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Environmental Management Plan (EMP)

Report

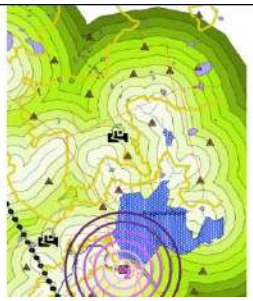
Version –Final

May 2012

Client Name: Otjozondu Mining (Pty) Ltd
Project Number: 11-314

Otjozondu Mining
The Namibian Manganese Company

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DOCUMENT ISSUE STATUS

Report Issue	Final		
Reference Number	11-314		
Title	Environmental Management Plan Report		
	Name	**Signature**	**Date**
Author	Simon Charter		November 2011
	Riana Panaino		May 2012
Document Reviewer	Estie Retief		May 2012
Document Authorisation	Ferdi Pieterse		May 2012

I. EXECUTIVE SUMMARY

Project background

The Otjozondu Manganese Project (the Project) is located in a brownfields manganese production area, known as the Otjozondu Manganese Field. The Project is owned by Otjozondu Mining (Pty) Ltd (Otjozondu Mining). Mining has taken place intermittently since the 1950s and continues today. The Project is located approximately 220km north-east of Windhoek, Namibia, near the villages of Otjozondu and Hochfeld, midway between Otjozondu and Okondjatu on the M112 secondary road.

Otjozondu Mining owns five Exclusive Prospecting Licences (EPLs) for base and rare metals (EPL3456, EPL3537 EPL3538, EPL3539 and EPL 3879) which cover approximately 1,300km^2 and one Mining Licence (ML 145) which covers approximately 710km^2 in the Okahandja district.

The dominant land use in the region of the project is agriculture and tourism on freehold land, with small areas of settlements. Mining has taken place intermittently since the 1950's and continues to this day. The mine and the processing plant are currently located on the farms Bosrand 395 and Labusrus501. The Project's focus is to produce approximately 250,000 tonnes of product per year via opencast mining methods commencing during the latter part of2012, which is planned to increase to 500,000 tonnes per year within two years thereafter (2014).

The expected lifespan of the mine is 20 years. In terms of timing the construction phase of the project is expected to extend over a period of 4 to 6 months and employ approximately 100 personnel. The capital expenditure associated with the construction phase will be in the region of$ 250 million.

A new manganese ore beneficiation plant will be constructed near the current mining area. After processing, the final product will be transported by vehicle to Okahandja where it will be offloaded at a proposed siding and material handling facility from where it will be transported to Walvis Bay Harbour.

Environmental authorisation process

The proposed construction of a new manganese ore beneficiation plant on or near the existing Otjozondu Manganese mine trigger listed activities under the Environmental

Assessment Policy for Sustainable Development and Environmental Conservation, 1995 (EA Policy), the Environmental Management Act, 2007 (Act No. 7 of 2007) (EMA), as well as the Environmental Assessment Regulations and Notice on the Listing of Activities in terms of the Environmental Management Act, 2010 (EA Regulations).

This report forms part of the Scoping and Environmental Impact Assessment (EIA) process as required by the above-mentioned legislation in order to obtain Environmental Clearance from the Directorate of Environmental Affairs.

GCS Namibia, an independent environmental consulting firm, has been appointed to undertake the Scoping and EIA process. GCS is also responsible for the relevant Public Participation Process related to the proposed project.

The following listed activities have been triggered by the proposed development in terms of the EA Policy:

- Listed Activity 4: Establishment of settlements;
- Listed Activity 11: Mining, mineral extraction and mineral beneficiation;
- Listed Activity 36: Water intensive industries; and
- Listed Activity42: Major groundwater abstraction schemes.

Background on Public Participation Process

The public notification period was initiated on 1 September 2011 with the placement of site notices in strategic locations advertising the project, as well as the advertisements in The Namibian and Die Republikein newspapers on the 1st and 8th of September 2011.

A list of Interested and Affected Parties (I&APs) were compiled through processes of networking, press advertisements and notices. The list was updated throughout the consultation process.

Public meetings were held on the 15th and 17th September 2011 at the Farm Otjekongo and the Otjozondu Primary School respectively.

Authority consultation

A meeting was held with a representative from the DEA, Ms. Lely Saima Angula, on

6th October 2011 to discuss the project, concerns raised during the PPP up until that time and the proposed Plan of Study including the recommended specialist investigations. The Plan of Study was accepted in principle and the EIA has been undertaken accordingly.

Scoping report

The Scoping Report was made available for review by I&APs and all registered I&APs wereinformed of the report's availability. The two week review period stretched from the 19th of October 2011 until the 2nd of November 2011.

Ongoing communication (i.e. telephonic, meetings, emails, fax etc.) has been undertaken to ensure an open and transparent channel of communications maintained. All I&APs were given the opportunity to raise their concerns with regard to the proposed project. All comments and/or concerns received have been noted and have been incorporated within the detailed investigations as part of the EIA and draft EMP processes.

Impact Identification

As an integral part of the EIA, various specialists were involved to assess the environment in which the project is located and identify the potential impacts that may occur. In addition to the assessment of the environment and the identification of the potential impacts, the specialists provide recommendations in order to prevent potential impacts and enhance the possible advantages associated with the project where possible. Where impacts could not be prevented the specialists provided recommended management measures to address these impacts to have the least significance on the bio-physical and/or social environment.

The following specialists where involved in the EIA:

Specialist Field	Specialist Company
Biodiversity	African Wilderness Restoration
Hydrology	GCS (Pty) Ltd
Hydrogeology	GCS (Pty) Ltd
Air Quality	Airshed Planning Professionals (Pty) Ltd
Noise	National Environmental Health Consultants CC
Social	Tony Barbour Environmental Consulting and Research
Traffic	Aurecon
PPP	GCS (Pty) Ltd

Conclusion

This Environmental Management Plan highlights the management measures that will be implemented in order to mitigate the environmental impacts of the proposed activities.

It is recommended that the following conditions are met and the outcomes incorporated into an amended EMP within one year of issuance of Environmental Clearance Certificate:

- The provisions stipulated within the EMP associated with this report are complied with.
- All associated licenses (Water Use, Tree Removals etc.) are obtained.
- A dust monitoring network should be designed for the proposed operations once a detailed site layout is available.
- Although the current Biodiversity Impact Assessment indicated no significant impacts, the specialist recommended that the EMP will need early review and revision through the re-evaluation of each impact once more information is available.
- As insufficient data was available when the hydrological assessment was undertaken, it is highly recommended that the following be undertaken to verify results in future:
    - Identify potential monitoring points to measure and record flow volumes as well as possibly measure water quality (during rainy season). These estimates would be used to gain understanding of the water flow, which can address appropriate measures against potential impacts to the environment.
    - The Storm Water Management Plan should be reviewed during further phases or when better information becomes available to verify the accuracy of the proposed solutions.
    - Develop a dynamic water balance model for the mine for planning. This must focus on ensuring optimum use of the limited water resources available.
- It is highly recommended that the mine install an automatic weather station on site to record climatic parameters. It is recommended that a numerical groundwater flow model be updated throughout the mining operation by using the measured water ingress and water levels to re-calibrate and refine the impact predictive scenarios to determine the impact on the surrounding land users.

- Should any critical issues arise during the above-mentioned studies, the authorities must be notified immediately and appropriate mitigation / management measures should be identified and implemented.

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1 INTRODUCTION

1.1 Background

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The expected lifespan of the mine is 20 years. In terms of timing the construction phase of the project is expected to extend over a period of 4 to 6 months and employ approximately 100 personnel. The capital expenditure associated with the construction phase will be in the region of N$ 250 million.

A new manganese ore beneficiation plant will be constructed near the current mining area. After processing, the final product will be transported by vehicle to Okahandja where it will be offloaded at a proposed siding and material handling facility from where it will be transported to Walvis Bay Harbour.

1.2 Environmental Approval

The proposed construction of a new manganese ore beneficiation plant on or near the existing Otjozondu Manganese mine trigger listed activities under the Environmental Assessment Policy for Sustainable Development and Environmental Conservation, 1995 (EA Policy), the Environmental Management Act, 2007 (Act No. 7 of 2007) (EMA), as well as the Environmental Assessment Regulations and Notice on the Listing of Activities in terms of the Environmental Management Act, 2010 (EA Regulations).

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- Listed Activity 4: Establishment of settlements;
- Listed Activity 11: Mining, mineral extraction and mineral beneficiation;
- Listed Activity 36: Water intensive industries; and
- Listed Activity 42: Major groundwater abstraction schemes.

1.3 Applicant details

1.3.1 Name and address of mine

Table 1-1: Name and Address of Applicant

Name of mine	Otjozondu Manganese Mine
Postal address	PO Box 24547 Windhoek
Physical address	Road M112 Otjozondu
Landline	+264 (0) 61 410 950
Facsimile	+264 (0) 61221009
Website	www.otjozondumining.com

1.3.2 Name and address of mine owner

Table 1-2: Name and Address of Mine Owner

Name of mine owner	Otjozondu Mining (Pty) Ltd
Postal address	PO Box 24547 Windhoek
Physical address	5 Johann Albrecht Street Windhoek West Windhoek
Landline	+264 (0) 61 410 950
Facsimile	+246 (0) 61 88 611 092
Website	www.otjozondumining.com
Operations Manager	Sean Richardson
Country Manager - Namibia	Ashley Jones

1.3.3 Name and address of mineral rights holder

Otjozondu Mining further owns five Exclusive Prospecting Licences (EPLs) for base and rare metals (EPL3456, EPL3537 EPL3538, EPL3539 and EPL 3879) which cover approximately

1,300km^2 and one Mining Licence (ML 14/2/3/2/145) which covers approximately 710km^2 in the Okahandja district.

Refer to Figure 1-1 for an indication of the prospecting and mining licences of the area and Figure 1-2 for the regional and local setting of the Otjozondu Mine.

1.4 Title deed description

The table below includes a summary of the land access agreements currently in place:

Table 1-3: Title Deed Description

Name	Type of Agreement	Expiry
Farm Bosrand 395	Prospecting & Mining Agreement	Ongoing
Farm Bosrand 395	Road Access Agreement	30 November 2012
Farm Labusrus 510	Agreement of Lease	30 September 2016
Farm Labusrus 510	Road Access Agreement	30 November 2012
Farm Labusrus 510	Prospecting & Mining Agreement	Ongoing
Farm Labusrus 510 (Portion 1)	Prospecting & Mining Agreement	Ongoing

1.5 Basic description of mining activities

Mining has taken place in the area since the 1950s and continues today. In terms of the proposed mining plans, Otjozondu Mining plans to produce approximately 250,000 tonnes of produce per annum commencing in 2012, increasing to 500,000 tonnes by the year 2014. As part of the proposed operations a new manganese ore beneficiation plant will be constructed near the current mining area.

The final product will be transported to Okahandja, where it will be offloaded at a proposed siding and material handling facility and transported by rail to Walvis Bay Harbour for export.

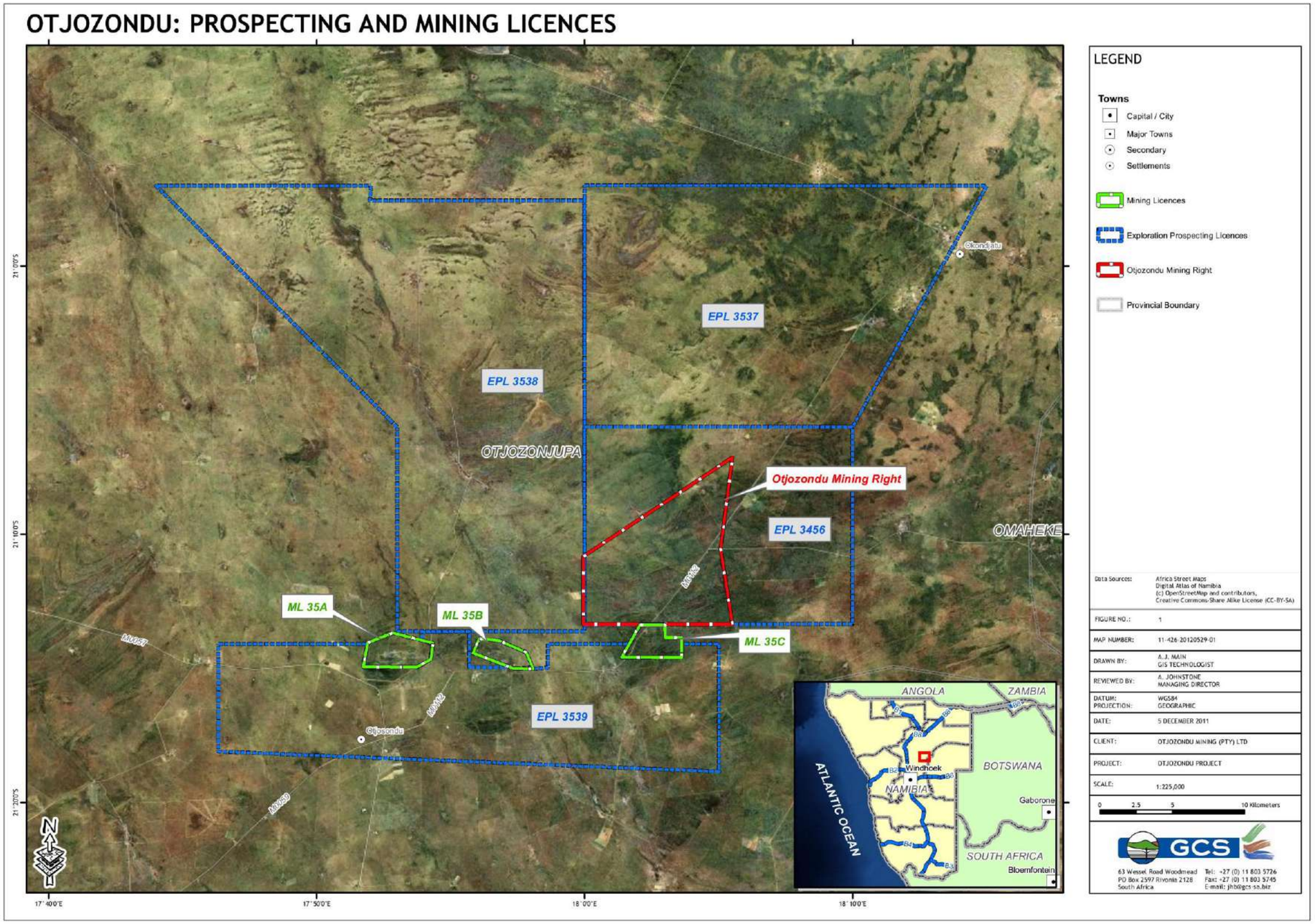

Figure 1-1: Prospecting and Mining Licenses of the area

1.5.1 Mineral deposit

The manganese mineralisation is associated with Banded Iron Formation (BIF) deposits approximately 50m thick. The visual impression of homogeneity of the deposit masks variations of mineralogy and variation of Manganesegrade. The primary ore is located on several layers with paleogeographic and sedimentologic controls implying lateral variation of facies which remains the object of further studies and investigations.

1.6 Regional setting

Figure 1-2 shows the Regional and Local Setting of the Otjozondu Mine.

1.6.1 Neighbouring towns

Neighbouring towns to the Otjozondu mine include Okahandja (±152km), Otjiwarongo (±295km). Various settlements and villages situated in the vicinity of the mine include Otjozondu (±15km), Hochfeld (±41km), Okondjatu (±33km) and Okakarara (±133km).

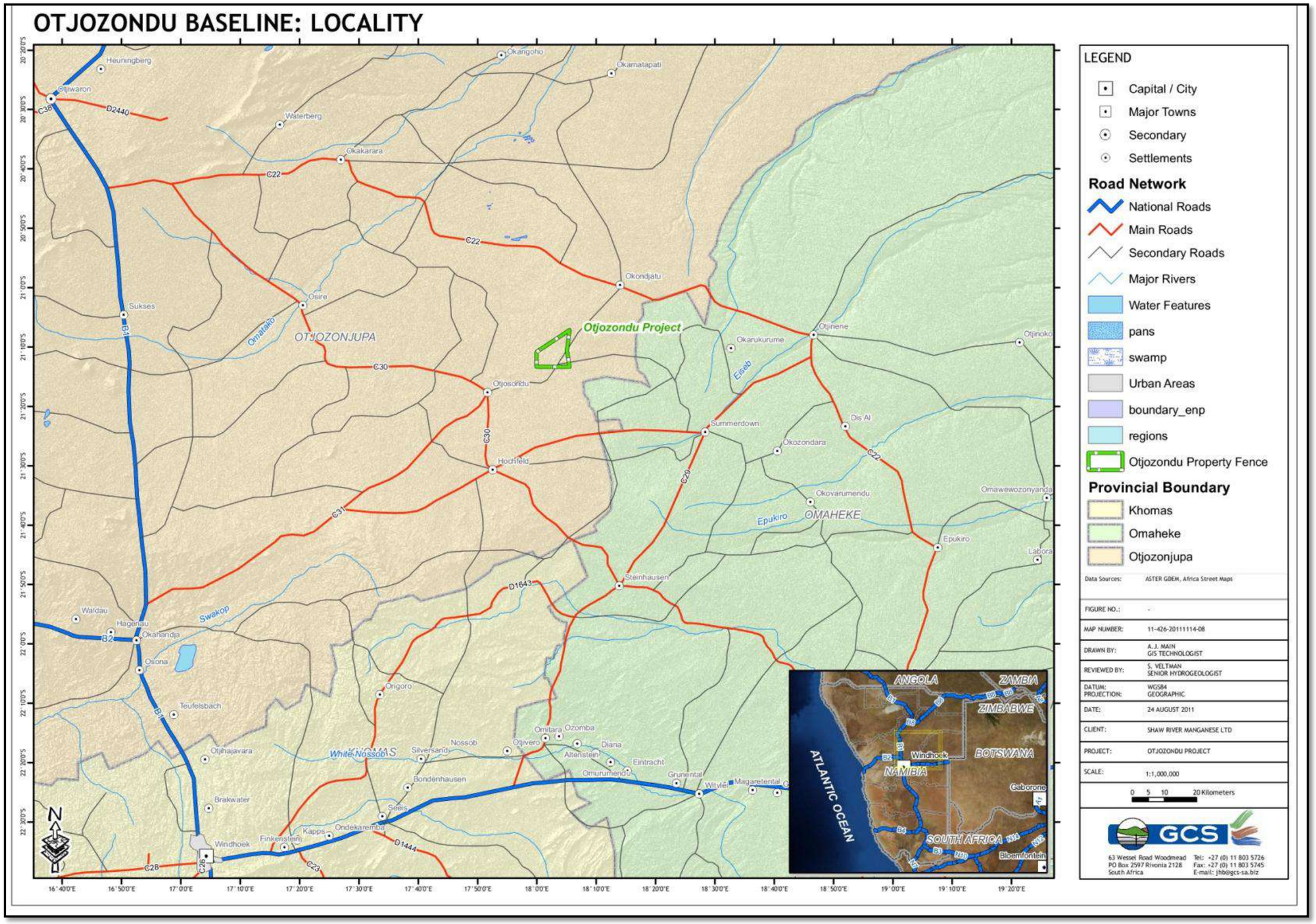

Figure 1-2: Locality map

1.7 Environmental assessment practitioner details

In terms of regulation 20 of the EA Regulations, a proponent must designate an Environmental Assessment Practitioner (EAP) to manage the environmental assessment (EA) process. For this purpose Otjozondu Mining appointed GCS Namibia (Pty) Ltd (GCS) to undertake and conduct the necessary environmental assessments and, in doing so, to comply with the provisions of the EMA, the Draft EA Regulations, any applicable guidelines as well as other applicable laws as is required in terms of regulation 21.

GCS is a Namibian registered company operating since early 2009, and is a subsidiary of GCS (Pty) Ltd, a South African based environmental and geohydrological consultancy.

The GCS team is made up as follows:

Table 1-4: EAP team

Name	Position	General qualifications	Years experience
Tanja Bekker	Environmental Project Manager	BSc (Geography / Environmental Management/ Geology): Rand Afrikaans University, Johannesburg, South Africa B.Sc (Hons) (Geography / Environmental Management): Rand Afrikaans University, Johannesburg, South Africa M.Sc (Environmental Management): Rand Afrikaans University, Johannesburg, South Africa	9
Simon Charter	Environmental Consultant	B.Sc – Environmental Science and Zoology (UCT) B.Sc (Hons) - Environmental Science (UCT) M.Sc - Environmental Management (UCT) Management Systems Auditor - ISO 14001:2004; ISO 9001:2001 & OHSAS 18001:1999 (RABQSA & SAATCA)	5
Alet Greeff	Environmental Lawyer	B.Comm – Accounting (NWU) LLB (NWU)	1

See Appendix C for the Curriculum Vitaes of the above persons as required in terms of regulation 24(1) (a) of the EA Regulations.

2 DETAILED PROJECT DESCRIPTION

2.1 Existing infrastructure and operations

2.1.1 Existing surface infrastructure

It is important to note that this project will take place on an existing mine. There are therefore a number of mining and processing activities currently underway.

Infrastructure present on the Site Fenced Area includes:

- Otjozondu Offices;
- Medical facilities;
- Laboratory;
- Product Storage area;
- Main Jig area;
- Fines Jig area;
- Stockpile areas; and
- Water Dam.

Approximately 8km north east of the site fenced area is the crusher area on the Bosrand farm. Mine areas on the Bosrand property are mainly included:

- Stockpile areas.

Other mining areas include the opencast pits, namely:

- Labusrus pit;
- Bosrand pit; and
- North Bosrand pit.

Mine employees are currently housed in their own or rented accommodation at Okondjatu. The mine provides daily transport from the village to the mine.

2.2 Proposed activities

2.2.1 Mining Operation

At this stage, detailed mine planning is not available. Despite this, a fairly accurate indication of activities is indicated in the site layouts presented in the next pages.

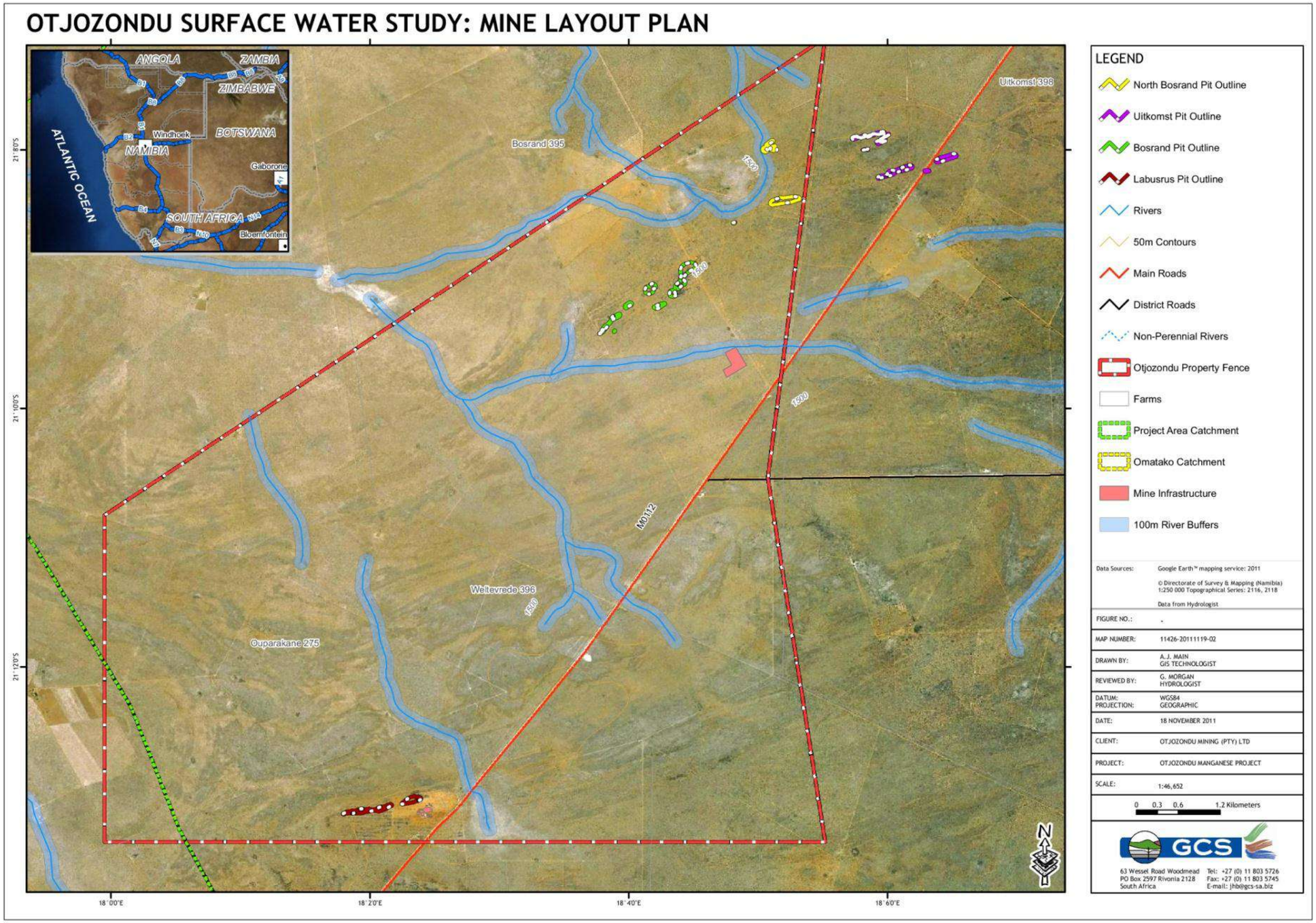

Figure 2-1: Mine Layout

The mining area consists of three distinct areas (Figure 2-1) linked by road namely the Bosrand North (mining), Bosrand (mine infrastructure and mining) (**Figure 2-2**) and Labusrus (mining) areas (**Figure 2-3**).

