 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.

#### Energy Supply

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 three 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.

### **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.

## 4. Description of the Affected Environment

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The description that follows has been extracted from the following Namdeb documents:

- 1994. Lower Orange River Baseline Study
- 1998. Open Cast Diamond Mining of Proto Orange River deposits at Sendelingsdrif, Namibia Environmental Impact Assessment for Sampling and Preliminary Environmental Impact Assessment for Mining.
- 2002. Multi-media Communications Backbone Oranjemund to Daberas Environmental Impact Assessment and Environmental Management Plan.
- 2002. Sendelingsdrif Additional Environmental Baseline
- 2004. *Juttadinteria albata* - global red list assessment
- 2007. Sendelingsdrif Exploration Camp, Sendelingsdrif. Environmental Impact Assessment on a new temporary consumer fuel storage facility.
- 2008. Rehabilitation plan for Namdeb's licence areas

All other sources are referenced separately in the text.

### 4.1 Geology, topography and soils

The study area is on the Gariep Belt, a sequence of sediments and volcanic material that has accumulated within the Namaqua Mobile Belt, Orange River Group, Vioolsdrif Suite and the Richtersveld Intrusive Complex. It is within a metamorphic unit of the Gariep Belt that is overlain by one to fifteen metres of diamondiferous palaeo-marine and palaeo-alluvial sediments that are covered by windblown sand. Metamorphic rocks of the Namakwa Group form the underlying basement while fluvial and aeolic processes created meanders, dune fields, steep canyons and gravel terraces.

Erosion and deposition over 15-18 million of years under mainly arid conditions have created the lower Orange River landscapes. Gem quality diamonds have accumulated along the banks of the Orange River, in old palaeo-channels and in relic marine beaches, as a result of erosion processes over time, with continual sorting and selection of the most resistant minerals. These deposits have been mined since 1908.

Diamonds are trapped in potholes and similar depressions in two suites of gravel terraces that lie on Middle to Late Proterozoic bedrock that was eroded from Late Cretaceous onwards. The older and higher terrace, about 50 m – 70 m above current river level, comprises the Arries Drift Gravel Formation; it dates to the early mid-Miocene (19-17 Ma) and is known as the Proto-Orange terrace (Jacob, *et al*, 1999). The lower terrace, the Meso-Orange terrace about 30 m – 40 m above current river level, is considered to be Plio-Pleistocene in age (5 – 2 Ma). The Meso-Orange terrace is largely parallel to the current riverbed, while the upper Proto-Orange terrace gravels are exposed on higher banks away from the river. The Proto-Orange deposits provide the bulk of diamond production, since the diamond grades in the Meso-Orange deposits are substantially lower. However, diamond grades vary throughout both terrace suites.

No arable soils cover the diamond deposits. The upper gravel terraces consist of cobble gravel with a silty clay-sand and grit matrix, broken up by sand pockets and cemented pockets of gravel.

In the study area Wassenaar (2010) found that gravels are layered with clay or silt lenses, and range in size from a few millimetres to over 300 mm. Soils are loamy with sandy patches. Fine sandy soils are found in the bottom of drainage lines and on the leeward, east and north facing slopes.

The highest concentrations of diamonds are found in fixed trapsites that are generated by fixed turbulence sites in the immediate vicinity of the bedrock. Another category of trapsite is the mobile trapsite with lower diamond grades. These were created when river conditions allowed fewer sites of turbulence and gravel accumulation, and were created within the river alluvium.

## 4.2 Climate

The Lower Orange River is part of the southern Namib, which mainly receives winter rains. In summer strong southerly winds prevail, while hot bergwinds result in occasionally high temperatures in winter.

The annual average of daily maximum temperatures at Oranjemund is 20°C and the daily minimum 11°C inland along the Orange River. Temperatures greater than 40°C are not unusual.

