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Ref: NCS 30/5/1/2/3/2/1(522)MR

23 February 2011

All waiting

REGISTERED MAIL

The Director
SAHRA
P O Box 4637
CAPE TOWN
8000

CONSULTATION IN TERMS OF SECTION 40 OF THE MINERAL AND PETROLEUM RESOURCES DEVELOPMENT ACT, 2002 (ACT 28 OF 2002) FOR THE APPROVAL OF THE AMENDMENT TO THE APPROVED ENVIRONMENTAL MANAGEMENT PROGRAMME IN RESPECT OF THE FARMS SOMNAAS NO 474, KOINGNAAS NO 475, SWARTLINTJIESRIVIER NO 484, LANGKLIP NO 489, MICHELL'S BAY NO 495 ADMINISTRATIVE DISTRICT: NAMAQUALAND

APPLICANT: DE BEERS CONSOLIDATED MINES – NAMAQUALAND (KOINGNAAS RIGHT)

1. Attached herewith, please find a copy of the Amendment to the approved Environmental Management Programme to the received from the above-mentioned applicant, for your comments.
2. It would be appreciated if you could forward any written comments or requirements your department may have in the case in hand to this office on or before **30 May 2011.**
3. Consultation in this regard has also been initiated with other relevant Sate departments.
4. Your co-operation will be appreciated.

SA HERITAGE RESOURCES AGENCY
RECEIVED
25 FEB 2011

Yours faithfully

REGIONAL MANAGER: MINERAL REGULATION
NORTHERN CAPE REGION

REPORT

January 2011

DE BEERS CONSOLIDATED MINES LIMITED, NAMAQUALAND MINES

Amended Environmental Management Programme for the Koingnaas Right

Submitted to:
De Beers Consolidated Mines Limited, Namaqualand Mines
Private Bag X01
Kleinsee
8282

Report Number. 12888-10329-7

Distribution:

2 copies - De Beers Consolidated Mines Limited, Namaqualand Mines
1 copy - Golder Associates Africa (Pty) Ltd

DE BEERS
A DIAMOND IS FOREVER

NAMAQUALAND MINES

Golder Associates

Executive Summary

This document is part of a suite of documents comprising:

1) De Beers Consolidated Mines Limited – Namaqualand Mines: Amended Environmental Management Programme for the Buffels Marine Right, Golder Report no. 12888-10333-9;

2) De Beers Consolidated Mines Limited – Namaqualand Mines: Amended Environmental Management Programme for the Buffels Inland Right, Golder Report no. 12888-10334-10;

3) De Beers Consolidated Mines Limited – Namaqualand Mines: Amended Environmental Management Programme for the Dikgat Right, Golder Report no. 12888-10335-11;

4) De Beers Consolidated Mines Limited – Namaqualand Mines: Amended Environmental Management Programme for the Brand-se-Baai Right, Golder Report no. 12888-103331-8;

5) De Beers Consolidated Mines Limited – Namaqualand Mines: Amended Environmental Management Programme for the Samson's Bak Right, Golder Report no. 12888-10336-12;

6) **De Beers Consolidated Mines Limited – Namaqualand Mines: Amended Environmental Management Programme for the Koingnaas Right, Golder Report no. 12888-10329-7**;

7) The document has been compiled on behalf of De Beers Consolidated Mines Limited, Namaqualand Mines, by Golder Associates. The document was solely compiled from information obtained from De Beers and comprises a desktop consolidation of this information.

INTRODUCTION

De Beers Consolidated Mines Limited - Namaqualand Mines' (Namaqualand Mines) mining licence covers approximately 97 000 ha of alluvial diamond area within the Namakwa District Municipality, along South Africa's west coast. The areas assigned to prospecting amounts to more than double this mining area.

Mining operations are currently divided into six active mining areas, where open pit mining methods are used to expose the diamond-bearing alluvial gravels that lie beneath varying depths of overburden. Alluvial diamonds, most of which are of gemstone quality, are recovered from the mining areas.

The Namaqualand Mines Strategic Business Plan indicates a resumption of production activities in 2012 resulting in an expected life of mine until 2023. The mine is constantly investigating new operating models to lower the costs of production and this could extend the remaining operational life of the mine. Towards this end, an expression of interest has been issued to interested parties to purchase the mine from DBCM. Concurrent with the present operations, the reclamation of disturbed areas is also conducted towards decommissioning and eventual closure.

In order to change the way in which the mine is managed, historically De Beers-owned services such as the recreational club, shop and guesthouses have been or are in the process of being privatised. In addition, both Kleinsee and Koingnaas are in the process of being proclaimed as 'open towns' (as opposed to De Beers-owned private mining settlements). Moreover, other measures are also being investigated by De Beers and other parties to be put in place to contribute to sustainable development once the mine's contribution to the local socio-economic status reduces and eventually ceases.

In order to facilitate the above development, areas disturbed by mining need to be reclaimed. Areas have been identified for reclamation and are being rehabilitated and restored. These areas are profiled to a slope which depends on the specific soil conditions. After the earthmoving is completed and an area is sloped, ecological restoration takes place based on specifications set out by a specialist ecologist contracted to the mine. These specifications include a combination of activities based on the surrounding ecology and the soil conditions on site. Restoration nets are set up to minimise the effects of wind erosion and help stabilise the soil for re-establishment of the natural vegetation. The re-establishment of natural vegetation is done

through the use of a combination of various methods (including restoration packs, transplants and broadcast seeding) as specified by the ecologist. These restoration methods and activities are documented and monitored to ensure compliance (See Appendix E – Rehabilitation and Restoration Procedure – NM PR26 SHHE).

Brief description of the Koingnaas Right

The Koingnaas Right (KNR), one of the six active mining areas comprising Namaqualand Mines, is located along the west coast south of the mining town of Kleinsee to just north of Michell's Bay. It includes the mining town of Koingnaas, from where the mine is operated. The KNR covers an area of approximately 12 606 ha.

Mining Licence ML 2/2003 for the KNR encompasses all or portions of the following farms:

- Somnaas 474;
- Koingnaas 475;
- Swartlintjesrivier 484;
- Langklip 489;
- Michell's Bay 495; and
- Adjacent sea strips as defined in the Notarial Lease agreement.
- The farms Somnaas 474 and Koingnaas 475 are shared by the KNR and Samson's Bak Complex (SBC) mining areas.

Run-of-mine (ROM) generated from the open pits within the KNR was treated through two beneficiation plants, namely at Michell's Bay and the central Koingnaas plant. The Koingnaas plant will be dismantled in 2011. Mining activities will resume with ore from KNR being treated through the Michell's Bay and Koingnaas Bulk Sample plants. The recovery plant located in the BMC is used for final recovery from all the Namaqualand Mines areas.

The accompanying locality map (Figure 1)) shows the positioning of the components of the KNR, as well as the situation of the KNR within the overall Namaqualand Mines mining area.

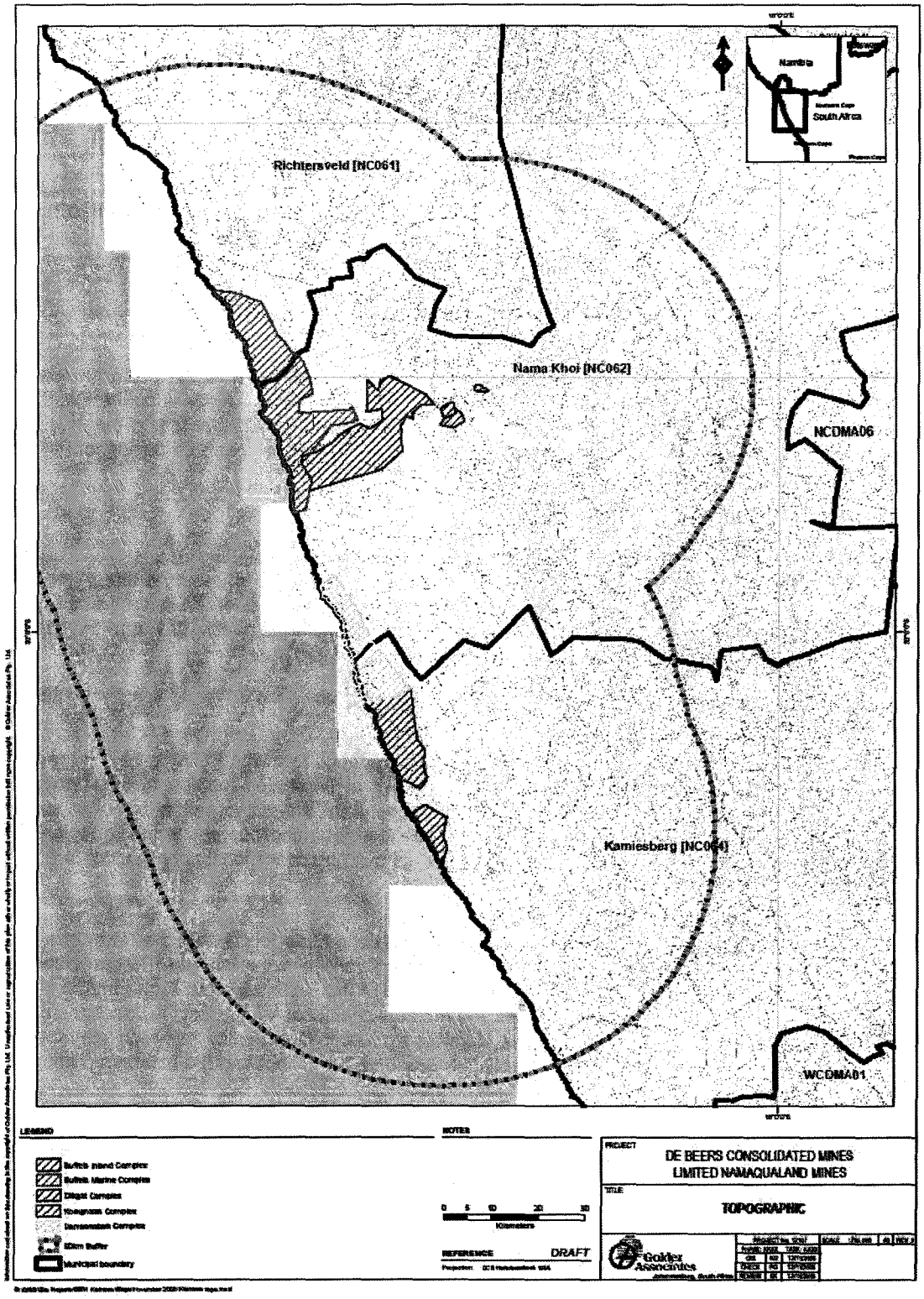

Figure 1:KNR within the Namaqualand Mines Area

ENVIRONMENTAL CONTEXT

The following summary is taken from the State of Environment Report for NM.

Water Resources

Surface water

The mine Rights making up the Namaqualand Mine fall within the quaternary drainage regions F20D, F20E, F30G, F30F, F40A, F40D, F40F, F40H, F50G and F60A as part of the Coastal sub-catchment of the Lower Orange Water Management Area (WMA). The Lower Orange WMA is the lowest WMA in the Orange River Basin and as such is affected by upstream activities. The area is arid with rainfall varying from 400 mm in the east to 50 mm on the west coast. The topography of the area is flat with large pans or endoergic areas that do not contribute runoff to the Orange River system.

The balance of surface water is stored in farm dams and reservoirs; groundwater is pumped from boreholes into these storage facilities. Prominent episodic drainages in the regional study area include the Swartlintjes, Buffels, Groen and Spoeg rivers. Wetlands in the area include the estuaries at the mouth of the Swartlintjes River, the lower part of the Groen River, the Buffels River, and various pans scattered throughout the area which contain water periodically.

Groundwater

Two distinct aquifers occur in the region, namely the Buffels and Somnaas-Noup aquifers. Conservative estimates of capacity and recharge conclude that the Somnaas-Noup aquifer is under no threat and that in fact may be suitable for increased exploitation. At present about one-third of Kleinsee's freshwater is obtained from subterranean flow in the Buffels River. Sandy sediments in the river valley form the extensive Buffels aquifer that is periodically recharged by rainfall over the catchment area.

Locally the groundwater flow is not well defined, however some local flow moves from the watersheds towards the Buffels River.

In Kleinsee water supplies are supplemented by groundwater pumped from the Fellman well in the Buffels River bed. Koingnaas' freshwater supply comes from a series of boreholes tapping the Somnaas-Noup aquifer which lies about 12 km north of the town. Upon request from the district authority, water supply to Hondeklip Bay from the Somnaas-Noup Aquifer has commenced. Farming operations in the region obtain groundwater from boreholes; most farms in the region have at least one operational borehole.

Social Environment

Situated on the north-west coast of South Africa, the Namaqualand Mine falls within the Namakwa District Municipality jurisdiction; which consists of three local municipalities, namely the Nama Khoi Local Municipality in which the Buffels Inland Right, southern portion of the Buffels Marine Right, northern portion of the Samsonsbak Right and the Dikgat Right fall, the Richtersveld Local Municipality in which the northern portion of the Buffels Marine Right lies and the Kamiesberg Local Municipality in which the Koingnaas (Koingnaas and Michell's Bay) Right, Groen River Right, Brand se Baai Right and the southern portion of the Samsonsbak Right fall.

The 50 km study area radius around the mining Rights includes three local municipalities situated in the Northern Cape, as well as two municipalities situated in the Western Cape namely Matzikama Local Municipality and the WCDMA01 District Management Area. A fraction of the Matzikama Local Municipality is affected and the WCDMA01 District Management Area does not include any major settlements, the focus of the social environment study was undertaken on the three local municipalities situated within the Namakwa District Municipality of the Northern Cape.

The effects of down-scaling of mines are driving population growth in both positive and negative directions. Retrenched mine workers from other areas are returning home, contributing to the population growth in the area. However, the down-scaling of mines may also drive an outflow of the population to a larger degree as

time progresses, with skilled mine workers expected to leave for urban areas to seek employment opportunities.

Economic Environment

The Namakwa District Municipality is faced with a declining economy in all sectors and the downscaling of mining activities, resulting in increased pressure on the employment sector. Capital investment in the economy is needed, but is not financially possible for municipalities. The major constraints to economic development in the Namakwa District Municipality includes the loss of skilled and educated workers to other areas, maintenance of infrastructure, lack of accessibility to funds, lack of secondary industries and no organised business sector. The major driving factors of the economy within the Namakwa District Municipality are government services and the retail and services industry, following the decline of mining as the predominant sector. The tourism sector may provide support to economic development in the greater area through projects such as: ecotourism, proposed marine aquaculture ventures, energy generation initiatives, however these initiatives suffer under the limited capacity of the Namakwa District municipality to serve as an institution that will drive a strategic agenda to improve the primary sectors of the economy (most likely due to limited capacity and funding). The disrepair of municipal infrastructure and the disrepair of the road network also contribute to the weakening local economy.

Ecological Environment

The Namaqualand Mine Rights forms part of the Succulent Karoo Biome. According to SANBI, the majority of the area is Veld Type SKs7 (Namaqualand Strandveld) and SKs8 (Namaqualand Coastal Duneveld) with small portions being Type SKs11 (Namaqualand Arid Grassland), SKn4 (Namaqualand Heuweltjieveld), SKs10 (Riethuis-Wallekraal Quartz Vygieveld) and FFd1 (Namaqualand Sand Fynbos).

The terrain varies from coastal sandy flats to mountain ranges of varying geological strata. The rainfall in Namaqualand, although low is reliable and this is the fundamental explanation for its diversity of leaf succulents, bulbs and high numbers of succulents. A special feature of the area is the high degree of endemism due to adaptation to very specific habitats. As a result, there are many species found in the Succulent Karoo that are not found anywhere else in the world.

The area is impacted by small scale agricultural activities as well as the development of infrastructure for mining. Agricultural activities which are associated with this area commonly include game and livestock farming; intensive crop production is costly and uncommon as a result of the low fertility of the soil, harshness of the climate and low rainfall which the area experiences.

Four distinct conservation areas currently occur in the region, namely; Namaqua and Richtersveld National Parks, as well as the Goegap and Kleinsee Nature Reserves.

Tourism

The growth in tourism ensures that visitors to the Northern Cape have a wide range of specialist travel agents and tour operators to choose from. Travel agents include large international companies down to smaller specialist agents who package everything from extreme adventure excursions, to game capture experiences, to heritage and cultural tours. The area has a rich heritage of diverse people, cultures and traditions, many of which still survive today.

A large attraction to the area is in the form of wild life and conservation areas. The region has a number of national parks and nature reserves. De Beers have created tourism initiatives whereby areas are promoted as tourism routes, e.g. Diamond Coast Tourism, which include hiking and 4x4 trails and mining tours.

Cultural resources

An archaeological site survey conducted as part of the Environmental Management Programmes applicable to the mining rights, revealed 38 coastal or shoreline shell middens of varying sizes and densities occurring within the various mining rights. Most of these were determined to be of medium to high significance, and one site was found to be very highly significant. Two formal cemeteries are documented, both of which carry

high significance. Within the study area there are multiple heritage sites of national importance, ranging from memorials, to graves and cultural sites.

Land Use & Infrastructure

The concentration of people living within the Namakwa District Municipality is due largely to the mining of diamonds in the area. The two towns of Kleinsee and Koingnaas are both currently under proclamation application and therefore would no longer be De Beers owned towns. Farming in the area has always been severely limited as a result of the low rainfall. Livestock farming is practiced in certain sectors however the major land use lends itself to that of conservation areas being established.

Land reform through the redistribution of land to previously disadvantaged communities and individuals poses threats to the environment, particularly through the sub-division of available land, change of land use and associated impacts, waste management and sewerage in settlement projects.

MINING CONTEXT

Mining operations involved the opening of mining excavations, within areas identified by prospecting and bulk sampling as having exploitable potential. Concurrent surface reclamation of the mined opencast pits is conducted as far as possible, but due to the fact that bedrock exposure and sweeping is required to recover the ore, reclamation of opencast pits takes place when mining is completed. As a result a number of opencast pits with exposed bedrock are awaiting reclamation. These as well as other factors have resulted in a notable surface reclamation backlog.

As mining in the area gradually proceeds towards closure, mining operations are accordingly being scaled down. However, operations still involve bulk sampling, prospecting, mining and ore treatment.