The mine currently has approval to produce 180,000 tonnes per annum (tpa) (product), although current mining is nowhere in the range due to a lack of mining infrastructure. Production is planned at approximately 250,000tpa of product commencing in 2012 and is set to increase to 500,000tpa within two years thereafter (2014).

Based on information provided by Otjozondu Mining ~ 80 tonnes of processed material will be transported per trip. Based on the full production level of 500,000tpa this would translate into ~ 18 trips per day for 365 days of the year. This would result in 36 round trips per day (empty vehicles would be returning to the mine from Okahandja).

Otjozondu Mine plans to construct a new manganese ore beneficiation plant on or near the existing Otjozondu Manganese Mine. The final product will be transported to Okahandja by truck. This project will require new onsite plant and mining infrastructure and services as well as additional housing for the increase in staff on site.

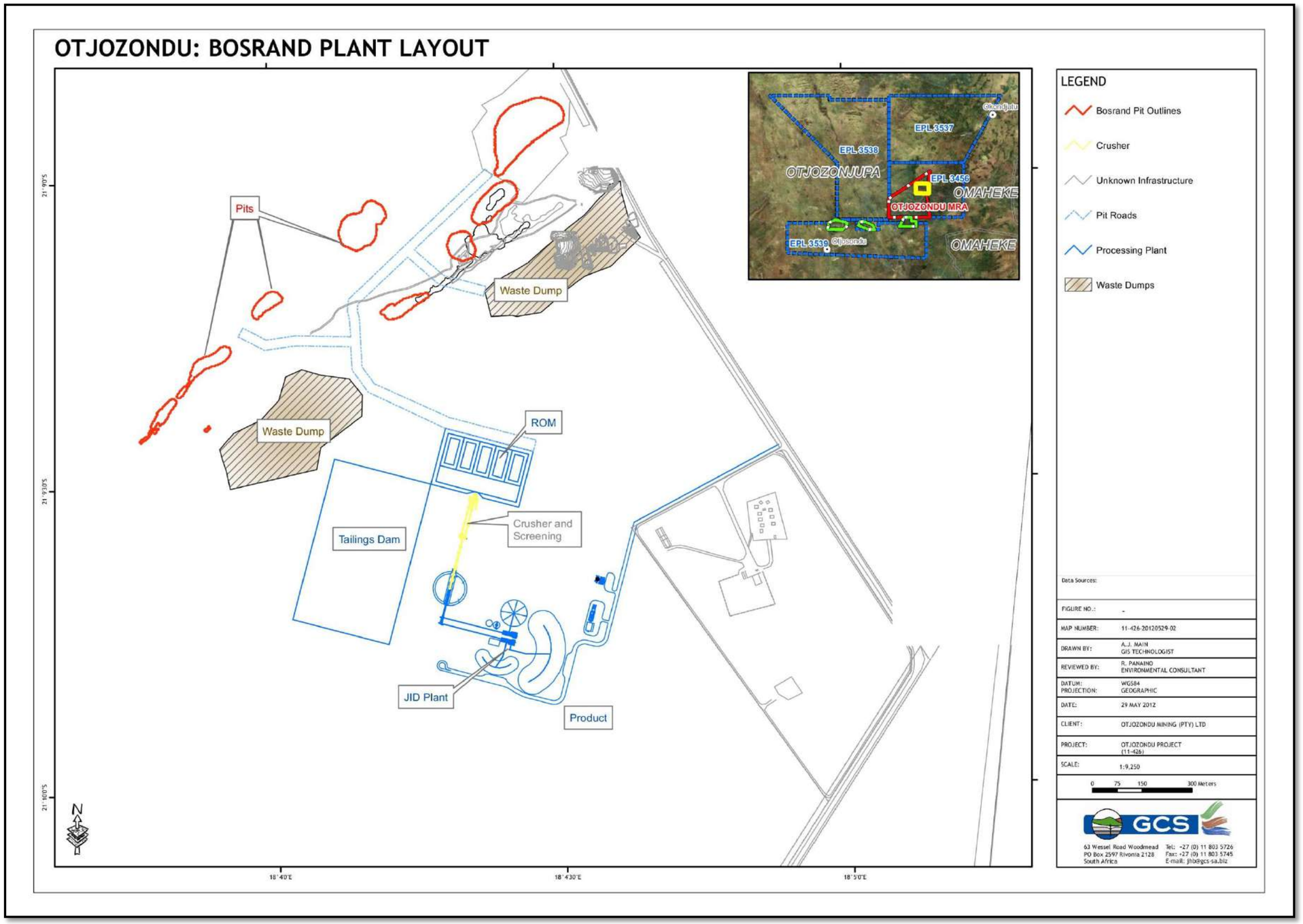

Figure 2-2: Future site layout –Bosrand

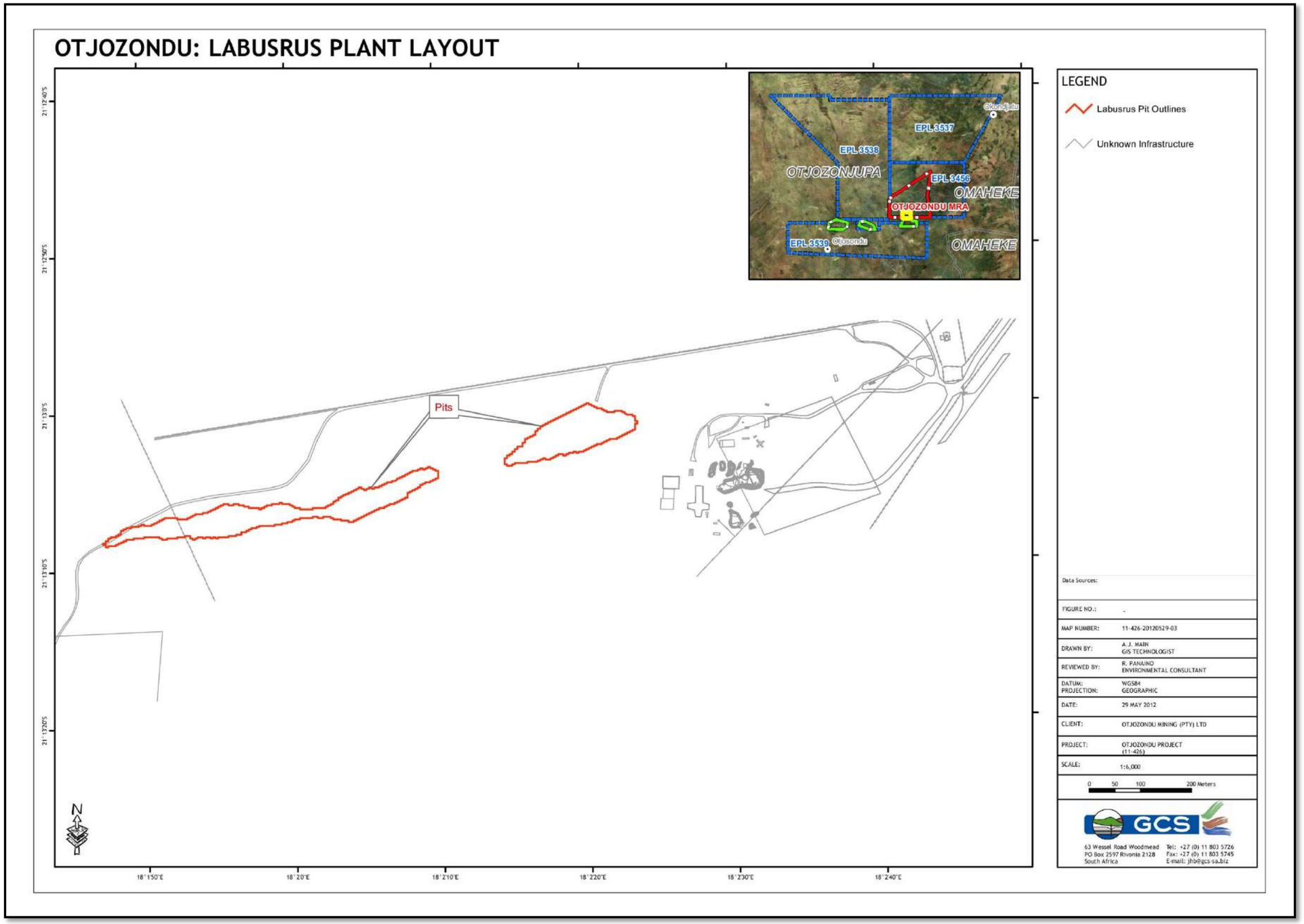

Figure 2-3: Future site layout - Labusrus

Otjozondu Mine aims to commence production during the latter part of 2012. Otjozondu Mine envisages Phase I to build up to a mining rate of 750,000tpa of ore to produce 250,000tpa of product for export.

The expected lifespan of the mine is 20 years. In terms of timing the construction phase of the project is expected to extend over a period of four to six months and employ approximately 100 personnel. The capital expenditure associated with the construction phase will be in the region of N$ 250 million.

The operations process flowchart for Phase I is represented in **Figure 2-4**, overleaf.

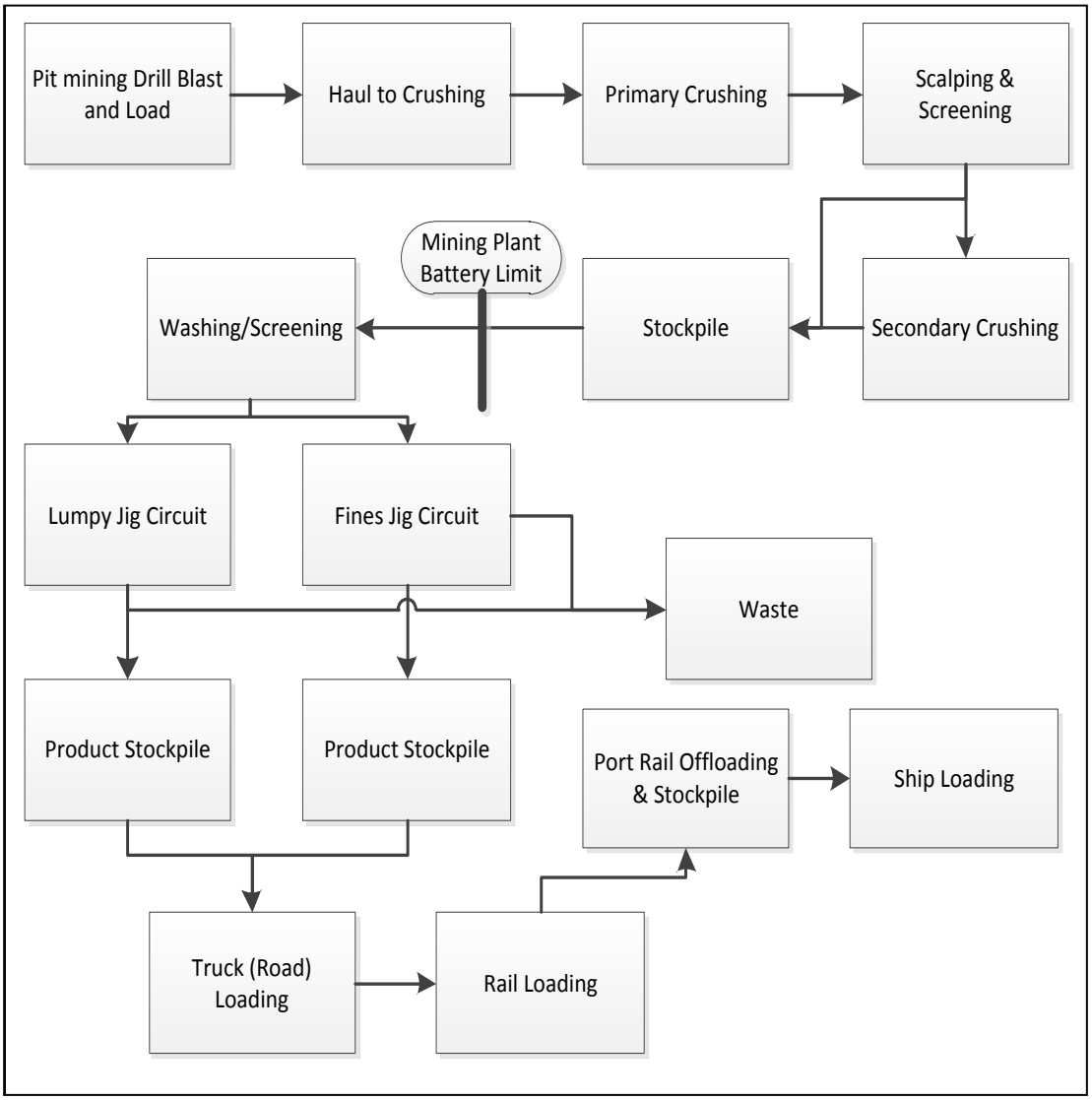

Figure 2-4: Phase I process flowchart

Phase II calls for the expansion to a mining rate of 1,500,000tpa of ore by 2014, nominally producing 500,000tpa of product. The aim of phase II is to process the fines produced as a by-product of the process outlined in phase I. The flowchart in
Figure 2-5 provides a representation of the process as envisaged during Phase II.

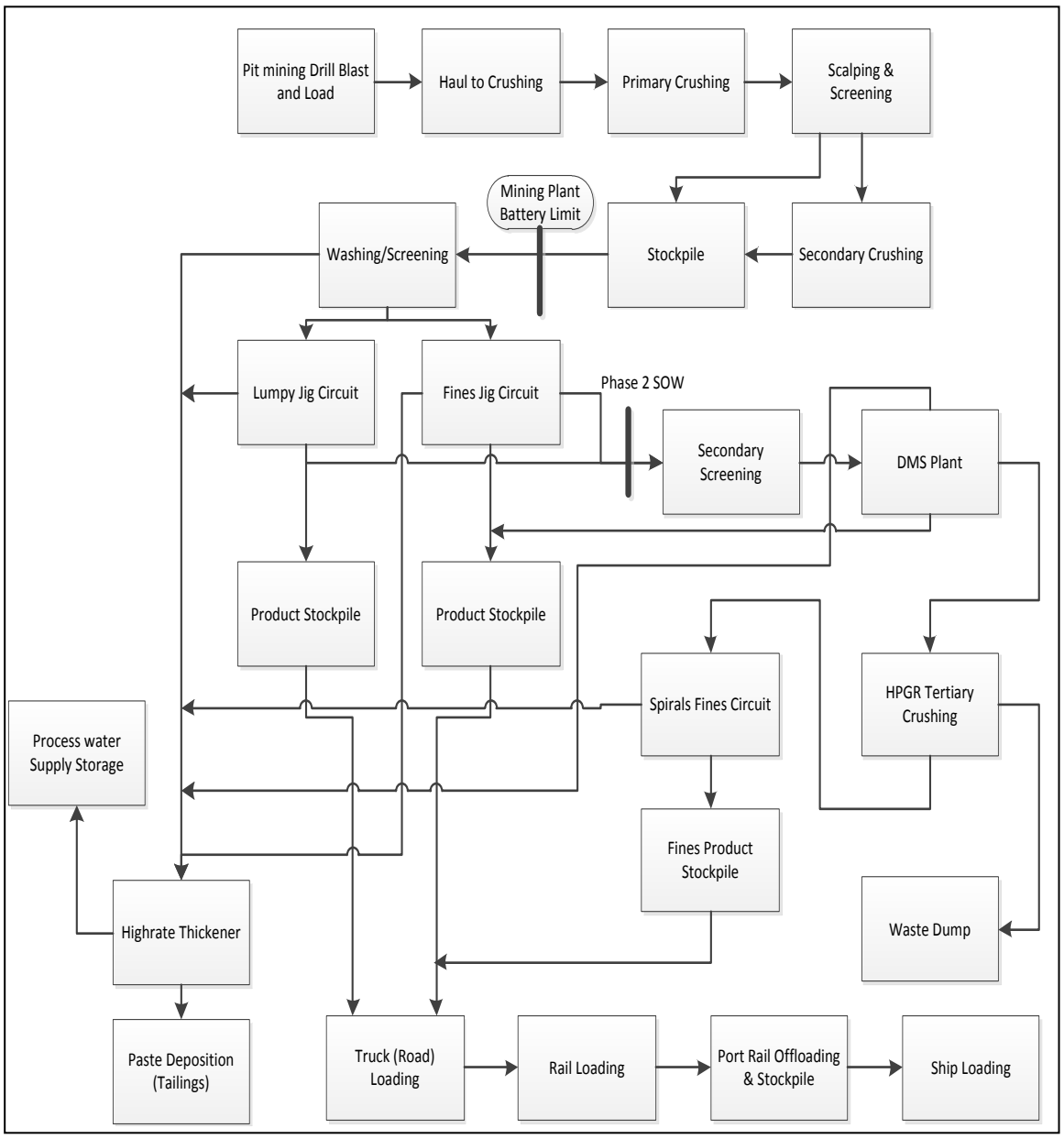

Figure 2-5: Phase II process flowchart

Mining is to be carried out in relatively shallow open pits (nominally 50m deep) using conventional loaders and off-road mining trucks using dedicated haul roads.

Processing will then be carried out using conventional crushing and gravity separation technology. No chemicals are proposed to be used in the process. Waste dumps and the paste disposal site are not expected to generate acid mine drainage issues.

The power-supply is to be obtained from a dedicated on-site diesel power station.

It is expected that the mine will require the abstraction of water in the region of 500 000 tonnes/annum initially. Water will be supplied from a borefield within a reasonable distance from the mine. A water recovery circuit is to be incorporated in the design to minimise make-up water requirements.

The final product is to be transported by road to a product handling facility and railway siding to be established at Okahandja for transhipment onto trains to Walvis Bay Harbour.

2.2.2 Employment and Housing

New housing will be required for the increase in staff as a result of the expansion project. Sewerage facilities will need to be provided in order to handle the sewage from the new staff accommodation. Until such time as a final option has been decided upon, the mine will continue to transport staff to site from Okondjatu.

During the operational phase ~ 200 employees will be employed on the site. The current mining operations employ ~ 50 employees. Otjozondu Mining has indicated that employees currently employed on the mine will be offered employment on the new mine. In terms of filling the posts (~150), Otjozondu Mining are committed to employing as many locals as possible. The workers will be accommodated in accommodation provided by the mine. Otjozondu Mining has indicated that they intend to implement a 2 week on 1 week off policy. This implies that all workers will spend 2 weeks on the site and then be transported back to their home towns where they spend 1 week before returning for another 2 week spell. This policy will reduce the potential risk posed by mine workers to the local communities in the area.

3 BROAD ENVIRONMENTAL MANAGEMENT OBJECTIVES

Environmental Objectives are identified to determine what results the mine would like to achieve in terms of the potential impacts the proposed activities would have on the environment.

All of objectives outlined in this section are based on the central tenet of Best Practical Environmental Option. All planning and implementation of the infrastructure and associated management measures will take place in such a manner that environmental risks are minimised, mitigated or where possible removed all together.

3.1 Geology

- To optimally utilise the geological resource in terms of the approved Mine Licence.
- To limit the mining activities within the approved Mine License area.
- To place infrastructure in such a manner as not to sterilise potential future mining resources.

3.2 Topography

- To limit the impact on the topography in terms of the planning of infrastructure.
- To plan the infrastructure with closure in mind and to ensure that the area could be rehabilitated to be free-draining as far as practically possible.

3.3 Soils, land capability and land use

- To conserve soil resources and to maintain the viability of soil disturbed by the development of the mine and associated infrastructure and to ensure that pre-mining land capability can be restored.
- To ensure the prevention of erosion.
- To minimise the amount of soil physical and chemical degradation occurring.
- To keep the area to be disturbed to a minimum and to restore disturbed land to its pre-disturbance potential, where possible.
- To minimise the disturbance of grazing land and to restore the disturbed areas to grazing land, where possible.

3.4 Flora

- To limit the impact on the vegetation to the mining area and associated infrastructure only, while protecting the rare and endangered species.
- To ensure the prevention and minimization of soil erosion, compaction and sedimentation.
- To ensure the control and management of the potential for alien-plant invasions.
- To reduce the pressure on plant resources (harvesting) due to an influx of people.

3.5 Fauna

- To minimise the loss of biodiversity and prevent hunting and poaching.

3.6 Surface water

- To prevent the contamination of and the wash down of soils into tributaries, drainage channels and pans.
- To reduce the impact of the alteration of drainage patterns (i.e. drainage channels) on the overall catchment.
- To prevent water contamination by chemicals, fuels and other contaminants.
- To ensure efficient stormwater management through clean dirty separation.

3.7 Groundwater

- To ensure that the construction phase and mining activities have a limited impact on groundwater quality or availability of any groundwater users.
- To minimise seepage, prevent contact between clean and dirty areas, and to recycle contaminated water.
- To minimise the extent of disturbance of the aquifer.
- To prevent degeneration of groundwater quality.
- To manage the anticipated impacts associated with the inflow of groundwater to the pit areas.
- To reduce the impact of abstracting water on the surrounding environment and groundwater users.

3.8 Air quality

- To limit the potential of dust dispersion on and around the mine.
- To minimise the tailpipe emissions from vehicles on site.

3.9 Noise

- To minimise the noise impact on the surrounding environment.

3.10 Heritage

- To ensure that the mine does not impact negatively on sites of archaeological and cultural interest.

3.11 Visual

- To limit the visual impact caused by the various mine infrastructure and activities on the surrounding area.

3.12 Socio-economic

- To reduce the impacts associated with the potential in migration to the area.
- To ensure that safe conditions are implemented at the mine.
- To maximise employment (directly or indirectly) by the mine.
- To reduce the impact of transfers and remittance outside the mine region.
- To ensure the safe transportation and arrival of all employees.
- To ensure that the establishment of the mine does not result in a negative impact on the power supply.
- To minimise the impact of heavy traffic on the haul and public roads.

4 MANAGEMENT MEASURES

Based on the outcomes of the specialist investigations, potential impacts associated with the proposed mining operations have been identified in the EIA. The specialist studies further assessed the significance of each of the identified impacts and recommended the best practical management measures and action plans to address the impacts.

The aim of the management measures in this section of the report is to eliminate potential impacts where possible. Where impacts cannot be eliminated, measures are provided to reduce the significance of the impacts. Action plans are further provided in order to guide the applicant in the implementation of the management measures.

Based on the above, the following tables provide the management measures recommended to manage the potential impacts rated in the EIA. In addition to the management measures provided, the table indicates the person responsible to ensure that these commitments are adhered to and implemented and the priority of these commitments (either prior to a phase, during a phase and/or ongoing).

The responsible persons at Otjozondu Mine have assessed these commitments in detail and have committed to the specific management measures where indicated in the table. Please note that the significance ratings included here indicate significance after mitigation.

4.1 Environmental Management measures

4.1.1 All phases

Some of the possible impacts associated with the proposed project will be applicable to the Construction, Operation and Closure phases. These are addressed in this section.

4.1.1.1 Vehicular traffic and transportation of goods

The following table details the possible impacts and proposed management measures for impacts related to vehicles traveling around and within the mining site. During construction and decommissioning phases there will be an increase in vehicles and machinery on and around the mining site. Construction vehicles and machinery will be clearing land and transporting materials on and off site during construction. During decommissioning infrastructure will be removed from site with vehicles, and machinery to rip soils and aid in rehabilitation will increase on site.

During operation some of the activities that will add to the vehicular traffic and transportation impact will be:

- ~ 80 tonnes of processed material transported per trip to Okahandja and back, thus 36 round trips per day;
- Conventional loaders and off-road mining trucks used for mining the manganese ore; and
- Until a final housing option has been decided upon, the mine will transport staff to site from Okondjatu.