The region is extremely arid. Average rainfall at Oranjemund is 51 mm and 54 mm at Rosh Pinah, which is about 75 km northeast of Oranjemund. There is a higher incidence of rains in the period of May to August at Oranjemund and March to June at Rosh Pinah.

Strong southerly and south-westerly winds characterise the southern Namib. Hot easterly bergwinds occur during the winter months. The bergwinds are often associated with dust storms. The strong winds coupled with the low precipitation creates an extremely harsh environment for plants and animals which adopt various strategies to avoid these extreme conditions.

Relative humidity (RH) is strongly influenced by distance from the sea. The mean annual humidity falls sharply towards the interior from around 85% at the coast. Periods of very low RH (<10%) are rare, when winter easterly berg winds blow. Very high evaporation rates are recorded during such episodes.

## 4.3 Palaeontology and archaeology

Section 55 of the National Heritage Act, 2004 (Act 27 of 2004) prescribes the approach that must be adopted towards certain development activities at any site where archaeological and palaeontological objects may be found. This includes an environmental impact assessment by a qualified practitioner to identify heritage resources, the impact on such resources and the extent of obtrusiveness on any protected place or listed building in the vicinity. Any buildings older than 50 years, such as the old police station at Sendelingsdrif legislation may require permission from the Heritage Council before it can be demolished.

Fossils generally contribute to an understanding of ancient environments; valuable fossils have been uncovered during prospecting and mining operations of river terraces. The Sperrgebiet as a whole is rich in fossils, and at least 80 animals species have been described, including marine snails, pigs and ostriches (Pallett, 1995). Were it not for mining, many fossils would not be discovered. The tradeoff between destroying or moving fossils and mining operations is that they are exposed for further study.

All Proto- and Meso-Orange River terraces are assumed to constitute a large Early/Middle Stone Age surface site. Late Stone Age sites and graves are generally not found on the mine deposits (Noli, 1995).

## 4.4 Terrestrial Ecology

The ecology of most of the desert is undisturbed because diamond mining areas such as Diamond Area 1 have been closed to the public since 1908. In addition, mining activities have been confined to the coastal strip and the Orange River valley.

### 4.4.1 Vegetation

The substrate of the Proto- and Meso-Orange terraces is a conglomerate of stone and gravel with shallow topsoil and built up gypsum in the top 3 metres. The vegetation covers about 5 % of the deposit at Sendelingsdrif, and consists of succulent shrubs with an average height of 0.5 metres.

The gravel plains are north-west of the deposit and largely covered with quartz gravel. The vegetation cover of 1% is dominated by *Brownanthus arenosus*. Shrub heights reach about 0.3 m.

South to south-east of the study area is an open, sandy plain with hardly any vegetation.

Because their distribution is limited, species of most critical conservation concern are *Juttadinteria albata*, *Cephalophyllum herrei*, *Pelargonium klinghardtense* and *Euphorbia gariepina* var. *gariepina*. Presently only two viable populations of *Juttadinteria albata* are known, both on Namdeb diamond deposits, namely, Daberas and Sendelingsdrif. Occurrences have been documented for Sendelingsdrif, Arrisdrijf, Kahanstal, Driegrat mountain and 4.4 km north of Driegratdrijf towards Rosh Pinah. It is found mainly in relict river terraces of the type found at Sendelingsdrif, in the sheltered gullies and side-gullies of terraces (Enviroscience, 2002).

The study, "*Juttadinteria albata* - global red list assessment", which Namdeb supported in 2004, changed the status of the plant from critically endangered to vulnerable. It recommended that rehabilitation plans incorporate the relocation and replanting of *Juttadinteria albata*, and provided minimum targets for maintaining the current red list status.