CLOSURE CONTEXT

A Preliminary Mine Closure Plan for NM was developed during 2010, which incorporates the Base Case Land Use Plan, the State of Environment Report, the Rapid Strategic Environmental Assessment and the Screening Level Environmental Risk Assessment. Six proposed land use zones have been identified for the entire NM area. These are described in Table 1:

Table 1: Description of the identified land use zones for Namaqualand Mines

Land use zone		Description
Zone	**Name**	
Zone 1	Core conservation areas	■ Areas required to sustain biological processes such as river corridors, dune systems and aquifers; ■ Areas of high biodiversity value, including rare and/or endangered habitats and endemic species; ■ All undisturbed natural areas; and ■ Heritage resources, historic buildings, sites, burial grounds and archaeological; and palaeontological sites.
Zone 2	Secondary conservation areas	■ Previously mined areas being restored; and ■ Previously, current and future mined areas to be restored.
Zone 3	Tourism areas	■ Showcase the natural resources and landscape, mining and its legacy, new industries and green living measures; ■ Support a variety of events; and ■ Minimise impacts on ecological processes

		and sensitive areas.
Zone 4	Commercial enterprises areas	■ Disturbed areas, particularly mined out areas, water logged pits and residue deposits, etc; and ■ Located where efficient access to pumped sea water can be achieved.
Zone 5	Settlements	■ Existing towns with infrastructure, in working condition; and ■ A variety of inter-related land uses and activities. These towns have been selected as feasible options for settlements in post-closure economy.
Zone 6	Farming / agricultural areas	■ Areas that are not connected via land ownership to mine rights or DBCM owned land; and ■ Areas that are already leased to adjacent farmers.

Various initiatives identified to close the mine in line with the planned land use are categorised into 7 focus areas, which are:

- Physical stability: Involves removing and/or stabilising surface infrastructure, unavoidable mining residues and open pits to facilitate the implementation of the planned land use;
- Environmental quality: Involves ensuring local environmental quality is not adversely affected by physical effects and chemical contamination arising from the mining areas as well as to sustain catchment yield post-closure;
- Health and safety: Involves limiting possible health and safety threats to humans and animals that would use the reclaimed mine areas as these areas enter the post closure phase;
- Land use/land capability: Involves re-instatement of suitable land capability over mining areas in line with the planned zoning for each area, and ensuring adequate safety measures to limit access to unavoidable mine residues and open pits;
- Aesthetic quality: Involves leaving each reclaimed mine area in an acceptable aesthetically pleasing state aligned to the respective planned land use;
- Biodiversity: Involves encouraging, where appropriate in terms of the planned land use, the re-establishment of native vegetation on reclaimed mine areas such that terrestrial and aquatic biodiversity can largely re-instate over time. A specific initiative is the creation and expansion of a wilderness area through the Namaqua Park (South African National Parks, Conservation International (CI) and De Beers);
- Social: Involves ensuring infrastructure transfer, measures and contributions made by the mine towards long term socio-economic benefit for the local communities are sustainable. In this regard, the following specific initiatives are underway:
  - The generation of renewable power through the establishment of wind farms;
  - The possible establishment of nuclear power stations on the farms Brazil and Schulpfontein, located between Kleinsee and Koingnaas;
  - The investigation of the extension of marine aquaculture businesses, such as the establishment of oyster, abalone and fin-fish farming (De Beers);

- Leveraging off other De Beers' tourism activities such as the Diamond Route and Diamond Coast: Forever Namaqualand initiatives;
- Transfer of mine-owned land portions currently leased to farmers; and
- Transfer of municipal infrastructure such as water supply, sewage works, roads and open space areas to the local municipality.

CONCLUSIONS

This document describes the closure and rehabilitation measures for mining activities, as well as providing initiatives for the eventual closure by 2023. This plan is based on the Preliminary Mine Closure Plan for Namaqualand Mines, 2010.

Closure measures stipulated in this EMP are intended to facilitate the establishment of planned future land uses envisaged for the mining area.

LIST OF ACRONYMS/ABBREVIATIONS AND DEFINITIONS

ADT	Articulated dump truck
BIR	Buffels Inland Right
BMR	Buffels Marine Right
BP	Before present
BSBR	Brand se Baai Right
cpht	carats per hundred tonnes
CRD	Coarse residue deposits
DGR	Dikgat Right
DWA	Department of Water Affairs
EMP	Environmental Management Programme
EMPR	Environmental Management Programme Report
FRD	Fine residue deposits
HDSA	Historically disadvantaged South African
KNR	Koingnaas Right
LOM	Life of mine
masl	metres above sea level
ML	Mining license
NHRA	National Heritage Resources Act
NM	Namaqualand Mines
ROM	Run of mine
SAHRA	South African Heritage Resources Agency
SBR	Samson's Bak Right

LIST OF DEFINITIONS

Reclamation	The re-instatement of an area into a usable state (not necessarily its pre-mining state), as defined by broad land use performance objectives.
Remediation	To assist in the reclamation process by enhancing the quality of an area through specific actions to improve especially bio-physical site conditions.
Rehabilitation	The return of a disturbed area to as close as possible to a virgin or pre-determined state.

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TABLES

FIGURES

APPENDICES

1.0 INTRODUCTION

This amended EMP is based on the following documents:

- Environmental Management Programme for the Koingnaas Right, January 2008;
- Namaqualand Mines Screening Level Environmental Risk Assessment to inform Mine Closure, August 2009;
- Namaqualand Mines Base Case Land Use Plan, June 2010;
- Preliminary Mine Closure Plan for Namaqualand Mines, August 2010;
- NM State of the Environment Report, August 2010; and
- DBCM- NM Strategic Business Plan 2010.

2.0 BRIEF PROJECT DESCRIPTION

Namaqualand Mines comprises a number of alluvial diamond activities owned and operated by De Beers Consolidated Mines Limited. Mining has been conducted since 1928 and NM is currently mining under six licences issued in terms of Section 9 of the Minerals Act, No 50 of 1991. The six old mining licenses have been converted to new mining rights, in terms of the Minerals and Petroleum Resources Development Act, Act No, 28 of 2002.

The mines are situated on the South African West Coast, and operations are run from the two mining towns of Kleinsee and Koingnaas, which are in the process of being proclaimed as public towns.

The current total mining license area is approximately 97 000 ha of which approximately 10 000 ha have been disturbed by mining. Mining operations are currently divided into six active mining areas of which the KNR is one, where various open pit mining methods are used to expose the diamond-bearing alluvial gravels that lie beneath varying depths of sandy overburden. The KNR is located along the west coast south of the mining town of Kleinsee to just north of Michell's Bay. (Table 2).

Current production rates for Namaqualand Mines are as documented in the NM- SBP.

2.1 Mine Details

Table 2 provides ownership and management details regarding Namaqualand Mine.

Table 2: Namaqualand Mine ownership and management details

MINE, MINE OWNER AND MINE MANAGER / RESPONSIBLE PERSON	
Name and address of mine	De Beers Consolidated Mines Limited **Namaqualand Mines** Private Bag X01 Kleinsee 8282 Tel: (027) 807 2001 Fax:(027) 807 2080
Mine and plant owner	De Beers Consolidated Mines Limited (Company Registration No. 11/00007/06)
Responsible person	Mr P Barton

MINERAL RIGHTS HOLDER	
Name and address	**De Beers Consolidated Mines Limited** Namaqualand Mines Private Bag X01 Kleinsee 8282
PROSPECTING PERMIT HOLDER	
Name and address	**De Beers Consolidated Mines Limited** Namaqualand Mines Private Bag X01 Kleinsee 8282
SURFACE RIGHTS AND TITLE DEED DESCRIPTION	
Surface rights	Surface rights for the KNR are owned by De Beers Consolidated Mines Limited. However, local farmers have grazing and servitude/cultivation rights over the above surface rights areas on some properties or portions of properties in terms of the registered servitudes.
Title deed description	The KNR (ML 2/2003) is located on all or portions of the farms listed below. These farming areas are owned by De Beers Consolidated Mines Limited - Namaqualand Mines. Somnaas 474* Koingnaas 475* Swartlintjesrivier 484 Langklip 489 Michell's Bay 495
SERVITUDES RELATED TO KOINGNAAS RIGHT(ML 2/2003)	
Presence of servitudes on farms comprising the mining area as per the above list	Access to the KNR is via gravel roads only with a 65 km private tarred road linking Koingnaas and Kleinsee. The most used roads are major secondary roads from Springbok to Kleinsee and Port Nolloth to Kleinsee. A 60 km private tar road links Koingnaas and Kleinsee. The closest rail end is located at Bitterfontein, approximately 180 km south of Springbok from where goods are transported by road further north. The Sishen-Saldhana railway line is located to the east of the Bitterfontein line. Eskom electricity is supplied to Namaqualand Mines from the national power grid via Upington, Aggeneys, Springbok and to a sub-station at Gromis, near Kleinsee. From this sub-station power is distributed within Namaqualand Mines and hence the KNR. Additional servitudes are for provincial roads and

	overland power lines. (Servitudes associated with the farm Somnaas 474 have not been used since De Beers Consolidated Mines Limited obtained exclusive ownership of the farm).

2.2 Regional Setting

2.2.1 Magisterial district and relevant regional services council authority

The mine is situated in the province of the Northern Cape, South Africa. Regionally, the mine falls under the jurisdiction of the Nama Khoi Municipality and the Namakwa District Municipality. The Koingnaas Right is operated from the town of Kleinsee situated 670 km north of Cape Town.

2.2.2 Location and neighbouring towns

The closest town to the KNR is Koingnaas, located within the complex's mining area, and approximately 65 km south of Kleinsee. Hondeklip Bay is situated in the middle of the KNR mining area, south of Koingnaas, with the Michell's Bay plant located approximately 20 km south of Hondeklip Bay. Koingnaas is linked to Kleinsee by approximately 60 km of privately-owned tar road. The closest major town is Springbok, some 100 km north-west of Koingnaas. Port Nolloth lies 120 km to the north of Koingnaas and has the Northern Cape Province's only harbour facility.

2.2.3 Roads, railway lines and power lines

Access to the Koingnaas Right is via gravel roads only. The most used roads are the secondary roads from Springbok to Kleinsee and Port Nolloth to Kleinsee. The road from Springbok to Kleinsee crosses this mining area. The Namakwa District Municipality maintains these roads.

A 60 km private tar road links Koingnaas and Kleinsee. Most of the roads in Kleinsee are tarred. A 40 km private gravel road, built and maintained by Namaqualand Mines, connects Kleinsee to Komaggas. The majority of roads lying to the west of the N7 are gravel or unsurfaced roads, and these roads range greatly in their state of repair and accessibility. In order to facilitate their mining activities in the region, De Beers have developed private roads in the area.

The closest rail end is located at Bitterfontein, approximately 180 km south of Springbok from where goods are transported by road further north. The Sishen-Saldhana railway line is located to the east of the Bitterfontein line.

Eskom electricity is supplied to Namaqualand Mines from the national power grid via Upington, Aggeneys and Springbok and to a sub-station at Gromis, near Kleinsee. From this sub-station, power is distributed within Namaqualand Mines.

2.2.4 Land tenure and adjacent land use

Other diamond mines are situated adjacent the KNR; the closest of these being situated inland in the Hondeklip Bay area (Figure 1).Diamond mining in the area is interspersed by extensive small stock farming. These farms tend to cover large areas due to the poor carrying capacity of the area. Consequently, farming homesteads are widely/infrequently spaced.

2.2.5 River catchment

The Namaqualand Mines Rights is located in the Lower Orange River Water Management Area, with the KNR within Swartlintjes River (F40D) and Spoeg River (F40F) quaternary catchments (Figure 2). The Swartlintjes River crosses the central portion of the KNR.

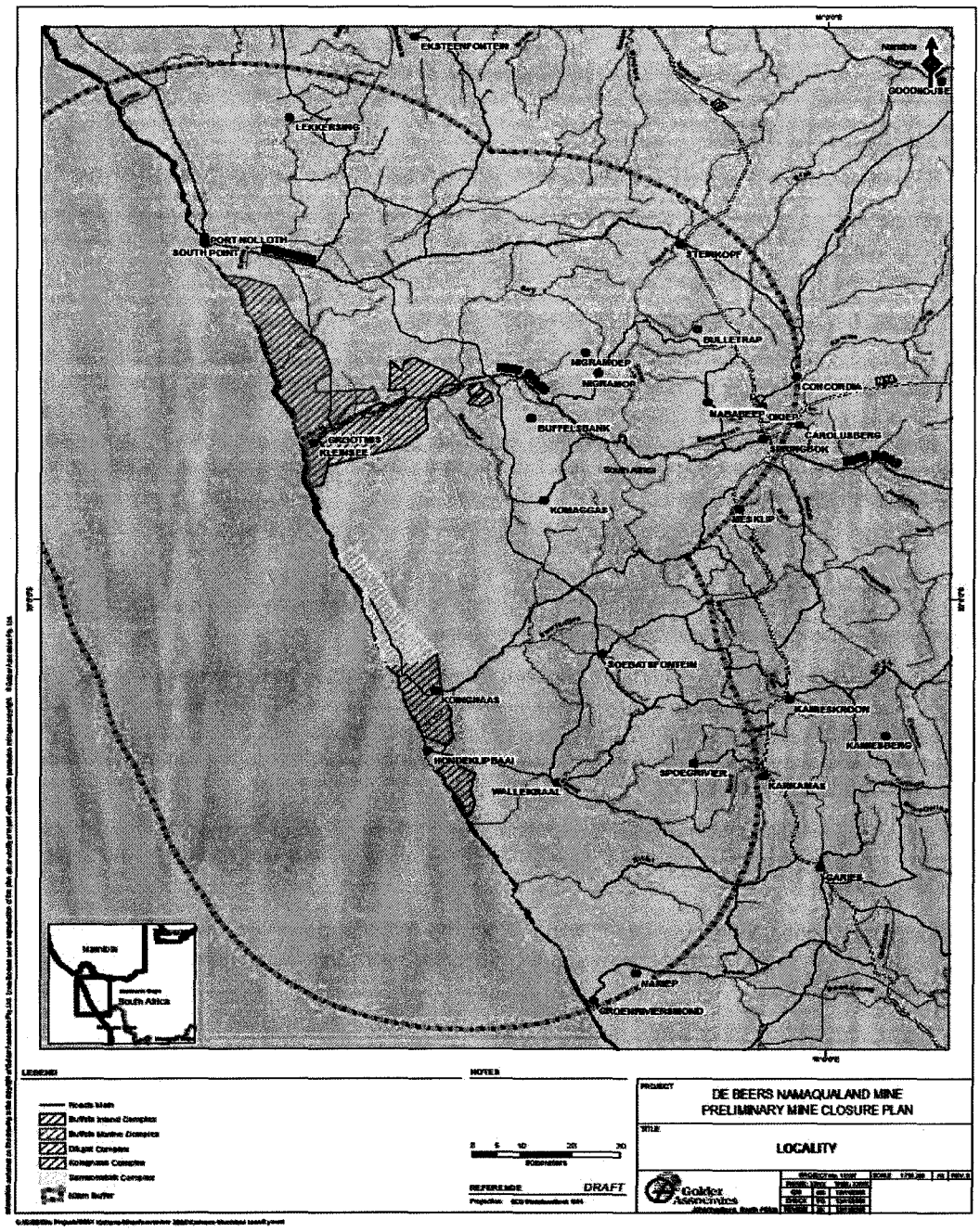

Figure 2: Location of Namaqualand Mines Right

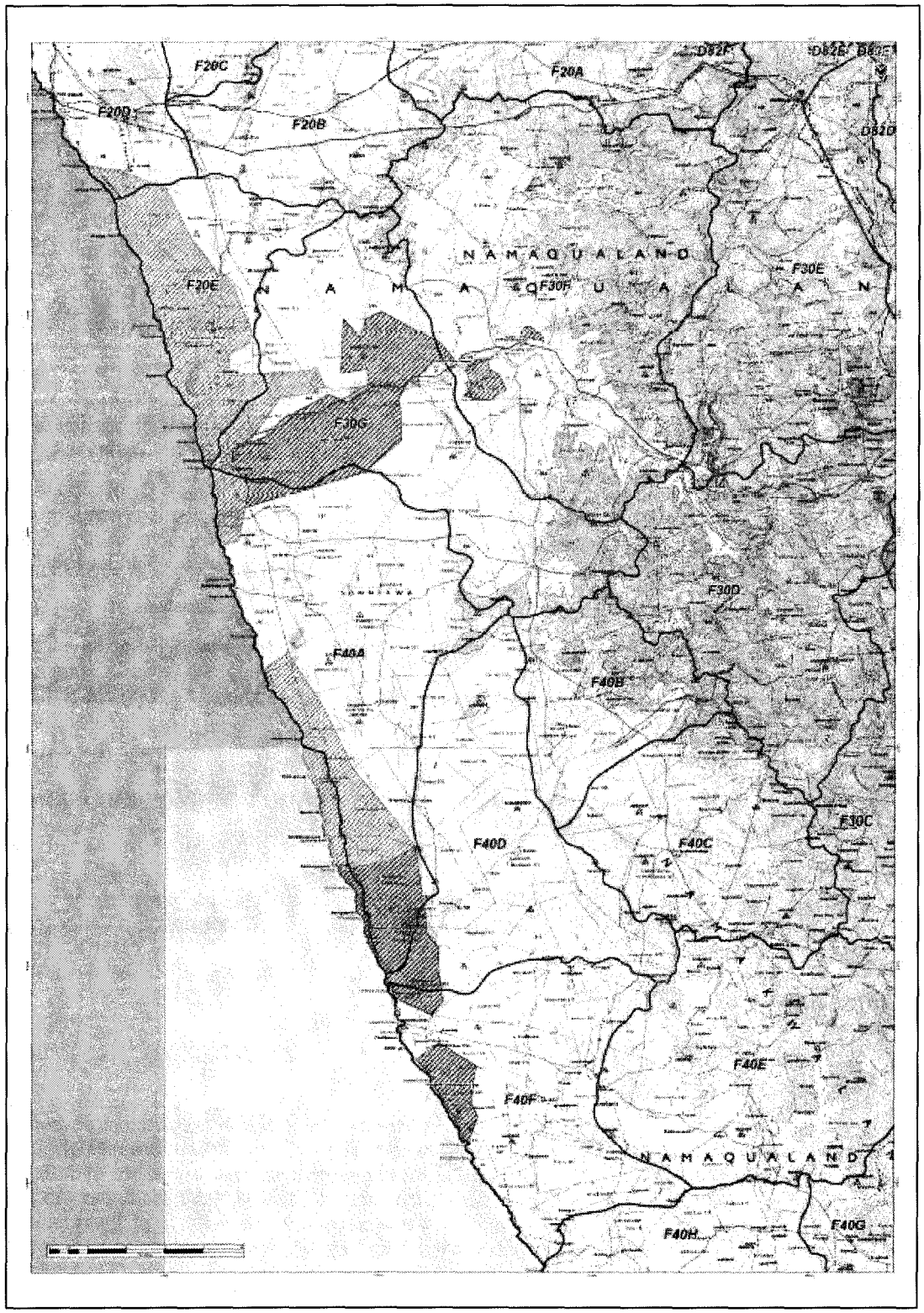

Figure 4: Catchment associated with the KNR area

2.2.6 Mineral deposit

The KNR is associated with alluvial diamond deposits of both fluvial and marine origin. The ore, in the form of mineralised gravel, lies on bedrock and tends to concentrate in depressions and gullies. These deposits are covered by sandy overburden of varying thickness which needs to be removed in order to access the ore.