Table 4-1: Vehicular traffic and transportation of goods

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Geology	No impacts					
Topography	No impacts					
Soil, land capability and land use	Vehicles travelling outside of designated areas will lead to soil physical degradation.	L	• Designated areas (roads, loading bays etc) will be fenced off in order to ensure that vehicles do not travel outside of the boundaries. • Induction and awareness training will address vehicular restrictions. • Drivers will receive induction and awareness training.	• Workers should complete induction prior to working on site.	Environmental supervisor	Ongoing
	Spills from vehicles / machinery may result in soil contamination.	L	• Vehicles will be regularly monitored and maintained. Maintenance programmes will be established and implemented. • There will be an incident management system, including procedures and training, for dealing with incidents as prescribed within the Environmental Awareness Programme. • If spills do occur and soils become contaminated, the appropriate remedial measures will be identified in consultation with an appropriately qualified specialist. If necessary, the polluted soils will be classified as waste and will be discarded at an appropriate permitted waste site. After removal of the contaminated soils, the affected areas will be landscaped and	• The incident management system will be communicated to all workers on site. • The environmental requirements on site will be communicated to all people working on site and will be included in contractual conditions.	Project Manager, Environmental Supervisor, contractors, staff	Ongoing

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
			rehabilitated.			
Surface water	Spills from vehicles / machinery may result in surface water contamination.	L	• Vehicles will be regularly monitored and maintained. Maintenance programmes will be established and implemented. • There will be an incident management system, including procedures and training, for dealing with incidents as prescribed within the Environmental Awareness Programme. • If spills do occur and soils become contaminated, the appropriate remedial measures will be identified in consultation with an appropriately qualified specialist. If necessary, the polluted soils will be classified as waste and will be discarded at an appropriate permitted waste site. After removal of the contaminated soils, the affected areas will be landscaped and rehabilitated. • Surface water will be monitored in accordance with Section 5.1 of the EMP.	• A vehicle / machinery maintenance and monitoring programme will be developed and established. • Ensure the Emergency Preparedness and Response Programme is updated regularly. • Brief employees on the Emergency Preparedness and Response Programme and enforce the implementation thereof. • The incident management system will be communicated to all people operating on site as part of the induction and awareness training. • The environmental requirements on site will be communicated to all contractors and will be included in contractual conditions.	Environmental Supervisor, vehicle maintenance	Ongoing
	The presence of linear infrastructure could lead to an increase in volume and speed of surface water run-off, increasing erosive capacity	L	• Roads will be constructed with appropriate drains, levelling and surfacing to ensure adequate drainage. • Erosion control measures are required on all slopes exceeding 2% and engineered erosion control measures are required on all slopes exceeding 15%. Slope angles of topsoil stockpiles will not exceed 1:3 (18°).	• Surface water will be monitored in accordance with Section 5.1 of the EMP.	Environmental Supervisor	Ongoing

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Visual	The roads will have a visual impact (visual intrusion, visibility and visual exposure).	M	• If dust fallout reaches an unacceptable level and restricts vision the sealing of roads should be investigated. • An ecological approach to rehabilitation and screening measures, as opposed to a horticultural approach to landscaping should be adopted. For example, communities of indigenous plants enhance bio-diversity and blend well with existing vegetation.	• Draw up a maintenance programme for existing infrastructure, and implement it. • Visual inspections of the surface infrastructure and reporting of any areas of concern to be implemented.	Environmental Supervisor	Ongoing
Fauna and flora	Sedimentation of pans and high sediment loads in streams during intensive rain could thus result in loss of wetland and riparian zone integrity in terms of biodiversity and function.	L	• Erosion control measures are required on all slopes exceeding 2% and engineered erosion control measures are required on all slopes exceeding 15%. Slope angles of topsoil stockpiles will not exceed 1:3 (18°). • Topsoil and natural vegetation self-succession will be used in the vegetating of the berm, rail, conveyor and road embankments.	• Implement monitoring and maintenance plan for stormwater, clean water and dirty water management systems.	Environmental Supervisor	Ongoing
	Direct destruction of organisms and their habitats (including road kills)	M	• Install highly visible speed limit notices and devices that effectively manage and control average traffic speed. • Train all drivers of vehicles in the necessary procedures to maintain regulated speed. • As much as operationally feasible, driving to and from the mining sites should be avoided at night, limited, if possible, only to within each mining area. • Develop road use policy and enforce this through regular checks. • Mark out all construction and mining footprints and clearly convey the rule of staying inside these boundaries to all construction crews and mining staff; make environmental management of construction an explicit part of building contracts with non-performance linked to a penalty clause.	• Speed limits must be strictly enforced. • Regular follow-up training must be done to instil appropriate vehicle control and a high degree of professional road conduct. • Police the construction crews' and mining staff's adherence to the rules and do not hesitate to invoke penalty clause/s. • Raise awareness through awareness campaigns and training of key staff. • A penalty system will be designed to address vehicular speed transgressions.	Project manager	Ongoing
	Direct and indirect effects on biodiversity due to change in the environment as a result of excessive dust, noise, light, artificial surface water and human presence	M	• At any time, confine mining-related activities to as small an area as possible. • Reduce noise and dust as much as possible	• A vehicle / machinery maintenance and monitoring programme will be developed and established. • Reduce dust by following recommendation concerning dust control; Section 4.2.	Environmental Supervisor	Ongoing

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Noise	Noise will be generated during the operation of roads by vehicles, machinery and staff on site which could be a nuisance to nearby residence.	L	• Activities will be reduced during the night time. • All the equipment, but especially the diesel powered mining equipment, will be well maintained. • Select vehicles with low sound power level rating, adequate exhaust silencers. Mufflers will be installed on vehicles that produce too much noise. • Ensure all vehicle noise emissions are within industry norms. • The maintenance schedule will include the checking of exhaust and intake silencers. Any change in the noise emissions characteristics of equipment must serve as an indicator for its immediate withdrawal from service and placement on the maintenance schedule.	• Noise monitoring forms part of the monitoring schedule. Refer to Section 5.4 of the EMP for information on noise monitoring. • A monitoring and maintenance plan for vehicles and equipment should be developed and must be updated on an annual basis. • Induction and awareness training will address the need to reduce noise emissions. • Noise monitoring will be undertaken to ensure that noise levels comply with Safety and Health Standards. Noise monitoring will take place in accordance with Section 5.3 of the EMP.	Environmental Supervisor, Maintenance	Ongoing
Air quality	Tailpipe emissions from construction and haul vehicles and other combustion driven machinery on site (water carts, graders, scrapers, dozers, excavators, FEL, tippers, compactors, light vehicles).	L	• Vehicles / machinery will be regularly monitored and maintained.	• A vehicle / machinery maintenance and monitoring programme will be developed and established.	Environmental Supervisor, Maintenance	Ongoing
	Wind erosion from exposed areas.	L	• If dust fallout levels from unpaved roads and are found to be exceeding acceptable levels than the sealing of roads must be investigated.	• Dust control measures have been outlined (refer to Section 4.2 of the EMP) • The dust monitoring programme in Section 5.3. of the EMP will be adhered to.	Project Manager, Environmental Supervisor	Ongoing
	Vehicle-entrained emissions from unpaved and paved roads.	M	• If dust fallout levels from unpaved roads are found to be exceeding acceptable levels than the sealing of roads must be investigated. • Speed limits will be maintained	• Dust control measures have been outlined (refer to Section 4.2 of the EMP). • The dust monitoring programme in Section 5.3 of the EMP will be adhered to.	Environmental Supervisor	Ongoing
Socio-economic	Degradation of roads due to heavy vehicles	M	• Speed limits will be adhered to. • The transport of manganese material from the Otjozondu Manganese Mine should be confined to Road 59, to avoid damage to majority of roads in the area.		Health & Safety Supervisor, Mine Manager	Ongoing
	Damage to vehicles. The poor quality of the road surface resulted in damage to vehicles, specifically	M	• The transport of manganese material from the Otjozondu Manganese Mine should be confined to	• Monitor the condition of the roads	Health & Safety Supervisor, Mine	Ongoing

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
	suspension and tyres.		Road 59, to avoid damage to majority of roads in the area. • The mine must ensure that damage caused to roads by the construction related activities, including heavy vehicles, is repaired. • If possible separate haulage roads should be developed at the cost of the mining company.		Manager	
	Resident's safety due to vehicles on site, reckless driving and passing schools and villages.	M	• Movement of construction traffic should be limited to weekdays. • Movement of heavy vehicle construction traffic should be limited to Road 59 (see above) and not the C31 via Hochfeld. • Potentially affected farmers should be made aware in advance of planned movements of abnormal loads on local roads. • The mine must ensure that damage caused to roads by the construction related activities, including heavy vehicles, is repaired. • All vehicles must be road-worthy and drivers must be qualified and made aware of the potential road safety issues and need for strict speed limits. • Otjozondu commits to discuss the possibility of fencing the section of the road that passes through Otjozondu and the primary school.	• Create awareness through induction and training. • Enforce speed limits • Ensure all drivers are appropriately licenced	Health & Safety Supervisor, Mine Manager	Ongoing
Heritage	No impacts					

4.1.1.2 Storage, use and disposal of diesel, oil and other hazardous chemical substances

The following table describes the possible impacts and proposed management measures for impacts related to the storage, use and disposal of diesel, oil and other hazardous chemicals on the mining site. The following possible substances will be used or stored on site and could impact on the environment if not managed correctly:

- Diesel will be used for generators to generate power for the mine;
- Diesel will be used as fuel for mine and construction vehicles and machinery on site; and
- Oil and other chemicals will be used on site for the maintenance of vehicles and machinery

No chemicals are however proposed to be used in the ore processing process.

Table 4-2: Storage, use and disposal of diesel, oil and other hazardous chemical substances

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Geology	No impacts					
Topography	No impacts					

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Fauna, Flora, Soil, land capability and land use	The inappropriate use of diesel, oil and other hazardous chemical substances may lead to the contamination of the natural environment.	L	• There will be an incident management system, including procedures and training, for dealing with incidents as prescribed within the Environmental Awareness Programme (Section 7 for the Emergency Procedures and Section 6 for information on the Environmental Awareness Programme). • Major spillage incidents will be reported to the Environmental Authority. Appropriate remedial measures will be implemented in consultation with these regulatory authorities. • If spills do occur and soils become contaminated, the appropriate remedial measures will be identified in consultation with an appropriately qualified specialist. If necessary, the polluted soils will be classified as waste and will be discarded at an appropriate permitted waste site. After removal of the contaminated soils, the affected areas will be landscaped and rehabilitated, where appropriate. • All chemicals stored on the mine site (fuels, lubricants etc.) will be kept in bunded areas capable of containing the designed storage volume and the rainfall that could result from a 1:50 year storm event. • Storage areas and vehicle maintenance areas will be surfaced and will have appropriate runoff containment measures, such as bunds and canals, in place. • All chemical, fuel and lubricant storage areas will be underlain by impermeable substrates. Drums containing chemicals will be stored upright in a secure, bunded area with an impermeable surface. Diesel and oil storage tanks will be kept in bunded areas capable of containing 110% of the capacity of the tanks. • Vehicles will be regularly serviced according to a pre-planned maintenance programme. • Pipelines will be monitored continuously to limit spillage.	• The environmental requirements on site will be communicated to all contractors and will be included in contractual conditions. • The incident management system will be communicated to all teams and contractors. • The detailed waste management programme will be provided to all teams and contractors. • Refer to Section 4.2 of the EMP for hazardous waste disposal guidelines. • Ensure the Material Safety Data Sheet (MSDS) obtained from the suppliers for all hydrocarbons and chemicals stored and/or utilised on site is updated regularly. All MSDS's must be displayed where hydrocarbons and/or chemicals are stored and utilised. • Brief all employees on the location of the MSDS and how this should be utilised. • Ensure the Emergency Preparedness and Response Programme is updated regularly. • Brief employees on the Emergency Preparedness and Response Programme and enforce the implementation thereof. • The handling, storage and disposal of hazardous chemical substances will be in accordance with Section 4.2 of the EMP. • Refer to Section 7 of the EMP for the Emergency Procedures and Responses. • Workers should complete induction prior to working on site.	Environmental Supervisor	Ongoing

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
	The handling and storage of fuel creates a fire risk. This could negatively impact the local fauna.	L	• There shall be an emergency preparedness plan is in place in order to fight accidental fires should they occur. The adjacent land owners/users/managers should also be informed and/or involved. • The induction and awareness programmes will address fire-related issues. • There must be sufficient fire-fighting equipment. This equipment must fulfil the Namibian Occupation Health and Safety requirements. • All vegetation adjacent to the fuel storage tanks will be continually removed. • Diesel and oil storage tanks will be kept in bunded areas capable of containing 110% of the capacity of the tanks.	• Refer to Section 7 of the EMP for the Emergency Procedures and Responses.	Fire Officer/ Environmental Supervisor	Ongoing
Surface water	The use of diesel, oil and other hazardous chemical substances may lead to the contamination of surface water.	L	• Surface water will be monitored in accordance with Section 5.1 of the EMP. • Diesel and oil storage tanks will be kept in bunded areas capable of containing 110% of the capacity of the tanks.		Environmental Supervisor	Ongoing
Groundwater	Hazardous chemical spills may reach groundwater, thereby impacting its quality.	L	• Boreholes will be monitored for groundwater level and quality to assess the impacts on the groundwater. The monitoring criteria are supplied in Section 5.2 of the EMP. • There will be an incident management system, including procedures and training, for dealing with incidents as prescribed within the Environmental Awareness Programme (Section 7 for the Emergency Procedures and Section 6 for information on the Environmental Awareness Programme). • Major spillage incidents will be reported to the Environmental Authority. Appropriate remedial measures will be implemented in consultation with these regulatory authorities.	• The monitoring criteria are supplied in Section 5.2 of the EMP.	Environmental Supervisor	Ongoing
Visual	No impacts					
Noise	No impacts					
Air quality	No impacts					

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Socio-economic	The handling and storage of fuel creates a fire risk. This could negatively impact the staff on site and local residents if a fire should spread to villages and farms.	L	• There shall be an emergency preparedness plan in place in order to fight accidental fires should they occur. The adjacent land owners/users/managers should also be informed and/or involved. • The induction and awareness programmes will address fire-related issues. • There must be sufficient fire-fighting equipment. This equipment must fulfil the Namibian Occupation Health and Safety requirements. • All vegetation adjacent to the fuel storage tanks will be continually removed. • All provisions relating to fire safety will be related during the induction and awareness training programme.	• Refer to Section 7 of the EMP for the Emergency Procedures and Responses.	Fire Officer	Ongoing
Heritage	No impacts					

4.1.1.3 High-density human presence

The following table details the possible impacts and proposed management measures for impacts related to the influx of people to the mine site. The construction phase of the project is expected to extend over a period of four to six months where approximately 100 personnel will be employed. During the operational phase ~ 200 employees will be employed on the site. The current mining operations employ ~ 50 employees. In terms of filling the additional posts (~150), Otjozondu Mining are committed to employing as many locals as possible. There will however be workers that aren't current local residents who will be employed.

Table 4-3: High-density human presence

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Geology	No impacts					
Topography	No impacts					

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Soil, land capability and land use	Workers may directly impact soils through improper waste disposal and not using sanitation facilities.	L	• A detailed waste management strategy will be established and implemented (refer to Section 4.2 of the EMP). • All employees will be educated on the procedures to follow and the environmental restrictions regarding all environmental parameters. This will form part of the environmental awareness plan (Section 6 of the EMP). • Access on site will be restricted to construction and operational areas. • Off-limit areas will be fenced off. • Penalties will be imposed on all staff that unnecessarily damage any environmental parameters.	• Induction and awareness training will address waste management on site.	Environmental Supervisor	Ongoing
Surface water	Workers may directly impact surface water through improper waste disposal and not using sanitation facilities.	L	• A detailed waste management strategy will be established and implemented (refer to Section 4.2 of the EMP). • Workers will be restricted to construction / operational areas. • All employees will be educated on the procedures to follow and the environmental restrictions regarding all environmental parameters. This will form part of the environmental awareness plan (Section 6 of the EMP). • Off-limit areas will be fenced off. • Penalties will be imposed on all staff that unnecessarily damage any environmental parameters.	• Induction and awareness training will address sanitation. • Adequate sanitation facilities will be provided by mine management.	Environmental Supervisor, mine management	Ongoing
Groundwater	No impacts					
Visual	No impacts					

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Fauna and flora	Direct and indirect effects on biodiversity due to dust, noise, light, artificial surface water and human presence	M	• At any time, confine mining-related activities to as small an area as possible. • Reduce noise as much as possible • Reduce fixed outdoor lights to the minimum that is compatible with operational effectiveness and safety. • Use yellow outdoor lights wherever possible. Invertebrates cannot see red light, and see yellow badly. Humans do not function well in red light and yellow is a compromise. • Install self-closing doors and non-opening windows in night-time operations buildings. • Where light is only intermittently needed, use motion detectors, time switches or similar to only supply light when needed.	• All employees will be educated on the procedures to follow and the environmental restrictions regarding all environmental parameters. This will form part of the environmental awareness plan (Section 6 of the EMP).	Environmental Supervisor	Ongoing
	Direct loss of biodiversity due to poaching, harvesting of plants and killing of animals	L	• Develop policy that limits independent movements by staff into the veld, ensure no poaching and harvesting is undertaken, not even of firewood. Enforce rules with “zero tolerance”. • Provide adequate access to food suppliers • Allow only mining personnel, service providers and construction staff, as well as registered mine visitors on site. • Locate living quarters away from the mine, if feasible. Staff should not spend recreational time at the mine and its surroundings. • Train all staff to appreciate the natural non-consumptive values of biodiversity. • Raise awareness concerning recognising venomous snakes from non-dangerous ones, and ensure that sufficient personnel are trained to handle snakes so as to move them away from the mine without killing. • Compensate farmers for livestock losses, based on valid claims.	• All employees will be educated on the procedures to follow and the environmental restrictions regarding all environmental parameters. This will form part of the environmental awareness plan (Section 6 of the EMP). • Monitor staff for possession of meat, wood or veldkos.	Environmental Supervisor	Ongoing

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
	Pollution due to rubbish and faeces	L	• Develop waste policy and actively enforce it • Develop policy of the management of hazardous materials and actively enforce it • Provide waste deposition facilities on site (rubbish bins, skips) • Do not allow medium to long-term storage of waste on site – all domestic waste should be transported to a managed waste dump site • Provide adequate toilet facilities for all workers at work sites	• All employees will be educated on the procedures to follow and the environmental restrictions regarding all environmental parameters. This will form part of the environmental awareness plan (Section 6 of the EMP). • Monitor area adjacent to mining sites for discarded waste and human waste	Environmental Supervisor	Ongoing
Noise	Workers from the mine could be a nuisance to nearby residence due to loud noise.	L	• Allow only mining personnel, service providers and construction staff, as well as registered mine visitors on site. • Locate living quarters away from the mine, if feasible. Staff should not spend recreational time at the mine and its surroundings.	• Refer to Section 5.4 of the EMP for details regarding noise monitoring.	Environmental Supervisor	Ongoing
Air quality	No impacts					
Socio-economic (positive)	Creation of employment and business opportunities and support for local economic development	H+	• The proponent, in consultation with the Otjozondjupa Region, should develop a database of local companies, specifically Small Medium and Micro Enterprises (SMME's), that qualify as potential service providers (e.g. catering companies, waste collection companies, security companies etc.) prior to the commencement of the tender process for construction contractors. These companies should be notified of the tender process and invited to bid for project-related work;	• Where possible, the proponent, in consultation with the Otjozondjupa Region, should assist local SMME companies to complete and submit the required tender forms and associated information.	Human Resources	Ongoing
Socio-economic (negative)	The presence of mine workers, specifically mine workers from outside the area, poses a potential risk to family structures and social networks in the area.	L	• The proponent should appoint local Namibian companies to undertake work associated with the operational phase where ever possible; • Otjozondu Mining should consider the establishment of a Monitoring Forum (MF) in order to monitor the operational phase and the implementation of the recommended mitigation measures. In this regard the MF established	• Audit and ensure compliance with the Social and Labour Plan.	Human Resources	Ongoing

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
			during the construction phase should be maintained during the operational phase and should include key stakeholders, including representatives from local communities, local councillors, farmers and the contractor(s); • Otjozondu Mining, in consultation with representatives from the MF, should develop a code of conduct for the operational phase. The code should identify which types of behaviour and activities are not acceptable. In this regard no mine workers should be permitted on the premises of the Otjozondu Primary School. Mine workers in breach of the code should be dismissed. All dismissals must comply with the Namibian labour legislation; • Otjozondu Mining should implement an HIV/AIDS awareness programme for all workers employed on the mine; • The movement of mine workers on and off the site should be closely managed and monitored by Otjozondu Mining. In this regard Otjozondu Mining should be responsible for making the necessary arrangements for transporting all workers from the area to and from site on a daily basis; • Otjozondu Mining should make the necessary arrangements for transporting all workers to and from the site every two weeks. Workers should not be permitted to spend their off week in the local area. This would reduce the risk posed to local family structures and social networks; • Otjozondu Mining must ensure that all mine workers from outside the area are transported back to their home towns within 1 day of their contract on the mine ending. This will reduce the risk of mine workers hang around in the area once their contracts come to an end.			

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
	Risk of stock theft, poaching and damage to farm infrastructure	L	• Develop policy that limit independent movements by staff into the veld, ensure no poaching and harvesting is undertaken, not even of firewood. Enforce rules with “zero tolerance”. • Provide adequate access to food suppliers • Allow only mining personnel, service providers and construction staff, as well as registered mine visitors on site. • Locate living quarters away from the mine if feasible. Staff should not spend recreational time at the mine and its surroundings. • Train all staff to appreciate the natural non-consumptive values of biodiversity. • Raise awareness concerning recognising venomous snakes from non-dangerous ones, and ensure that sufficient personnel are trained to handle snakes so as to move them away from the mine without killing. • Compensate farmers for livestock losses, based on valid claims.	• All employees will be educated on the procedures to follow and the environmental restrictions regarding all environmental parameters. This will form part of the environmental awareness plan (Section 6 of the EMP). • Monitor staff for possession of meat, wood or veldkos.	Environmental supervisor	Ongoing
Heritage	No impacts					

4.1.1.4 Waste generation

The following table details the possible impacts and proposed management measures for impacts related to waste generation at the mine site. Sources of waste could be as follows:

- Building rubble, generated during construction and decommissioning activities;
- Construction and mine workers disposing of food boxes, wrappers, cans and other rubble due to inadequate rubbish bins;
- Waste oil and chemicals from maintenance workshops

Table 4-4: Waste Generation

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Geology	No impacts					
Topography	No impacts					

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Soil, land capability and land use	The generation of waste may lead to soil contamination.	L	• A detailed waste management strategy will be established and implemented (refer Section 4.2 of the EMP for information on the disposal of waste).	• The detailed waste management programme will be provided to all construction teams and contractors. • Refer to Section 4.2 of the EMP for waste disposal guidelines. • The environmental requirements on site will be communicated to all contractors and will be included in contractual conditions. • The incident management system will be communicated to all construction teams and contractors. • Workers should complete induction prior to construction activities being undertaken.	Environmental supervisor	Ongoing
Surface water	The generation of waste may lead to surface water contamination.	L	• A detailed waste management strategy will be established and implemented (refer Section 4.2 of the EMP for information on the disposal of waste). • Surface water will be monitored in accordance with Section 5.1 of the EMP.	• The detailed waste management programme will be provided to all construction teams and contractors. • The environmental requirements on site will be communicated to all contractors and will be included in contractual conditions. • The incident management system will be communicated to all construction teams and contractors. • Refer to Section 4.2 of the EMP for waste disposal guidelines.	Environmental Supervisor	Ongoing

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Groundwater	Handling of waste and transport of building material can cause various types of spills (domestic waste, sewage water, hydrocarbons) which can infiltrate and contaminate the groundwater system.	L	• Waste should to be discarded in the allocated waste area. The waste area should be bunded. Spills should be cleaned up immediately according to the specified conditions, and the DWA Namibia should be notified in the event of a significant spill. • Solid waste must similarly either be stored at site on an approved waste disposal area, or removed by credible contractors. • Boreholes will be monitored for groundwater level and quality to assess the impacts on the groundwater.	• Groundwater will be monitored in accordance with the provisions outlined in Section 5.2 of the EMP. • A detailed waste management strategy will be established and implemented (refer Section 4.2 of the EMP for information on the disposal of waste).	Environmental Supervisor	Ongoing
Visual	Waste accumulation may have a negative visual impact.	L	• A detailed waste management strategy will be established and implemented (refer Section 4.2 of the EMP for information on the disposal of waste).	• Waste management strategy to be implemented.	Environmental Supervisor	Ongoing
Fauna & Flora	The generation and improper disposal of waste could affect local ecosystem function.	L	• A detailed waste management strategy will be established and implemented (refer Section 4.2 of the EMP for information on the disposal of waste). • Develop policy of the management of hazardous materials and actively enforce it • Provide waste deposition facilities on site (rubbish bins, skips) • Do not allow medium to long-term storage of waste on site – all domestic waste should be transported to a managed waste dump site • Provide adequate toilet facilities for all workers at work sites	• Waste management strategy to be implemented.	Environmental Supervisor	Ongoing
	Waste accumulation may attract pest faunal species.	L	• A detailed waste management strategy will be established and implemented (refer Section 4.2 of the EMP for information on the disposal of waste) • Pest control measures will be implemented at all area where domestic waste will accumulate.	• Waste management strategy to be implemented.	Environmental Supervisor	Ongoing

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Noise	No impacts					
Air quality	No impacts					
Socio-economic	No impacts					
Heritage	No impacts					

4.1.2 Construction Phase

4.1.2.1 Land clearing and construction of infrastructure (access roads, haul roads, buildings, conveyors)

The following table details the possible impacts and proposed management measures for impacts related to land clearing and construction. Prior to commencement of mining the vegetation and topsoil will be stripped to clear the area that will be mined. Areas where infrastructure will be placed will also be cleared before building commences. This project will require new onsite plant and mining infrastructure and services as well as additional housing for the increase in staff on site.