### 4.4.2 Invertebrates

The study site is situated on a biome border. The lower parts nearer the river form part of the Lower Orange River Desert Biome Outlier, grading into Arid Lowland Succulent Karoo Biome further from the river (Irish, 1994). The Richtersveld/Huns Mountains have a high number of endemic insects which are likely to occur also in the Sendelingsdrif area. Within the licence area the Skilpadberg harbours a rich insect fauna in a confined area which has conservation potential. The arachnid and myriad fauna is poorly known; however, species of spiders, solifuges are known to exist in the licence area.

### 4.4.3 Reptiles and amphibians

The Orange River Licence Area hosts numerous snakes, such as puff adders, cobras, dwarf adder and whip snakes and a variety of lizards and geckoes. Two species of dwarf adder and skinks as well as the Namib padloper are restricted to the Sperrgebiet and its surroundings. Seven species of frogs are expected in this area.

### 4.4.4 Mammals

Due to the mountainous terrain and a permanently flowing river, the Orange River licence area is believed to host the richest fauna in the Sperrgebiet, although the total diversity of the fauna is not

known. Wassenaar (2010) observed a herd of about 20 gemsbok, with steenbok and springbok, and found evidence of baboons and porcupines closer to the river.

Of 35 mammal species recorded in the licence area, none are restricted to this particular area. Six of the carnivores are Red Data species catalogued as vulnerable in the country. These are aardwolf, brown hyena, Cape and bat-eared fox, wildcat and Cape clawless otter. The antelopes include common duiker, gemsbok, grey rhebok, klipspringer, steenbok and springbok.

#### **4.4.5 Birds**

About 110 species of birds have been recorded in the interior of the Sperrgebiet, while many more occur along the Orange River. The majority of the avifauna is made up of ground-dwelling species such as bustards, chats, coursers, larks and ostrich while fish eagle and other birds of prey are less common sightings.

#### **4.4.6 Fishes**

Only 16 species of fish occur naturally in the Orange River, 9 of which were recorded in a survey between Sendelingsdrif and Arriesdrif in 1994 (O'Keffee *et al.* 1994). This included the endemic *Barbus hospes*, a species listed as rare in the IUCN Red list and *Barbus kimberlyensis* which is catalogued as vulnerable in the IUCN Red list.

#### **4.4.7 River hydrology**

##### **4.4.7.1 Flow regime**

Although the Orange River is the largest river in South Africa with an annual discharge of 9344 million m<sup>3</sup>, large losses to evaporation and abstraction have resulted in a greatly reduced flow in its lower reaches. As a result of numerous small weirs and large dams along the river and its tributaries summer flows are lower and winter flows higher than before the impoundments were built. In the lower reaches the flow is extremely variable ranging from nearly no flow such as during a very dry period in 1993 to an estimate of 75 m<sup>3</sup>/s (O'Keffee *et al.* 1994).

##### **4.4.7.2 Water quality**

The water quality between Sendelingsdrif and Arriesdrif is generally good and suitable for all uses (O'Keffee *et al.* 1994). A comparison of measurements up- and downstream of Auchas Mine revealed no differences in pH or turbidity, but showed slightly lower dissolved oxygen and higher salinity downstream during low flow conditions. This may be attributed to mining activities but could also have other biological or physical causes not related to the mining activities. However, the effects are unlikely to be severe or far-reaching, except possibly at low or no flow conditions (O'Keffee *et al.* 1994).

#### **4.4.8 Population Centres**

##### **4.4.8.1 Oranjemund**

The majority of Namdeb's workforce are Namibians. Those who are employed from outside the country bring skills not available in Namibia in the technical, professional and management fields. Prevalence of HIV/AIDS among the workforce is high and constitutes the single highest risk in Oranjemund. All medical services for the mine and Oranjemund are provided by the Chief Medical Officer based at the town's hospital. The clinical medical services provided include physiotherapy,



dental, x-ray, laboratory, paramedical services, social therapy, occupational health and preventative health. Namdeb also provides a district surgeon.

Namdeb delivers social services to the community in the form of individual casework, family counselling and community development projects. Community health, family planning, baby and immunisation clinics are available once per week. Alcohol abuse is one of the main problems experienced by Namdeb employees and thus a branch of Alcoholics Anonymous has been established in the town.