2.2.7 Mine product

Alluvial diamonds, most of which are of gemstone quality, are recovered from the mining area of the KNR.

2.2.8 Estimated reserves or extent of target area

The actual mined area in the KNR is estimated to be 5 000 ha. At the current mining rate, it is estimated that reserves in the KNR will last until 2023.

2.2.9 Mining method

Open pit mining methods are used to expose the diamond-bearing ore which lies beneath varying depths of sandy overburden. Before the initial cut is opened, topsoil is removed and stockpiled for use in reclamation.

Current mining methods include truck-and-shovel operations. After stripping, the majority of exposed ore is dozed into windrows and loaded into trucks for transportation to the treatment plants. Teams of bedrock workers using either mechanised or manual methods collect the remaining ore. The ore is routed via road by trucks to beneficiation plants. Reclamation or rehabilitation is conducted concurrent to mining activities.

At the treatment plants diamonds are separated out in a series of concentrating processes.

Rehabilitation is generally carried out by back-dumping into mined out areas, flattening steep-sided overburden dumps and dangerous benches, and covering the resulting surface with topsoil. Experimentation is an integral part of rehabilitation methods and various soil treatments, seeding and netting are carried out in some cases.

2.2.10 Production rate

The total production rate in the overall NM mining areas is approximately 0.1 million carats per year. This production rate will be maintained for the remainder of the life of mine.

2.2.11 Planned life of mine

Based on current ore reserves and production costs, the life of mine has been calculated to the year 2023. The production rates as described in the Life of Mine Plan are subject to change due to a variety of factors including:

- Changes in the costs of production;
- Changes in the diamond market; and
- Discovery of new deposits.

Recognising the potentially negative effects of mine closure on the social and economic environment of Namaqualand, De Beers Consolidated Mine commissioned a state of environment assessment and rapid strategic environmental assessment of the consequences of future mine closure. In addition to describing the possible effects of mine closure, the study also makes a number of recommendations on how to minimise these impacts. A Preliminary Mine Closure Plan for NM incorporates the findings of these studies into different initiatives required to close the mine sustainably, several of which Namaqualand Mines are now instituting.

2.2.12 Closure

A Preliminary Mine Closure Plan has been developed to guide rehabilitation measures as reclaimed mine areas are prepared for closure. This plan is guided by the Base Case Land Use Plan, which proposes 6 land use zones which have been identified for the entire NM area. These are described in Table 3:

Table 3: Description of the identified land use zones for Namaqualand Mines

Land use zone		Description
Zone	**Name**	
Zone 1	Core conservation areas	■ Areas required to sustain biological processes such as river corridors, dune systems and aquifers; ■ Areas of high biodiversity value, including rare and/or endangered habitats and endemic species; ■ All undisturbed natural areas; and ■ Heritage resources, historic buildings, sites, burial grounds and archaeological; and palaeontological sites.
Zone 2	Secondary conservation areas	■ Previously mined areas being restored; and ■ Previously, current and future mined areas to be restored.
Zone 3	Tourism areas	■ Showcase the natural resources and landscape, mining and its legacy, new industries and green living measures; ■ Support a variety of events; and ■ Minimise impacts on ecological processes and sensitive areas.
Zone 4	Commercial enterprises areas	■ Disturbed areas, particularly mined out areas, water logged pits and residue deposits, etc; and ■ Located where efficient access to pumped sea water can be achieved.
Zone 5	Settlements	■ Existing towns with infrastructure, in working condition; and ■ A variety of inter-related land uses and activities. These towns have been selected as feasible options for settlements in post-closure economy.
Zone 6	Farming / agricultural areas	■ Areas that are not connected via land ownership to mine rights or DBCM owned land; and ■ Areas that are already leased to adjacent farmers.

Various initiatives identified to close the mine in line with the planned land use are categorised into 7 focus areas, which are:

- Physical stability: Involves removing and/or stabilising surface infrastructure, unavoidable mining residues and open pits to facilitate the implementation of the planned land use;
- Environmental quality: Involves ensuring local environmental quality is not adversely affected by physical effects and chemical contamination arising from the mining areas as well as to sustain catchment yield post-closure;
- Health and safety: Involves limiting possible health and safety threats to humans and animals that would use the reclaimed mine areas as these areas enter the post closure phase;
- Land use/land capability: Involves re-instatement of suitable land capability over mining areas in line with the planned zoning for each area, and ensuring adequate safety measures to limit access to unavoidable mine residues and open pits;
- Aesthetic quality: Involves leaving each reclaimed mine area that is acceptably aesthetically pleasing and is aligned to the respective planned land use;
- Biodiversity: Involves encouraging, where appropriate in terms of the planned land use, the re-establishment of native vegetation on reclaimed mine areas such that terrestrial and aquatic biodiversity can largely re-instate over time. A specific initiative underway is the creation and expansion of a wilderness area through the Namaqua Park (South African National Parks, Conservation International (CI) and De Beers);
- Social: Involves ensuring infrastructure transfer, and measures and contributions made by the mine towards long term socio-economic benefit for the local communities are sustainable. In this regard, the following specific initiatives are underway:
  - The generation of renewable power through the establishment of a wind farm (Third Planet Enterprises and Namakwa District Municipality);
  - The possible establishment of nuclear power stations on the farms Brazil and Schulpfontein, located between Kleinsee and Koingnaas;
  - The investigation of the extension of marine aquaculture businesses such as establishment of oyster, abalone and fin-fish farming (De Beers);
  - Leveraging off tourism activities such as the Diamond Route and Diamond Coast: Forever Namaqualand initiatives;
  - Transfer of mine-owned land portions currently leased to farmers; and
  - Transfer of municipal infrastructure such as water supply, sewage works, roads and open space areas to the local municipality.

3.0 DESCRIPTION OF THE PRE-MINING ENVIRONMENT

3.1 Geology

3.1.1 Regional Geology

The regional geology along the Namaqualand coast is characterised by Precambrian basement overlain by Cainozoic to Recent sediments.

Proterozoic gneisses or granite-gneisses underlie the greater part of the area, previously broadly classified as the Namaqualand Metamorphic Complex. This basement consists of an older suite of supracrustal rocks, now seen as bands and xenoliths of metamorphosed sedimentary and volcanic rocks.

Cainozoic sediment deposits are composed of alternating layers of conglomerate, sandstone, limestone, shales, marls, dune rock and sands of various colours (red, orange, greyish-white and beige) ranging from a depth of a few metres to greater than 100 m. Calcrete forms a cap over the sedimentary sequence in places. It is highly inconsistent in both composition and thickness and varies from calcium-rich grits and sands to almost pure, chalky, calcareous material up to 1m in thickness.

3.1.2 Geology of the KNR

The KNR and the deposits of the adjacent Hondeklip Bay property are unusual as they do not conform to the West Coast mineralisation pattern where diamonds are associated with linear raised beach deposits as represented in the BMR, north of Kleinsee. The KNR geology is somewhat more complex. In the KNR accumulations of high-grade marine sediments occur mainly in discrete bedrock depressions which are underlain in by older river channel deposits.

The KNR area is underlain by fresh to weathered gneisses and schists. The dominant structural features in the bedrock reflect the break-up fabric resulting from the split between Africa and South America about 130 million years ago (dominantly NNW – SSE). Diamonds occur in small cretaceous age dentritic channel features. The drainage pattern of these channel features were mainly influenced by structural trends within the bedrock. The origin of these channels is only a couple of kilometres inland suggesting a local source on the coastal plain for the diamonds. Subsequently these channel features were re-used by different fluvial phases over time. The current fluvial fill, where preserved is between 25 million and 55 million years old. Most of the sediments in these channel features were subsequently reworked by marine processes ranging in age from approximately 10,000 to 5 million years.

Diamonds generally occur close to or on bedrock. The ore is generally less than a meter thick and consists of an angular argillaceous quartz rubble (channel sediments) or well rounded marine grits and gravel. The marine deposits generally result in an upgrade when it reworks channel sediments. Marine reworking results in a halo of economic grades in close proximity to channel depressions. Grade varies from <5 to >500 carats per hundred tonnes (cpht) (average grade mined is approximately 25 cpht) and stone size is generally 0.22 to 0.25 carats/stone. Overburden varies in thickness from <5 to 30 m and consist of terrigenous sand, windblown sand, marine sand as well as fluvial clay and peat. Laterite (dorbank) may occur close to or on the surface.

3.1.2.1 Presence of dykes, sills and faults

Various geological faults pattern the coastal lowland, forming ridges and depressions running in a north-south orientation. No dykes or sills are recorded in the area.

3.2 Climate

3.2.1 Brief description of regional climate

Namaqualand Mines is situated in a semi-arid area. Most of the mining areas are next to the coast and therefore experience the moderating effects of the ocean.

Rainfall is less than 200 mm a year and falls during the autumn and winter months (i.e. from May to August). Coastal fogs occur year round but are more frequent during the winter period. Temperatures are relatively cool but increase markedly during berg wind conditions. The predominant wind direction is southerly.

3.2.2 Mean monthly and annual rainfall for the site and number of days per month with measurable precipitation

Average rainfall in the region amounts to about 100 mm a year and summer aridity is extreme. Table 4 shows the average monthly rainfall for the study area measured at Kleinsee for the period 1995-2003, and the number of days with measurable precipitation measured at Koingnaas and Springbok, further inland.

Table 4: Mean monthly and annual rainfall

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Annual
Rainfall (mm) ***Kleinsee***	16	16	11	5	8	4	6	5	6	7	12	15	111
Rain days (No.) ***Koingnaas***	6	4.2	2.2	4	2.2	2	0.6	1.4	1.8	2.8	3.2	4.2	34.6
Rain days (No.) ***Springbok***	4	4.3	3	2.5	1.3	1.1	0.8	1.1	2	2.5	3.8	4.3	30.6

3.2.3 Maximum rainfall intensities per month

Table 5 shows the average maximum 24 hour rainfall intensities per month measured at Koingnaas on the coast and the town of Springbok, further inland.

Table 5: Maximum rainfall intensities

	Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun
Intensity/ 24 hr ***Springbok***	57.2	64.3	47	40.6	54.4	34	36	59.2	49	51.8	47	76.2
Intensity/ 24 hr ***Koingnaas***	28.5	21.8	27.5	11	5.5	5.5	4.5	13	2.3	18.5	24.5	16.5

The frequency of fog days decreases from the coast towards the interior, a feature of all West Coast deserts. The presence of onshore winds is vital to the advection of sea fogs landwards. Fog extends furthest inland along river courses.

3.2.4 Mean monthly, maximum and minimum temperatures

Coastal air temperatures are cool throughout the year but increase markedly during berg wind conditions. The cold waters of the Benguela current cool and stabilise the near surface air mass thereby moderating air temperature and reducing the potential for rainfall along the coast. Inland, temperatures are usually warmer than at the coast.

The table below shows the average monthly temperatures for the study area measured for Kleinsee for the period 2005-2007. An average taken of these values shows the temperature to be a relatively constant 12-18°C all year round.

Table 6: Mean monthly temperature (°C)

Jul	Aug	Sep	Oct	Nov	Dec	Jan	Feb	Mar	Apr	May	Jun	Annual
15	14	14.5	15.5	17	17	18	17.5	17.5	16.5	16	15.5	16

3.2.5 Monthly mean wind direction and speed

Prevailing winds are determined by the South Atlantic high pressure system, the atmospheric pressure over the subcontinent and east-moving low pressure systems associated with the west-wind belt south of Africa.

The anticlockwise airflow around the South Atlantic high tends to be guided by the coast, so that near the coast, the wind is predominantly from the south (onshore). In winter the winds decrease considerably and blow more frequently from the north. Berg winds are a feature of the entire Benguela region and may occur throughout the year, but are more frequent in winter. The wind is hot and dry and usually blows from the east or north-east.

3.2.6 Mean monthly evaporation

The evaporation rates are higher than expected for a coastal area as a result of the wind regime. The occurrence of coastal fog drastically reduces evaporation. The gross annual evaporation rate is on average 2 500 mm. Thus, with an annual average rainfall of 111 mm, the net evaporation may be calculated to be 2 389 mm, which denotes extremely dry conditions.

3.2.7 Incidence of extreme weather conditions

Extreme weather conditions are rare and, in general, the coastline climate is fairly consistent. Winds occasionally reach gale force velocity and berg wind conditions can persist for a week or longer, causing higher than usual temperatures. Drought conditions are rare and rainfall is usually higher than average once in every 10 years, causing ephemeral rivers to flow.

3.3 Topography

The coastal lowland rises gently from the sea to approximately 150 m above sea level. Over this area it is generally flat and featureless. The Great Escarpment marks the eastern border of the coastal plain. From an altitude of approximately 1500 m, rivers cut their way down and dissect the coastal plain. The foothills of the escarpment and the interior are more undulating than near the coast. The influence of rivers like the Buffels River in creating this landscape is clearly visible.

Various geological faults pattern the rest of the coastal lowland, forming ridges and depressions running in a north-south orientation. Nearer the coast, the predominant southerly winds have played a major role in moving sediment northwards and inland. Dune fields and blow-out depressions are common. Rocky outcrops, where they occur, have been exposed to sandblasting and wind erosion.

A topographical assessment of the KNR has resulted in the delineation of the following units:

- The 'strand', which takes the form of a rocky coastline for the most part, with intermittent dune areas.
- Stable and mobile dune fields: coastal dunes and sandveld dunes are distinguished.
- Vast stabilised sandy areas: white and red sand plains are distinguished.

Across the width of the KNR which extends approximately 7 km inland, the coastal lowland rises very gradually to approximately 140 metres above sea level (masl).

Mining in the KNR has changed the topography. In addition to the construction of roads and minor buildings, the introduction of equipment and labour introduce daily issues relating to the avoidance and cleaning up of waste materials, litter, etc (Figure 5). Inevitably these activities have resulted in unintentional changes to the topography.

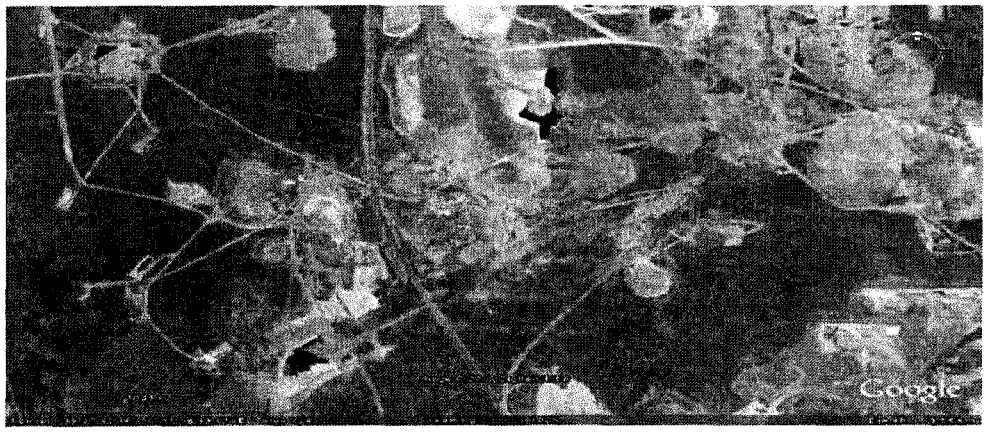

Figure 5: Mining within the KNR

3.4 Soil

The soils of the KNR are, Aeolian sands with a marine origin of various ages that cover most of the Namaqualand coastal plain can be found. Near the coast, the sands are white in colour and range from mobile dunes through to vegetated hillocks.

Further inland the area is characterised by reddish consolidated sands that are much older and less mobile. The reddish colour of the sand is a result of iron oxidation in the older sands. Mobile dune fields are present in various inland areas of the coastal plain.

Deeper sediments include yellowish Pleistocene deposits of terrigenous feldspathic sands which grade upwards into reddish or brownish silty sands. A calcrete layer usually separates these deeper sands from surface aeolian Pleistocene sediments. Near the coast, recent dune sands often overlie the Pleistocene sands.

Undisturbed (unmined) soils in the coastal areas are described as generally loosely packed sands, brown in colour which would classify as Namib from the Beachwood family. The first 0.5 m shows signs of deposition by wind.

Most plant growth is restricted to the relatively shallow topsoil layer. Most of the soils range from sands to sandy loams. The deeper sediments are sodic and salinity increases with depth due to the marine origin of these sands. When brought to the surface, these sands are not suitable for plant growth.

The soils exhibit a very alkaline pH, a characteristic of soils developing in a climatic regime where evapo-transpiration greatly exceeds precipitation. Organic carbon levels are very low. There appear to be adequate levels of available phosphorous given the high pH of these soils. Trace element analyses reveal no apparent plant growth inhibitors.

Mined soils are mainly brown in colour, but depending on the source of the material may also be white or grey. At places, conspicuous layering is visible due to the mixing that takes place during dumping. These soils also have higher gravel content than unmined areas. Mined soils often have a hardened surface crust which is likely to inhibit root penetration by plants. The strength seems to be derived from chemical cementation of the soil particles, which is exacerbated by dispersion of clays and physical compaction of the soil structure.

Dryland agricultural production is not possible because of the arid climate and lack of irrigation water. Natural vegetation in the area supports small stock farming. Soil fertility variables are similar for mined and unmined soils, although as can be expected, the carbon content of mined soils is lower. Mined soils appear to have adequate levels of most plant nutrients and do not contain any toxic levels of trace elements.