Table 4-5: Land clearing and construction of infrastructure (access roads, haul roads, buildings, conveyors)

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Topography	Landscaping in order to accommodate new infrastructure will result in topographical alterations.	L	• Landscaping must be limited to those areas that require changes. No construction or project related activities may be undertaken outside of the demarcated areas. • Where possible, topographical alteration will be designed to take the natural topography and drainage of the area into account. • Where possible haul roads and conveyors will be built in mutual / existing servitudes. • The height of the topsoil stockpiles will range between 1.5 and 5m.	• Design drawings must take into account the natural topography of the environment to ensure minimal impact. • Update the on-going rehabilitation programme to ensure that disturbed areas can be rehabilitated on an on-going basis, which will include ongoing monitoring. Landscaping will be included in the rehabilitation plan. • Develop monitoring and manage plans for all rehabilitated areas. Include access control measures in the areas where rehabilitation is being undertaken.	Project Manager, Environmental Supervisor	Prior to construction, , on-going

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Soil, land capability and land use	The removal of vegetation will expose soils, allowing increased soil and water erosion. This in turn would lead to a loss of soil resources and impacts on soil physical characteristics	L	• Natural vegetation establishment (self-succession) will be encouraged. • Erosion prevention measures will be implemented. Ascertain the erosion potential of soils and ensure that erosion-control measures are in place where necessary. • The mine will investigate an appropriate seed mix for the rehabilitation purposes should self-succession not establish on rehabilitated sites. • Areas of construction must be clearly demarcated. No construction or project related activities may be undertaken outside of the demarcated areas. • Where vegetation cannot be established during the life of construction and operations, appropriate measure will be taken to control erosion. These will include grading of surfaces to prevent rapid run-off of storm water and / or the use of energy dissipaters. • Erosion control measures are required on all slopes exceeding 2% and engineered erosion control measures are required on all slopes exceeding 15%. Slope angles of topsoil stockpiles will not exceed 1:3 (18°). • The mine will ensure that erosion controls are included in the designs of all linear infrastructure (access roads, conveyors or open channels) and points of water discharge. Such linear structures and discharge points will be inspected on a weekly basis to check that the measures are effective.	• Update the on-going rehabilitation programme to ensure that disturbed areas can be rehabilitated on an on-going basis, which will include ongoing monitoring. Landscaping must be included in the rehabilitation plan. • Include access control measures in the areas where rehabilitation of cleared land is being undertaken. • Develop monitoring and manage plans for cleared areas.	Environmental Supervisor	Ongoing

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
	The removal and stockpiling of topsoil may lead to a loss of soil resource and land capability through erosion of the stockpiles and chemical and physical degradation.	L	• Effective vegetation stripping along with the topsoil removal will help to maintain the structural integrity of the soils, and retain the seed source. • Stockpiling must take place in accordance with the guidelines outlines in Section 4.2: Soil conservation guide. • Soils, which are stripped could be used in the construction of berms or other storm water measures. If soils are not used in the construction, they must be stored as close as possible to the area where they will be utilized for rehabilitation, as separate managed stockpiles so that they can be easily accessed and used for rehabilitation at closure.	• A topsoil stockpile monitoring programme will be developed and implemented. • Draw up a topsoil stockpile procedure, indicating the depth of topsoil to be removed, the location of the stockpile areas as well as reflecting the method of stripping, stockpiling and stockpile management. • Brief contractors (induction) on the topsoil stockpile procedure and areas and enforce the implementation thereof.	Environmental Supervisor, contractors	Design phase, Construction phase
	The development of haul and access roads, and plant infrastructure will result in loss of land capability and use	M	• Areas of construction must be clearly demarcated. • No construction or project related activities may be undertaken outside of the demarcated areas. • The boundary of the mine and associated infrastructure will be fenced to prevent cattle from having access to potential safety risks and to keep project related activities separate from grazing areas. The fence will be routinely inspected and maintained. • Vegetation and Animal rescue will be undertaken where appropriate.	• The boundaries of the construction area will be determined prior to their establishment and will be incorporated into the site layouts. • Effective vegetation stripping along with the topsoil removal will help to maintain the structural integrity of the soils, and retain the seed source.	Environmental Supervisor, contractors, project design team	Design phase, Construction phase
Surface water	The alteration of drainage patterns may lead to increased surface runoff and erosion	L	• Where possible construction will be designed to take the natural topography and drainage patterns into account.	• Ensure that all design drawings include effective erosion control measures. • Draw up a surface water-monitoring programme to prevent, manage and monitor potential erosion.	Environmental Supervisor, contractors, project design team	Design phase, Construction phase

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
	The removal of vegetation during construction will have an impact in terms of soils washing into pans and other watercourses especially during intensive rainstorms. This results in siltation, which adversely affects the water quality as well as the habitat of the living organisms.	L	• Storm water controls at all sites of mine infrastructure will be established prior to the commencement of construction activities. • Erosion control measures are required on all slopes exceeding 2% and engineered erosion control measures are required on all slopes exceeding 15%. Slope angles of topsoil stockpiles will not exceed 1:3 (18°). • Stockpiles will be constructed in such a way to ensure stability and thereby preventing the possibility of wash down. • A berm will be constructed down gradient of the mining infrastructure to prevent wash down soil from entering the sensitive surface water areas.	• Ensure that all design drawings include effective erosion control measures. • Develop monitoring and maintenance plan for erosion protection measures. • Surface water will be monitored in accordance with Section 5.1 of the EMP. • Use suitably qualified contractors. Ensure staff inductions are undertaken by all workers. • Draw up a contingency plan for sediment discharge off-site.	Environmental Supervisor, Project Manager, project design team	Ongoing
	Topographical changes will alter the natural drainage patterns of the area.	L	• Ensure the channel diversions are properly engineered. • Erosion control measures will be implemented. • Surface water drainage diversions (as part of the clean and dirty water systems and associated culverts), management measures and designs must incorporate the geomorphologic components of the area in order to ensure that as far as practically possible the man-made structures have the least impact on the environmental processes in the area. • All culverts required will be constructed to accommodate the 1:100 year storm event.	• Design drawings must take into account the natural topography of the environment to ensure minimal impact. • Monitor rehabilitated overburden runoff – when quality is adequate allow all runoff back into catchment • Update the on-going topographical rehabilitation programme to ensure that disturbed areas can be rehabilitated to maintain natural environmental processes on an on-going basis, which will include ongoing monitoring.	Project Manager, Environmental Supervisor	Prior to construction, construction phase, ongoing
Groundwater	Clearing topsoil for footprint areas can increase infiltration rates of water to the groundwater system and decrease buffering capacity of soils to absorb contaminants from spills on surface. This can increase the risk of contamination of the groundwater system (increases aquifer vulnerability.	L	• Avoid spills on exposed areas. • No construction of any water management measures, such as the storm water management berms, nor the haul roads will be undertaken with carbonaceous material, • Should it be indicated through monitoring and investigation by a suitably qualified person that any legitimate groundwater users are negatively impacted upon in terms of quantity or quality of borehole water due to mining activities, negotiations between the mine and the groundwater users will be entered into to resolve the situation. • Dirty water will be contained in fit-for-purpose designed facilities, which will limit infiltration of contaminated water to the groundwater.	• Keep the exposed areas as small as possible and clean up spills • Stormwater management systems will be designed prior to construction. • The incident management system will be communicated to all construction teams and contractors. • The environmental requirements on site will be communicated to all contractors and will be included in contractual conditions. • Groundwater will be monitored in accordance with the provisions outlined in Section 5.2 of the EMP. • Ensure the Emergency Preparedness and Response Programme is updated as	Project Manager, Environmental Supervisor	Prior to construction, construction phase

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
			• Boreholes will be monitored for groundwater level and quality to assess the impacts on the groundwater. The monitoring criteria are supplied in Section 5.2 of the EMP.	required. • Brief employees on the Emergency Preparedness and Response Programme and enforce the implementation thereof. • The handling, storage and disposal of hazardous chemical substances will be in accordance with Section 4.2 of the EMP. • Refer to Section 7 of the EMP for the Emergency Procedures and Responses. • Refer to Section 4.2 of the EMP for waste disposal guidelines.		
	The construction of the ore beneficiation plant, buildings, workshops and basic infrastructure will cause reductions in the groundwater recharge rate due to compaction reducing permeability of soils.	L	• Boreholes will be monitored for groundwater level and quality to assess the impacts on the groundwater. The monitoring criteria are supplied in Section 5.2 of the EMP.	• The boundaries of the construction area will be determined prior to their establishment and will be incorporated into the site layouts.	Environmental Supervisor, contractors, project design team, Project manager	Design phase, Construction phase
Noise	Noise will be generated during the construction of roads and infrastructure, by vehicles, machinery, construction activities and staff on site.	L	• All the equipment, but especially the diesel powered mining equipment, will be well maintained. • Ensure all vehicle noise emissions are within industry norms. Induction and awareness training will address the need to reduce noise emissions. • The maintenance schedule will include the checking of exhaust and intake silencers. Any change in the noise emissions characteristics of equipment must serve as an indicator for its immediate withdrawal from service and placement on the maintenance schedule. • Noise monitoring will be undertaken throughout the life of the mining activities to ensure that noise levels comply with Safety and Health Standards. Noise monitoring will take place in accordance with Section 5.4 of the EMP.	• Noise monitoring will take place in accordance with Section 5.4 of the EMP. • A monitoring and maintenance plan for vehicles and equipment has been developed and must be updated on an annual basis. • Induction and awareness training will address the need to reduce noise emissions.	Environmental Supervisor, Maintenance	Ongoing
Air quality	Fugitive dust generated from landscaping, preparation, material handling (soils and aggregate) and construction activities and wind erosion from exposed surfaces.	L	• If dust fallout levels are found to be exceeding acceptable levels than the sealing of roads must be investigated.	• Dust control measures have been outlined (refer to Section 4.2 of the EMP) • The dust monitoring programme in Section 5.3 of the EMP will be adhered to.	Project Manager, Environmental Supervisor	Ongoing

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Visual	The removal of vegetation and construction of infrastructure will have a visual impact (visual intrusion, visibility and visual exposure).	L	• The minimum amount of existing vegetation and topsoil will be removed for construction areas. • Ensure, wherever possible, that all existing natural vegetation is retained and incorporated into the site design. • Eradication of vegetation will be done in a 'natural manner', avoiding harsh straight lines. • An ecological approach to rehabilitation and screening measures, as opposed to a horticultural approach to landscaping will be adopted. For example, communities of indigenous plants enhance bio-diversity and blend well with existing vegetation. • Natural vegetation re-establishment will be encouraged. • Should natural vegetation re-establishment not take place, options for re-seeding of the embankments will be investigated.	• Design drawings will indicate the boundaries of the construction area. Activities will be limited to these areas. • Draw up a plan clearly defining the access routes and allowable lay down and construction areas to be utilised. • A rehabilitation plan will be developed and implemented • Fences will be included in all designs. • All soils will be ripped and prepared to allow for the self-succession of natural vegetation. • Visual inspections of the site and reporting of any areas of concern to be implemented.	Project Manager, Environmental Supervisor	Ongoing

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Fauna & Flora	Direct destruction of organisms and their habitats	M	• As much as possible avoid areas identified as ecologically or biologically sensitive (such as ephemeral pans, and any part of rocky outcrops not actually mined). • Assess usefulness of plant rescue and translocation operations of red-listed or protected species by consulting the relevant experts (restoration ecologist/botanist) and implement such a programme if deemed necessary and of low risk. • Mark out all construction and mining footprints and clearly convey the rule of staying inside these boundaries to all construction crews and mining staff; make environmental management of construction an explicit part of building contracts with non-performance linked to a penalty clause. • Rigorously police the construction crews' and mining staff's adherence to the rules and do not hesitate to invoke penalty clause(s). • Develop road use policy and enforce this through regular checks. • Enforce speed limits. • Detect important breeding structures, such as nests of bird species of sensitive conservation status, dens or crèches of mammals that are important to protect and avoid. • Raise awareness through awareness campaigns and training of key staff. • Fence and/or earthen-bund mining areas to reduce the chances of animals being destroyed by blasting, incurring damage by mining equipment.	• Design footprints of mine to be as small as practically possible. • Select areas for land clearing such that it minimises the loss of trees, rocky outcrops or ephemeral pans. • Develop decommissioning and rehabilitation plan for such roads/tracks that were used only for construction and commence rehabilitation	Project Manager, Environmental Supervisor	Ongoing

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
	Indirect loss of local biodiversity due to loss of habitat and habitat fragmentation	L	• Fence the smallest possible operational mining area to allow access to grazing on parts of the rocky hills not currently subjected to mining. • Avoid placing waste rock dumps on any undisturbed areas of rocky outcrops which will not be mined, and rather place it in less sensitive areas of surrounding plains. • Rehabilitate areas around linear infrastructure such that they minimise habitat fragmentation, allowing populations to be connected across them (e.g. rehabilitate tracks used to install power lines and rehabilitate tracks)	• Avoid placing waste rock dumps, tailings, or any embankments (e.g. roads) in the way of water surface flow or install culverts and drains to retain drainage so as to keep the natural surface hydrology such that ephemeral pans do not experience hydrological changes. • Avoid destroying trees or disturbing their proximity as much as possible, so that animals can continue to use them. • Develop and enforce traffic control measures (especially with regard to haul trucks) to minimise continuous disturbance of wildlife	Project Manager, Environmental Supervisor	Ongoing
	Sedimentation of pans and high sediment loads in streams during intensive rain could thus result in loss of wetland and riparian zone integrity in terms of biodiversity and function.	L	• Erosion control measures are required on all slopes exceeding 2% and engineered erosion control measures are required on all slopes exceeding 15%. Slope angles of topsoil stockpiles will not exceed 1:3 (18°). • Topsoil and natural vegetation self-succession will be used in the vegetating of the berm, rail, conveyor and road embankments.	• Develop monitoring and maintenance plan for erosion protection measures.	Project Manager, Environmental Supervisor	Ongoing
	Disturbed land could lead to the establishment of alien and invasive vegetation.	L	• Otjozondu will establish and implement a regular weed-control programme to eradicate existing invader plants and to prevent new invasions.	• Implement the weed eradication plan and monitor the area.	Environmental Supervisor	Ongoing
Socio-economic	Vehicles on site	Refer to section 4.1.1.1				
	High density human presence	Refer to section 4.1.1.3				

4.1.3 Operational Phase

4.1.3.1 Ore Beneficiation Process

The following table details the possible impacts and proposed management measures for impacts related to the beneficiation process. Otjozondu Mine plans to construct a new manganese ore beneficiation plant on or near the existing Otjozondu Manganese Mine. At this plant extracted ore from mining will be separated into two streams: mineral and gangue. Processing will be carried out through means of conventional crushing and gravity separation technology. No chemicals are proposed to be used in the ore beneficiation process. The manganese ore will further be exposed to water and oxygen at the Jig plant, possibly resulting in leachate generation.

Table 4-6: Ore Beneficiation Process

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Geology	No impacts					
Topography	No impacts					
Soil, land capability and land use	No impacts					
Surface water	Deterioration of water quality as a result of diffuse pollution from the mine.	L	• Storm water controls at all sites of mine infrastructure will be established around all the mining activities in the mining area. • The perimeter or footprint of the plant and surrounding infrastructure will be inspected to see whether storm water is flowing off site to the veld. If such an activity occurs measures must be implemented for this water to be contained. • Cut off trenches will be maintained by continuous inspections. The cut off trenches should be clean at all times, ensuring that they contain no obstacles. • Should any spillages occur, these should be removed immediately.	• The incident management system will be communicated to all people working on site. • Surface water will be monitored in accordance with the provisions outlined in Section 5.1 of the EMP.	Environmental Supervisor	Ongoing
	Leakages from pipelines could result in water losses and discharge of contaminated water	L	• Engineering design and controls.	• Inspection and maintenance.	Environmental Supervisor	Ongoing
	Overflow from sediment dams	L	• Sediment basins designed to handle the sediment discharge. In accordance with Namibian laws of estimated soils and construction. • During the rainy season monitor and re-use appropriately to ensure capacity control. • Engineering design and controls. • Inspection and maintenance.	• Develop contingency plan for sediment discharge off site.	Environmental Supervisor	Ongoing

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Groundwater	Deterioration of groundwater quality as a result of diffuse pollution from the plant.	L	• Dirty water will be contained in fit-for-purpose designed facilities, which will limit infiltration of contaminated water to the groundwater. • Boreholes will be monitored for groundwater level and quality to assess the impacts on the groundwater. • Should it be indicated through monitoring and investigation by a suitably qualified person that any legitimate groundwater users are negatively impacted upon in terms of quantity or quality of borehole water due to mining activities, negotiations between the mine and the groundwater users will be entered into to resolve the situation	• The incident management system will be communicated to all people working on site. • Groundwater will be monitored in accordance with the provisions outlined in Section 5.2 of the EMP. • The handling, storage and disposal of hazardous chemical substances will be in accordance with Section 4.2 of the EMP.	Environmental Supervisor	Ongoing
	Manganese ore will be exposed at the jig to water and oxygen, potentially resulting in leachate generation, and spills from the site can contaminate groundwater.	L	• Spills from the crushing, screening and washing plant area needs to be cleaned up immediately	• Boreholes will be monitored for groundwater level and to assess the impacts on the groundwater. The monitoring criteria are supplied in Section 5.2 of the EMP.	Environmental Supervisor	Ongoing
	Groundwater contaminant plume from unlined settling ponds.	L	• All water from pits, jig and production boreholes will be recycled and re-used. The settling ponds will act as water balancing dams.	• Boreholes will be monitored for groundwater level and quality to assess the impacts on the groundwater. The monitoring criteria are supplied in Section 5.2 of the EMP • Should it be indicated through monitoring and investigation by a suitably qualified person that any legitimate existing groundwater users are negatively impacted upon in terms of quantity or quality of borehole water, alternative water sources will be investigated.	Environmental Supervisor	Ongoing

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Visual	The ore beneficiation plant will have a visual impact as it is in the line of site (visual intrusion, visibility and visual exposure).	L	• Security flood lighting and operational lighting will only be used where absolutely necessary and carefully directed, preferably away from sensitive viewing areas. Wherever possible lights should be directed downwards so as to avoid illuminating the sky. • An ecological approach to rehabilitation and screening measures, as opposed to a horticultural approach to landscaping will be adopted. For example, communities of indigenous plants enhance bio-diversity and blend well with existing vegetation.	• Visual inspections of the surface infrastructure and reporting of any areas of concern to be implemented.	Environmental Supervisor, Mine manager	Ongoing
Fauna and flora	No impact					
Noise	Noise will be generated during the operation of the ore beneficiation plant by processing activities and staff on site.	L	• Select equipment with low sound power level rating. • Ensure the rollers used for the conveyor system are machined for optimum roundness. • Limit loud activities to daylight hours as far as possible. • All the equipment, but especially the diesel powered mining equipment, will be well maintained. • Noise monitoring will be undertaken throughout the life of the mining activities to ensure that noise levels comply with Safety and Health Standards. Noise monitoring will take place in accordance with Section 5.4 of the EMP.	• Noise monitoring forms part of the monitoring schedule. Refer to Section 5.4 of the EMP for information on noise monitoring. • Induction and awareness training will address the need to reduce noise emissions.	Environmental Supervisor, Maintenance, OSM Manager	Ongoing
Air quality	No impacts					
Socio-economic	No impacts					
Heritage	No impacts					

4.1.3.2 Paste Disposal and Storage

The following table details the possible impacts and proposed management measures for impacts related to the disposal of the paste from the beneficiation process. The paste (or tailings) resulting from the beneficiation process will be stored on the paste disposal facility at the mine site.

Table 4-7: Paste Disposal and Storage

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Geology	No impacts					
Soil, land capability and land use	No impacts					
Topography	Topographical alterations will result due to the continual disposal of paste at the paste disposal facility	M	• The design of the paste disposal facility will take into account the natural topography of the area. • Deposition will take place with closure in mind.	• Design paste disposal facility with closure in mind.	Project manager Environmental Supervisor	Ongoing
Surface water	The deposit has the potential to contaminate surface water.	L	• Cut off trenches will be maintained by continuous inspections. The cut off trenches should be clean at all times, ensuring that they contain no obstacles.	• Surface water will be monitored in accordance with Section 5.1 of the EMP. • Regular visual inspections of the physical integrity of the paste disposal will take place.	Environmental Supervisor , mine manager	Ongoing

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Groundwater	Potential seepage from the paste disposal facility may lead to decrease in groundwater quality.	L	• Dirty water will be contained in fit-for-purpose designed facilities, which will limit infiltration of contaminated water to the groundwater. • Boreholes will be monitored for groundwater level and quality to assess the impacts on the groundwater. • Should it be indicated through monitoring and investigation by a suitably qualified person that any legitimate existing groundwater users are negatively impacted upon in terms of quantity or quality of borehole water, alternative water sources will be investigated. • Due to the shortage of water in the area, the mining operations will operated with a closed water circuit (reuse and recycling), to conserve water effectively, hence no water will be discharged into the surrounding environment. Should an emergency situation arise, excess dewatered water will be contained in the return water dams and additional storage tanks on site. This is however not envisaged due to the shortage of water on site and the need for water by the mining operations.	• Groundwater will be monitored in accordance with the provisions outlined in Section 5.2 of the EMP.	Environmental Supervisor	Ongoing

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Visual	The paste disposal facility has a visual impact (visual intrusion, visibility and visual exposure).	M	• Natural vegetation will be retained wherever possible. • An ecological approach to rehabilitation and screening measures, as opposed to a horticultural approach to landscaping will be adopted. For example, communities of indigenous plants enhance bio-diversity and blend well with existing vegetation. • As an alternative option (due to the dry nature of the region), waste rock could be used to form the side slopes of the paste disposal facility. This would result in the surface of this facility to be below the top of the side walls during operations which may result in a reduction in wind entrainment from the surfaces. In addition waste rock can also be used to cover the slopes of the large overburden dump and topsoil piles. This is based on the waste rock dump being the lowest source of windblown dust from all the sources included.	• Draw up a maintenance programme for existing infrastructure, and implement it. • Monitor re-vegetation of the paste disposal facility banks and establishment of vegetative visual barrier. Should the re-establishment of vegetation not be sufficient, options must be investigated for the speeding up of the process.	Environmental Supervisor	Ongoing
Fauna and flora	The presence of disturbed land could allow the establishment of alien invasive vegetation.	L	• Otjozondu will establish and implement a regular weed-control programme to eradicate existing invader plants and to prevent new invasions.	• Implement the weed eradication plan and monitor the area.	Environmental Supervisor	Ongoing
Noise	No impacts					

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Air quality	Wind erosion from exposed areas.	L	• The walls of the paste disposal facility will be vegetated progressively throughout the life of mine. The vegetation cover should be such to ensure at least 80% control efficiency for the walls. This should be an on-going process. As an alternative option (due to the dry nature of the region), waste rock could be used to form the side slopes of the paste disposal facility. This would result in the surface of this facility to be below the top of the side walls during operations which may result in a reduction in wind entrainment from the surfaces. This is based on the waste rock dump being the lowest source of windblown dust from all the sources included.	• Dust control measures have been outlined (refer to Section 4.2 of the EMP). • The dust monitoring programme in Section 5.3 of the EMP will be adhered to.	Environmental Supervisor	Ongoing
Socio-economic	No impacts					
Heritage	No impacts					

4.1.3.3 Operation of Diesel Generators (Power supply)

The following table details the possible impacts and proposed management measures for impacts related to diesel generated power supply. Power-supply is to be obtained from diesel-powered generator sets as existing grid connections are unable to supply enough reliable power.