By road, Oranjemund is accessible from three different directions:

- A gravel road along the north bank of the Orange River from Rosh Pinah in the east;
- A security gravel road from the Lüderitz-Aus road in the south; and,
- From South Africa via the Ernst Oppenheimer bridge seven kilometers south-east of Oranjemund.

Oranjemund is connected to Alexander Bay and thence to Port Nolloth via a tarred road. The single-lane Oppenheimer Bridge spans the Orange River some 9 km from its mouth.

#### **4.4.8.2 Rosh Pinah / Skorpion**

Rosh Pinah is about 75 kilometers to the north-east of Oranjemund. It is a mining town that is managed jointly by Roshkor, the company founded by Rosh Pinah Zinc Corporation and the Skorpion Zinc Project to jointly develop this desert town. Because it is not able to exercise the same immigration control available to Oranjemund and Alexander Bay, an informal settlement has developed adjacent to the town.

Since the opening of the Skorpion Zinc Mine, heavy-duty traffic has increased considerably on the stretch of gravel road that used to be the mining town's only link to the interior of Namibia. Rosh Pinah is also linked to the south by a gravel road that crosses the Orange River and connects to Alexander Bay. This is currently the only link for the general public to Oranjemund.

#### **4.4.9 Tourism**

The proposed mine operation lies within the Sperrgebiet that has been proclaimed a national park. Permits to enter the area are issued by the Namibian Police. In 1999, the Ministries of Environment and Tourism (MET), Mines and Energy (MME) and Lands, Resettlement and Rehabilitation are preparing a draft a land use plan for the Sperrgebiet.

The main objective of the land use plan is to seek ways of developing and managing the area in an integrated way for the long-term benefit of the country. The Sperrgebiet is one of the world's 25 top globally recognised bio-diversity hotspots for fauna and flora, and offers unique scenery ideal for high quality, low impact tourism. The area has been identified as a priority area for conservation in the Succulent Karoo Ecosystem Plan (SKEP), a 20-year strategy that now guides conservation action in this hotspot.

## 5. Plan of study for the EIA

The Plan of Study for the EIA is shaped by the findings of the Scoping process.

### 5.1 Identification of key issues

Table 5.1 below provides a summary of all issues raised by stakeholders during the public consultation in April 2010 raised by . These are grouped into the following categories:

- Socio economic
- River ecology
- Project description (including health and safety)

The EIA team's responses to each of these issues are presented in the Issues Trail in Appendix I.

Table 5-1 Key issues raised during the Scoping Process

<b>ISSUE</b>	<b>DESCRIPTION OF COMMENTS</b>
<b>Socio-economic</b>	<ul style="list-style-type: none"> <li>▪ <i>What about development plans for tourism in the area.</i></li> <li>▪ <i>How many people will be employed by this proposed mining project.</i></li> <li>▪ <i>With Namibia's high unemployment rate, people flock to any potential opportunity. Rosh Pinah is vulnerable as most job seekers will move there as they cannot enter Oranjemund; Rosh Pinah is already overcrowded and limited in terms of available plots, sewer facilities, electrical capacity, water capacity, school capacity and medical facilities. - job seekers will stop at Rosh Pinah and will want to be accommodated there. What pro-active plans are in place to assist Rosh Pinah (RoshSkor) deal with this?</i></li> <li>▪ <i>Will recruitment for construction work be done through the Karas Forum; during construction phase and the recruitment of the 10 new employees for operations, please consider the close-by communities, such as Rosh Pinah first; preference should be given to Oranjemund and Rosh Pinah communities.</i></li> <li>▪ <i>Will construction be done by Namdeb or external contractors?</i></li> </ul>
<b>River ecology</b>	<ul style="list-style-type: none"> <li>▪ <i>General concern about the use of water in upper and lower Orange and Fish river basin, and concern about how the extension will impact on the environment and social aspect of the people living in those areas.</i></li> <li>▪ <i>Namdeb is very concerned about other industrial/mining plants along the southern border of the Orange River (i.e. in SA), who don't seem to follow environmentally sound methods, which could endanger the water quality of the river - there are also a lot of farms on the SA side of the river bed further downstream.</i></li> </ul>
<b>Archaeology</b>	<ul style="list-style-type: none"> <li>▪ <i>Will archaeological sites in the area be fenced-off and not be affected.</i></li> <li>▪ <i>Will the police station be treated as an archaeological site.</i></li> </ul>