The sandy soils of Aeolian origin that are so predominant in the region are all considered sensitive due to their vulnerability to erosion.

Mobile dunes are devoid of vegetation, and are shifted by the wind while the vegetated hillocks in the region are stabilised by the rooting systems of the plants that inhabit them. Such areas that are denuded of vegetation are exposed to the eroding action of the wind. Deflation areas and blowouts are a feature of inland areas often associated with overgrazing or mechanical disturbance.

Subsoil brought to the surface during excavating activities does not support vegetation growth well (this appears to be related to the high salinity of the soil and the high sodium content). Although the soils have a high sand content and rainfalls are low and not particularly intense, the mined soils have a low infiltration rate, and yield most of the overland flow that causes gullying of slopes. Rain causes the soil surface to slump and form a crust, so that overland flow and surface erosion occurs. As little rainwater is able to enter the soil profile, natural leaching does not take place, and the salts remain in the surface layers of the soil. These salts and the difficult physical conditions inhibit plant growth.

3.5 Land Capability

3.5.1 Stock farming

There is limited farming in the Koingnaas Right.

Regionally, environmental factors along the West Coast have resulted in agricultural activity being based mostly on small stock farming activity, where sheep and goats are the main breeds. Some ostrich and game farming occur in the area as well. Within the mine area land owned by the mine, but not used for mining operations, is leased to farmers.

3.5.2 Cultivation

There is no cultivation in the Koingnaas Right.

Cultivation is scarce in the region, with water being the limiting factor. Where soil depths allow, cultivation is sometimes possible along river courses under irrigation.

3.6 Land Use

3.6.1 Pre-mining land use

Historically, farming in the Koingnaas Right and regionally has always been severely limited by the arid environment, and consists primarily of small stock farming, mostly sheep and goats. Agriculture alone is insufficient to provide more than a subsistence income for a few farmers.

3.6.2 Evidence of misuse

Although there is no evidence of intentional misuse, historical drought farming practices and overgrazing have occurred in the area.

3.6.3 Existing structures

The existing structures within the Koingnaas Right include roads, water supply pipelines and powerlines that pass through the area.

3.6.4 Planned land use post-closure

Six land use zones have been developed for the NM area as described in Table 7

Table 7: Identified land use zones for NM area

Land use zone	Criteria	Land uses and activities	Development rules and guidelines	Risks associated with zone
■ ZONE 1: Core conservation areas (CCAs)	■ Areas required to sustain biological processes such as river corridors, dune systems and aquifers; ■ Areas of high biodiversity value, including rare and/or endangered habitats and endemic species; ■ All undisturbed natural areas; and ■ Heritage resources, historic buildings, sites, burial grounds and archaeological; and palaeontological sites.	■ Conservation; ■ Low impact tourism activities (including selected concessions); ■ Linear surface infrastructure; ■ Identified mining areas; ■ Wind turbines (provided visual impacts are addressed); ■ Selected hunting; and ■ Bird watching.	■ Disallow any new permanent structures, development or buildings in CCAs, except where they are required to improve the functioning of ecosystems (e.g. the construction of a "drift" across the Swartlintjes River); ■ Rehabilitate mining areas immediately upon completion of mining; ■ Keep new linear infrastructure to a minimum; ■ Prepare an Environmental Management Plan complying with the National Environmental Management: Protected Areas Act (Act 57 of 2003) (NEMPAA). (The CCAs should in time receive formal protection under NEMPAA); and ■ Explore the option of entering into a management agreement with SANPARKS, manager of the adjoining Namaqua National Park, for the CCAs that are in close proximity to the park such as game farming area and the Swartlintjes River corridor as a first step towards achieving formal protection. The decision regarding the type of protection to be afforded	■ If conservation lease agreements and management structures are not practical (i.e. SANParks or other bodies are not interested in the land for conservation), resulting in this land use becoming less feasible; ■ Visual impact of wind farms (turbines) could affect the tourism potential of these areas; and ■ Current long term leases with adjacent farmers could affect the viability of such areas for conservation, in terms of contractual matters or land degradation because of overgrazing.

Land use zone	Criteria	Land uses and activities	Development rules and guidelines	Risks associated with zone
			to these areas would also be influenced by the ability to access funding for their management as well as De Beers' long-term interests in the land.	
■ ZONE 2: Secondary conservation areas (SCAs)	■ Previously mined areas being restored; and ■ Previously, current and future mined areas to be restored.	■ Mining (small scale); ■ Conservation (including rehabilitation); ■ Land Art; ■ Wind turbines; ■ Events; ■ Surface infrastructure including roads, power lines and pipelines; ■ Temporary and linear tourism infrastructure, i.e. hiking trails, mountain bike trails, 4X4 trails, temporary viewing facilities, stages, ablution facilities, kookskerms (i.e. excluding permanent facilities & accommodation); ■ Scuba Diving (in open pits); ■ Boating; ■ Swimming;	■ Rehabilitate mined areas immediately upon the completion of mining; ■ Require environmental management plans, including agreed service provision and any required environmental restoration for periodic activities such as events; ■ Rationalise the road network, maintain roads to an agreed standard; ■ Rehabilitate roads which are no longer required; ■ Assess, measure and mitigate the visual impact of existing (i.e. re-used) or new infrastructure (e.g. berms for pipelines); and ■ Small scale mining to be done only in areas where surrounding conservation, environmental features and eco-tourism potential is low.	■ Effective rehabilitation will take time, and with significant cost; ■ Areas must be made safe in order to allow selected public access; and ■ Rehabilitated areas may be jeopardized by human activity and events.

Land use zone	Criteria	Land uses and activities	Development rules and guidelines	Risks associated with zone
		■ Kayaking; ■ Diving; ■ Donkey cart adventures; and ■ Abalone ranching.		
■ ZONE 3: Tourism nodes	■ Showcase the natural resources and landscape, mining and its legacy, new industries and green living measures; ■ Support a variety of events; and ■ Minimise impacts on ecological processes and sensitive areas.	■ Accommodation (including chalets, campsites and lodges); ■ Restaurants & outdoor eating facilities; ■ Information centres; ■ Interpretation and lecture facilities; ■ Arts and crafts workshops; ■ Retail outlets; ■ View sites & platforms; ■ Fishing; ■ Hiking; ■ Biking; ■ Heritage Trails; ■ Flower tourism; and ■ Kookskerms and seafood braais.	■ Use existing infrastructure and buildings before new construction is considered; ■ Use local materials, labour and skills in all new development and renovation/ redevelopment. Develop and enforce strict environmental impact measures and standards to reduce this impact (green technologies should be highlighted in all development); ■ Develop site plans for all tourism uses and activities. Indicate: ▪ Access; ▪ Parking; and ▪ Building footprint. Sensitive biophysical features of significance, including visible or known archaeological sites and any features of historical, environmental or cultural importance ▪ Building height and elevation;	■ Long distance from Cape Town and Gauteng may influence; ■ Visual and noise impacts of small scale mining and un-rehabilitated areas may influence the eco-tourism market for the area associated with the core conservation zone; ■ Kleinsee as tourism destination hub might be jeopardized if the time between old and new economy is too long (i.e. infrastructure might fall into disrepair); and ■ The use of potable water for the Golf Course at Kleinsee is not sustainable; changes to the golf course or the loss thereof might influence the golf tourism market.

Land use zone	Criteria	Land uses and activities	Development rules and guidelines	Risks associated with zone
			▪ Services; ▪ Refuse areas; ▪ Landscape elements; and ▪ Use and surfacing of outside areas. ■ Produce environmental management plans for both construction and operation.	
■ ZONE 4: Commercial enterprise zone (CEZ)	■ Disturbed areas, particularly mined out areas, water logged pits and residue deposits, etc; and ■ Located where efficient access to pumped sea water can be achieved.	■ Aquaculture; ▪ Flooded pit farming: ▪ Tank farms ■ Micro algae propagation; ■ Seawater greenhouses; ■ Nurseries; ■ Crop farming; ■ Energy generation: ▪ Mining; ▪ Infrastructure: and ▪ Administration buildings. ■ Guided tours of the various low-carbon facilities.	■ Require precinct plans for each CEZ indicating sites uses, infrastructure and access; ■ Restore unused areas within CEZs, incorporate into secondary conservation areas; ■ Share access, parking and loading within CEZs to the maximum extent possible; ■ Establish agreements regarding security measures required. In general, do not use solid walls, but visually permeable fencing, at an agreed standard; ■ Require site development plans for each enterprise in this CEZ. Indicate: ▪ Access; ▪ Parking; and	■ A heavy reliance for this zone has been placed on low carbon, high income uses. Although correct in principle, these "green" business models have yet to be tested in South Africa, and its yield and workability in other (mostly first world countries) cannot necessarily be proof of local workability. ■ Pumped seawater has a high infrastructure maintenance and electricity cost, and these costs might influence the profit margin in the long run; and ■ Substantial input costs are required to "kick-start" these industries, and their break-even times must be determined.

Land use zone	Criteria	Land uses and activities	Development rules and guidelines	Risks associated with zone
			▪ Building footprint. ■ Sensitive biophysical features of significance, including visible or known archaeological sites and any features of historical, environmental or cultural importance ▪ Building height and elevation; ▪ Services; ▪ Refuse areas (screening materials to be agreed); and ▪ Landscape elements. ■ Use and surfacing of outside areas (indigenous plants or local material – no lawns); ■ Require visual impact assessment and mitigation measures for structures in the CEZ; ■ Require environmental management plans for both construction and operation; and ■ All non-industrial buildings & structures should conform to architectural guidelines.	

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Land use zone	Criteria	Land uses and activities	Development rules and guidelines	Risks associated with zone
■ ZONE 5: Settlements	■ Existing towns with infrastructure in working condition; and ■ A variety interrelated land uses and activities. These towns have been selected as feasible options for settlements in a post-closure economy. *Note: Hondeklip Bay will not be discussed here as it is not owned by DBCM.*	■ Residential (employees of the various new sectors; ■ Kleinsee as potential retirement village; ■ Tourism hubs with visitor accommodation (Such as the Tourism office in Kleinsee); and ■ Temporary stay of specific projects such as construction teams.	■ Improve the sense of place ▪ create and develop public open space (around existing public facilities, waterfront); ▪ plant trees; ▪ create opportunities for small scale agriculture; and ▪ improve and define the town's entrance. ■ Guard against low density urban sprawl when considering new development; ■ New development should include: ▪ guidelines regarding orientation of buildings and architectural style (including height, massing and materials); and ▪ requirements for the use of green technologies to minimise the environmental impacts ■ Target future development around a green corridor that connects the previously	■ Koingnaas town service infrastructure may be a liability to Kamiesberg Municipality; ■ It is possible that the Nama Khoi Municipality may not agree to take over Kleinsee town, and the liability of up keeping the service infrastructure, without a viable tax base. The cost of conventional services, as is the historical case, will not be economically feasible in Kleinsee. Especially where the services will have to be retrofitted or replaced with green technology to lower cost in the long run, and that will include: ▪ Landfill Sites (waste management strategy); ▪ Bulk Water; ▪ Sewage; ▪ Electricity; and ▪ Accommodation (removal of asbestos). ■ The activities in the town could decline too far before the new economy is strong enough (resulting in potential disrepair and exorbitant service

Land use zone	Criteria	Land uses and activities	Development rules and guidelines	Risks associated with zone
			segregated parts of the town in order to integrate the two; and ■ Introduce communal infrastructure to facilitate recycling of waste. **Koingnaas** Koingnaas remains in DBCM ownership, but DBCM is in negotiations with the KM to incorporate the town into the Municipality with a view to dispose of the entire town's infrastructure. This entails the formal subdivision of the town, so that the residential erven can be sold, and requires the KM to take over land and infrastructure traditionally managed by municipalities, including roads, open spaces and service provision in the town. An independent assessment of the viability of the town indicated the need for a substantial capital investment to ensure the town's sustainability over the short to medium term. **Kleinsee** ■ Kleinsee remains in DBCM ownership, but DBCM is in negotiations with the Nama Khoi Municipality (NKM) to incorporate the town into the jurisdiction and proclaim the	infrastructure maintenance and repair costs); ■ The simplest option is to privatise the town into a retirement village or resort, but that will mean agreeing with private property development companies, which has poor access to capital from banks in the current economic climate, and reduced interest from a stretched buyers market; and ■ The sustainability of the golf course using potable water is questionable.

Land use zone	Criteria	Land uses and activities	Development rules and guidelines	Risks associated with zone
			town; ■ In the meanwhile, as much activities and usage of the town must be promoted through eco- and golf tourism, events and small scale economy initiatives; ■ There is a movement of "semi-grants" (i.e. people moving or retiring away from Gauteng to more rural settings, where quality of life, safety and such aspects become more important. The west coast is a popular destination for this move. A clear option for Kleinsee is that of a retirement village / town, as it has all the key amenities such a village would require: ▪ Airstrip; ▪ Safety (fencing and gates already in place); ▪ Recreation opportunities; ▪ Infrastructure (bulk water, sewage and electricity); ▪ Scenic surroundings; and	

Land use zone	Criteria	Land uses and activities	Development rules and guidelines	Risks associated with zone
			▪ Hospital (can be converted to frail care).	
■ Zone 6: Farming/Agricultural Areas	■ Areas that are not connected via land ownership to mine Rights or DBCM owned land; and ■ Areas that are already leased to adjacent farmers.	■ Agriculture (livestock)	■ Transfer land where possible (when safe and rehabilitated) to suitable private persons; and ■ Monitor and evaluate those farms that are leased to guard against the risk of overgrazing and subsequent land degradation.	■ Overgrazing; ■ Land degradation; and ■ Illegal mining.

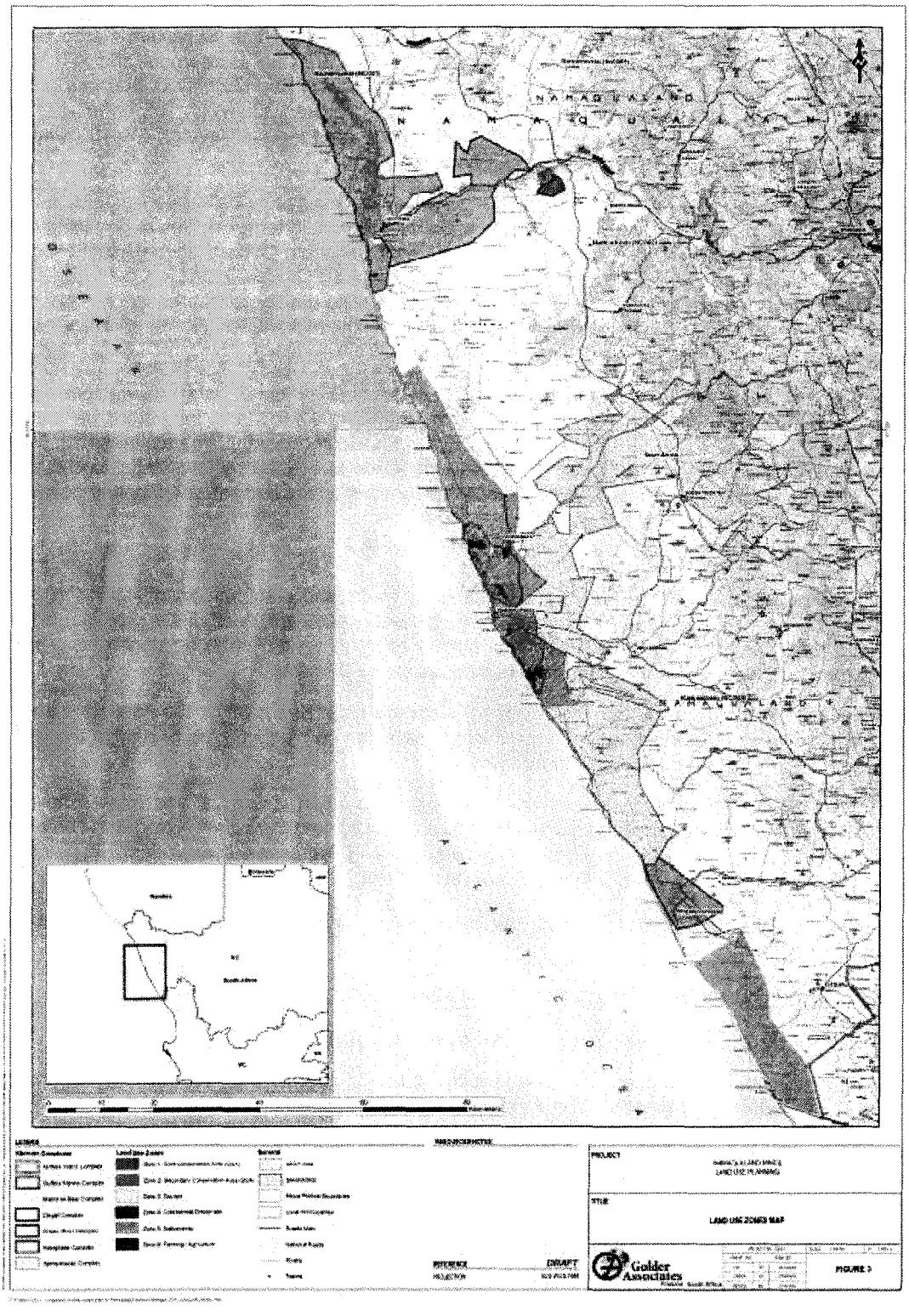

Figure 6: Land use zones proposed for the entire NM area

3.7 Natural Vegetation (plant life)

The Namaqualand Mine Rights forms part of the Succulent Karoo Biome. The Succulent Karoo Biome stretches from Sutherland westwards to Nieuwoudtville and Calvinia, over the escarpment and in a broad band along the west coast into Namibia in the north. According to SANBI, the majority of the area is Veld Type SKs7 (Namaqualand Strandveld) and SKs8 (Namaqualand Coastal Duneveld) with small portions being Type SKs11 (Namaqualand Arid Grassland), SKn4 (Namaqualand Heuweltjieveld), SKs10 (Riethuis-Wallekraal Quartz Vygieveld) and FFd1 (Namaqualand Sand Fynbos).