Table 4-8: Operation of Diesel Generators (Power supply)

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Geology	No impacts					
Topography	No impacts					
Soil, land capability and land use	The spillage of hydrocarbons (diesel, oil, grease etc.) and other chemicals (detergents etc.) during the operation of the diesel generators may lead to the contamination of soils.	L	Refer to Section 4.1.1.2			

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Surface water	The spillage of hydrocarbons (diesel, oil, grease etc.) and other chemicals (detergents etc.) during the operation of the diesel generators may lead to the contamination of surface water.	L	Refer to Section 4.1.1.2			
Groundwater	The spillage of hydrocarbons (diesel, oil, grease etc.) and other chemicals (detergents etc.) during the operation of the diesel generators may lead to the contamination of groundwater through filtration.	L	Refer to Section 4.1.1.2			
Visual	No impacts					
Fauna and flora	Noise from generators could be a nuisance for the animals in the area.	L	• Generators will be equipped with necessary measures to reduce the emission of noise. • Where noise becomes a nuisance management measures will be investigated and implemented to address these. • Carry out measurements of noise both within the workplace and at points of sensitivity in order to demonstrate compliance with Occupational Health and Safety Standards.	• A maintenance programme will be established and implemented. • Noise monitoring forms part of the monitoring schedule. • Refer to Section 5.4 of the EMP for the noise monitoring programme.	Vehicle maintenance, Environmental Supervisor, OSH Manager	Operations
	Chemical pollution, waste oil could impact on the natural habitat and contaminate animal food sources.	L	• Develop waste policy and actively enforce it • Develop policy of the management of hazardous materials and actively enforce it • Apply appropriate hydrocarbon-handling principles (storage tanks should have bunding and be regularly inspected, lubricants should be stored in properly designated and appointed facilities, spillages should be cleaned up immediately, adequate control over use of fuels)	• Monitor handling of hydrocarbons and any other hazardous wastes in light of appropriate and relevant principles • Monitor groundwater and soil conditions for signs of pollutants, following guidelines described in the hydrogeological report (GCS 2012)	Vehicle maintenance, Environmental Supervisor, Mine Manager	Operations
Noise	Generators will create noise which could be a nuisance to the public.	L	• Generators will be equipped with necessary measures to reduce the emission of noise. • Carry out measurements of noise both within the workplace and at points of sensitivity in order to demonstrate compliance with Occupational Health and Safety Standards.	• A maintenance programme will be established and implemented. • Noise monitoring forms part of the monitoring schedule. • Refer to Section 5.4 of the EMP for the noise monitoring programme.	Vehicle maintenance, Environmental Supervisor, OSH Manager	Operations

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Air quality	The generators will release emissions that will have negative air quality impacts.	L	• Generators will be equipped with necessary measures to reduce the emissions of air pollutants.	• A maintenance programme will be established and implemented.	Vehicle maintenance, Environmental Supervisor	Operations
Heritage	No impacts					

4.1.3.4 Blasting

The following table details the possible impacts and proposed management measures for impacts related to blasting activities. Controlled blasting will be used to excavate, break down or remove rock during the opencast mining process.

Table 4-9: Blasting

Environmental parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Surrounding properties and landowners	Blasting impact.	M	• Prior to the commissioning of blasting activities at the mine, the technical blasting team of Otjozondu Mine will assess the various blasting schedules in a working group. • An exclusion zone of 500m will be established around the blast area. • A signature trace analysis will be undertaken prior to the commencement of blasting operations, in order to examine the blasting procedure. It is recommended that the survey to be undertaken by a registered company. • The mine will establish an open channel of communication with surrounding landowners, in order to ensure that all issues and concerns are known and are addressed.	• A blasting schedule must be developed. • Develop and implement blast monitoring programme. • Blasting procedures and the associated safety measures will be developed.	Mine Manager	Ongoing

Environmental parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Safety risk to surrounding residence and passers by	Blasting creates a safety risk	M	• Scheduled blasting times will be planned in advance and will be clearly indicated on the mining area. Blasting boards, at the plant gate, as well as at all access areas, will be updated at least 24 hours prior to the blast, displaying the time and date of the blast. • Surrounding property owners will be informed of the blasting procedures and schedules. • Employees and outside contractors etc. will be informed of the blasting procedures and the associated safety measures, during induction. • Prior to blasting, all vehicles and machinery will be removed from the blast area and parked at a designated site, as determined by the site manager. • All possible access roads will be blocked by personnel with red flags. • Where access roads cannot be barricaded by means of booms or gates, a vehicle equipped with a red flag will barricade the road. • Warnings will be given prior to blasting. • Blast holes and the placement of the explosives will be undertaken in such a manner to reduce the possibility of air blasts and ground vibrations. • Explosives material will be handled according to Legislation (Explosives Act 15 of 2003)	• Blasting procedures and the associated safety measures will be developed.	Mine Manager	Ongoing

4.1.3.5 Mining activities (Opencast mining)

The following table details the possible impacts and proposed management measures for impacts related to the mining of the manganese ore. The manganese mineralization is associated with banded iron formation (BIF) deposits approximately 50m thick and mining will be carried out in relatively shallow open pits (nominally 50m deep) using conventional loaders and off-road mining trucks using dedicated haul roads.

Table 4-10: Mining activities (Opencast mining)

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Geology	Removal of material from the pits will result in the complete destruction of geological strata.	M	• Mining operations will remain within the limits of the proposed opencast operations thereby reducing any potential impact on the surrounding geology.	• The mining programme has been developed and will be implemented.	Mine Manager	Life of mine
Topography	Mining of the pit will result in topographical alterations.	M	No mitigation possible			
Soil, land capability and land use	The mining of the pit will result in a loss of soil resources.	L	No mitigation possible			

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Surface water	During operational activities, there is the potential for contamination of surface runoff systems due to diffuse pollution.	L	• Storm water controls at all sites of mine infrastructure will be established prior to the commencement of operational activities. • Berms, to serve as diversion systems, will be constructed upstream of the opencast pits to ensure that clean water is kept separate from dirty water and to divert clean water away from the contaminated areas. • All berms will be sized so as to prevent spilling for up to a 1:50 year storm event. • Dirty water will be stored in-pit at the opencast pits, and will be utilized for dust suppression on the mine haul roads and as operational water in the plant. • Clean Water Diversion - It is a legal requirement that all clean water runoff arising from an external catchment be prevented from flowing into the pit and consequently becoming contaminated. The storm water diversion systems are sized to contain the peak runoff from the external catchment expected from the 1:50 year recurrence interval storm. • Cut off trenches will be maintained around pits by continuous inspections. The cut off trenches should be clean at all times, ensuring that they contain no obstacles.	• Ensure the Material Safety Data Sheet (MSDS) obtained from the suppliers for all hydrocarbons and chemicals stored and/or utilised on site is updated regularly. All MSDS's must be displayed where hydrocarbons and/or chemicals are stored and utilised. • Brief all employees on the location of the MSDS and how this should be utilised. • The handling, storage and disposal of hazardous chemical substances will be in accordance with Section 4.2 of the EMP. • Surface water will be monitored in accordance with the provisions outlined in Section 5.1 of the EMP.	Environmental Supervisor, Mine Manager	Ongoing
	The opencast operations will impact natural surface water flow regimes.	L	• Surface water will be monitored in accordance with Section 5.1 of the EMP.		Environmental Supervisor	Ongoing

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Groundwater	Mining of manganese may result in groundwater inflows into the mining pits, which needs to be pumped out for mine safety and the resultant dewatering of the groundwater structures in the immediate vicinity of the pits. Privately owned boreholes are likely to be affected.	M	• Should water be dewatered from the opencast pits, the water will be used by the mine in place of borehole. • The in-pit water table will be monitored in order to verify the predicted rate of dewatering towards closure and the recovery rate after closure. The monitoring results will be used as a design parameter for the closure management measures. It therefore provides a perfect opportunity to obtain measured values against the current predictions. • Boreholes will be monitored for groundwater level and quality to assess the impacts on the groundwater. The monitoring criteria are supplied in Section 5.2 of the EMP. The numerical model will be calibrated using such data and different management and rehabilitation options will be evaluated. The results of the water level monitoring will be used to verify impact of the dewatering (should this occur) on the surrounding groundwater resources. • Should it be indicated through monitoring and investigation by a suitably qualified person that any legitimate groundwater users are negatively impacted upon in terms of quantity or quality of borehole water due to mining activities, negotiations between the mine and the groundwater users will be entered into to resolve the situation.	• Action plan will be developed in the unlikely event of groundwater being reached.	Mine Manager, Environmental Supervisor	N/A

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
	The operational activities at the opencast pits may result in impacts on groundwater quality through the infiltration of contaminated water.	L	• Wastage of mined product or mine waste outside the allocated dirty water management area during the construction phase will be prevented. • The drains and cut-off trenches (storm water management system) around the proposed open pits will be installed before commencing with pit development. • No construction of any water management measures, such as the storm water management berms, will be undertaken with carbonaceous material. • Boreholes will be monitored for groundwater level and quality. The results of the water quality monitoring will be used to verify the rate of movement of the groundwater pollution plume. The numerical model will be calibrated using such data and different management and rehabilitation options will be evaluated. • Should it be indicated by a suitably qualified person that the yield and quality of groundwater available to existing surrounding users are affected due to the proposed construction phase activities, an alternative water resource will be investigated. • Keep the pits clear of water. • Disturbing geological strata is a result of mining. • Mining pits need to be kept as dry as possible to reduce contact time of water and oxygen with exposed rock and therefore keep contamination to a minimum.	• The incident management system will be communicated to all people working on site. • Ensure the MSDS's obtained from the suppliers for all hydrocarbons and chemicals stored and/or utilised on site is updated regularly. All MSDS's must be displayed where hydrocarbons and/or chemicals are stored and utilised. • Groundwater will be monitored in accordance with the provisions outlined in Section 5.2 of the EMP. • The handling, storage and disposal of hazardous chemical substances will be in accordance with Section 4.2 of the EMP. • Refer to Section 4.2 of the EMP for waste disposal guidelines. • Groundwater will be monitored in accordance with the provisions outlined in Section 5.2 of the EMP.	Environmental Supervisor	Ongoing

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Visual	The opencast pits will have a visual impact (visual intrusion, visibility and visual exposure).	L	• Light pollution will be seriously and carefully considered and kept to a minimum wherever possible as light at night travels great distances. • Security flood lighting and operational lighting will only be used where absolutely necessary and carefully directed, preferably away from sensitive viewing areas. Wherever possible lights should be directed downwards so as to avoid illuminating the sky.	• Visual inspections of the surface infrastructure and reporting of any areas of concern to be implemented.	Environmental Supervisor	Ongoing
Fauna & flora	Indirect effects on biodiversity due to lowering of groundwater table	M	• Based on an understanding of the nature of the groundwater, measures should be undertaken to minimise the area of aquifer that is drained, and to isolate the drainage into the mining pit as much as possible from surrounding groundwater systems • Minimise water abstraction other than draining into the pit	• Develop a good understanding of the nature of groundwater through the development and testing of a groundwater hydrological model • On-going monitoring of groundwater levels in boreholes (see GCS 2012). Annually monitor health condition of a sample of large trees throughout the life of mine in a radius of 5 km of each mine and, should there be significant mortalities, initiate research to understand the relationship between plant health, water level and likelihood of mortality	Project Manager, Environmental Supervisor	Prior to construction

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Noise	Noise will be generated during the mining of the opencast pits by vehicles, machinery, drilling, blasting and staff on site.	M	• Activities will be reduced during the night time. • All the equipment, but especially the diesel powered mining equipment, will be well maintained. • Select vehicles with low sound power level rating, adequate exhaust silencers. • Ensure all vehicle noise emissions are within industry norms. • The maintenance schedule will include the checking of exhaust and intake silencers. Any change in the noise emissions characteristics of equipment must serve as an indicator for its immediate withdrawal from service and placement on the maintenance schedule. • All blasting procedures will be limited to the day time. • Noise monitoring will be undertaken to ensure that noise levels comply with Safety and Health Standards. Noise monitoring will take place in accordance with Section 5.3 of the EMP.	• Noise monitoring forms part of the monitoring schedule. Refer to Section 5.4 of the EMP for information on noise monitoring. • A monitoring and maintenance plan for vehicles and equipment should be developed and must be updated on an annual basis. • Induction and awareness training will address the need to reduce noise emissions.	Environmental Supervisor, Maintenance	Ongoing
Air quality	Materials handling operations and soil exposure will produce fugitive dust.	L	• Section 4.2 indicates the dust control measures that will be implemented. • The dust monitoring programme in Section 5.3. of the EMP will be adhered to.	• Dust control measures have been outlined (refer to Section 4.2 of the EMP). • The dust monitoring programme in Section 5.3 of the EMP will be adhered to.	Environmental Supervisor	Ongoing
	Drilling and blasting will produce fugitive dust.	L	• Section 4.2 of the EMP indicates the dust control measures that will be implemented. • The dust monitoring programme in Section 5.3. of the EMP will be adhered to.	• Dust control measures have been outlined (refer to Section 4.2 of the EMP). • The dust monitoring programme in Section 5.3 of the EMP will be adhered to.	Environmental Supervisor	Ongoing
Socio-economic	Transportation of ore via roads may lead to degradation of roads, thereby impacting on the safety of people utilising this infrastructure.	M	Refer to section 4.1.1.1			
	Presence of construction workers and potential impacts on family structures and social networks	L	Refer to section 4.1.1.3			

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Heritage	No impact					

4.1.3.6 Material handling and stockpiling

The following table details the possible impacts and proposed management measures for impacts related to materials handling and stockpiling. Materials and overburden will be removed from the opencast pits and stockpiled on the mining site close to the opencast pit areas.

Table 4-11: Material handling and stockpiling

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Geology	No impacts					
Topography	The natural topography of the region will be altered by stockpiling.	L	• Stockpiles will be designed to ensure that blend into the surrounding environmental as near as practically possible. • Slopes of all stockpiles will be vegetated to ensure that the slopes are stable and in order to reduce any potential of erosion.	• Design drawings must take into account the natural topography of the environment to ensure minimal impact. • Develop monitoring and maintenance plan for erosion protection measures. • Update the on-going rehabilitation programme to ensure that disturbed areas can be rehabilitated on an on-going basis. Landscaping will be included in the rehabilitation plan.	Project Manager, Environmental Supervisor	Prior to construction, construction phase, ongoing
Soil, land capability and land use	The soils underlying and adjacent to stockpiles will be disturbed, leading to a loss of soils resources.	L	• Strip soil to a depth of 0,25 metre or to hard material. Stockpile the soils adjacent to the relevant areas for future rehabilitation. • Soils, which are stripped could be used in the construction of berms or other storm water measures. If soils are not used in the construction, they must be stored as close as possible to the area where they will be utilized for rehabilitation, as separate managed stockpiles so that they can be easily accessed and used for rehabilitation at closure.	• The boundaries of the construction area will be determined prior to their establishment and will be incorporated into the site layouts. • Brief contractors on the topsoil stockpile procedure and areas and enforce the implementation thereof.	Environmental Supervisor, contractors, project design team	Design phase, Construction phase

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
	Stockpiled material will be susceptible to erosion	L	• Erosion control measures are required on all slopes exceeding 2% and engineered erosion control measures are required on all slopes exceeding 15%. Slope angles of topsoil stockpiles will not exceed 1:3 (18°). • The re-establishment of natural vegetation on the tailings and ROM stockpiles will be encouraged. Should re-establishment not take place, re-seeding options will be investigated.	• Ensure that all design drawings include effective erosion control measures. • Draw up a surface water-monitoring programme to prevent, manage and monitor potential erosion. • Develop monitoring and maintenance plan for erosion protection measures.	Environmental Supervisor, Contractors	Construction phase
	Stockpiling will result in the loss of both wilderness and grazing land (loss of land capability).	M	• Areas of stockpiling must be clearly demarcated. • No stockpiling may be undertaken outside of the demarcated areas unless approval is given by the Environmental Supervisor.	• The boundaries of the construction area will be determined prior to their establishment and will be incorporated into the site layouts.	Environmental Supervisor, contractors, project design team	Design phase, Construction phase
Surface water	Runoff from stockpiles may flow into pans and other watercourses especially during intensive rainstorms. This results in siltation, which adversely affects the water quality.	L	• Berms will be constructed upstream and downstream of the dumps and stockpiles to ensure that clean water is kept separate from dirty water. Water contained in the berms downstream will evaporate. • All berms will be sized so as to prevent spilling for up to a 1:50 year storm event. • Stockpiles will be constructed in such a way to ensure stability and thereby preventing the possibility of wash down.	• Ensure that all design drawings include effective erosion control measures. • Surface water will be monitored in accordance with Section 5.1 of the EMP. • Develop a rehabilitation plan for areas impacted by runoff and scouring.	Environmental Supervisor, Project Manager, project design team	Ongoing

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Groundwater	The stockpiling of low-grade and hard-rock material may lead to a decrease in groundwater quality through the infiltration of contaminated water. Stockpiling of manganese ore will expose ore to water and oxygen, resulting in leachate from site. Contamination of the groundwater system can occur from these sites.	L	• Preparation, including compaction of the foundation layer for the low grade- and hard rock stockpile areas will be undertaken with the purpose of limiting infiltration of contaminated water to the groundwater. • Boreholes will be monitored for groundwater level and quality to assess the impacts on the groundwater s. • Clean water needs to be kept away from the stockpiling area to minimise water infiltrating from the site. Keep stockpiles as small as possible, to minimise their footprint.	• Groundwater will be monitored in accordance with the provisions outlined in Section 5.2 of the EMP.	Environmental Supervisor, project design team, contractors	Ongoing
Visual	The removal, transport and stockpiling of material will have a visual impact (visual intrusion, visibility and visual exposure of stockpiles).	M	• Stockpile heights will be restricted. • Stockpiles will only be placed within the mine area boundaries.	• Stockpiling will take place within pre-planned sites.	Environmental Supervisor, Project Manager	Ongoing
Fauna	No impacts					
Flora	No impacts					
Noise	More noise will be generated during the removal, transport and stockpiling of material, which could be a nuisance to residents in the area	L	• All the equipment, but especially the diesel powered mining equipment, will be well maintained. • Ensure all vehicle noise emissions are within industry norms. • The maintenance schedule will include the checking of exhaust and intake silencers. Any change in the noise emissions characteristics of equipment must serve as an indicator for its immediate withdrawal from service and placement on the maintenance schedule. • Noise monitoring will be undertaken throughout the life of the mining activities to ensure that noise levels comply with Safety and Health Standards.	• Noise monitoring forms part of the monitoring schedule. Refer to Section 5.4 of the EMP for information on noise monitoring. • A monitoring and maintenance plan for vehicles and equipment has been developed and must be updated on an on-going basis. • Induction and awareness training will address the need to reduce noise emissions.	Environmental Supervisor, Maintenance	Ongoing

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Air quality	The removal, handling and stockpiling of materials will increase dust fallout.	L	• If dust fallout levels are found to be exceeding acceptable levels than the sealing of roads must be investigated.	• Dust control measures have been outlined (refer to Section 4.2 of the EMP). • The dust monitoring programme in Section 5.3 of the EMP will be adhered to.	Environmental Supervisor	Ongoing
Socio-economic	No impacts					
Heritage	No impacts					

4.1.3.7 Sewerage treatment

The following table details the possible impacts and proposed management measures for impacts related to the increase in sewerage due to the increase in workers on site. Sewerage facilities will need to be provided in order to accommodate the sewage from the new staff accommodation.

Table 4-12: Sewage Treatment

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Geology	No impacts					
Topography	No impacts					

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Soil, land capability and land use	An Accidental release of inadequately treated water or sewerage may result in soil contamination.	L	• There will be an incident management system, including procedures and training, for dealing with incidents as prescribed within the Environmental Awareness Programme. • The incident management programme will address sewerage spills. • Major spillage incidents will be reported to the Environmental Authority (DWA and MME). Appropriate remedial measures will be implemented in consultation with these regulatory authorities. • If spills do occur and soils become contaminated, the appropriate remedial measures will be identified in consultation with an appropriately qualified specialist. If necessary, the polluted soils will be classified as waste and will be discarded at an appropriate permitted waste site. After removal of the contaminated soils, the affected areas will be landscaped and rehabilitated. • All water leaving sewerage works, if not removed by contractors, will be channelled into the dirty water system, feeding the stormwater dams.	• A monitoring and maintenance programme will be established for all sewerage treatment facilities. • The incident management system will be communicated to all people working on site. • Refer to Section 6 for information on the Environmental Awareness Programme • The sewerage works will be monitored on a weekly basis.	Environmental Supervisor	Ongoing
Surface water	Accidental release of inadequately treated water or sewerage may result in surface water contamination. This could lead to eutrophication of standing water bodies and the development of potentially harmful algal blooms.	L	• Spills should be contained and cleaned where possible. • Infrastructure should be maintained to avoid accidental spills. • The process should be monitored to avoid accidental releases. Employees should be trained properly in order to identify problems in the treatment process.	• Surface water will be monitored in accordance with Section 5.1 of the EMP.	Environmental Supervisor	Ongoing
Groundwater	An accidental release of inadequately treated water or sewerage may result in soil and surface water contamination. This could occur due to flaws in the plants or due to the plants being unable to handle the sewerage requirements and “overflowing”. Contaminated water from soils or surface water may enter the groundwater, leading to a loss of groundwater quality.	L	• Boreholes will be monitored for groundwater level and quality to assess the impacts on the groundwater resources.	• The monitoring criteria are supplied in Section 5.2 of the EMP.	Environmental Supervisor	Ongoing

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Visual	No impacts					
Fauna and flora	No impacts					
Noise	No impacts					
Air quality	Odours from sewerage facilities may have air quality impacts in the form of unwanted odours.	L	• The sewerage plants are/will be located at sufficient distances from work areas to prevent disturbance of workers. • Excessive odours must be dealt with by the mine. • The sewerage plant will be monitored and maintained in order to reduce / eliminate unpleasant odours. • Qualitative monitoring of odours will take place.	• Sewerage plant monitoring will be incorporated into the monitoring schedule.	Environmental Supervisor	Ongoing
Socio-economic	No impacts					
Heritage	No impacts					

4.1.3.8 Groundwater abstraction

The following table details the possible impacts and proposed management measures for impacts related to the abstraction of groundwater for use within mining processes. Groundwater in the region of 500 000 tpa will initially be abstracted for mining processes. Water will be supplied from a bore field within a reasonable distance from the mine.

Table 4-13: Groundwater abstraction

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Geology	No impacts					
Topography	No impacts					
Soil, land capability and land use	No impacts					
Surface water	No impacts					
Groundwater	Abstraction of water for operations may lower groundwater levels. Privately owned boreholes are likely to be affected.	L	• Boreholes will be monitored for groundwater level and quality to assess the impacts. The numerical model will be calibrated using such data and different management and rehabilitation options will	• The monitoring criteria are supplied in Section 5.2 of the EMP. • Recharge, flow and contaminant migration needs to be simulated in a numerical model, with the	Environmental Supervisor	Prior to operation

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
			be evaluated. The results of the water level monitoring will be used to verify impact of the dewatering on the surrounding groundwater resources. • Should it be indicated through monitoring and investigation by a suitably qualified person that any legitimate groundwater users are negatively impacted upon in terms of quantity or quality of borehole water due to mining activities, negotiations between the mine and the groundwater users will be entered into to resolve the situation.	geochemical static testing results, where these impact can then be quantified taking into account flow from other lithologies. • Due to the shortage of water in the area, the mining operations will be operated with a closed water circuit (reuse and recycling), to conserve water effectively		
Visual	No impacts					
Fauna & Flora	Indirect effects on biodiversity due to lowering of groundwater table	M	• Develop a good understanding of the nature of groundwater impact through the development and testing of a groundwater hydrological model and monitoring. • Mining operations should be operated with a closed water circuit (reuse and recycling), to conserve water effectively. To reduce the need for abstraction. • Minimise water abstraction other than draining into the pit	• Compile a numerical groundwater model. Update using groundwater monitoring data.	Environmental Supervisor	Ongoing
Noise	No impacts					
Air quality	No impacts					
Socio-economic	Abstraction of water from production boreholes may affect neighbouring boreholes accessing the same aquifers.	M	• Boreholes will be monitored for groundwater level and quality to assess the impacts. The numerical model will be calibrated using such data and different management and rehabilitation options will be evaluated. The results of the water level monitoring will be used to verify impact of the dewatering on the surrounding groundwater resources. • Should it be indicated through monitoring and investigation by a suitably qualified person that any legitimate groundwater users are negatively impacted upon in terms of quantity or quality of borehole water due to mining activities, negotiations between the mine and the groundwater users will be	• The monitoring criteria are supplied in Section 5.2 of the EMP. • Recharge, flow and contaminant migration needs to be simulated in a numerical model, with the geochemical static testing results, where these impact can then be quantified taking into account flow from other lithologies.	Environmental Supervisor	Prior to operation

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
			entered into to resolve the situation.			
Heritage						

4.1.4 Decommissioning and Closure Phase

4.1.4.1 Removal of infrastructure

The following table details the possible impacts and proposed management measures for impacts related to the infrastructure removal process. When mining is completed the infrastructure, such as buildings and roads, will be removed during the decommissioning and closure phase. Heavy vehicles and machinery will be utilized during this process.