<p><b>Project description (including health and safety)</b></p>	<ul style="list-style-type: none"> <li>▪ <i>When will the project start, how long will it last, what is the anticipated life of mine; where will workers stay; where will the workshops be built; how far is Sendelingsdrif from Daberas; is it in the Sperrgebiet.</i></li> <li>▪ <i>With dry mining, dust will be a problem – what about dust extraction plants or water arbitration.</i></li> <li>▪ <i>What will be done with the excess water; Water Act requires that water be reused rather than wasted.</i></li> <li>▪ <i>What will the mining rate be; electricity needs of the mine.</i></li> <li>▪ <i>What is the gradient difference.</i></li> <li>▪ <i>Good SHE policy required, strong production team.</i></li> <li>▪ <i>Because of processing at Sendelingsdrif, waste rock and tailings dumps would also now be located there. The Background Information Document gives essentially no useful information about the location or footprints of any of these new developments, so it is not really possible to give an informed opinion on their potential impacts relative to the previous mine plan.</i></li> </ul>
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## 5.2 Approach to specialist studies and impact assessment

This section outlines the assessment methodology for specialist studies.

### 5.2.1 Generic Terms of Reference for the assessment of impacts

The identification of potential impacts should include impacts that may occur during the construction and operational phases of the activity. The assessment of impacts is to include direct, indirect as well as cumulative impacts.

In order to identify potential impacts (both positive and negative) it is important for the nature of the proposed activity to be well understood, in order for the impacts associated with it to be analysed. The process of identification and assessment of impacts will include:

- Determination of current environmental conditions in sufficient detail so that there is a baseline against which impacts can be identified and measured.
- Determination of future changes to the environment that will occur if the activity does not proceed (“no project” alternative).
- An understanding of the activity in sufficient detail to understand its consequences; The identification of significant impacts which are likely to occur if the activity is undertaken.

For the assessment of alternatives and impacts the following methodology is to be applied to the prediction and assessment of impacts. Potential impacts should be rated in terms of the direct, indirect and cumulative effects:

- **Direct impacts** are impacts that are caused directly by the activity and generally occur at the same time and at the place of the activity. These impacts are usually associated with the construction, operation or maintenance of an activity and are generally obvious and quantifiable.
- **Indirect impacts** of an activity are indirect or induced changes that may occur as a result of the activity. These types of impacts include all potential impacts that are not immediately apparent when the activity is undertaken, or which occur at a different place as a result of the activity.
- **Cumulative impacts** are impacts that result from the incremental impact of the proposed activity on a common resource when added to the impacts of other past, present or reasonably foreseeable future activities. Cumulative impacts can occur from the collective impacts of individual minor actions over a period of time and can include both direct and indirect impacts.
- **Spatial extent** – The size of the area that will be affected by the impact:
  - Site specific
  - Local (<2 km from site)
  - Regional (within 30 km of site)
  - National.
- **Intensity** –The anticipated severity of the impact:
  - High (severe alteration of natural systems, patterns or processes)
  - Medium (notable alteration of natural systems, patterns or processes)
  - Low (negligible alteration of natural systems, patterns or processes).
- **Duration** –The timeframe during which the impact will be experienced:
  - Temporary (less than 1 year)
  - Short term (1 to 6 years)
  - Medium term (6 to 15 years)
  - Long term (the impact will cease after the operational life of the activity)
  - Permanent (mitigation will not occur in such a way or in such a time span that the impact can be considered transient).