The terrain varies from coastal sandy flats to mountain ranges of varying geological strata - granite, gneiss, quartzitic sandstone, quartzite, dolomite, conglomerate and shale. The mild temperatures during winter and summer remain constant as a result of the influence of the cold Benguela Current of the Atlantic Ocean, however in summer, extreme temperatures can reach in excess of 40°C. Rain borne on cold fronts falls during winter, and is on average less than 400 mm a year. Fog is common nearer the coast. The rainfall in Namaqualand, although low is reliable and this is the fundamental explanation for its diversity of leaf succulents, bulbs and high numbers of succulents.

The Succulent Karoo Biome, in which Namaqualand Mines is situated, is found along the western coastal plain of the coast from the Orange River southwards to the Berg River, and inland to the western escarpment. The Biome occupies 5.35 % of the land surface of the subcontinent. Namaqualand is one of six geographic regions that constitute the biome. The succulent Karoo is defined by low winter rainfall (50 – 350 mm p.a.), generally falling from May to August, extreme summer aridity and lime-rich, poorly developed soils.

3.7.1 Dominant species

The vegetation of the Succulent Karoo Biome is dominated by dwarf, succulent shrubs, of which the vygies (Mesembryanthemaceae) and stonecrops/plakkie family (Crassulaceae) are particularly prominent. Mass flowering displays of annuals (mainly Daisies - Asteraceae) occur in spring, often on degraded or fallow lands. Grasses are rare, except in some sandy areas, and are of the C3 type.

Namaqualand is broadly divided into four regions: the Richtersveld, the Knersvlakte, the Klipkoppe and the Sandveld. The distribution of the vegetation in the mining areas can conveniently be related to the type of substrate: sand, rocky outcrops, shallow soil or calcrete.

Along the Buffels River, rocky outcrops and gravel exposures support a unique and interesting dwarf succulent flora. On the farm Nuttabooi, the dominant vegetation is Lowland Succulent Karoo with some plant communities classified as Transitional to Upland Succulent Karoo. The Lowland Succulent Karoo can be divided into three distinct habitats, each with a different set of plants:

- Dwarf succulent plant communities on low, angular gneiss and quartz lag-gravel covered koppies and slopes;
- Mixed grass and shrub communities on recent aeolian sands (Sandveld); and;
- Succulent shrub communities on colluvium (heuweltjies veld).

Transitional Upland Succulent Karoo communities include mixed leaf succulent shrub, woody shrub and tree communities all of which occur on steep scree slopes and around gneiss outcrops.

Just inland of the coast the vegetation grows to about one metre in height and is dominated by the common vygie bush t'arra-t'kooi (*Stroeberia frutescens*). Skilpadbos (*Zygophyllum morgsana*), ossierapuis (*Othona cylindrica*) and other shrubby vygies such as *Lampranthus suavissimus* and volstruisvygie (*Cephalophyllum spongiosum*) are common a kilometre or so inland. Various grass species, such as *Cladoraphis cyperoides* and *Eragrostis sabulosa*, also occur. Although this is still mainly strandveld, elements of lowland succulent karoo (formerly known as succulent karoo) begin to appear. In comparison with other farming areas in Namaqualand, the Koingnaas area has been conservatively stocked and the veld is in good condition.

3.7.2 Endangered or rare species

Temperatures within the biome vary from 5 - 40°C and fog is frequent along the coast, being an important source of supplementary moisture. A special feature of this vegetation type is the high degree of endemism in the biome due to the development of adaptations to very specific habitats. Thus, there are many species found in the Succulent Karoo that are not found anywhere else in the world. Of the five centres of endemism identified in this biome, three are found in Namaqualand.

In general, vegetation is most lush along the coast and in the wetter escarpment area and more sparse in the arid inland areas. The interior areas of the Koingnaas Right are generally characterised by red aeolian sand and sparse, arid-adapted vegetation. Along the Buffels River, rocky outcrops and gravel exposures support a unique and interesting dwarf succulent flora.

3.7.3 Intruder or exotic species

The following invader species have been identified in the area.

- *Acacia Cyclops* (Rooikrans);
- *Acacia saligna* (Port Jackson);
- *Atriplex lindleyi* (Klappiesbrak);
- *Nicotiana glauca* (Tobacco tree);and.
- *Atriplex spp. (*Oumansoutbos*).*

3.8 Animal Life

3.8.1 Commonly occurring species

Steenbok, duiker and meerkat are encountered in the mining areas. Occasionally, African wild cat, black backed jackal, bat-eared fox and yellow-tailed mongoose can be seen.

The area supports a high proportion of species endemic to southern Africa, especially in its inland avifauna. Ludwig's bustard, Martial eagle, Caspian, Antarctic and Damara terns are Red Data Species occurring in the area. Some of the species most likely to be encountered year-round are:

- terrestrials such as Kori and Ludwig's bustards and Southern Black Korhaan, which are often flushed from the shrubs in the nature reserve;
- raptors such as Southern Pale Chanting Goshawk and Jackal Buzzard;
- insect-eaters such as Karoo Scrub-Robin and Karoo Prinia; and
- nectar-feeders such as Southern Double-collared and Malachite sunbirds.

Other key birds occurring in the area include Barlow's Lark, Cape Eagle-Owl, Black-necked Grebe, Cape Penduline-Tit, Cape Long-billed Lark, Chat Flycatcher, Tractrac Chat, Black-headed Canary, Lesser Swamp Warbler, Little Rush Warbler, Grey-backed Cisticola, Bokmakierie, Large-billed Lark, Layard's Tit-Babbler, Dusky Sunbird, Pale-winged Starling and Lark-like Bunting.

In the Succulent Karoo biome, the largest proportion of endemic animal species is represented by reptiles. Of the forty-five species of reptiles known to occur in this biome, a tortoise, two snakes, seven legless skinks, seven lizards, one gecko and one chameleon species are endemic. Red Data Species include the Namaqua dwarf adder *(Bitis schneideri)* and the desert rain frog *(Breviceps macrops).*

No freshwater fish species occur, due to the absence of permanent surface (fresh) water in the region and surf angling catches along the coast from Groen River to Port Nolloth are known to be very poor. The West Coast rock lobster (*Jasus lalandii*), a member of the group of spiny lobsters, is the primary species of the commercial rock lobster industry in South Africa.

3.10.4.2 *Buffels aquifer*

At present about one-third of Kleinsee's freshwater is obtained from subterranean flow in the Buffels River. Sandy sediments in the river valley form an extensive aquifer that is periodically recharged by rainfall over the catchment area. In the past, the mine was totally dependent on water extracted from a Fellman well in the river. In 1994, the construction of a groundwater barrier in the riverbed was completed and has resulted in a rise of the water level at the Fellman well improving the recovery capacity.

3.11 Air Quality

3.11.1 Ambient conditions

Coastal areas are, for most of the year, subject to an almost constant southerly onshore wind. These winds are responsible for moving large volumes of sand naturally in a northerly direction up the coast. Occasional hot, dry easterly winds (Berg Winds) blow from the escarpment throughout the year but are most common during the winter months.

Berg winds are a feature of the entire Benguela region and may occur throughout the year, but are more frequent in winter. They result from the development of a large high-pressure system over or to the south of the southern part of the subcontinent during autumn and winter. The resultant airflow is downward off the plateau towards the sea and is heated by compression. The wind is hot and dry and usually blows from the east or north-east. These berg winds may persist for a number of days and are responsible for some of the year's warmest and dustiest weather conditions, often carrying dust out to sea.

3.11.2 Dust

In the KNR opencast mining methods and strong winds generate dust. Most of the dust is generated from overburden stripping, exposed overburden dumps, loading and hauling of ore and fine residue deposits.

3.11.2.1 *Other emissions*

Exhaust emissions from diesel powered earthmoving equipment and petrol-driven support vehicles are rapidly dispersed in the windy environment in which Namaqualand Mines is situated.

3.12 Noise

In the KNR, earthmoving equipment generates most of the noise in the mining area. Other than the mine, there are no important sources of man-made noise. Most of the road traffic is either mine or farming related. The wind is also a constant feature of the natural background noise.

All employees working in areas with a noise level greater than or equal to 85 decibels are required, in terms of safety regulations, to wear hearing protection devices. For the purpose of this application, this includes nearly all earthmoving machines (ranging from 75 dB to 105 dB) and probe drills (at 85 dB).

Of relevance is the remote rural nature of the area, which is relatively sparsely populated. Receptor sites are limited to other mining operations and neighbouring stock farms close to the Koingnaas Right.

As closure approaches, operations will taper off. Nevertheless closure and rehabilitation of the mine areas will continue to require earthmoving equipment.

3.13 Site of archaeological and cultural interest

It is commonly recognised that Later Stone Age people settled along the coastal regions of the Northern Cape from approximately 30 000 years (Before Present (BP). The landscape was generally dominated by hunter-gatherer occupation until the introduction of pastoralists into the area approximately 2 000 years BP.

The Northern Cape is characterised by a low Iron Age presence on the landscape, as a result of the general high aridity of the region. Arid areas are usually not conducive to cattle rearing and agriculture. During prehistoric times these areas were mostly occupied by Stone Age hunter-gatherers (San) and nomadic pastoral Khoekhoen (Khoi-Khoi) groups.

The archaeological site survey revealed about 38 coastal or shoreline shell middens of varying sizes and densities. Most of these were determined to be of medium to high significance, and one site was found to be very highly significant. Two formal cemeteries were documented, both of which carry high significance.

Archaeological remains can be defined as human-made objects, which reflect past ways of life, deposited on or in the ground. All archaeological remains, artificial features and structures older than 100 years and historic structures older than 60 years are protected by the relevant legislation, in this case the National Heritage Resources Act (NHRA) (Act No. 25 of 1999).

All the shell middens and historical structures are protected under this Act. A permit must be obtained from SAHRA before a site can be destroyed.

All historical structures (including graves) older than 60 years must be extensively documented and a permit must be obtained from SAHRA before a structure can be destroyed.

In excavations on the farm Nuttabooi shared by the Dikgat and Buffels Inland Rights, bioturbated quartizites have been discovered, but with no body fossils. Fossilised wood and vertebrate material has previously been reported from the Buffels Bank a few kilometres upstream of the Buffels Inland Right. Based on the highly indurated nature of the sediments in the Buffels River valley, a Tertiary age has been proposed, but until diagnostic fossils are found this remains uncertain.

3.14 Sensitive Landscapes

The following features have been highlighted as sensitive environments. Some of these are under statutory protection, while others have been included by virtue of their inherent sensitivity:

- The Spoeg,Swartlintjes and Buffels River estuaries;
- Vegetation communities especially sensitive to disturbance;
- Archaeological and Palaeontological sites;
- Cemeteries, graves and burial sites;
- Sites of historical and cultural importance such as early twentieth century farm buildings;
- Farming related structures and infrastructure; and
- Scenic places such as Gys se Berg.

3.15 Visual Aspects

The relatively flat and undulating topography of the region implies that tall infrastructure, structures and residue dumps tend to be highly visible. The mine is not situated on any major road transport routes however, air traffic between Namibia and Cape Town passes overhead at high altitude.

The KNRs mining area is not visible from the nearby coastal village of Hondeklip Bay, as it is shielded from view by the local topography. The mining area is however adjacent to the Koingnaas residential area and the treatment plants and associated FRDs and CRDs are visible from the town.

Whilst ongoing rehabilitation during operations continues, unavoidable mine residue dumps and open pits will remain present post closure.

3.16 Regional Socio-Economic Structure

Although the Northern Cape covers a large surface area (361 830 km^2) it has a relatively small population (of 0.82 million people). Some sources estimate that the population is declining at 2.1% per annum. This figure is in stark contrast to the national population growth rate of 0.868%, and indicates that residents are moving out of the Province in search of employment in other areas.

The province has a gross domestic product which, despite its size, constitutes only 2% of the country's gross domestic product (GDP). The Provincial GDP contribution is thus roughly proportional to the Northern Cape's share of the national population. Some 27% of the gross geographic product (GGP) is minerals based. The Provincial economy is very much a resource-based economy dependent primarily on mining and, to a lesser extent, on agriculture. There is no manufacturing base of any significance.

The province is reasonably well endowed with minerals. The mineral industry has been a critical component of the Province's economy since the start of diamond mining in Kimberly in 1888 and remains so today.

The Namakwa District Municipality is one of five District Municipalities in the Northern Cape Province, and is sub-divided into six Local Municipalities. The total surface area covered by the District Municipality is 126 750 km^2, and it has an estimated total population of 117 960. This makes it the largest District Municipality in South Africa in terms of surface area, but it has a low population density of less than 1 person per km^2. The population growth rate from 1996-2001 was about 2%. This could largely be attributed to the decline of mining in other areas, resulting in migrant workers returning to their homes in this District Municipality. However, the growth rate is expected to decline in the coming few years with the downscaling of mining, which may result in a static population figure in the next few years. The impact of HIV/AIDS is also expected to become more pronounced in the following few years, slowing the population growth even more.

The mining area falls within the Nama Khoi Local Municipality, the Richtersveld Local Municipality and the Kamiesberg Local Municipality.

3.16.1 The Nama Khoi Local Municipality

The Nama Khoi Local Municipality is located in the Namakwa District Municipality, and consists of 9 wards. The surface area covered by the municipality is 15 025 km^2, with the total population being approximately 44 740 in 2001, which has grown to approximately 48 430 in 2008.

The Nama Khoi Municipality has its head office in Springbok, in the heart of Namaqualand. It covers an area of 13 970 km^2 with a population density of 3.2 people per km^2. The municipality includes the towns of Springbok, Fonteintjie, Kleinsee, Concordia, Bergsig, Matjieskloof, Okiep, Nababeep, Rooiwinkel, Bulletrap, Goodhouse, Steinkopf, Vioolsdrift, Gamoep, Komaggas, Carolusberg and Buffelsrivier. The area was once the domain of the ancient indigenous cultures of the Nama and Khoi-San who had lived in this area for hundreds of years.

3.16.2 The Richtersveld Local Municipality

The Richtersveld Local Municipality is located in the Namakwa District Municipality in the Northern Cape Province. This local municipality consists of 4 wards, with a surface area of approximately 9 600 km^2. The total population in this local municipality is approximately 10 950, with a population density of 1.1 persons per km^2.

The largest settlements include Port Nolloth (the municipal headquarters), Lekkersing, Khubus and Eksteenfontein. Mining is the main economic activity, but has been declining in recent years. The municipality also is actively growing the tourist industry, with the unspoilt Richtersveld landscape and the Richtersveld National Park receiving about 5 000 visitors per year. However, tourism and other developments in this area are restricted due to water scarcity.

3.16.3 The Kamiesberg Local Municipality

The Kamiesberg Local Municipality is located in the Namakwa District Municipality in the Northern Cape Province. The Kamiesberg Local Municipality consists of 4 wards, with a surface area of approximately 11 740 km^2. The total population is approximately 11 630, with a population density of slightly less than 1 person per km^2.

The Kamiesberg Local Municipality includes the towns of Aalwynsfontein, Garies, Groenriviersmond, Hondeklip Bay, Rooifontein, Leliefontein, Paulshoek Kamassies, Nourivier, Tweerivier Kamieskroon, Kharkams, Koingnaas, Kotzerus, Nariep, Platbakkies, Soebatsfontein, Spoegrivier and Wallekraal. Garies, is the fourth largest town in the overall Namakwa District municipality.

Hondeklip Bay was first used as a harbour to transport copper ore from the mines around Springbok. The town today serves as a fishing and diamond-mining community. It remains a popular holiday destination. An important source of income for the community is found in the rich marine resources available, specifically the crayfish catch. Farming is the main economic activity in the Kamiesberg municipality; stock farming (sheep, cattle and goats), is the primary land use.

3.17 NM Social and labour plan

The Social and Labour Plan (August 2006) of Namaqualand Mines is based on objectives as stated in the Minerals and Petroleum Resources Development Act, No. 28 of 2002. These objectives are to consider the operation of Namaqualand Mines in the context of generally recognised standards of sustainable development by integrating the social, economic and environmental factors in planning the mining operations throughout the life of the mine, by:

- Promoting and advancing the social and economic welfare of the people of the Namakwa District Municipality;
- Contributing to the transformation of the mining industry; and
- Extending De Beer's Consolidated Mines' contribution to the socio-economic development of the Namakwa District Municipality.

The Social and Labour Plan includes the following major aspects relevant to the NM employees.

- Literacy and Numeracy Plan, which in consultation with labour will offer every employee an opportunity to be functionally literate and numerate;
- Career Path Plan, which aims to implement career paths to provide opportunities to Historically Disadvantaged South African (HDSA's) employees to progress in their chosen career; and
- Scholarships, Bursary and Learnerships Plan. By interfacing with education authorities, Namaqualand Mines will provide scholarships, bursaries and learnerships to promote mining related education advancement, especially in the fields of mathematics and science at school level.

3.17.1 Employment Equity Plan

Namaqualand Mines is dedicated to creating non-discriminatory employment practices in which employees are treated the same at all levels, regardless of their background, race, gender or disability. The company commits to and supports the principles of employment, development and advancement of HDSA's. This plan is applicable to all employees who are South African citizens or permanent residents.

It is the aim of Namaqualand Mines to achieve equitable representation of designated groups in all levels in the workplace. The company has set itself a five year plan to achieve Employment Equity numerical targets by 2009.

3.17.2 Migrant Labour Policy

Namaqualand Mines is committed to creating a workplace in which employees of ability and application can develop rewarding careers at all levels, regardless of their background, race gender or disability.

The company is therefore committed to non-discriminatory employment practices. This policy is applicable to all employees, including those recruited from outside South Africa.

3.17.3 Namaqualand Mines workforce

Overall Namaqualand Mines employs a total number of 133 permanent employees. Most of the employees are drawn from towns in Namaqualand; primarily Komaggas and Steinkopf. A few employees come from the Sterkspruit area of the Eastern Cape and were recruited during the days of migrant labour.

The profile of Namaqualand Mines permanent workforce is depicted in Table 8 detailed in section 2.16.4 to 2.16.10

Table 8: Full time workforce at Namaqualand Mines

Employee Subgroup	Gender Key	Total
FTC	Female	1
	Male	28
	Count	**29**
Group Category	Female	1
	Male	7
	Count	**8**
Non-Group Category	Female	15
	Male	63
	Count	**78**
Temp - Monthly	Female	1
	Male	17
	Count	**18**
Gender Count		
Female		18
Male		115
	Grand Total	**133**

Permanent employee numbers are expected to increase to 250 – 300 when production resumes in 2012.