Table 4-14: Removal of infrastructure

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Geology	No impacts					
Topography	Near natural topography will be restored through landscaping and the removal of the plant – Positive impact	+M	• Where required infrastructure will be removed. • The area will be rehabilitated.	• Landscaping will be included in the rehabilitation plan. • Update the on-going rehabilitation programme to ensure that disturbed areas can be rehabilitated on an on-going basis, which will include ongoing monitoring. • Include access control measures in the areas where rehabilitation is being undertaken. • Monitor and manage all rehabilitated areas.	Project Manager, Environmental Supervisor	Prior to removal of plant, during rehabilitation
Soil, land capability and land use	The removal of Infrastructure may result in waste being generated. This could result in soil contamination	L	Refer to Section 4.1.1.4 of the EMP.			
	Vehicles and machinery used for removing infrastructure may move out of the affected area, compacting previously undisturbed or rehabilitated soils and leading to soil degradation	L	Refer to Section 4.1.1.1 of the EMP.			
	The use of hydrocarbons and other hazardous chemical substances during decommissioning may result in soil contamination through spills.	L	Refer to Section 4.1.1.2 of the EMP			

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Surface water	The removal of infrastructure may result in waste being generated. This could affect surface water.	L	Refer to Section 4.1.1.4 of the EMP.			
	The use of hydrocarbons and other hazardous chemical substances during decommissioning may result in surface water contamination.	L	Refer to Section 4.1.1.2 of the EMP			
	The presence of exposed soils may lead to an increase in volume and speed of surface water run-off, increasing erosive capacity, thereby causing the sedimentation of surface water.	L	• Topsoil and natural vegetation self-succession will be used in the re-vegetation process. • Should vegetation self-succession not take place adequately, appropriate seed mixes and soil preparation techniques will be investigated and implemented. • Surface water will be monitored in accordance with Section 5.1 of the EMP.	• Monitoring will be undertaken to ensure that the rehabilitated areas are self-sustaining. Monitoring will only cease once this has been confirmed. • The rehabilitation plan will include provisions relating to stormwater management and erosion control measures.	Environmental Supervisor	Ongoing
Groundwater	No impacts					
Visual	The removal will leave a bare “scar” on the landscape, creating a temporary visual impact.	L	• Natural vegetation establishment (self-succession) will be encouraged. • The mine will investigate an appropriate seed mix for the rehabilitation purposes should self-succession not establish on rehabilitated sites. • An ecological approach to rehabilitation and screening measures, as opposed to a horticultural approach to landscaping, will be adopted. For example, communities of indigenous plants enhance bio-diversity and blend well with existing vegetation.	• Plans for the removal will include landscape restoration. • All soils will be ripped and prepared to allow for the self-succession of natural vegetation.	Project Manager, Environmental Supervisor	Prior to removal, during decommissioning
Fauna and Flora	No impact change expected during this phase. With the completion of the rehabilitation, fauna will slowly return to the area as the disturbances will be reduced.	+H	Re-create a habitat that is suitable for animals to forage or live within. The objective will further be to make the areas safe for animals to live in.			
	The presence of disturbed land following the removal of the ore beneficiation plant could allow the establishment of alien invasive vegetation.	L	• Otjozondu will establish and implement a regular weed-control programme to eradicate existing invader plants and to prevent new invasions.	• Implement the weed eradication plan and monitor the area.	Environmental Supervisor	Ongoing

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
	The presence of exposed soils may lead to an increase in volume and speed of surface water run-off, increasing erosive capacity. Sedimentation of pans and high sediment loads in streams during intensive rain could thus result in loss of wetland and riparian zone integrity in terms of biodiversity and function.	L	• Topsoil and natural vegetation self-succession will be used in the re-vegetation process. • Should vegetation self-succession not take place adequately, appropriate seed mixes and soil preparation techniques will be investigated and implemented. • Berms will be constructed around the opencast area and associated mining areas where appropriate, to prevent surface run-off from entering directly into drainage lines and pans. • The rehabilitation of the soils will play a significant role in the rehabilitation of the vegetation.	• Monitoring will be undertaken to ensure that the rehabilitated areas are self-sustaining. Monitoring will only cease once this has been confirmed. • The rehabilitation plan will include provisions relating to stormwater management and erosion control measures.	Environmental Supervisor	Ongoing
	The removal of the ore beneficiation plant will produce waste, which may impact the local ecology.	L	Refer to Section 4.1.1.4			
Noise	Noise will be generated, with decommissioning of the plant, by vehicles, machinery, drilling, blasting and staff on site.	L	Refer to Section 4.1.2.1			
Air quality	Fugitive dust will be produced during the closure and decommissioning phase	L	Refer to Section 4.1.2.1			
Socio-economic	No impacts					
Heritage	No impacts					

4.1.4.2 Land rehabilitation (Ripping, shaping, vegetating, etc)

The following table details the possible impacts and proposed management measures for impacts related to the rehabilitation process. Otjozondu Mining does not plan to backfill the open pits. Given the safety risk attached to such open pits, it is vital that Otjozondu Mining commits to re-shaping and re-vegetating all waste rock dumps. Soils will be ripped and topsoil replaced to encourage self succession of vegetation on areas that were previously built on and compacted.

Table 4-15: Land rehabilitation (Ripping, shaping, vegetating, etc)

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Geology	No impacts					
Topography	The opencast pits will not be returned to original pre-mining conditions.	M	• Berms will be constructed around the opencast area and associated mining areas where appropriate, to prevent surface run-off from entering directly into drainage lines and pans.	• Erosion control measures are required on all slopes exceeding 2% and engineered erosion control measures are required on all slopes exceeding 15%. Slope angles of topsoil stockpiles will not exceed 1:3 (18°).	Project Manager, Environmental Supervisor	Prior to removal, during decommissioning
	Near natural topography will be restored through the removal of infrastructure and the ripping of material. – Positive impact	+M	• The area will be rehabilitated to be free draining. • Rehabilitation of the site will include the restoration to reflect the natural topography. • All hard surfaces will be ripped.	• Landscaping will be included in the rehabilitation plan. • Update the on-going rehabilitation programme to ensure that disturbed areas can be rehabilitated on an on-going basis, which will include ongoing monitoring. • Include access control measures in the areas where rehabilitation is being undertaken. • Monitor and manage all rehabilitated areas.	Project Manager, Environmental Supervisor	Prior to removal of plant, during rehabilitation
Soil, land capability and land use	Removal of infrastructure may result in construction waste being generated which could affect the soils	L	Refer to Section 4.1.1.4 of the EMP.			
	Vehicles and machinery used for removing roads may move out of the affected area, compacting previously undisturbed or rehabilitated soils.	L	Refer to Section 4.1.1.1 of the EMP.			
	Ripping and topsoil replacement will restore the soil physical characteristics – positive impact	+M	• No mitigation required.	• Update the on-going rehabilitation programme to ensure that disturbed areas can be rehabilitated on an on-going basis, which will include ongoing monitoring.	Environmental Supervisor	During decommissioning
Surface water	The removal of the buildings, workshops, services and basic infrastructure may result in construction waste being generated. This could affect surface water.	L	Refer to Section 4.1.1.4 of the EMP.			

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
	The use of hydrocarbons and other hazardous chemical substances during decommissioning may result in surface water contamination.	L	Refer to Section 4.1.1.2 of the EMP			
	The presence of exposed soils may lead to an increase in volume and speed of surface water run-off, increasing erosive capacity, thereby causing the sedimentation of surface water.	L	• Topsoil and natural vegetation self-succession will be used in the re-vegetation process. • Should vegetation self-succession not take place adequately, appropriate seed mixes and soil preparation techniques will be investigated and implemented. • Erosion control measures are required on all slopes exceeding 2% and engineered erosion control measures are required on all slopes exceeding 15%. Slope angles of topsoil stockpiles will not exceed 1:3 (18°). • Surface water will be monitored in accordance with Section 5.1 of the EMP.	• Monitoring will be undertaken to ensure that the rehabilitated areas are self-sustaining. Monitoring will only cease once this has been confirmed. • The rehabilitation plan will include provisions relating to stormwater management and erosion control measures. • The area will be rehabilitated to be free draining by implementing storm water drainage systems, which will follow the natural drainage direction	Environmental Supervisor	Ongoing
Groundwater	The ripping of soils will result in greater groundwater recharge due to the softening of surfaces – positive impact	+M	• No mitigation required.	• Update the on-going rehabilitation programme to ensure that disturbed areas can be rehabilitated on an on-going basis, which will include ongoing monitoring.	Environmental Supervisor	During decommissioning
Visual	The removal will leave a bare “scar” on the landscape, creating a temporary visual impact.	L	• Natural vegetation establishment (self-succession) will be encouraged. • The mine will investigate an appropriate seed mix for the rehabilitation purposes should self-succession not establish on rehabilitated sites. • An ecological approach to rehabilitation and screening measures, as opposed to a horticultural approach to landscaping, will be adopted. For example, communities of indigenous plants enhance bio-diversity and blend well with existing vegetation. • Where possible, landscaping will restore the natural aesthetics of the area.	• Plans for the removal will include landscape restoration. • All soils will be ripped and prepared to allow for the self-succession of natural vegetation.	Project Manager, Environmental Supervisor	Prior to removal, during decommissioning

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
	The rehabilitation (ripping, topsoil replacement and landscaping) will remove the visual incongruity – positive impact	+M	• An ecological approach to rehabilitation and screening measures, as opposed to a horticultural approach to landscaping, will be adopted. For example, communities of indigenous plants enhance bio-diversity and blend well with existing vegetation. • Where possible, landscaping will restore the natural aesthetics of the area.	• All soils will be ripped and prepared to allow for the self-succession of natural vegetation.	Project Manager, Environmental Supervisor	Prior to removal, during decommissioning
Fauna and flora	With the completion of the rehabilitation, fauna will slowly return to the area as the disturbances will be reduced – positive impact	+H	• Re-create a habitat that is suitable for animals to forage or live within. The objective will further be to make the areas safe for animals to live in.	n/a	Project Manager, Environmental Supervisor	Prior to removal, during decommissioning
	The presence of disturbed land following the removal of the roads could allow the establishment of alien invasive vegetation.	L	• Otjozondu will establish and implement a regular weed-control programme to eradicate existing invader plants and to prevent new invasions.	• Implement the weed eradication plan and monitor the area.	Project Manager, Environmental Supervisor	Prior to removal, during decommissioning
	The presence of exposed soils may lead to an increase in volume and speed of surface water run-off, increasing erosive capacity. Sedimentation of pans and high sediment loads in streams during intensive rain could thus result in loss of wetland and riparian zone integrity in terms of biodiversity and function.	L	• Topsoil and natural vegetation self-succession will be used in the re-vegetation process. • Should vegetation self-succession not take place adequately, appropriate seed mixes and soil preparation techniques will be investigated and implemented. • Berms will be constructed around the opencast area and associated mining areas where appropriate, to prevent surface run-off from entering directly into drainage lines and pans. • Erosion control measures are required on all slopes exceeding 2% and engineered erosion control measures are required on all slopes exceeding 15%. Slope angles of topsoil stockpiles will not exceed 1:3 (18°).	• Monitoring will be undertaken to ensure that the rehabilitated areas are self-sustaining. Monitoring will only cease once this has been confirmed. • The rehabilitation plan will include provisions relating to stormwater management and erosion control measures. • The rehabilitation of the soils will play a significant role in the rehabilitation of the vegetation.	Environmental Supervisor	Ongoing
	The removal of the roads will produce waste, which may impact the local ecology.	L	Refer to Section 4.1.1.4 of the EMP.			

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Noise	The ripping process will increase the ambient noise levels in the area.	L	• Vehicles will be equipped with necessary measures where practical to reduce the emission of noise. • Where noise becomes a nuisance management measures will be investigated and implemented to address these. • Noise monitoring will take place in accordance with Section 5.4 of the EMP.	• A pre-planned maintenance plan for vehicles and equipment must be updated. • Regular audit or checks to be done on vehicles and equipment	Environmental Supervisor	Ongoing
Air quality	Fugitive dust will be created by wind erosion from exposed surfaces.	L	Refer to Section 4.1.2.1 of the EMP.			
	Vehicle-entrained fugitive dust emissions.	M	Refer to Section 4.1.1.1 of the EMP.			
	Tailpipe emissions from vehicles.	L	Refer to Section 4.1.1.1 of the EMP.			
Socio-economic	No impacts					
Heritage	No impacts					

4.1.4.3 Closure of mine

After completion of mining activities, the mine will close down. This could have the following impacts on the social-economic structure of the area:

- Loss of income; and
- Impacts associated with inadequate closure and rehabilitation.

Table 4-16: Closure of mine

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
Social-Economic	Retrenchments causing loss of income	M	• Otjozondu Mining should ensure that retrenchment packages are provided for all staff that stand to lose their jobs when mine is closed; • Otjozondu Mining should equip employees with non-mine related skills they can use	• Otjozondu Mining should implement a skills training programme. The skills development programme should be designed to take into account current education and skills levels of employees. The skills training programme should be	Mine	Ongoing

Environmental Parameter	Impacts	Sig. L/M/H	Management Measures	Action Plan	Responsibility	Timeframes
			when the mine closes. • Otjozondu Mining should provide employees with a basic financial management course to enable them to make informed decisions with regard to investing their earnings. Otjozondu Mining should also appoint financial advisors to provide employees with advice regarding investments, pensions schemes, etc.	implemented from the outset of the operational phase and should be funded by Otjozondu Mining		
	Inadequate closure and rehabilitation due to failure to allocate sufficient funds during the operational phase to cover the costs of rehabilitation and closure.	L	• Otjozondu Mining should cover the costs of decommissioning and rehabilitation of disturbed areas.	• Otjozondu Mining should establish an Environmental Rehabilitation Trust Fund. The Trust Fund should be funded by a percentage of the revenue generated from the sale of produce during the operational phase of the mine.	Mine	Ongoing

4.2 Environmental Management - Guidelines

The following table details the proposed guideline on the disposal of domestic and industrial waste that Otjozondu must adhere to.

Table 4-17: Disposal of Domestic and Industrial Waste

Items to be considered		Intentions
General	**Specific**	
Procedures	General	A waste management procedure will be developed. This will cover the storage, handling and transportation of waste.
	Waste minimization and recycling	Opportunities to minimize waste production will be identified and taken where possible. Where possible, waste will be recycled.
Waste disposal facilities	Collection points	Waste collection points will be established on site. Care will be taken to ensure that there will be sufficient collection points with adequate capacity and that these are serviced frequently. Different skips shall be provided for wood, scrap metal, and hazardous waste.
	On site waste disposal facilities	No waste disposal facility will be developed without the relevant permission.
	Off site waste disposal facilities	Waste will be disposed of at appropriate permitted waste disposal facilities. An agreement will be put in place to ensure that the facility is capable of handling the additional waste.
Waste transport	Contractor	An approved subcontractor, working to local authority standards, will undertake the waste transport.

Items to be considered		Intentions
General	**Specific**	
Disposal of different types of waste	Hazardous wastes (if any)	Hazardous waste will be collected by a licensed hazardous waste transport company and will be removed to a permitted hazardous waste disposal facility. Hazardous waste may only be stored on site, in a fenced off area with access control, for up to 90 days.
	Non-hazardous waste	An approved subcontractor, working to local authority standards, will undertake the waste transport.
	Any soil polluted by a spill of chemicals	If remediation of the soil in situ is not possible, the soils will be classified as waste in terms of the Minimum Requirements and will be disposed of at an appropriate permitted hazardous waste facility.
	Building rubble	Care will be taken to ensure that building rubble does not become polluted or mixed with any other waste. The building rubble will be used to backfill excavations.
	Scrap metal	Care will be taken to ensure that scrap metal does not become polluted or mixed with any other waste. The scrap metal will be collected in a designated area for scrap metal (scrap yard). It will be sold to scrap dealers.
	Oil	Oil will be collected in suitable containers at designated collection points. The collection points will be bunded and underlain by impervious materials to ensure that any spills are contained. Notices will be erected at each waste oil point giving instructions on the procedure for waste oil discharge and collection. An approved subcontractor will remove oil from site.

The following table details the proposed guideline on dust control issues that Otjozondu must adhere to.

Table 4-18: Dust control measures

ASPECT	IMPACT	MANAGEMENT ACTIONS/OBJECTIVES	RESPONSIBLE PERSON(S)	TARGET DATE
Construction of the new Beneficiation plant and expanded mining operations				
Land clearing activities such as dozing and scraping of vegetation and topsoil	PM10 and PM2.5 Concentrations and dust fallout	Water sprays to be applied at the area to be cleared should significant amounts of dust be generated. Moist topsoil will reduce the potential for dust generation when tipped onto stockpiles. Ensure travel distance between clearing area and topsoil piles to be at a minimum.	SM/EM Contractor(s)	Pre- and during construction
Wind erosion from exposed areas	PM10 and PM2.5 Concentrations and dust fallout	Ensure exposed areas remain moist through regular water spraying during dry, windy periods. Single dust fallout bucket to be placed downwind to the west of the existing and proposed tailings storage facilities with monthly dust fallout rates not exceeding 1 200 mg/m^2/day(a).	SM/EM Contractor(s)	Ongoing and post operational
Operational Phase of the expanded mine				
Dust generation from open pit mining operations	PM10 and PM2.5 Concentrations and dust fallout	Drilling to be controlled through water sprays to ensure 70% control efficiency. Controlled blasting techniques to be used to ensure minimal dust generation. Blasting only to be conducted on cloudless days.	SM/EM	Duration of operations
Materials transfer points	PM10 and PM2.5 concentrations and dust fallout	Drop height from excavator into haul trucks to be kept at a minimum for ore and waste rock. Tipping onto ROM storage piles to be controlled through water sprays should significant amounts of dust be generated.	SM/EM	Duration of operations

ASPECT	IMPACT	MANAGEMENT ACTIONS/OBJECTIVES	RESPONSIBLE PERSON(S)	TARGET DATE
Crushing and screening operations	PM10 and PM2.5 and manganese concentrations and dust fallout	Water sprays combined with chemicals at the primary and secondary crushers and screens to ensure dust control of 50% if the processes result in significant dust generation. Moist ore can be up to 20 times lower than dry ore. Single dust fallout bucket to be placed in the vicinity of the primary and secondary crushers with monthly dust fallout rates not exceeding 1 200 mg/m^2/day (a).	SM/EM	Duration of operations
Construction of the new Beneficiation plant and expanded mining operations				
Wind erosion from existing and new tailings storage facilities	PM10 and PM2.5 Concentrations and dust fallout	Progressive vegetation of side walls of new tailings storage facilities to ensure 80% cover up to 1 m from the top. Single dust fallout buckets to be placed to the west and to the north-northwest (downwind) of the new tailings storage facilities with monthly dust fallout rates not exceeding 1 200 mg/m^2/day (a).	SM/EM	Ongoing and Post operational phase
Vehicle activity on unpaved haul roads	PM10 and PM2.5 Concentrations and dust fallout	Speed limit on unpaved roads not to exceed 40 km/hr. Single dust fallout bucket to be placed next to the main haul roads with monthly dust fallout. rates not exceeding 1 200 mg/m^2/day(a).	SM/EM	Duration of operations
Vehicle activity on unpaved haul roads	PM10 and PM2.5 concentrations and dust fallout	Product trucks to be covered to minimise spillages on paved road.	SM/EM	Duration of operations
Decommissioning phase				

ASPECT	IMPACT	MANAGEMENT ACTIONS/OBJECTIVES	RESPONSIBLE PERSON(S)	TARGET DATE
Wind erosion from exposed areas and tailings storage facilities	PM10 concentrations and dust fallout	Reshape all disturbed areas to their natural contours. Cover disturbed areas with previously collected topsoil and replant native species. Ensure full vegetation cover on tailings storage facilities (this should be done throughout the life of mine).	SM/EM Contractors	Ongoing and Post operational

SM = Site Manager / EM = Environmental Manager

(a) South African dust fall limit of 1 200 mg/m^2/day for heavy commercial and industrial sites not to be exceeded for two sequential months and not more than three exceedances in a year.

The following table details the proposed guideline on soil conservation and management that Otjozondu must adhere to

Table 4-19: Soil conservation guide

Steps	Factors to consider	Detail
Delineation of areas to be stripped	N/A	The removal of soil will only occur where they are to be disturbed and an end-use for the stripped soils has been identified
Delineation of stockpiling areas	Location	When areas to be pre-stripped have been identified, suitable stockpiling areas will be identified, preferably in the vicinity of the soil source and foundations will be prepared.
	Storm water controls	All stockpiles will be established within the bounds of the storm water management infrastructure.
	Footprint and height	The areas set aside for soil stockpiles will be delineated based on the expected soil volumes that are to be stored.
	Designation of the areas	Soil stockpiles will be clearly identified as such.
Open Cast Mining - Stripping	Topsoil / subsoil	The full thickness of topsoil and subsoil will be stripped to a maximum depth of 0.25 metres and put aside, together with any vegetation cover present (only large bushes and trees to be removed prior to stripping). Where soil depth is less than 0.25 metres, stripping will stop when hard material is reached.
Stockpiles	Topsoil / subsoil	Topsoil and subsoil will be stockpiled separately from any other stockpiles, in the vicinity of the soil source. The construction of all topsoil stockpiles will be undertaken in a series of 1.5m lifts.
	Vegetation establishment and erosion control	Rapid growth of vegetation on the stockpiles will be promoted, by means of watering and fertilisation. This will help to combat both water and wind erosion.

Steps	Factors to consider	Detail
	Waste	No waste material of any kind will be placed on the soil stockpiles.
	Slope angles	Slope angles of the topsoil stockpiles should not exceed 1:3 (18°)
	Compaction	Equipment movement over the stockpiles will be limited to avoid soil compaction and subsequent damage to soil structure or the seed bank.
Rehabilitation of disturbed land; restoration of land capability	Placement of topsoil	To help re-establish grazing land capability, topsoil will be replaced.
	Fertilisation	Samples of the stripped soils will be analysed immediately prior to replacement to determine the nutrient status of the soils. Based on the analysis, fertilisers will be applied if necessary.
	Erosion control	Erosion control measures will be implemented to ensure that the topsoil is not washed away and erosion gullies do not develop in the grazing / arable land.

The following table details the storage of hazardous chemical substances and management guidelines that Otjozondu must adhere to.

Table 4-20: Storage of hazardous chemical substances

Product	Storage
Oils	Mild steel or stainless steel drums. The containers will be stored in bunded facilities that will have the capacity contain all potential spills.
Diesoline	Diesoline will be stored in tanks within bunded areas with smooth, impermeable surfaces. Diesoline may be stored in externally clean 210 L drums. These drums may only be stored on smooth, impervious surfaces in facilities that will contain spills.

Product	Storage
Herbicides & pesticides	These substances will be stored under lock and key and away from food and water sources. Sub-contractors who require such substances for the execution of their duties will also be expected to store these hazardous substances in an appropriate storage area or they will be required to keep the substances off site at their usual business premises. Such sub-contractors will be liable for control over the issuing of the herbicides to their staff, and thus are required by law to maintain records. Material Safety Data Sheets are required to be kept by the competent person, and these will be submitted when a specific substance is brought to site for use/application.
Other: **Paint, thinners, varnish, turpentine, detergents, petroleum, etc.**	These substances must be stored in clearly marked containers. These containers must be sealable and must not leak. These may only be stored within the workshops and storerooms.

The following table details the handling of hazardous chemical substances and management guidelines that Otjozondu must adhere to.

Table 4-21: Handling of hazardous chemical substances

Product	Handling
Oils	All oils will be handled according to their specific Material Safety Data Sheets.
Diesoline	Diesel will be handled according to its Material Safety Data Sheet. Where possible, diesel transferrals must take place in the designated refuelling areas on smooth, impervious surfaces. Drip trays will be positioned at each machine whilst being refilled. Drip trays will be drained into suitable containers. Smaller plant and tyre wheeled equipment will also re-fuel at the main storage areas.
Herbicides & pesticides	Herbicides, pesticides and other potentially poisonous substances

Product	Handling
	will be used according to the manufacturer's specifications. Care will be taken to avoid spills and unnecessary contact with any part of the environment for which they were not intended e.g. soil, water bodies and vegetation or animals. Mixed herbicide/ pesticide or other poison shall be kept in clearly marked, closed containers and decanting will occur over a drip tray to prevent spillage, this will not take place within forty meters of any watercourse.
Other: **Paint, thinners, varnish, turpentine, detergents, petroleum, etc.**	These substances must be used in accordance with their respective MSDSs.

The following table details the disposal of hazardous chemical substances and management guidelines that Otjozondu must adhere to.

Table 4-22: Disposal of hazardous chemical substances

Product	Disposal
Oils	Old/used oil will be stored in drums and weatherproof waste oil collection containers. Receipts /proof of their final disposal must be received and kept on file.
Other: Paint, thinners, varnish, turpentine, detergents etc.	These substances must be used in accordance with their respective MSDSs.

5 ENVIRONMENTAL MONITORING AND PERFORMANCE ASSESSMENTS

5.1 Surface water monitoring

The first priority for monitoring should be for appropriate management to be undertaken on site to ensure water released into the environment does not cause pollution. The monitoring regime should be designed to allow management on site to implement the appropriate management measures to ensure that discharges are kept within the appropriate limits. Specific objectives of the water quality monitoring program are as follows:

- Determine whether the water quality at the sampling sites exceeds water quality standards;
- Assess the status of water quality in the surrounding areas;
- Provide analytical water quality information that describes present conditions and changes (trends); and
- Provide timely data for other users.

Within the study area, the quality of water can affected by three major categories of physical and chemical stress factors:

- The potential discharge into the environment of wastewater generated by ore mining, and processing, and containing relevant pollutants – acidity, copper, iron, manganese, arsenic, cadmium, nickel, lead, mercury, selenium, chromium, sulphate, dissolved salts, etc.; and,
- The area's potential for a high degree of mineralisation.
- Potentially high sediment loads generated in the very intense rainfall events (short term).