Using the criteria above, the impacts will further be assessed in terms of the following:

- **Probability** –The probability of the impact occurring:
  - Improbable (little or no chance of occurring)
  - Probable (<50% chance of occurring)
  - Highly probable (50 – 90% chance of occurring)
  - Definite (>90% chance of occurring).
- **Significance** – Will the impact cause a notable alteration of the environment?
  - Low to very low (the impact may result in minor alterations of the environment and can be easily avoided by implementing appropriate mitigation measures, and will not have an influence on decision-making)
  - Medium (the impact will result in moderate alteration of the environment and can be reduced or avoided by implementing the appropriate mitigation measures, and will only have an influence on the decision-making if not mitigated)
  - High (the impacts will result in major alteration to the environment even with the implementation on the appropriate mitigation measures and will have an influence on decision-making).

- **Status** - Whether the impact on the overall environment will be:
  - positive - environment overall will benefit from the impact
  - negative - environment overall will be adversely affected by the impact
  - neutral - environment overall not be affected.
- **Confidence** – The degree of confidence in predictions based on available information and specialist knowledge:
  - Low
  - Medium
  - High.
- **Management Actions and Monitoring of the Impacts (EMP)**
  - Where negative impacts are identified, mitigatory measures will be identified to avoid or reduce negative impacts. Where no mitigatory measures are possible this will be stated
  - Where positive impacts are identified, management actions will be identified to potentially enhance positive impacts
  - Quantifiable standards for measuring and monitoring mitigatory measures and enhancements will be set. This will include a programme for monitoring and reviewing the recommendations to ensure their ongoing effectiveness.

Table 5.2 below will be the standard format used by specialists for the rating of impacts.

Table 5-2 Standard format of the table for rating of impacts

<i><b>Nature of Impact: Job creation during construction and operation of the new mine operation</b></i>	
Extent	
Duration	
Intensity	
Probability	
Status of Impact	
Degree of Confidence	
<b>Significance (without enhancement)</b>	
<b>Significance (with enhancement)</b>	

Other aspects to be taken into consideration in the assessment of impact significance are:

- Impacts will be evaluated for construction, operation and decommissioning phases of the development. The impact evaluation will, where possible, take into consideration the cumulative effects associated with this and other facilities/projects which are either developed or in the process of being developed in the mine environs.
- The impact assessment will attempt to quantify the magnitude of potential impacts (direct and cumulative effects) and outline the rationale used. Where appropriate, national standards are to be used as a measure of the level of impact.
- The impact assessment will take into consideration relevant national and international guidelines, standards or recognised best practice that are practical and feasible for this particular project.

### 5.3 Specific issues to be addressed in specialist studies

Table 5.3 shows which specialist studies will be undertaken by specialists as part of the EIA phase.

Table 5-3 Specialists and their roles in the EIA

<b>Specialist Study</b>	<b>Specialist</b>
<i>Vegetation</i>	<i>Coleen Mannheimer; Independent consultant.</i>
<i>Restoration ecology</i>	<i>Theo Wassenaar; African Wildlife Restoration</i>
<i>River ecology</i>	<i>Stef de Wet; Independent consultant.</i>
<i>Socio-Economic (incl. tourism, planning &amp; land use)</i>	<i>Stephanie van Zyl and Carla Saayman; Enviro Dynamics</i>
<i>Small mammals and reptiles</i>	<i>Peter Cunningham, Environment and Wildlife Consulting Namibia</i>
<i>Invertebrates</i>	<i>Telane Greyling; Ecological Equine Consultancy John Irish; Independent consultant.</i>
<i>Groundwater studies</i>	<i>Pierre Botha, Water Sciences</i>

The Terms of Reference (TORs) for the specialist studies will essentially consist of the generic assessment requirements and specific issues identified for each study. These issues will have been identified through the baseline studies, I&AP and authority consultation, as well as input from the proposed specialists based on their experience.