3.17.4 Demographics

The Northern Cape has the smallest provincial population of 0.82 million people (1.8 % of the RSA total) and the lowest population density of 2 persons per km². The Coloured population is in the majority at 51 %, followed by the black population at 33 %, the white population at 12 % and the Asian population at 4 %. The most widely spoken language in the province is Afrikaans, with 70 % of the population using it as their home language.

There has been a small decline in the total population size and the trend is expected to continue. The shortage of jobs has resulted in younger people leaving the region in search of employment and higher salaries elsewhere in the country. The average life expectancy was 63 years in 1995 and illiteracy was recorded to be 18 %.

3.17.4.1 Economic activities

The major economic activities in Namaqualand are mining, agriculture, fishing and tourism.

3.17.4.2 Mining and mineral processing

The minerals economy of the Northern Cape is a hundred and fifty years old and is still the mainstay of its economy. Mining constitutes 58 % of the turnover of Namaqualand and is the most important economic

activity. Minerals extracted include beryl, barite, amethyst, diamonds, copper, feldspar, lead, lithium, mica, silica, silimanite, gold, silver, calcrete and quartzite. Diamond mining is by far the largest mining activity in the region. Approximately 41 % of Namaqualand's economically active population are employed in the mining industry.

Although certain sub-sectors of the mining industry in the Northern Cape are approaching maturity, with downscaling having already or about to commence, it is claimed that there are still significant minerals that will sustain the mining industry for many years to come.

3.17.4.3 Agriculture

Farming in the Namaqualand Mines areas is severely limited by the arid environment, and consists primarily of small stock farming, mostly sheep and goats. Drought farming is a way of life although agriculture alone is insufficient to provide more than a subsistence income for a few farmers.

However, in other parts of the Northern Cape agriculture is one of the mainstays of the provincial economy.

Two major challenges face the agricultural sector in the Northern Cape, both of which if successfully overcome could result in a massive increase to the agricultural sector's contribution to the provincial economy. Firstly, the industry must undergo and achieve transformation so that new and emerging farmers can take their rightful place as equal members of the commercial agricultural fraternity. Secondly, the irrigated agricultural sub- sector needs to achieve a greater level of diversification, not only to spread the aggregate risk across the irrigation sub- sector but also to promote the development of crops that have a high affinity for agro- processing.

3.17.4.4 Fishing and marine aquaculture

The fishing industry in the Namaqualand Mines' areas is seasonal and offers irregular employment. It is centred on Hondeklip Bay and Port Nolloth. Other marine-based activities along the coast include oyster farming at the mouth of the Orange River, Port Nolloth and Kleinsee; and kelp collection. The area's greatest economic opportunity lies in the development of the pump-ashore marine aquaculture industry, which entails the cultivation of a range of high- value marine species, primarily for export to lucrative overseas markets.

3.17.4.5 Tourism

Regionally, tourism is becoming increasingly important to the Namaqualand economy and is regarded as one of the few potential growth sectors. Since 1994, the Northern Cape tourism industry has blossomed, largely as a result of the opening up of South Africa as a long-haul tourist destination and also because the Northern Cape tourism product caters ideally for today's nature-based eco-tourist who is looking for a new experience. More importantly, a number of major new conservation and tourism developments are currently underway in the Northern Cape and offer a range of new investment opportunities in the province.

A strategy that SANParks has adopted recently is the "Commercialization as a Conservation Strategy". In the Northern Cape, this strategy will be applied to the Kgalagadi Transfrontier Park and it is anticipated that others will soon follow. These, in the Northern Cape, are the Ai-Ais Richtersveld Transfrontier Conservation Park, the Augrabies, Vaalbos and Tankwa Karoo National Parks, as well as in the newly proclaimed Namaqua National Park.

The following tourism activities currently present in the area could provide initiatives for post closure economic activities at NM:

- Tourism activities such as the Diamond Route and Diamond Coast: Forever Namaqualand initiatives; and
- The creation and expansion of a wilderness area through the Namaqua Park (South African National Parks, Conservation International (CI) and De Beers)

3.17.4.6 Other sectors contributing to the economy

Other sectors that make important contributions to the economy of Namaqualand are construction, commerce and catering, transport and communications, finance, real estate and government. Small businesses predominate among the regions non-mining activities. More than half of these are general dealerships and most are found in urban areas. Springbok is the economic centre of the region.

3.17.5 Unemployment

With limited opportunities in the formal employment sector, unemployment is high and is expected to increase. The area is highly dependent on mining, which with near depleted ore reserves appears to be waning. Other development initiatives need to encourage diversification in the regional economy. The unemployment rate for the Northern Cape has been estimated to be 33 %.

3.17.6 Housing

The private mining settlement of Koingnaas was developed to support the requirements of Namaqualand Mines and in particular the Koingnaas Right. A large number of employees live in surrounding communities such as Hondeklip Bay, Buffels River and Komaggas.

The mine's housing strategy includes current forms of assistance and future plans to ensure homeownership and improved living standards such as the proclamation of Koingnaas as an open town and the incorporation into the local Municipality.

In this respect, all its employees are provided with accommodation through the provision of Company owned accommodation.

3.17.7 Social infrastructure

Most rural villages/communities in the region have poorly developed social infrastructure. Springbok, the regional centre, however is a well developed town, with a diverse social infrastructure incorporating the full scope of amenities one would expect to find in a town of its size.

3.17.7.1 Koingnaas

The social infrastructure of the town of Koingnaas is extremely well developed, including facilities normally provided in urban situations, such as housing, a clinic, shops, sport and recreation and other utilities (power, sewerage, roads, communication).. Post closure sustainability of these services is being investigated.

3.17.8 Water supply

89 % of Northern Cape households have access to piped water (at least to a community stand within 200m of the dwelling) an in general 66 % of the dwellings in the province have an improved toilet facility inside the dwelling (i.e. a flush toilet). 11 % have no sanitation at all. The mine's water supply could provide a source of water for the communities post-closure.

3.17.9 Power supply

59 % of the Northern Cape population utilise electricity for cooking and 75 % for lighting. Eskom supplies electricity to the Namaqualand region from the national grid via Upington and Aggeneys. Many rural communities are as of recently serviced with electricity.

3.18 Interested and Affected Parties

The EIA Report / EMP process, described in the Minerals and Petroleum Resources Development Act (Act 28, 2002), requires consultation with interested and affected parties (I&APs).

A public participation process was undertaken during the compilation of the EMPR in 2004, and at the commencement of the closure process at the end of 2005. The aim of the public consultation was to elicit the

views of stakeholders on the identification of potential risks, opportunities and mutual benefits of the Namaqualand Mines' mining activities, as well as to provide sufficient and accessible information to the I&APs an objective manner to assist them to:

- raise concerns and suggestions for enhanced benefits and alternatives; and
- contribute local knowledge and experience.

3.18.1 Public participation

The principles of the National Environmental Management Act (Act No. 107 of 1998) govern many aspects of environmental impact assessments (EIAs), including stakeholder engagement. These principles include the provision of sufficient and transparent information to stakeholders on an ongoing basis, to allow them to comment, and ensuring the participation of previously disadvantaged people, including women and the youth.

The stakeholder engagement process is designed to provide sufficient and accessible information to interested and affected parties (I&APs) in an objective manner.

The database of stakeholders consulted included the decision-making authority, various compliance organisations, local authorities, non-government organisations, local farmer unions, Namaqualand Mines farm lessees, and neighbouring land owners/users.

The opportunity for stakeholders to participate in the EMP amendment process was announced as follows:

- Personal correspondence; and
- A public meeting early 2011.

Public participation is ongoing, and De Beers Consolidated Mines Limited encourages all I&APs to actively participate throughout the EMP process.

4.0 MOTIVATION FOR PROPOSED PROJECT

4.1 Benefits of the project

It is generally accepted that diamond mining in the area, and in particular Namaqualand Mines, has made a notable contribution to the Namaqualand economy and this will continue for the remainder of the operational life of the mine, However, this contribution will decrease towards closure of the mine and other initiatives to stimulate economic development in the area are being pursued.

4.2 Consideration of project alternatives

Not applicable as the project is in the operational phase.

5.0 DETAILED DESCRIPTION OF THE PROPOSED PROJECT

5.1 Surface infrastructure

5.1.1 Roads, railways and power lines

5.1.1.1 Roads

Access to the mine is via gravel roads only. The three most used are secondary roads from Springbok to Kleinsee, Port Nolloth to Kleinsee and Garies to Koingnaas. The District Municipality maintains theses roads (except for 20 km from Koingnaas to the intersection with the Hondeklip Bay to Garies road).

A 60 km private tar road links Koingnaas and Kleinsee. Most of the roads in these towns are tarred and maintained by the mine. A 40 km private gravel road, built and maintained by Namaqualand Mines, connects Kleinsee to Komaggas.

The majority of roads lying to the west of the N7 are gravel or unsurfaced roads, and these roads range greatly in their state of repair and accessibility. In order to facilitate their mining activities in the region, De Beers have developed roads in the area, which are private roads. Such roads are either tarred or well graded gravel offering comfortable drivability.

Other (public) roads in the area are gravel roads, usually not in good state, and not maintained as often as is required.

The KNR mining areas are accessed via existing public or private roads. Prospecting activities require a reasonably extensive network of roads and tracks to allow access by rigs, lowbeds, tankers, LDV's and 4x4 vehicles off the main roads into the various farms. Considering the sparse distribution of existing farms roads and tracks, it is certain that quite a significant number of new access routes may have been made in the Koingnaas Right. Some of these routes would have been used on a regular basis for the entire prospecting period, while others would only have been used a few times over a short period of time.

The main haul roads run from the various mining areas to the main treatment plants and are well constructed. Smaller light vehicle roads connect offices, workshops and other frequently visited destinations. Numerous tracks are created and used during prospecting. When no longer required roads are closed off and ripped up to facilitate natural re-vegetation. Tracks are left to recover naturally.

5.1.1.2 Railways

The closest rail end is located at Bitterfontein, approximately 180 km south of Springbok from where goods are transported by road further north. The Sishen-Saldhana railway line is located to the east of the Bitterfontein line.

There are no railway lines within the KNR.

5.1.1.3 Powerlines

Eskom electricity is supplied to Namaqualand Mines via a 220 kV transmission line from the national power grid via Upington, Aggeneys and Springbok. A sub-station is located at Gromis, near Kleinsee, from where power is distributed by overhead lines throughout the entire NM.

The KNR has approximately 41km of overhead powerlines

5.1.2 Solid waste management facilities

5.1.2.1 Industrial and domestic waste disposal sites

Currently the mines follow a waste management procedure developed with a recognised specialist in waste management. In this respect, waste guideline documents covering numerous fields have been developed and submitted to DWA.

Solid waste generated by the mines is managed by means of dumps, including soft scrap (domestic/general waste) and hard scrap (recyclable) dumps, garden refuse dumps, salvage dumps and building rubble dumps. A total of 22 waste permits have been issued to Namaqualand Mines for these dumps. Four of these sites are situated within the KNR (Table 9).

Table 9: Waste sites located within the KNR

Location	Nature of Waste *	No. of sites
Koingnaas	Hard scrap	1
	Soft scrap	1
Michell's Bay	Hard scrap	1
	Soft scrap	1
Total waste sites:		**9**

***Note:** The permits for the above are filed with Namaqualand Mines.*

In addition to the above wastes, Namaqualand Mines deals with other wastes as follows:

- Medical waste from the Kleinsee hospital and clinics is removed off-site by a contractor for safe disposal;
- Asbestos fibre sheeting is removed off-site by a contractor and disposed of at the registered hazardous waste facility at Vissershok in Cape Town; and
- Used oil is collected and recycled by Oilkol.

***Note:** Oils and hydrocarbon spills are treated on-site.*

- Other hazardous wastes (such as lubricants from the dragline, oil contaminated with chlorinated hydrocarbons, electrical cleaning solvent, certain chemicals and fluorescent tubes) are treated in accordance with Namaqualand Mines' waste management protocol and disposed of at Vissershok. Removal of the hazardous waste is conducted quarterly by contractor.

5.1.2.2 Mine residue disposal sites in the KNR

The major mining-related wastes produced are fine residue and coarse residue.

Coarse residue arises from beneficiation of the ore within Koingnaas, Michell's Bay, the bulk sample plant and prospecting plant. The ROM is crushed to -12 mm or smaller (Table 10) and after various separation processes, including cycloning, the course discard produced is end-tipped from overland conveyor onto a coarse residue deposit (CRD) located in close proximity of the Koingnaas plant (Figure 7). All coarse and fine residue generated in the bulk sample- and prospecting plants is disposed of to the Koingnaas CRD and FRD).

Table 10: Rate of rise and particle size for KNR coarse residue deposits

Mining area	Height (m)	Rate of advance (m/month)	Materials deposited
Koingnaas	82.0	5.60	-12 mm +0.5 mm tailings
Michell's Bay	0	-	oversize stockpile
Bulk sample	35.4	-	-12mm +0.5mm tailings
Prospect plant	0	-	oversize stockpile

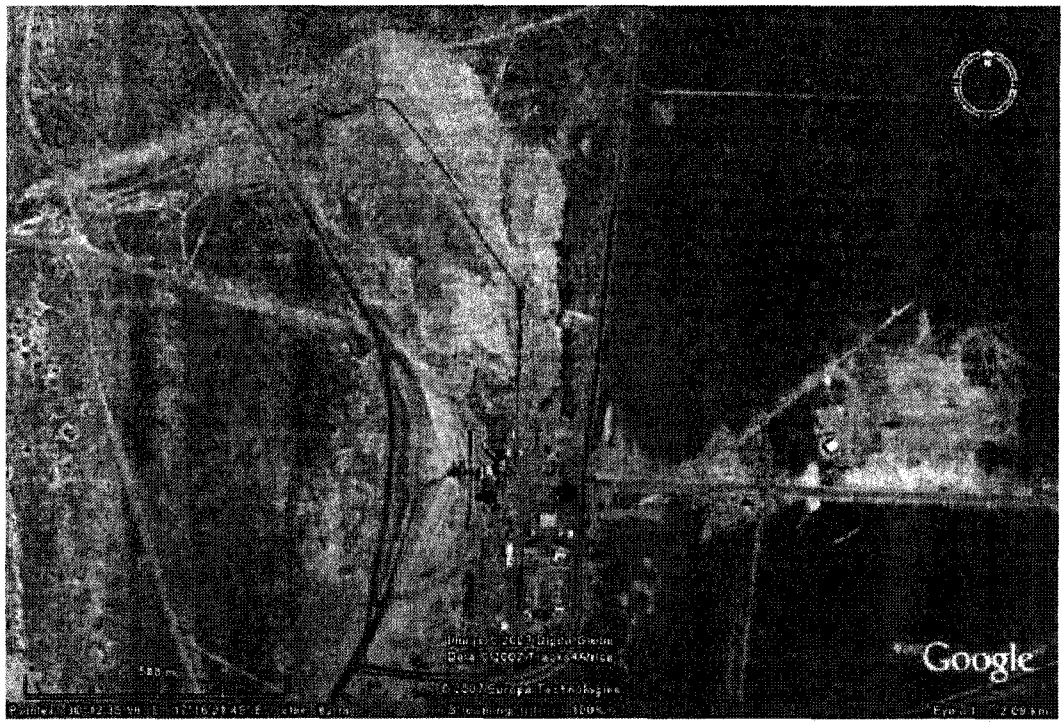

Figure 7: CRD within the Koingnaas plant area

In the past, fine residue generated within the KNR was disposed of in the sea. This practice was discontinued in the early 80s and all fine residue produced at Koingnaas and Michell's Bay is now disposed of in dedicated fine residue deposit (FRD). The fines are deposited by open-end spigotting.(Figure 8)

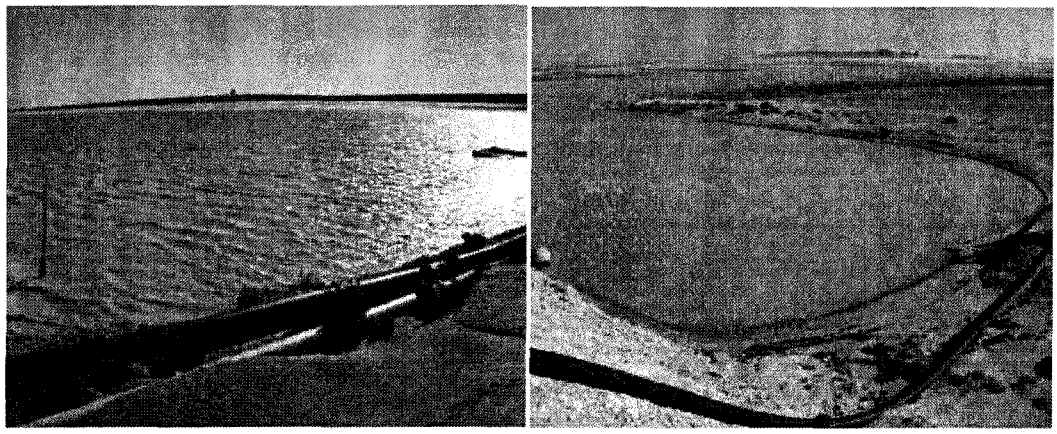

Figure 8: FRD within the Michell's Bay plant (left) and Koingnaas plant (right).

5.1.3 Water pollution management facilities

5.1.3.1 Sewage plant

The town of Koingnaas has reticulated water borne sewage with an activated sludge treatment works that is registered with the Department of Water Affairs. The effluent is used for irrigation, and the sludge is excavated from the ponds and deposited in a fenced off area. Within the mining areas, sewage is disposed of in septic tanks and associated French drains.

5.1.3.2 *Pollution control dams, paddocks and evaporation dams*

Workshops, maintenance areas and storage areas represent potential pollution risks as a result of spillages, leaks and seepage of hydrocarbons, chemicals and other hazardous substances. All these areas (workshops, maintenance areas, hazardous substance stores, refuelling areas, and waste storage areas) will be equipped with required pollution containment measures for as long as these areas are in use. Such measures include drip trays for short term applications, and a concrete floor contained by a bund wall in more long term situations. These measures are as temporary as the other structures and facilities on site and will be completely removed upon completion of work at a site.

No runoff is allowed to flow through such contained areas, and no contaminated water from within the areas is allowed to enter the surrounding environment.

5.1.4 Process-/sea water abstraction

Process water for use in the KNR at the Koingnaas Bulk Sample and Michell's Bay beneficiation plants is sourced from the nearby sea, with each of the plants having dedicated sea intake points for this purpose.