Ore mining and processing activities have potential for generate highly acidic wastewater and high concentrations of heavy metals and other toxic contaminants.

In this environment this type of pollution may be identified as Acid Rock Drainage (ARD). The collection of such pollutants involves interception ditches, catchment dams and ponds. The project area being so dry it can be expected that no discharge will take place from mining activities and this will subsequently reduce the risks of potential pollution sources. Also, the presence of sulphide material is low therefore; even with the addition of water the ARD risk is low.

5.1.1 Location of monitoring points

Three monitoring points (i.e. S1 – S3) illustrated in Figure 5-1are recommended. These points, although some distant from mining activity, have the potential to be impacted. It is recommended that monitoring be undertaking on a monthly basis (if water is available to be sampled), however the locations and time step should be evaluated as better information becomes available.

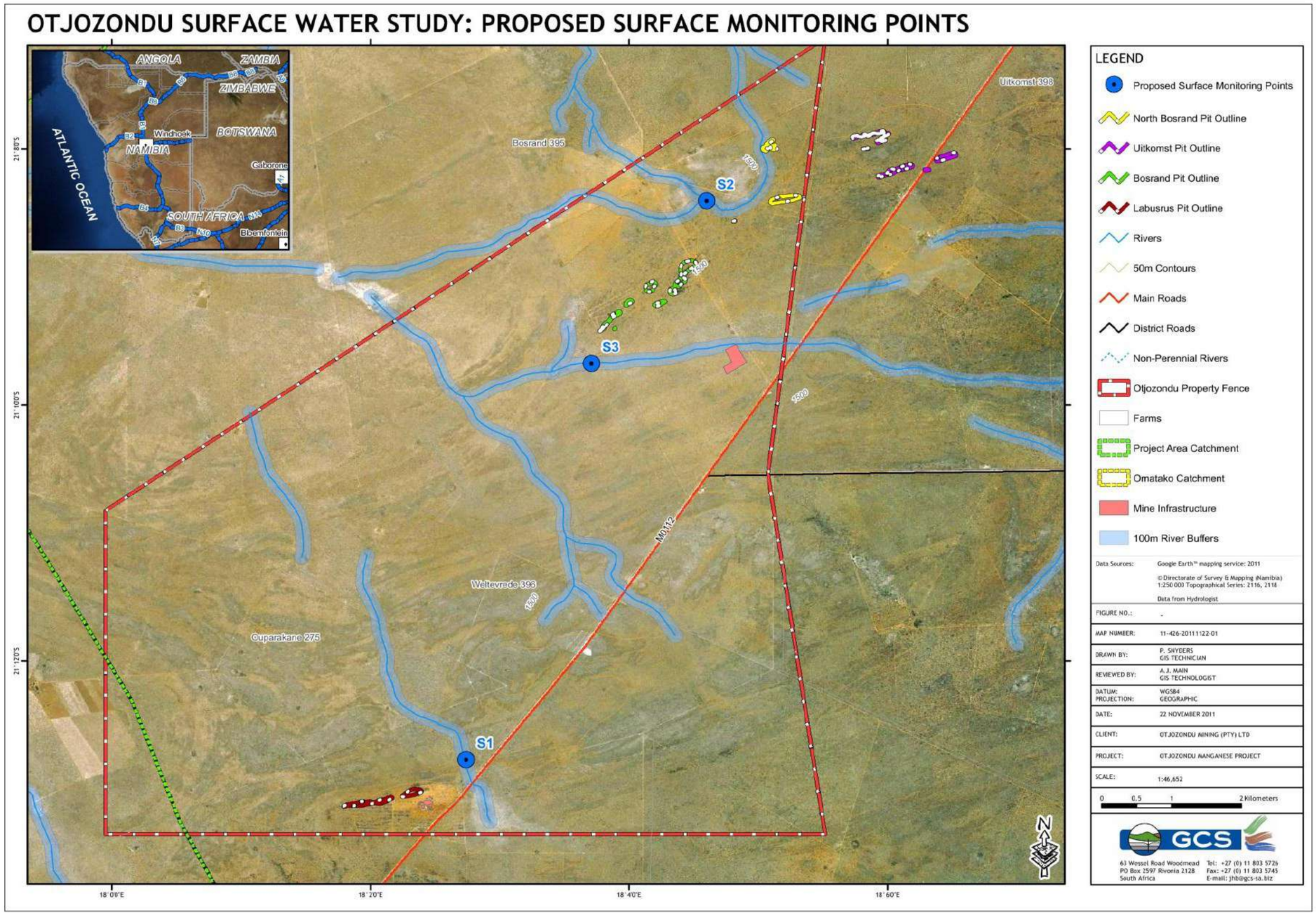

Figure 5-1: Proposed surface water monitoring locations

5.1.2 Conclusions and recommendations

The proposed monitoring program should ensure compliance with legislation, but should also be a management tool to assist the mine in ensuring that the mining activities do no cause downstream pollution. For this reason, the mine should continuously monitor the parameters as required by the Water Act, but also identify other possible parameters if required and if possible, which could be indicative of contamination caused by mining or processing activities at the Mine.

5.2 Groundwater monitoring

The objective of a groundwater monitoring plan is to detect any changes that the mining activities have on water quality and ground water levels in the area. The boreholes in the monitoring network should be able to assess contaminant sources, receptors, potential contaminant plumes and aquifer responses. Furthermore, monitoring of the background groundwater quality and levels are also required.

Groundwater monitoring should be conducted to assess the following:

- The impact of mine dewatering on the surrounding aquifers. This will be achieved through monitoring of groundwater levels in the monitoring boreholes. If private boreholes are identified within the zone of impact on groundwater levels, these will be included in the monitoring programme;
- Groundwater inflow into the mine workings. This will be achieved through monitoring of groundwater levels in the monitoring boreholes as well as measuring water volumes pumped from mining areas;
- Groundwater quality trends. This will be achieved through sampling of the groundwater in the boreholes at the prescribed frequency; and
- The rate of groundwater recovery after mining ceases.

Groundwater monitoring should be undertaken according to international best practices with the schedule presented in Table 5-1 overleaf. The proposed monitoring network can be seen in Figure 5-2 and listed in Table 5-2. This network complies with the above mentioned criteria. It is envisaged that the frequency of monitoring remains on a biannual basis for quality, while water level monitoring should be conducted on a quarterly basis. A total of 12 boreholes

around the mining activities should be monitored for water quality and water level, while water levels in an additional 26 boreholes should be monitored.

Table 5-1: Groundwater monitoring program

Monitoring position	Sampling interval	Analysis	Water Quality Standards
Construction, Operational, Decommissioning and Post Closure Phases			
All monitoring boreholes	Quarterly: measuring the depth of groundwater levels	N/a	N/a
Selected monitoring boreholes	Biannual: sampling for water quality analysis	Full analysis in April and October Groundwater level	WHO Drinking Water Standards, Namibia Water Quality Guidelines:
Rainfall	Daily at the mine	N/a	N/a

The boreholes selected for groundwater monitoring at Otjozondu are presented in Table 5-2 and Figure 5-2 and shows the boreholes in relation to the two mining areas and proposed pits. The proposed program should include the following boreholes that were selected for monitoring:

- LAB T1, T2 & T3
- BOS T1, T2, T3, T4 and T5
- HEB1, HEB7, HEB8 and HEB9
- EXPL1
- KU1 and KU6
- JMT1
- MNPIT1
- OM1 and OM2
- MH10

Table 5-2: Boreholes in proposed monitoring network

Position ID	Coordinates		Use	Monitoring status
	X	Y		
ATO1	21.2491	18.08619	Domestic use	Water level only
BGK1	21.27885	18.04168	Domestic use	Water level only
BGK2	21.27781	18.04219	Domestic use	Water level only
BGK3	21.27766	18.04398	Cattle post	Water level only

Position ID	Coordinates		Use	Monitoring status
	X	Y		
BGK8	21.25805	18.04945	Cattle post	Water level only
EXPL1	21.15848	18.07149	Exploration borehole	Water level only
GUL1	21.24926	18.0177	Domestic use	Water level only
GUL2	21.23746	17.99549	Cattle post	Water level only
GUL3	21.228	18.01843	Cattle post	Water level only
GUL4	21.26582	18.02187	Cattle post	Water level only
HEB2	21.16991	18.03365	Not in use	Water level only
HEB6	21.13353	18.05895	Domestic use	Water level only
HEB9	21.16933	18.08353	Not in use	Water level only
KU1	21.15119	18.10027	Domestic use	Water level only
KU3	21.10549	18.10225	Domestic use	Water level only
KU4	21.10551	18.10312	Domestic use	Water level only
KU6	21.14518	18.10517	Domestic use	Water level only
MHO10	21.21606	18.04483	Cattle post	Water level only
MHO11	21.24646	18.06368	Cattle post	Water level only
MHO3	21.2163	17.96398	Cattle post	Water level only
MHO7	21.20298	17.98981	Domestic use	Water level only
MHO8	21.20141	18.01332	Cattle post	Water level only
MOB4	21.19589	18.10063	Cattle post	Water level only
OM1	21.2169	18.04341	Domestic use	Water level only
OM2	21.2162	18.04352	Domestic use	Water level only
PWO5	21.11782	18.00358	Cattle post	Water level only
BOS T1	21.14688	18.07557	Newly drilled	Water quality and level
BOS T2	21.14836	18.07675	Newly drilled	Water quality and level
BOS T3	21.1524	18.07176	Newly drilled	Water quality and level
BOS T4	21.15861	18.06371	Newly drilled	Water quality and level
BOS T5	21.1584	18.0782	Newly drilled	Water quality and level
HEB1	21.16155	18.06106	Not in use	Water quality and level
HEB8	21.1365	18.06858	Cattle post	Water quality and level
JMT1	21.16108	18.08027	Domestic use	Water quality and level
LAB T1	21.21648	18.03996	Newly drilled	Water quality and level

Position ID	Coordinates		Use	Monitoring status
	X	Y		
LAB T2	21.21884	18.0292	Newly drilled	Water quality and level
LAB T3	21.21771	18.04007	Newly drilled	Water quality and level
MNPIT1	21.22308	18.02734	Old mine pit	Water quality and level

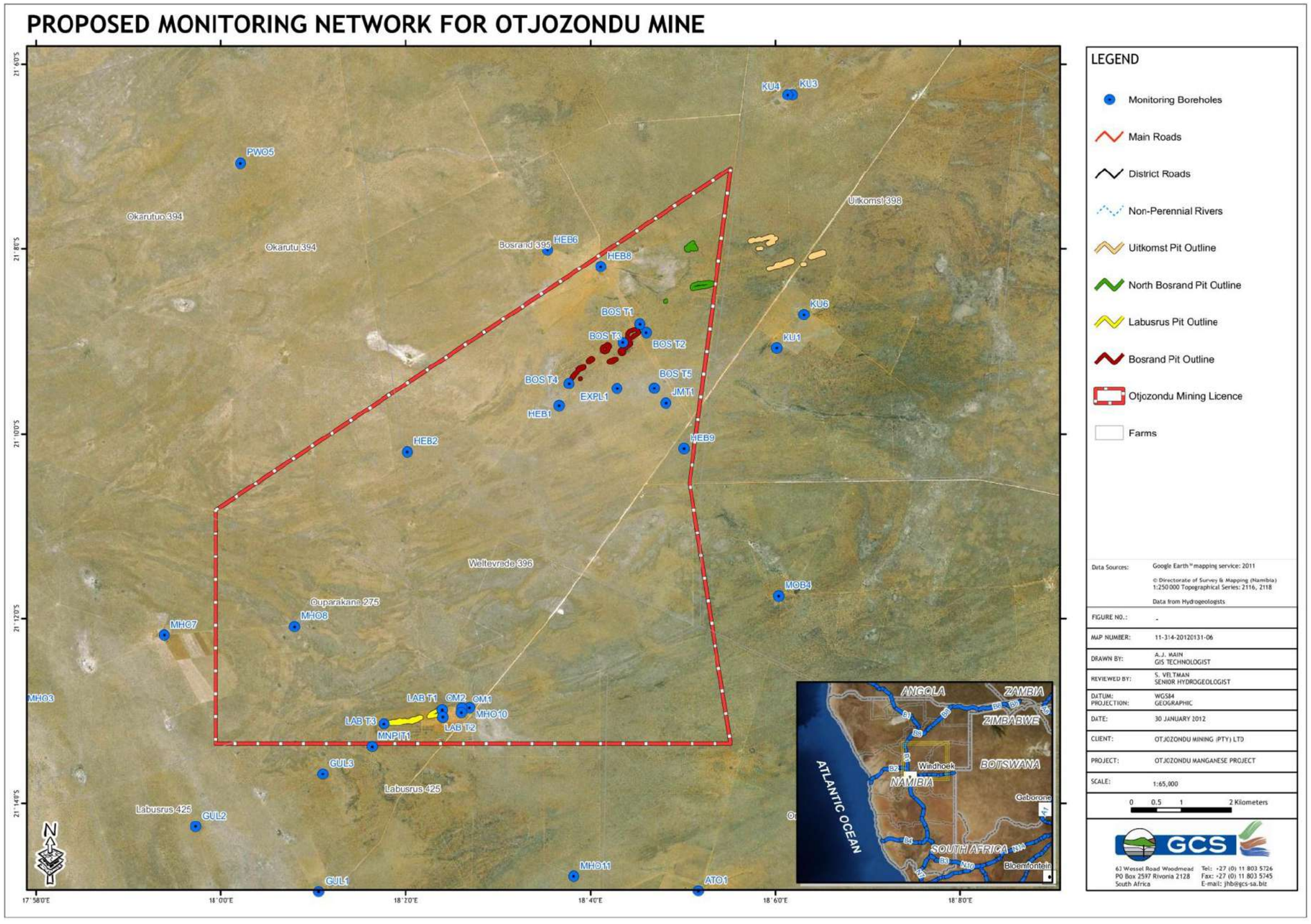

Figure 5-2: Proposed groundwater monitoring network

The identification of the monitoring parameters is crucial and depends on the chemistry of possible pollution sources. It comprises a set of physical and/or chemical parameters (e.g. groundwater levels and predetermined organic and inorganic chemical constituents) and the list for Otjozondu Manganese Mine were presented in Table 5-3. Once a pollution indicator has been identified it can be used as a substitute to full analysis and therefore save costs. The use of pollution indicators should be validated and revised on a regular basis.

Table 5-3: Selected Monitoring Parameters for Otjozondu

Analysis method	Physical Parameters	Chemical Parameters
Full	Groundwater levels	• Field measurements: pH, EC, TDS • Laboratory analyses: Anions and cations (Ca, Mg, Na, K, NO_3, Cl, SO_4, F, Fe, Mn, Al, & HCO_3); • Petroleum hydrocarbon contaminants (where applicable, near workshops and petroleum handling facilities) • Sewage related contaminants (E.Coli, faecal coliforms) in borehole in proximity to septic tanks or sewage plants.

Laboratory analysis techniques should comply with Namibian guidelines. A groundwater monitoring database should be established and updated on a monthly basis, as information becomes available. The database will be used to analyse the information and evaluate trends.

An annual compliance report should be compiled and submitted to the authorities for evaluation and comment. This report should be submitted annually for the construction, operational and decommissioning phases as well as for two years after mine closure. The mine should develop a monitoring response protocol after the completion of the Construction Phase of the project. This protocol will describe procedures in the event that groundwater monitoring information indicates that action is required.

5.3 Dust monitoring

A dust monitoring network should be designed for the proposed operations once a detailed site layout is available. This network should comprise of single dust fallout units following the following the American Society for Testing and Materials standard method for collection and analysis of dust fall (ASTM D1739). Dust fallout should not exceed 1 200 mg/m2/day for any three months in a calendar year or for two consecutive months. The main focus areas for dust bucket placement should be:

- Next to each of the main haul roads.
- Next to each of the primary and secondary crushers.
- To the west and north-north-west of each of the tailings storage facilities.

5.4 Noise monitoring

Noise monitoring must continue to determine the impact that construction, operation and closure will have on the sound levels. As there are no sensitive receptors in the vicinity of the proposed Development, a detailed model to predict sound levels is not considered necessary. Once the sound power level specifications for construction and the operational plant are available, however, it will be possible to process the model, if required.

5.5 Soil monitoring

The objectives of the soil monitoring would be to determine that management measures put in place to avoid erosion, aid in vegetation succession and the rehabilitation of impacted areas are effective. Specific objectives of the soil monitoring program are as follows:

- Determine whether vegetation succession on stockpile and rehabilitated areas are satisfactory. If not, appropriate seed mixes should be investigated to aid in revegetation; and
- Monitor the erosion control measures and ensure that these are affective throughout. Take immediate action if it is found that some areas are still being eroded.

5.6 Periodic mine environmental audit

A register of environmental monitoring and auditing results will be kept on site. In order to ensure compliance with the environmental management programme and to assess the continued appropriateness and adequacy of the environmental management programme, Otjozondu commits to:

- Conduct monitoring on an ongoing basis.
- Commission an independent environmental performance assessment of the environmental management programme annually.

The mine further undertakes to:

- Appoint a responsible person(s), in writing, who will monitor all environmental aspects of the site on a regular basis. The appointed person will communicate, on a regular basis, with the local I&APs identified with regards to the project and will report on the progress made with regards to implementation of the mitigation measures. Any complaints with regard to the mining activity will be reported to the appointed person and be recorded in a complaint register.

- Maintain records relating to compliance/non-compliance with the conditions of authorisation.

5.7 Data Management

Monitoring results will be entered into an electronic database as soon as these are available, and at no less than one monthly interval, allowing:

- Data presentation in tabular format, and
- Presentation of data, statistics and performance on diagrams and maps.

As far as possible, the same monitoring points will be used from the construction phase through the operational and decommissioning phases to after mine closure to develop a long term data record and enable trend analysis and recognition of progressive impacts with time.

6 ENVIRONMENTAL AWARENESS PROGRAM

6.1 Induction

Comprehensive induction forms a critical component during the construction and operational period. This includes the following:

- Ensuring that all employees are aware of their individual impact on the environment.
- Ensuring that employees are aware of any ecologically sensitive, culturally sensitive and historically sensitive sites.
- Ensuring that employees are aware of the measures and procedures to be followed should ecologically sensitive, culturally sensitive or historically sensitive sites be detected.
- Ensure that employees are aware of the measures and procedures to be followed should an environmental impact (such as a hydrocarbon spill, etc.) take place.
- Ensuring that preventative measures and procedures are undertaken in order to reduce the risk of a potential impact.

6.2 Communication from external parties and employees

In order to enhance communication from external parties and employees the following will be implemented:

- Establishing, facilitating and enhancing External and Internal Communication.
- Establishing a Monitoring Forum.
    - A monitoring forum will be established and used as a forum to keep I&APs informed of the significant environmental aspects identified through the EA.
    - I&APs will have the opportunity to raise environmental concerns during the committee sittings.
    - Records will be kept of all decisions and concerns.
    - All issues and concerns raised will be addressed within a specific timeframe as approved by the relevant stakeholders and authorities.
    - The Monitoring Forum will be chaired by the Environmental Manager, or another appropriately appointed individual.
    - Bi-annual forum meetings will be held at which time stakeholders will be presented with the opportunity to raise issues and concerns. Should the stakeholders require more meetings (i.e. quarterly) this will be considered.

6.3 On-the-job training

On the job training is an essential tool in environmental awareness. Employees will be given details of the expected environmental issues and concerns specifically related to their

occupation. Employees will be trained on how to respond if an environmental problem or source of environmental pollution arises. The training will be on-going.

7 ENVIRONMENTAL EMERGENCY PREPAREDNESS AND RESPONSE

An effective, comprehensive, well-considered and tested environmental Emergency Preparedness and Response Plan has the potential to save lives, prevent unnecessary damage to the company and other property. It furthers has the potential to manage environmental risk in the event of a large hydrocarbon spill, oil spill, fuel spill, explosives spill or sewerage spill.

Environmental emergencies occur over the short term and require an immediate response. An Emergency Preparedness and Response Plan must be compiled and disseminated to all employees and contractors and in the event of an emergency; the emergency response plan should be consulted.

This plan should be placed around the mine where it will be easily viewed. The plan should contain a list of procedures, evacuation routes and emergency contact numbers. It is advisable that the mine tests the emergency response plan in order to identify any areas for improvement.

If the emergency has the potential to affect surrounding residents, they should be alerted via alarm signals or contacted in person. The surrounding community will be informed, prior to mining taking place, of the potential dangers and emergencies that exist, and the actions to be taken in such emergencies.

Communication is vital in an emergency and thus communication devices, such as mobile phones, two-way radios, pagers or telephones, must be placed around the mine. A checklist of emergency response units must be consulted and the relevant units notified.

The checklist includes:

- Fire department;
- Police;
- Emergency health services such as ambulances, paramedic teams, poisons centres;
- Hospitals, both local and further afield, for specialist care;
- Public health authorities;
- Environmental agencies, especially those responsible for air, water and waste issues;
- Public works and highways departments, port; and
- Public information authorities and media organisations.

7.1 Emergency procedures

See Table7-1 below for the basic environmental emergency procedures to be followed and incorporated into the Emergency Preparedness and Response Plan.

Table7-1: Environmental emergency and response procedures

Possible environmental related emergency	Action plans / Remediation	Time / Periods	Responsible person / party
Spillage of oil, diesel by vehicles, tankers, storage tanks etc.	The spillage should be contained (bund earth walls) by all means. Depending on the amount of spillage it could be remediated in-situ or in the case of large amount of spillage that is contained, could be removed, etc.	Immediately	Mine Manager, Environmental Supervisor
	Leakage from the vehicle, tanker etc, that caused the emergency, should be removed to the workshop area for repairs immediately.		
	Cover the spills with absorbent material.		
	Obtain Material Safety Data Sheet (MSDS) if the substance is known.		
	The person who reported the spill must fill out an incident report and forward it to the Environmental Department after a thorough investigation.		
Sewerage spills	The spillage should be contained (bund earth walls) by all means. Depending on the amount of spillage it could be remediated in situ or in the case of large amount of spillage that is contained, could be removed, etc.	Immediately	Mine Manager, Environmental Supervisor
	The leakage must be stopped and reason for spill must be rectified.		
	The person who reported the spill must fill out an incident report and forward it to the Environmental Department after a thorough investigation.		

Possible environmental related emergency	Action plans / Remediation	Time / Periods	Responsible person / party
Fires	All fires in the veld, buildings, diesel tanks, chemical fires, etc. should be extinguish and prevented to spread to any other piece of land, building, etc. During the winter months an adequate fire breaks should be put in place around the mine. The necessary equipment should be in place and ready to be used if an accidental fire is started.	Immediately	Environmental manager, Safety officer, Local Fire Brigade
	Follow the emergency preparedness and response procedure.		
	Take precautions when working with welding or grinding equipment near potential sources of combustion. Such precautions include having a suitable, tested and approved fire extinguisher immediately at hand and the use of welding curtains.		

8 CONCLUSION

This Environmental Management Plan highlights the management measures that will be implemented in order to mitigate the environmental impacts of the proposed activities. In addition to these management measures, this report also highlights the requirements for the Environmental Awareness Plan and the Emergency Preparedness and Response procedure.

It is recommended that the following conditions are met and the outcomes incorporated into an amended EMP within one year of issuance of Environmental Clearance Certificate:

- The provisions stipulated within the EMP associated with this report are complied with.
- All associated licenses (Water Use, Tree Removals etc.) are obtained.
- A dust monitoring network should be designed for the proposed operations once a detailed site layout is available.
- Although the current Biodiversity Impact Assessment indicated no significant impacts, the specialist recommended that the EMP will need early review and revision through the re-evaluation of each impact once more information is available.
- As no data was available when the hydrological assessment was undertaken, it is highly recommended that the following be undertaken to verify results in future:
    - Identify potential monitoring points to measure and record flow volumes as well as possibly measure water quality (during rainy season). These estimates would be used to gain understanding of the water flow, which can address appropriate measures against potential impacts to the environment.
    - The Storm water management plan should be reviewed during the further phases of the project or when better information becomes available to verify the accuracy of the proposed solutions.
    - Develop a dynamic water balance model for the mine for planning. This must focus on ensuring optimum use of the limited water resources available.
    - It is highly recommended that the mine install an automatic weather station on site to record climatic parameters.
- It is recommended that a numerical groundwater flow model be updated throughout the mining operation by using the measured water ingress and water levels to re-calibrate and refine the impact predictive scenarios to determine the impact on the surrounding land users.
- Should any critical issues arise during the above-mentioned studies, the authorities must be notified immediately and appropriate mitigation / management measures identified and implemented.

The EMP is a legal document, which commits the applicant to comply with all management measures, monitoring programmes and other plans as presented herein. As part of the EMP, detailed monitoring programmes have been provided to manage and control areas including surface water, groundwater, air quality and soils. In addition to this, the requirements for a comprehensive Environmental Awareness Plan and Emergency Preparedness and Response Procedure have been included to ensure the effective management and associated environmental awareness within the Otjozondu Mine.