Additional issues, identified through public and authority consultation during the Scoping phase might be included in the final Terms of Reference for specialists.

#### 5.3.1 Terrestrial ecology

##### 5.3.1.1 Vegetation

Plant surveys in close vicinity of the Sendelingsdrif site. These are to establish species of concern that require mitigation, rescue, propagation or other action.

- Conduct a survey of available literature;
- Review previous reports on the area, including field trials;
- Complete a baseline survey around the mining deposit;
- Conduct an assessment of impact on vegetation by the mining operations, and infrastructure such as the powerlines and fibre optic line;
- Formulate a methodology for field trials, and determine targets for rehabilitation.



### 5.3.1.2 Restoration ecology

The rehabilitation planning component will develop at least a conceptual rehabilitation plan and integrate this with Namdeb's current rehabilitation programme. Depending on available information, this will be taken through to an operational plan.

- Site visit to gain *In situ* insight of the project environment;
- Review and understanding of literature and available information;
- Develop a concept model and plan;
- Prepare a risk assessment and gap analysis;
- Agreement on feasible ecological goals;
- Define explicit realistic ecological goals;
- Integrate findings of specialist studies for restoration plan;
- Finalise concept plan for operational planning;
- Implement trials for experimental design, and analyse data;
- Define an adaptive management plan for rehabilitation.

### 5.3.1.3 River ecology

A desk study of all previous projects in the study area that involve the baseline of the Orange River ecology and water quality. These results will be summarised and made applicable to the current project to produce appropriate impact statements, accompanied by mitigating measures to avoid any potential deterioration of the Orange River ecology and water quality.

- Determine a river ecology baseline through literature on the project area and the Orange River, water quality data from Namdeb and interviews with key informants.
- Prepare a river ecology assessment;
- Integrate findings of specialist studies for mitigation plan.

### 5.3.2 Socio-Economics

The specialist study will determine the positive and negative impacts of the project on the socio-economic environment. It will be a desk study, based on research from available socio-economic data, Namdeb documents, and key informant interviews.

- Interview key informants and focus groups;
- Conduct a site visit;
- Determine a socio-economic baseline;
- Investigate the following:
  - The benefits and risks associated with additional employment creation and job seekers;
  - Implications of the project for current land use planning and compatibility with existing land usage.
- Prepare socio-economic impact assessment report

### **5.3.3 Small mammals and reptiles**

A pre mining reference collection of reptiles & small mammals will be undertaken in the Project area, which involves:

- Literature study of reptiles & small mammals expected in the area;
- Field collection of reptile specimens encountered in the area;
- Field collection of small mammal specimens encountered in the area.

A reference collection of reptiles & small mammals will be summarised and made applicable to the current project to produce appropriate impact statements, accompanied by mitigating measures for indirect habitat destruction.

- Reptiles and small mammals trapped and photographed. Species of reptiles and small mammals that occur in the project area are determined;
- Reference collection established. Occurrence of reptiles and small mammals in the project area is scientifically documented for future use.
- Preparation of assessment and mitigation report. It will discuss reptiles & small mammals expected and encountered during the field work; conservation status of endemic, rare, threatened and endangered species encountered during field work; potential mitigating measures for indirect habitat destruction.

### **5.3.4 Invertebrate baseline study**

The work method will deliver a reasonably good representation of the invertebrate fauna in the area.

- Field survey of invertebrate population. Specimens of various habitat types are collected;
- Supplementary collection. More species such as butterflies are collected;
- Identify habitat groups. Taxonomy of specimens collected is determined.

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## Policy and statutory framework

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## Previous environmental studies



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# Appendix I

## Issues Trail from the Scoping Process