- **Koingnaas Bulk Sample plant**: Seawater seeps naturally into a sand-dam located behind the primary dune. A pump station pumps water from the dam to the storage reservoir and from there to the beneficiation plant. The sand-dam is regularly dredged. Water is recovered from the FRD for recycling in the plant.
- **Michell's Bay plant**: Seawater intake is situated in a rock gully, and water is pumped to a storage tank at the beneficiation plant. A schematic layout of the Michell's Bay plant is provided in Figure 12.

Seawater is occasionally used on gravel roads for dust control purposes

5.1.5 Mineral processing plants

Mineral processing in the KNR occurs in two areas, namely the Koingnaas Bulk Sample plant and the Michell's Bay plant.

5.1.5.1 *Koingnaas Bulk Sample Plant*

The Bulk Sample Plant consists of a crushing scrubbing and screening section, capable of treating 30 tph and a DMS section capable of treating 15 tph..

The material is screened with the +12 mm material entering a discard/optional recycle circuit and the -12 mm/+1 mm material reporting to the DMS. At all screens the -1mm fraction reports to the FRD. The concentrate is removed from the DMS with the discard reporting to the CRD.

The Koingnaas CRD that is growing at approximately 5.6 metres per month. The FRD consists of three facilities, two historical and one current, all constructed of coarse sands and overburden. Their gross capacity is 107 3200 m^2

Concentrate generated by this plant is treated through the Recovery Plant.

5.1.5.2 *Michell's Bay Plant*

A single tip feeds the Michell's Bay plant where all material reports to a primary crusher and then to a scrubber. The material then passes over a linear screen, with one section removing the -1mm fraction to the FRD and the other removing the +12 mm fraction to a discard bin. The -12 mm/+1 mm material is then transported for further treatment to the Koingnaas plant.

Coarse material from the Michell's Bay plant is disposed of in mined-out areas. Fines (-1 mm) from the Michell's Bay washing plant is discharged into adjacent mined out areas, where the slimes level will be built up to match the original surface level..

5.1.6 Workshops, administration and other buildings

5.1.6.1 Koingnaas Bulk Sample plant

The management and administration of the Koingnaas Right is carried out from within the mine. The main building contains the Management offices as well as the records, accounting and financial divisions of the Administration department.

The Mine Stores performs materials management. The department is responsible for the purchase, storage, and distribution of goods required by the mine.

The Human Resources department manages the workforce of the mines. It has recruitment, education, training, industrial relations, communications, community liaison and housing related functions. A wide-range of recreation facilities is also available to employees.

The Safety department helps ensure a safe and healthy workplace. Modern health care facilities include a clinic, with dedicated professionals, attending to needs.

Stringent security measures are required to safeguard the mine's diamond production - these services are provided by the Security department and a group of independent security contractors.

Various independent organisations provide postal, banking, catering, laundry, horticultural and other services.

5.1.6.2 Michell's Bay plant

Although the main management of the Michell's Bay plant is carried out in Koingnaas, a small on-site administration office is located in close proximity to the plant.

5.1.7 Housing, recreation and other employee facilities

Recreational facilities include a:

- rugby field;
- church;
- café;
- recreation club; and

Table 11 provides a breakdown of the residential infrastructure of Koingnaas

Table 11: Residential infrastructure of Koingnaas

Infrastructure	No. at Koingnaas
Occupancy rate	29%
No of houses	129
No of single quarters	20
No of hostel beds	250
No of telephone lines	No De Beers lines to Telkom. Only internal comms possible.
Schools	1 Pre- primary school
Recreational facilities	2 Recreational centres (community hall, restaurant, pub, canteen etc) 1 without equipment, other to be donated to Municipality) 2 Sports fields 2 Swimming pools;

Infrastructure	No. at Koingnaas
	1 Squash court; 2 Tennis courts
Sewage treatment works	1
Shopping centres; Banks; Post Office; Bottle store; Laundromat.	1 1 ATM 1 (Private) 1 1 (Private)
Private garages	1
Medical facilities	1 Clinic

5.1.8 Transport

Transport in the Koingnaas Right is mainly by busses or 4x4 vehicles.

5.1.9 Water balance diagram

Process water for use in the KNR at the Koingnaas Bulk Sample and Michell's Bay beneficiation plants is sourced from the nearby sea, with each of the plants having dedicated sea intake points for this purpose.

- **Koingnaas Bulk Sample plant**: Seawater seeps naturally into a sand-dam located behind the primary dune. A pump station pumps water from the dam to the storage reservoir and from there to the beneficiation plant. Water is recovered from the FRD for recycling in the plant. A schematic layout of the Koingnaas plant is provided in Figure 9.
- **Michell's Bay plant**: Seawater intake is situated in a rock gully, and water is pumped to a storage tank at the beneficiation plant. A schematic layout of the Michell's Bay plant is provided in Figure 10.

Seawater is occasionally used on gravel roads for dust control purposes.

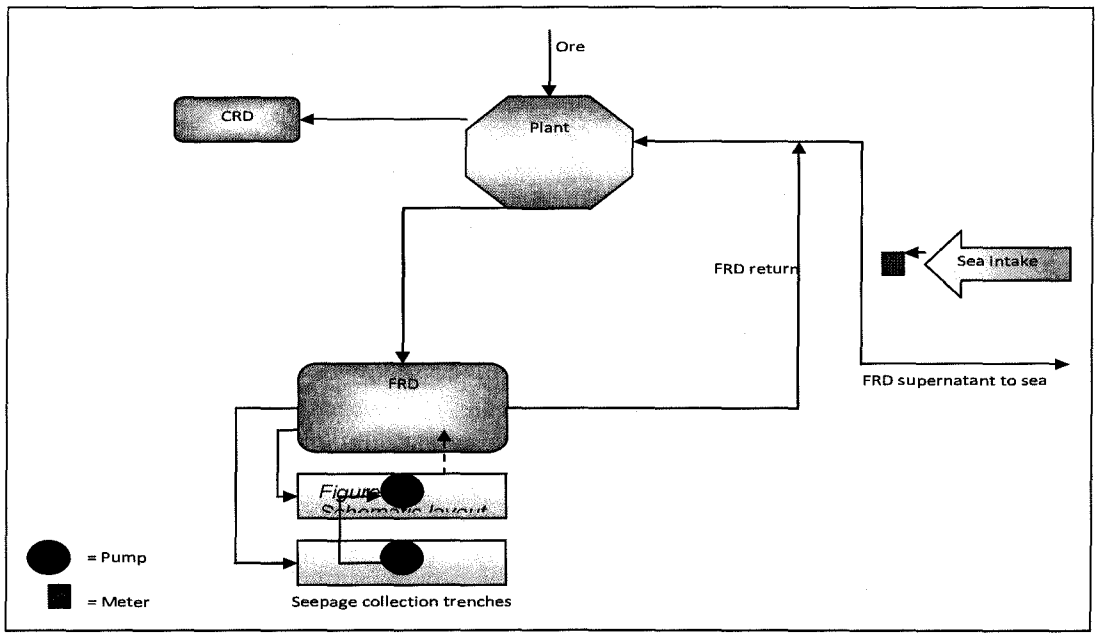

Figure 9: A simplified water reticulation for Bulk Sample Plan

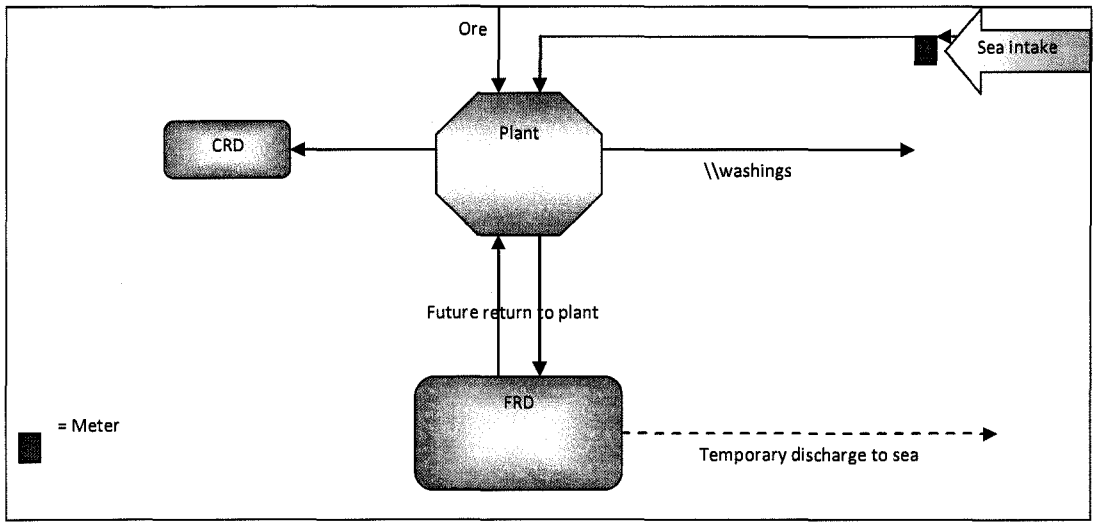

Figure 10: Schematic layout of the Michell's Bay plant

5.1.10 Disturbance of watercourses

No watercourses have or will be disturbed during mining operations in the KNR

5.1.11 Storm water

Storm water is not a concern in the KNR due to the low annual precipitation experienced in the area.

5.2 Construction Phase

Not applicable as the Koingnaas Right is in the operational phase.

5.3 Operational Phase

5.3.1 Prospecting

Diamonds are found along the entire West Coast, but the concentration of the deposits varies and the challenge lies in recovering these in an economic manner. Prospecting activities can be divided into two categories:

5.3.1.1 Contiguous exploration

This is carried out in the main mining areas and is aimed at extending the Life of Mine. It is a program of systematic prospecting and evaluation of the areas immediately adjacent to existing operations. Findings may lead to incremental additions to the proven ore reserve. Reviews of the ore reserve are periodically undertaken to ensure optimal depletion of the resource.

5.3.1.2 Primary exploration

This is a much broader prospecting program and is targeted at areas throughout the Namaqualand coastal plain. Primary exploration aims to conceive, explore, discover, and evaluate potential deposits in virgin territory, outside the current mining areas. New finds may extend the life of Namaqualand Mines by identifying new mining areas.

Typical prospecting methods employed are:

- Surface mapping by geologists of features such as rock outcrops, alluvial gravels, topographic depressions, etc. Fieldwork is carried out using four-wheel drive vehicles;

- Geophysical surveys involving fieldwork and remote sensing including aerial photography, ground resistivity, gravimetry, magnetometry, etc;
- Small diameter drilling (150 - 200mm) using percussion, reverse circulation or mud drilling methods to assess stratigraphy and the presence or absence of diamondiferous gravels;
- Large diameter drilling using an auger drill, casing puller and support crews to sample gravels in areas of deep overburden; and
- Trenching using excavators, trucks and support crews to sample gravels in areas of shallow overburden.

5.3.2 Mining

5.3.2.1 Planning

A mine planning system, known as the ore reserve management system, is used to produce the Life of Mine Plan. Information from various technical systems (i.e. costs, ore reserves, etc) is integrated to produce the mine plan.

The overall mine planning strategy is that of mining at the average grade of the planning reserves per plant area. The rate of production in terms of tons treated and the operating shifts each year on these plants, are planned with the objective that separate plant areas in the same Right are depleted at approximately the same time. A phased approach to mine closure has been adopted as that which will have the least impact on the region.

5.3.2.2 Mining Operations

Various opencast mining methods are used to expose the diamond bearing alluvial gravels that lie beneath the mainly sandy, but occasionally hard, overburden. The mining operation can be divided into five phases; first there is stripping of the topsoil and overburden, this is followed by bulk mechanical extraction of the diamond-bearing ore, then follows cleaning of the exposed bedrock, loading and hauling of run-of-mine gravels to the treatment plants and finally, the rehabilitation of the mined area.

Ancillary operations include dozing, ripping, drilling and blasting, road construction, excavating and trenching.

5.3.3 Ore Treatment

Diamond-bearing ore exposed by stripping is mined out and transported by haultrucks to the closest treatment plant.

Concentrate from the treatment plants is sorted in the final recovery building (situated in the BMR) and recovered diamonds are transported to Kimberley.

5.3.4 Plant residue disposal

The plant produces a coarse residue and a fine residue. The coarse residue is disposed of on the coarse residue deposit (CRD) by means of a system of conveyor belts and the fine residue on the fine residue deposit (FRD) as slurry. Various CRDs and FRDs are maintained for continuous production purposes and emergency situations.

5.3.5 Transport

Mining areas are accessed via existing public or private roads. Mining activities require a reasonably extensive network of roads and tracks to allow access by rigs, lowbeds, tankers, LDV's and 4x4 vehicles off the main roads into the various farms.

5.3.6 Proposed river diversions

There are no river diversions within the KNR.

5.4 Closure / Decommissioning Phase

Concurrent rehabilitation is undertaken during operations. However closure measures have been identified and consist of three different aspects:

- Land forming, the earthmoving and shaping of a disturbed area;
- Restoration, the ecological interventions for disturbed areas; and
- Sign off, the sign off and removal of an area from the mine's closure liability.

These are described below. (For technical details of each of the activities below see Appendix E: NM-PR-SHE-25)

5.4.1 Land forming

a) Predetermine the shape:

The Rehabilitation Manager and Officer determine the level of land forming and shape of a specific area.

b) Predetermine the earthmoving machine requirements:

The types of earthmoving machines that are used for this may vary from site to site, depending on factors such as the size of the area, the depth of the cut and or the type of area. The earthmoving requirements are determined by the Rehabilitation Manager.

c) Backfill mine dumps and cuts:

Overburden is backfilled into existing mine cuts and the resulting dumps profiled using the predetermined earthmoving equipment.

d) Profile dumps:

Backfilled overburden is profiled to the predetermined shape as was decided upon by the Rehabilitation Manager and the environmental officer.

e) Cover profiled area with topsoil or growth medium:

For optimal restoration results the profiled areas are covered with topsoil or suitable growth medium where available. The topsoil or growth medium is deposited at an approximate thickness of 30cm. Areas should only be covered with growth medium or topsoil if it can be netted and restored in the same restoration year.

5.4.2 RESTORATION

Restoration includes the ecological intervention to ensure that a disturbed area is recovered to a self-sustainable ecosystem.

The restoration is done in accordance with specifications set out by an independent ecologist. The following steps form part of the restoration process: netting, seed collecting and processing, restoration packs, transplants and broadcast seeding.

Strict methods have to be followed for each of the restoration activities (see attached addenda for methodology).

a) Netting:

Netting is erected on areas that have received topsoil or growth medium in order to stabilize the movement of the soil. The use of nets mimics the effect of larger plant in the natural ecosystems. The nets are set up in such a way that it is perpendicular to the dominant wind direction of the area in order to minimize wind erosion.

b) Seed collecting and processing:

Collecting and processing seeds are in accordance with the specifications as set out by the ecologist. This entails physically going out into the field and collecting seeds from naturally occurring plants. The seeds are dried and processed to get them out of their protective shields and enable germination. Furthermore the processed seeds are put into seed-packs to ensure a mixture of seeds from different species.

c) Restoration packs:

Restoration packs consist of planting cardboard boxes in the field and planting the processed seed-packs inside. The restoration packs are planted in patches of ten. These patches have two different seed-pack recipes planted together, five of each, to form the ten individual packs per patch. The boxes mimic the smaller to medium sized plants in the field, and provide protection against the wind for the seeds planted inside them. The specifications for the combination of seeds needed for restoration packs are determined by the ecologist depending on what species occur naturally in the area.

d) Transplants:

Transplants are plants that are removed from the field and planted in patches of ten between the restoration packs. These plants are removed from the natural veldt and/or from areas that are earmarked to be stripped for mining within the next year.

5.4.3 Health and safety

To limit the possible health and safety threats to humans and animals using the reclaimed mine site as it becomes available.

5.4.4 Social

To ensure that the infrastructure transfers, measures and/or contributions made by the mine towards the long-term socio-economic benefit of the local communities are sustainable, by:

- Identifying buildings and other infrastructure that will be of commercial and/or other value/benefit to the local community and transferring these to third parties as agreed between the mine and these parties and/or the stakeholders;
- Communicating and negotiating with local communities and related civil structures on the closure of the mine and the possible transfer of surface infrastructure to them;
- Ensuring effective hand-over of pre-determined mining-related surface infrastructure for future use by other parties;
- Providing, until hand-over of the mining-related surface infrastructure, training and awareness creation to empower the community to effectively manage the financial and/or commercial resources transferred from the mine; and
- Clearly defining the roles of the parties responsible for future management of the transferred facilities.

6.0 ENVIRONMENTAL IMPACT ASSESSMENT

This section details the environmental impact assessment conducted for operations at the Koingnaas Right and demonstrates that the impacts and potential impacts on the environment (as described in Chapter 2) have been considered and understood.

The significance of the identified impacts on the various environmental components was determined using the approach outlined below. This incorporated two aspects for assessing the potential significance of impacts (terminology from the Department of Environmental Affairs and Tourism Guideline document on EIA

Regulations, April 1998) namely, occurrence and severity.

These were further sub-divided as follows:

- Occurrence
  - Probability of occurrence; and
  - Duration of occurrence.
- Severity
  - Magnitude of impact; and
  - Scale/extent of impact.

In order to assess each of these factors for each impact, the following four ranking scales were used:

Probability (P)	**Duration (D)**
5 - Definite/don't know 4 - Highly probable 3 - Medium probability 2 - Low probability 1 - Improbable 0 – None	5 - Permanent 4 - Long-term (impact ceases after the operational life of the activity) 3 - Medium-term (5-15 years) 2 - Short-term (0-5 years) 1 – Immediate
Scale (S)	**Magnitude (M)**
5 - International 4 - National 3 - Regional 2 - Local 1 - Site only 0 – None	10 - Very high/don't know 8 - High 6 - Moderate 4 - Low 2 - Minor

Once these factors were ranked for each impact, the significance of the two aspects, occurrence and severity, were assessed using the following formula:

SP (significance points) = (magnitude + duration + scale) x probability

The maximum value is 100 significance points (SP). The environmental effects are then rated as of **High** (>75 SP), **Moderate** (50 - 75 SP) or **Low** (<50 SP) significance, both with and without mitigation measures and for both occurrence and severity, on the following basis:

SP >75	Indicates **high** environmental significance	Where it would influence the decision regardless of any possible mitigation. An impact which could influence the decision about whether or not to proceed with the project.
SP 50 - 75	Indicates **moderate** environmental significance	Where it could have an influence on the decision unless it is mitigated. An impact or benefit which is sufficiently important to require management. Of moderate significance - could influence the decisions about the project if left unmanaged
SP <50	Indicates **low** environmental significance	Where it will not have an influence on the decision. Impacts with little real effect and which should not have an influence on or require modification of the project design or alternative mitigation

The outcome of the impact assessment is detailed below.