9 REFERENCES

The following references were utilised for the compilation of this report:

9.1 Specialist Reports

African Wilderness Restoration (AWR): Otjozondu Manganese - Biodiversity Baseline Study and Impact Assessment Report on Desk & Field Study (March 2012)

References Utilised for Biodiversity Assessment: (Alphabetical Order)

- Alexander, G., Marais, J. 2007. A guide to the reptiles of southern Africa. Struik, Cape Town.
- AWR (African Wilderness Restoration). 2011a. Otjozondu Manganese Project: Scoping the biodiversity baseline study requirements. Unpublished report to Groundwater Consulting Services for the client Otjozondu Mining (Pty) Ltd.
- AWR (African Wilderness Restoration). 2011b. Otjozondu Manganese Project - Biodiversity Baseline Study: report on desktop study and a generic Biodiversity Impact Assessment. Unpublished report to Groundwater Consulting Services for the client Otjozondu Mining (Pty) Ltd.
- Bagri, A., McNeely, J., Vorhies, F. 1998. Biodiversity and Impact Assessment. Paper presented at a workshop on Biodiversity and Impact Assessment, Christchurch, New Zealand, 21-22 April 1998.
- Barnes, R.D., Fagg, C.W., Milton, S.J. 1997. Acacia erioloba monograph and annotated bibliography. Tropical Forestry Papers No. 35. Oxford Forestry Institute, Department of Plant Sciences, University of Oxford.
- Branch, B. 1998. Field guide to snakes and other reptiles of southern Africa. Struik, Cape Town, 399 pp.
- Coaton, W.G.H. 1971. Five new termite genera from South West Africa (Isoptera: Termitidae). Cimbebasia, (A) 2: p.1-34.
- Coaton, W.G.H. &Sheasby, J.L. 1975. National Survey of the Isoptera of Southern Africa. 8. The genus Hodotermes Hagen (Hodotermitidae). Cimbebasia, (A) 3(10): p.105-138.
- Costa, C., Vanin, S.A. &Casari-Chen, S.A. 1994. Cladistic analysis and systematics of the Tetralobinisensu Stibick, 1979 (Coleoptera, Elateridae, Pyrophorinae). Arquivos de Zoologia (São Paolo), 32(3): p.111-157.
- Curtis, B.A., Mannheimer, C.A. 2005. Tree Atlas of Namibia. National Botanical Research Institute, Windhoek.

- Dean, W.R.J. 1997. Ostrich. In: Harrison, J.A. et al. (eds). The Atlas of Southern African Birds. Vol 1:2 – 3.
- Dikow, T. 2003. Revision of the genus Euscelidia Westwood, 1850 (Diptera: Asilidae: Leptogastrinae). African Invertebrates, 44(2): p.1-131.
- Dikow, T. & Londt, J.G.H. 2000. A review of Lamyra Loew (Diptera: Asilidae: Laphriinae). African Entomology, 8(2): p.189-200.
- Dombrow, H. 1997. Revision of the genus Eriesthis Burmeister (Coleoptera: Scarabaeidae: Melolonthinae: Hopliini). Genus, 1: p.41-115.
- Du Preez, L., Carruthers, V. 2009. A complete guide to the frogs of southern Africa. Cape Town, Struik Nature.
- Durden, L.A. & Musser, G.G. 1994. The sucking lice (Insecta, Anoplura) of the world: A taxonomic checklist with records of mammalian hosts and geographical distribution. Bulletin of the American Museum of Natural History, 218: p.1-90.
- Endrödy-Younga, S. 2000. Revision of the subtribe Gonopina (Coleoptera: Tenebrionidae, Opatrinae, Platynotini). Annals of the Transvaal Museum, 37: p.1-54.
- Envirosolutions. 2007. Environmental Impact Assessment for the envisaged mining and processing plant between Otjozondu and Okandjatu. Otjozondu Mining (Pty) Ltd, 32 pp.
- Envirosolutions. 2008. Environmental Management Plan, Update October 2007, Manganese Mining and Processing Activities. Otjozondu Mining (Pty) Ltd, 12 pp.
- Ferreira, G.W. 1980. The Parandrinae and the Prioninae of southern Africa (Cerambycidae, Coleoptera). Memoirs of the National Museum, Bloemfontein, 13: p.1-335.
- Ferreira, M.C. 1978. The genus Onitis F. of Africa south of the Sahara (Scarabaeidae, Coleoptera). Memoirs of the National Museum, Bloemfontein, 10: p.1-410.
- GBIF 2012. Global Biodiversity Information Facility: Home Page. Available at: http://www.gbif.org/ [Accessed October 31, 2011; January 7, 2012].
- GCS 2012. Otjozondu Hydrogeological Investigation, Phase 3: Groundwater Impact Assessment. Unpublished report by Groundwater Consulting Services for the client Otjozondu Mining (Pty) Ltd.
- Giess, W. 1971. A preliminary vegetation map of South West Africa. Dintera 4: 1-114.
- Grainger, M.J., van Aarde, R.J., Wassenaar, T.D. 2011. Landscape composition influences the restoration of subtropical coastal dune forest. Restoration Ecology, 19: 111-120.
- Griffin, M. 1998. The species diversity, distribution and conservation of Namibian mammals. Biodiversity and Conservation 7(4): 483-494.

- Griffin, M. 2003. Annotated checklist and provisional national conservation status of Namibian reptiles. Ministry of Environment and Tourism, Windhoek.
- Grimm, R. 2001. Faunistik und TaxonomieeinigerArten der Gattung Tribolium Macleay, 1825, mit Beschreibung von dreineuen ArtenausAfrika (Coleoptera, Tenebrionidae). Entomofauna, 22(19): p.393-404.
- Hall, L.S., Krausman, P.R. & Morrison, M.L. 1997. The habitat concept and a plea for standard terminology. Wildlife Society Bulletin, 25: 173-182.
- Hancock, D.L., Kirk-Spriggs, A.H. & Marais, E. 2001. An annotated checklist and provisional atlas of Namibian Tephritidae (Diptera: Schizophora). Cimbebasia, 17: 41-72.
- Harrison, J.A., Allan, D.G., Underhill L.G., Herremans, M., Tree, A.J., Parker, V. Brown, C.J. (eds). 1997. The atlas of southern African birds. Vol 1: Non-Passerines, and Vol 2: Passerines. BirdLife South Africa, Johannesburg.
- Herman, L.H. 2001. Catalog of the Staphylinidae (Insecta: Coleoptera). 1758 to the end of the second millennium. I. Introduction, history, biographical sketches and Omaliine Group. Bulletin of the American Museum of Natural History, 265: p.1-4218.
- Hockey, P.A.R., Dean, W.R.J., Ryan, P.G. (eds). 2005. Roberts Birds of Southern Africa, 7th Edition. The Trustees of the John Voelcker Bird Book Fund, Cape Town.
- Holm, E. 1978. Monograph of the genus Acmaeodera Eschscholtz (Coleoptera: Buprestidae) of Africa south of the Sahara. Entomology Memoirs, Department of Agriculture, Republic of South Africa, 47: p.1-210.
- Holm, E. & Gussmann, S.M.V. 1992. Revision of the genus Sternocera Eschscholtz of Africa (Coleoptera: Buprestidae). Entomology Memoirs, Department of Agriculture, Republic of South Africa, 85: p.1-84.
- Holm, E. & Marais, E. 1992. Fruit chafers of southern Africa (Scarabaeidae: Cetoniini). Hartebeespoort: Ekogilde.
- Irish, J. 2010. Specialist study: supplementary work on invertebrates, reptiles and amphibians of Omitiomire area. Unpublished report to Craton, via ASEC.
- Irish, J. 2011. Desktop study of potential invertebrate occurrence in the Otjozondu study area. Unpublished report for AWR.
- IUCN 2010. IUCN Red Data List of Species, Categories and Criteria, Version 2010.4. Available at www.iucnredlist.org.
- IUCN. 2001. Red Data List of Species, Categories and Criteria, Version 3.1. Available at http://www.iucnredlist.org/apps/redlist/static/categories_criteria_3_1#categories.

- IUCN. 2005. Guidelines for using the IUCN Red List Categories and Criteria. Prepared by the IUCN Standards and Petitions Subcommittee of the IUCN SSC Red List Programme Committee.
- IUCN. 2008. Red List (2008). Available at http://www.iucnredlist.org/details/7960/0.
- Jarvis, A, Robertson, T. 1999a. Namibia's inland endemics. Africa – Birds & Birding, 4, 50 – 56.
- Karny, H. 1910. Orthoptera (s. str.). Denkschriften der Medizinisch-naturwissenschaftlichen Gesellschaftzu Jena, 16: p.35-90.
- Kurahashi, H. & Kirk-Spriggs, A.H. 2006. The Calliphoridae of Namibia (Diptera: Oestroidea). Zootaxa, 1322: p.1-131.
- La Greca, M. 1990. Il genere AcrotylusFieb. (Insecta, Orthoptera, Acrididae) in Namibia, e riesame del gruppo di specie insubricus-fischeri-patruelis-somaliensis. Animalia (Catania), 17: p.153-188.
- La Greca, M. & Messina, A. 1989. Le specie di AcanthoplusStål 1873 della Namibia e lorovariabilita' intraspecifica (Insecta, Orthoptera, Hetrodidae). Animalia (Catania), 16: p.5-19.
- Lamoral, B.H. 1979. The scorpions of Namibia (Arachnida: Scorpionida). Annals of the Natal Museum, 23(3): p.497-784.
- Lawrence, R.F. 1975. The Chilopoda of South West Africa. Cimbebasia, (A)4: p.35-45.
- Londt, J.G.H. 1987. Afrotropical Asilidae (Diptera) 14. The genus Neolophonotus Engel, 1925. Part 3. The pellitus species-group (Asilinae: Asilini). Annals of the Natal Museum, 28(2): p.383-454.
- Londt, J.G.H. 1993. Afrotropical Asilidae (Diptera) 23. The genera Connomyia Londt, 1992 and Danomyia gen. n. (Stenopogoninae). Annals of the Natal Museum, 34(1): p.103-151.
- Londt, J.G.H. 2007. A review of the genus Hoplistomerus Macquart, 1838 (Diptera: Asilidae: Laphriinae). African Invertebrates, 48(2): p.167-198.
- Loots, S. 2005. Red data book of Namibian Plants. Southern African Botanical Diversity Network Report No. 38, 154 pp.
- Louw, S. 1979. A partial revision of the subtribes Oxurina and Hypomelina (Coleoptera: Tenebrionidae: Molurini). Cimbebasia, (A)5: p.95-177.
- Louw, S. 1986. Revision of the Microcerinae (Coleoptera: Curculionidae) with an analysis of their phylogeny and zoogeography. Memoirs of the National Museum, Bloemfontein, 21: p.1-331.
- Maggs, G.L., Craven, P. , Kolberg, H. 1998. Plant species richness, endemism, and genetic resources in Namibia. Biodiversity and Conservation, 7, 435–446.

- Mannheimer, C.A. & Curtis, B.A. 2009. Le Roux and Müller's field guide to the trees and shrubs of Namibia. Macmillan Education Namibia, Windhoek, 525 pp.
- Mansell, M.W. 1987. The ant-lions of southern Africa (Neuroptera: Myrmeleontidae): genus Cymothales Gerstaecker, including extralimital species. Systematic Entomology, 12: p.181-219.
- Marais, E. & Holm, E. 1989. Synonymic notes on the African Cetoniinae IV: Genus Elaphinis Burmeister (including Micrelaphinis Schoch and a new genus) (Coleoptera, Scarabaeidae). Cimbebasia, 11: p.19-32.
- Mendelsohn, J., Jarvis, A., Roberts, C., & Robertson, T. 2002. Atlas of Namibia. Sunbird Publishers.
- Milton, S.J. & Dean, W.R.J. 1995. How useful is the keystone species concept, and can it be applied to Acacia erioloba in the Kalahari Desert? ZeitschriftfürÖkologie und Naturschutz, 4: p.147-156.
- Munting, J. 1969. Observations on some armoured scale insects (Homoptera: Coccoidea: Diaspididae) from South West Africa and neighbouring territories. Cimbebasia, (A)1: p.115-161.
- NaBiD 2011. Namibian Biodiversity Database Web Site. Available at: http://www.biodiversity.org.na/index.php [Accessed October 31, 2011].
- National Herbarium of Namibia (WIND). 2009. SPMNDB Database. National Herbarium of Namibia (WIND), National Botanical Research Institute, MAWF, Windhoek, Namibia.
- Penrith, M.-L. 1977. The Zophosini (Coleoptera: Tenebrionidae) of western southern Africa. Cimbebasia Memoir, 3: p.1-291.
- Penrith, M.-L. 1979. Revision of the western Southern African Adesmiini (Coleoptera: Tenebrionidae). Cimbebasia, (A)5(1): p.1-94.
- Penrith, M.-L. &Endrödy-Younga, S. 1994. Revision of the subtribe Cryptochilina (Coleoptera: Tenebrionidae: Cryptochilini). Transvaal Museum Monographs, 9: p.1-144.
- Péringuey, L. 1907. Catalogue of the Coleoptera of South Africa [part]. Transactions of the South African Philosophical Society, 13: p.289-546.
- Ruelle, J.E., Coaton, W.G.H. &Sheasby, J.L. 1975. National Survey of the Isoptera of Southern Africa. 8. The genus Macrotermes Holmgren (Termitidae: Macrotermitinae). Cimbebasia, (A) 3(8): p.73-94.
- SABIF 2012. South African Biodiversity Information Facility Portal. Available at: http://www.sabif.ac.za/ [Accessed October 31, 2011; January 7, 2012].
- Scholtz, C.H. 1980. Monograph of the genus Trox F. (Coleoptera: Trogidae) of Subsaharan Africa. Cimbebasia Memoir, 4: p.1-104.
- Simmons, RE, Griffin, M, Griffin RE, Marais, E and Kolberg H. 1998. Endemism in Namibia: patterns, processes and predictions. Biodiversity and Conservation 7:513-530.

- Skinner, J.D., Chimimba, C.T. 2005. The mammals of the southern African subregion. Cambridge University Press, Cambridge.

- Suhling, F. & Martens, A. 2007. Dragonflies and damselflies of Namibia. Windhoek: Gamsberg Macmillan.
- Van Eck, J. 2007. MAN Müller grasses of Namibia. National Botanical Research Institute, Ministry of Agriculture, Water & Forestry, 317 pp.
- Van Oudshoorn, F. 2009. Guide to grasses of southern Africa. Briza Publications, Pretoria, 288 pp.
- Van Wyk, A.E., Smith, G.F. 2001. Regions of Floristic Endemism in Southern Africa. Umdaus Press, Hatfield.
- Wharton, R.A. 1981. Namibian Solifugae (Arachnida). Cimbebasia Memoir, 5: p.1-87.
- Wygodzinsky, P. 1970. Thysanura associated with termites in southern Africa (Insecta). Bulletin of the American Museum of Natural History, 142(3): p.213-254.
- Zumpt, F. 1961. The Arthropod parasites of Vertebrates in Africa South of the Sahara (Ethiopian Region). Volume I (Chelicerata). Publications of the South African Institute for Medical Research, No. 1 (Vol. 9): p.1-457.

GCS: Otjozondu Hydrogeological Investigation, Phase 3: Groundwater Impact Assessment (March 2012)

References Utilised for Hydrogeological Investigation: (Alphabetical Order)

- Chiang W.H. and Kinzelbach W.,1994, PMPATH. An advective transport model for Processing Modflow and Modflow. Geological Survey of Hamburg, Germany.
- Christelis, G. and Struckmeier, W., 2011. Groundwater in Namibia: an explanation to the Hydrogeological Map. Ministry of Agriculture, Water and Rural Development, Namibia.
- Fetter, C W. 2001. Applied Hydrogeology 4th Ed. Englewood Cliffs, NJ : Prentice Hall, 2001.
- GCS, 2011a, Hydrological Baseline Assessment and Conceptual Stormwater Management Plan, Otjozondu Mining (Pty) Ltd , Project no. 11-426
- GCS, 2011b, Otjozondu Hydrogeological Investigation: Phase 1 final draft, Project no. 11-314
- GCS, 2011c, Otjozondu Hydrogeological Investigation: Phase 2 final draft, Project no. 11-314
- Harbaugh A.W., 2005, MODFLOW-2005, the U.S. Geological Survey modular groundwater model – the Ground-Water Flow Process: U.S. Geological Survey Techniques and Methods 6-A16.

- Otjozondu Mining Pty Ltd, 2011, General geological info
- Simcore Software, 2011, Processing Modflow, version 8.0.16
- Van Wyk, 2011. Characteristics of Local Rainwater-Groundwater Interactions in Semi-Arid Hard Rock Terrains. Paper presented at the International Conference of the Groundwater Division of the Geological Society of South Africa, September 2011, Pretoria, South Africa.

GCS: Hydrological Baseline Assessment and Conceptual Stormwater Management Plan (November 2011)

References Utilised for Hydrological Investigation: (Alphabetical Order)

- Department of Water Affairs and Forestry, 1996. South African Water Quality Guidelines (second edition), Volume 1: Domestic Water Use.
- Kunz, R. (2004), Daily rainfall data extraction utility, ICFR in conjunction with BEEH, KwaZulu-Natal, South Africa.
- Hydrological Research Unit, (1978), A Depth Duration Frequency Diagram for Point Rainfall in Southern Africa. Report 2/78. University of Witwatersrand. Johannesburg.
- Hughes, D.A. and Sami, K. (1994) Transmission losses to alluvium and associated moisture dynamics in a semiarid ephemeral channel system in southern Africa. Hydrol. Processes, 6, 45-53.
- McKenzie, R.S., Roth, C. and Stoffberg, F. (1993) Orange River losses. In: Sixth South African National Hydrological Symposium (September 1993, Pietermaritzburg, South Africa), 351-358.
- Mostert, A. C., McKenzie, R. S. and Crerar, S. E. (1993), A rainfall/runoff model for ephemeral rivers in an arid or semiarid environment. In: Sixth South African National Hydrological Symposium (September 1993, Pietermaritzburg, South Africa), 219-224.
- Midgley, D.C., Pitman, V.W. and Middleton B.J. (1994), Surface Water Resources of South Africa. WRC Report No. 298/1/94.
- Pitman, V.W., 1973, A mathematical model for generating monthly river flows from meteorological data in South Africa. Report No. 2/73, Hydrological Research Unit, Univ. of the Witwatersrand.
- Pitman,V.W., Bailey, A.K., and Kakebeeke, J.P. (2000), The monthly WRSM2000 model.

National Environmental Health Consultants Cc (NEHC): Baseline Environmental Noise Assessment Report (October 2011)

References Utilised for Noise Investigation: (Alphabetical Order)

- Guidelines for Community Noise, World Health Organization, Geneva, 1999.
- SANS 10103:2008 'The measurement and rating of environmental noise with respect to annoyance and to speech communication', Edition 6.
- SANS 10357:2004 'The calculation of sound propagation by the "Concave method". Edition 1.2.
- Scoping Report Version 1 September 2011: Otjozondu Mining (Pty) Ltd

Tony Barbour: Environmental Consulting And Research: Impact Assessment For Otjozondu Mine, Otjozondjupa Region Namibia (November 2011)

References Utilised for Social Investigation: (Alphabetical Order)

- Barbour, A.H. 2007. Guideline for undertaking Social Impact Assessment in the EIA processes: Republic of South Africa, Provincial Government of the Western Cape, Department of Environmental Affairs & Development Planning, Cape Town, South Africa.
- Central Bureau of Statistics Namibia (CBS). 2006. Income and Expenditure Survey 2003/2004. CBS, Windhoek.
- Namibia Household Income & Expenditure Survey (NHIES) (2003/2004).
- National Planning Commission of Namibia (NPC). 2007. Preliminary National Accounts 2006. NPC, Windhoek; Directorate of Extension and Engineering Services Grootfontein, November 2003).

9.2 References – General Report

- AFRICAN WILDERNESS RESTORATION [AWR]. 2011. Otjozondu Manganese Project: Scoping the biodiversity baseline study requirements.
- CENTRAL BUREAU OF STATISTICS [CBS]. 2006. Population Projections. [Web:] http://www.npc.gov.na/publications/census_data/2001_Population_projections_Report.pdf [Date of access: 17 August 2011].
- CHRISTELIS, G. & STRUCKMEIER, W., 2011. Groundwater in Namibia: an explanation to the Hydrogeological Map. Ministry of Agriculture, Water and Rural Development, Namibia.
- DEPARTMENT OF WATER AFFAIRS [DWA]. 2011. Groundwater in Namibia: An Explanation to the Hydrogeological Map. Government Press : Windhoek.
- DIGITAL ATLAS OF NAMIBIA. 2002. [Web:] http://www.uni-koeln.de/sfb389/e/e1/download/atlas_namibia/index_e.htm [Date of access: 12 August 2011].

- ENVIROSOLUTIONS. 2007. Environmental Impact Assessment for the Envisaged Manganese Mining and Processing Plant Between Otjozondu and Okondjatu.

- GCS. 2011. Otjozondu Hydrogeological Investigation.
- GEOLOGICAL SURVEY OF NAMIBIA. 20002. Generalised geological map of Namibia. [Web:] http://www.gsn.gov.na/mapping.htm [Date of access: 15 August 2011].
- MAPS OF THE WORLD [MOW]. 2011. Namibia Topography. [Web:] http://mapsof.net/namibia/static-maps/png/namibia-topography [Date of access: 12 August 2011].
- MENDELSOHN, J. 2006. Farming Systems in Namibia. [Web:] http://www.met.gov.na [Date of access: 9 August 2011].
- MERKEL, B. 2004. Hydrogeology and Environmental Geology. [Web:] http://www.geo.tu-freiberg.de/studenten/namibia/namex_hp/hydrogeologie.htm [Date of use: 12 August 2011].
- MILLENNIUM CHALLENGE ACCOUNTS [MCA]. 2006. Millennium Challenge Accounts - Namibia. Government Press : Windhoek.
- MINISTRY OF ENVIRONMENT AND TOURISM [MET]. 2008. Climate Change Vulnerability and Adaptation Assessment Namibia. [Web:] http://www.met.gov.na [Date of access: 9 August 2011].
- MINISTRY OF GENDER EQUALITY AND CHILD WELFARE. 2007. Gender Action Plan for Local Authorities in the Otjozondjupa and Oshikoto Regions. [Web:] http://www.alan.org.na/files/09641_gender_action_plan_otjozondjupaoshikoto_st_0608.pdf [Date of access: 17 August 2011].
- UNIVERSITY OF NAMIBIA [UNAM]. 2008. Research on Farming Systems Change to Enable Adaptation to Climate Change. [Web:] http://www.met.gov.na [Date of access: 9 August 2011].

9.3 Register of Legislation

9.3.1 Namibia

- Atmospheric Pollution Prevention Ordinance, No. 11 of 1976
- Constitution of the Republic of Namibia, 1990
- Environmental Management Act, No. 7 of 2007
- Forest Act, No. 12 of 2001
- Minerals (Prospecting and Mining) Act, No. 33 of 1992
- Nature Conservation Ordinance, No. 4 of 1975
- Petroleum Products and Energy Amendment Act, No. 3 of 2000
- Pollution Control and Waste Management Bill, 1999

- Soil Conservation Act, No. 76 of 1969
- Water Act, No. 54 of 1956
- Water Resources Management Act, No. 24 of 2004

9.3.2 South Africa

- National Environmental Management Act, No. 107 of 1998

9.3.3 International

- Agenda 21, 1992
- Convention on Biological Diversity, 1992
- Kyoto Protocol, 1997
- Southern African Development Community Protocol on Forestry, 2002
- Southern African Development Community Protocol in Mining, 1997
- Southern African Development Community Protocol in Transport, 1996
- United Nations Conference on the Human Environment, 1972
- United Nations Framework Convention on Climate Change, 1992

9.4 REGISTER OF GOVERNMENT PUBLICATIONS

9.4.1 Namibia

- Environmental Assessment Policy for Sustainable Development and Environmental Conservation, 1995
- Environmental Assessment Regulations and Notice on the Listing of Activities in terms of the Environmental Management Act, 2007 in GG.
- Declaration of South-West Africa as a Controlled Area for the purposes of section 4(1)(a) of the Atmospheric Pollution Prevention Ordinance 11 of 1976 GN 309 in GG 3571 of 1 November 1976
- Regulations for the health, safety and welfare of persons employed or otherwise present in or at mines GN 156 in GG 1617 of 1 August 1997

9.4.2 South Africa

- Regulations in Terms of Chapter 5 of the National Environmental Management Act, 1998 GNR 385 in GG 28753 of 21 April 2006
- List of Activities and Competent Authorities Identified in terms of Sections 24 and 24D of the National Environmental Management Act, 1998 GNR 386 in GG 28753 of 21 April 2006

- List of Activities and Competent Authorities Identified in terms of Sections 24 and 24D of the National Environmental Management Act, 1998 GNR 387 in GG 28753 of 21 April 2006