6.1 Construction phase

Not applicable as KNR is currently in the operational phase and is entering the decommissioning phase.

6.2 Operational phase

Table 12 sets out the results of the Environmental Impact Assessment for the operational phase of the operations within KNR.

Table 12:: Impact Assessment - Operational Phase

Area of impact **Environmental Significance (before mitigation)** **Operational phase**

	M	D	S	P	Tot	SP	
Geology	8	5	3	4	64	M	The most significant impact of the entire mining operation is the large areas of land surface that are disturbed. In this respect mining results in the total destruction of the geological and sediment profile of the immediate mining site. The sensitivity of the area is less of a contributing factor because most of this activity is linked to similar geological features, although it obviously does play a role.
Surf-zone mining	6	4	2	4	48	L	Surf-zone mining impacts arise from the removal of gravels from the ocean floor by suction pump, the dislodging of rocks and boulders to get access to the gravels and the cutting of kelp to ensure safe access to suitable areas, thereby disrupting marine life. However, consideration should be given to the scale of these disturbance activities in relation to natural ocean events. On average surf-zone mining is conducted over an approximate area of 20 km, and can only dive for a few days a month due to tidal influences.
Beach mining	6	4	2	4	48	L	Beach mining impacts also occur in various places along the coast. Small-scale mining of the beach deposits lying between the low and high water marks, and in some cases above high water, is being carried out. These deposits are localized and not suitable for intensive mining operations as carried out on land. The mine uses dozers and/or excavators to stockpile sand/overburden in a windrow along the edge of the exposed area in cuts approximately 20m wide. Exposed gravels are then removed with the oversize material immediately screened out and returned to the beach. The ore is treated in small diamond concentration plants near the mining site. The area is then rehabilitated by dozing the sand windrow back across the mined out area, to return the beach to its original profile
Climate	-	-	-	-	-	N/A	There are no significant impacts on the climate, generated from the KNR.
Topography	8	5	2	4	60	M	Localised topographical changes (small changes to the topography) of the area will result from

							operation and/or management of equipment/labour on-site related to the avoidance and cleaning up of waste materials, litter, etc. and associated aesthetic impacts such as the visibility of drilling-grids and linear trench lines as seen from the air. This will, however, be of a temporary nature.
CRD / FRD	8	5	2	5	75	M	The establishment and growth of FRDs and CRDs associated with the KNR will result in a moderate impact that will exist until reclamation of these dumps during decommissioning and closure.
Soils	10	4	2	5	80		Due to stripping, prospecting and mining, loss of topsoil from the mining areas occurs. These soils are also highly dispersive and prone to wind erosion.
	10	4	2	5	80		Due to the removal and dumping of overburden, contamination of topsoil occurs in the localised area where the mining is taking place.
	10	4	2	4	80		Mining results in the inversion of the soil profile. This is significant because it results in a change in the soil characteristics at the surface of the exposed material compared with that of undisturbed sites. Such soil material can be unsuitable for plant growth, more easily eroded or prone to wind dispersion. These factors greatly influence the successful reclamation and re-vegetation of the mining areas.
	10	4	2	5	80		The most significant impact associated with ore treatment is the large volume of seawater that is used in the process. Once seawater is brought on land it has the potential to salinise the soil and hence affect vegetation if any spillages occur from the pipelines or storage facilities designed for its containment.
Land capability and use	8	4	2	5	75	M	The KNR covers approximately 200 km^2 of Namaqualand Mines' mining area. Prospecting and mining result in the conversion of local wilderness area into mining areas, thereby altering the land capability. The existence of prospecting and mining infrastructure and the provision of services such as roads, electricity, communication and water can and does affect large areas of land surface, its associated fauna and flora, and future land capability. The impact from the storage of seawater is most evident in seepage from the Koingnaas and Michell's Bay FRD's and would also likely have an effect on future land capability.
Plant life (flora)	6	5	2	4	52	M	During prospecting and mining large areas of land are cleared, reducing the available space for plant establishment and affecting the growth of local biodiversity.
	6	4	2	4	48	L	Windblown sand from exposed mining areas can result in changes in the downwind vegetation

	6	4	2	4	48	L	No endangered floral species that are under threat due to operational procedures have been identified within the KNR.
	6	4	2	4	48	L	Areas disturbed during the operational phase of the KNR will be susceptible to the invasion of weedy plants and alien invasive species. Most of these weedy plants are pioneer species which stabilise the soil, prevent erosion and allow for annual grass species to establish. However, in the absence of appropriate control, alien plants and weeds could continue to compete with the naturally occurring species and degrade the ecological quality of the site.
Animal life (fauna)	8	4	2	5	70	M	The KNR is known to have a number of Red Data species, although the precise extent of the location of such species is not known. The removal of vegetation during prospecting and mining activities reduces the availability of habitats for local fauna.
	6	4	2	3	36	L	Noise from blasting and general mining activities can affect wildlife. The establishment of mining infrastructure such as open pits result in the loss of natural habitat, and can create artificial barriers to the movement of local fauna. Concurrently, the presence of roads increases the chance of potential road-kills.
Surface water	6	4	1	5	55	M	The impact on surface water is insignificant due to the arid environment, lack of free-standing water, and the dry air-drilling techniques employed. As the exploration activities are confined to the company's mining areas there is little effect on other parties. The severity of these impacts is usually closely related to the intensity of the drilling (exploration) programme. Although opencast mining activities can affect the drainage of surface water, these factors are not as significant in this arid region as they would be in wetter parts of the country. Within the main mining area of the KNR there is no surface water. As the last downstream user, any impacts on these resources can only affect the mine and the natural environment. Due to the very low rainfall experienced in the area formation of storm water features is unlikely.
	6	4	2	4	48	L	Due to the lack of surface water in the area it is unlikely that recharge volumes will be affected.
	6	4	2	4	48	L	Erosion resulting in an increase in downstream suspended solids is unlikely from the KNR.
Groundwater	8	5	1	5	70	M	The impact on groundwater is insignificant due to the arid environment, lack of free-standing water, and the dry air-drilling techniques employed. As the exploration activities are confined to the company's mining areas there is little effect on other parties. The severity of these impacts is usually closely related to the intensity of the drilling (exploration) programme. Although opencast mining activities can affect the drainage of various groundwater aspects, these factors are not as significant in this arid region as they would be in wetter parts of the

							country.
	8	5	2	5	75	M	Even though the environment is arid, the impact on groundwater from the normal operations in the KNR is largely unknown and therefore may be seen as being moderate and will remain so until closure.
	4	2	1	4	28	L	Due to the arid environment and lack of groundwater in the KNR mining area, the effect on groundwater quality due to spillage or seepage from the CRD's and FRD's is unlikely.
	2	3	2	5	30	L	Due to the arid environment and lack of groundwater in the KNR mining area the effect on groundwater in the event of a failure of the CRD's or FRD's is likely to be insignificant.
Air quality	6	2	2	4	40	L	Exposed mine areas are susceptible to wind and are a source of dust. This affects air quality but due to the remote location and rural setting of the mine, has little impact on other parties.
Noise	6	2	2	4	40	L	Noise is a significant aspect of the plant and its associated operations. The use of hearing protection equipment is required of all employees working in noisy areas and where possible noise is engineered out of the process (*e.g.* rubber liners for scrubbers). Due to the remote location this does not have any significant affect on any surrounding communities. The maintenance of numerous workshops carries with it problems of waste management, noise and pollution potential. These impacts are similar to those of any small township and light industrial area.
	6	2	2	3	30	L	Noise results from blasting operations – when required, these are carried out at 4:30 pm. By comparison with other mines, blasting is not a large or significant aspect of Namaqualand Mines' mining activities. Noise from blasting and general mining activities can affect wildlife, but due to the mines remote location does not significantly affect any other human communities.
Visual aspects	10	5	2	5	85		Since the area in which the mining takes place is flat, mining activities are highly visible from both the ground and the air. However, due to the remote location of the operations not many people are currently affected by this aspect.
Sites of historical and cultural importance	6	5	2	3	39	L	The impacts on all sensitive landscapes (including the heritage sites) during the operational phase are similar to those experienced during the construction phase, and no additional impacts will be experienced. There are also no known sites of historical and cultural importance within the KNR.
Sensitive landscapes	8	4	3	4	60	M	There are no sensitive areas in the mining area, however, of significance to conservationists are the large areas in and outside the mining areas that have remained virtually untouched for over 50 years and can serve as ecological benchmarks for the region. The existence of these areas will also aid the reclamation of disturbed areas. From a conservation viewpoint, it is

	therefore important that the long-term future of these areas is determined before mine closure.
Socio-economic aspects	■ The above impacts must be balanced by the positive aspects of mining which include the revenues generated for regional and national government, employment and other socio-economic benefits. The road infrastructure is also of possible socio-economic value to the region. ■ Much of the existing infrastructure represents a major investment in the regional economy, a significant positive impact on the socio-economic environment. ■ The biggest impact in terms of the socio-economy of the region will be the closure of the mine and increased unemployment.
Interested and affected parties	■ Public consultation already established with a forum of stakeholders was continued during the compilation of the EMPR. During September 2005 and at the commencement of the closure process at the end of 2005. This process included: ■ Mine site advertising, ■ mine press advertising, ■ personal correspondence, and a ■ public meeting. ■ Stakeholders included the regulatory authorities, local authorities, non-government organisations, local farmer unions, Namaqualand Mines farm lessees, usufructuary farmers on Namaqualand Mines properties, and neighbouring land owners/users. ■ The following issues were noted during the above interaction with stakeholders. ■ The process of awarding unused land and lease land was perceived not to be transparent. Emerging farmers with little knowledge of conservation get awarded land. Upcoming farmers do not know veld management and 80% of farmers, that receive farms, are not evaluated correctly. ■ Farmers who are able to farm full-time should be considered when land is awarded. ■ Insufficient communication between farmers and Namaqualand Mines in the past. ■ That it had become evident that communal farming was not successful as the land could not accommodate a number of farmers on one property. ■ That nature areas between farms are not optimally used/utilised as there is not sufficient control over fencing and predators on the SanParks side. ■ That it be investigated whether surface rights owners or even lessees could obtain title deed, should no minerals be found on a particular property. ■ That enough time be allowed when making changes in land use or ownership. Farmers required enough time to remove livestock and/or allow feeding patterns to adjust ■ That local farmers have a wealth of knowledge regarding plant growth and could play a valuable role in reclamation of mining areas.

	■ That a certain amount of grazing on rehabilitated land actually promoted reclamation and that the concept of a *preservation farmer* should be explored. ■ The fences between farms and Namaqualand Mines property are not maintained and should be replaced as required. ■ Predators from Namaqualand Mines and SANPARKS areas enter the adjacent farms and are the cause of stock losses. ■ Consideration be given to small scale mining by land owners or communities in the area. ■ Tourism should be encouraged in the area and that Koingnaas and Hondeklip Bay could successfully be developed into tourist attractions. ■ Successful mussel farming is already practiced along the coast and that investigation into marine aquaculture for the area should be encouraged. ■ That it should be kept in mind that any development needed water to be successful. ■ Water within the Buffels River valley previously utilised to supply water to Okiep and Nababeep could be used in small enterprises.

6.3 Closure / Decommissioning phase

Namaqualand Mines, with a long mining history could gradually close over the period up to 2023. Towards this end Namaqualand Mines is making a concerted effort to address the surface reclamation backlog on the mine site. Experience with the establishment and maintenance of native vegetation on reclaimed areas has been gained over the past few years. However, extensive earthworks and shaping is required over vast disturbed areas to prepare these areas for re-vegetation. Moreover, a number of closure measures to render the reclaimed mine site stable and safe also was confirmed by external studies funded by the Company and the findings of these experiments are currently implemented. Dedicated full-scale trials are being undertaken to ensure that the rehabilitation and restoration methodology are tailored to the specific environmental needs of the individual sites.

The methodology followed for the environmental impact assessment for the operational phase was also undertaken for the decommissioning phase. Table 13 sets out the potential impacts for the decommissioning phase.

In general it could be stated that the nature of the potential impacts during the decommissioning phase would for most cases be very similar those during the operational phase, since the activities during decommissioning would largely match those of mining operations, namely earthworks, shaping and re-vegetation.

Table 13: Impact Assessment - Decommissioning Phase

Area of impact	Environmental Significance (before mitigation)						Decommissioning phase
	M	D	S	P	Tot.	SP	
Geology	n/a	n/a	n/a	n/a	n/a	N/A	No further destruction of geological and/or sediment profiles will occur.
Climate	n/a	n/a	n/a	n/a	n/a	N/A	There are no significant impacts on the climate, generated from the KNR.
Topography	5	5	2	5	60	M	Localised topographical changes (small changes to the topography) of the area will result from the reclamation of the mined areas. Changes in the topography will occur due to: Demolition and removal of plants and buildings Ploughing / ripping of identified roads in mining areas Reclamation of disturbed areas Reclamation of overburden and final voids Closure of unavoidable mine residues
	n/a	n/a	n/a	n/a	n/a	N/A	No further growth or establishment of new residue deposits envisaged.
Soils	10	4	2	5	80		Topsoil will be replaced on shaped areas, although some disturbance of the soil profile could have occurred during removal and storage. Such soils are more easily eroded or prone to wind dispersion. These factors greatly influence the successful reclamation and re-vegetation of the mining areas and hence specific measures need to be taken to mitigate this situation. Also, the deeper soils contain high levels of sodium and clay which inhibit plant growth. These soils are also highly dispersive and prone to wind.
Land capability and use	n/a	n/a	n/a	n/a	n/a	N/A	Rehabilitation of disturbed areas and residual infrastructure, in line with the planned land use zones will ensure closure has a positive effect
Plant life (flora)	n/a	n/a	n/a	n/a	n/a	N/A	No further areas of land will be cleared.
	4	2	2	3	24	L	Windblown sand from exposed areas can result in changes in the downwind vegetation during the reclamation period.
	n/a	n/a	n/a	n/a	n/a	N/A	No endangered floral species within the KNR.
	8	4	2	4	56	M	Areas disturbed during the operational phase of the KNR will be susceptible to the

Area of impact	Environmental Significance (before mitigation)						Decommissioning phase
	M	D	S	P	Tot.	SP	
							invasion of weedy plants and alien invasive species for a period after mining has ceased. Most of these weedy plants are pioneer species which stabilise the soil, prevent erosion and allow for annual grass species to establish. However, in the absence of appropriate control, alien plants and weeds could continue to compete with the naturally occurring species and degrade the ecological quality of the site. The climatic conditions in this arid area mean that plants are generally slow growing.
Animal life (fauna)	n/a	n/a	n/a	n/a	n/a	N/A	No further removal of vegetation will occur so that availability of habitats will not be reduced further than during operations.
	4	4	2	2	20	L	Noise from blasting and general mining activities will be limited during the decommissioning phase, so that no further loss of natural habitat will occur, and artificial barriers that were created during the operational phase will be reduced.
Surface water	n/a	n/a	n/a	n/a	n/a	N/A	Formation of storm water diversion features is not applicable to the de-commissioning phase.
	6	4	2	4	48	L	Due to the lack of surface water in the area it is unlikely that recharge volumes will be affected.
	6	4	2	4	48	L	Erosion resulting in an increase in downstream suspended solids is unlikely from the KNR.
Groundwater	4	4	1	5	45	L	The impact on groundwater is insignificant during decommissioning.
	n/a	n/a	n/a	n/a	n/a	N/A	Impact from normal operation will cease during decommissioning.
	4	2	1	4	28	L	Due to the arid environment and lack of groundwater in the KNR mining area, the effect on groundwater quality due to spillage or seepage from the CRD's and FRD's is likely to be insignificant.
	2	3	1	6	36	L	Due to the arid environment and lack of groundwater in the KNR mining area the effect on groundwater in the event of a failure of the CRD's or FRD's is likely to be insignificant. It is also expected that the FRD's and CRD's will be further stabilised once operations have ceased.
Air quality	6	2	1	4	36	L	Exposed mine areas and associated earthworks could be sources of wind blown

Area of impact	Environmental Significance (before mitigation)						Decommissioning phase
	M	D	S	P	Tot.	SP	
							dust. This affects air quality but due to the remote location and rural setting of the mine, would most likely have limited impact on other parties. Moreover, it is expected that this impact will not only be less than the operational period, but would also reduce as decommissioning proceeds.
Noise	6	2	2	3	30	L	The process of reclamation of the mining areas and workshops will have limited noise that will be localised.
	n/a	n/a	n/a	n/a	n/a	N/A	Blasting will not take place during decommissioning.
Visual aspects	10	5	2	5	85		Dedicated attention is required to ensure that the measures implemented during decommissioning add to the aesthetic quality of the reclaimed mine site. This applies to the created land forms, general surface topography as well as the infrastructure that is left behind.
Sites of historical and cultural importance	n/a	n/a	n/a	n/a	n/a	N/A	Not different to the operational phase. Development of tourism initiatives associated with cultural and historical features will enhance post closure sustainability of the community.
Sensitive landscapes	n/a	n/a	n/a	n/a	n/a	N/A	No sensitive landscapes in the KNR.
Socio-economic aspects	10	5	2	4	68	M	The biggest impact in terms of the socio-economy of the region will be the increased unemployment due to the closure of the mine, and thus reduced economic activity. However, the towns of Kleinsee and Koingnaas will be proclaimed as townships and will be gradually 'privatised' during the remaining operational period of mining. Some of the mining workshops and office blocks could be left intact to facilitate the establishment of small businesses. Tourism and eco-tourism initiatives will be pursued as per the preliminary closure plan. Transfer of land parcels to farmers will be considered for the post closure situation.
Interested and affected parties	Public consultation will need to continue for a period during the decommissioning phase.						

6.4 Residual impacts after closure

6.4.1 Adverse effects

Although notable effort would be made to reclaim the land directly and indirectly/affected by mining, residual adverse impacts would remain post closure. These mainly relate to possible reduced land capability, vegetation in a state of becoming self sustaining, remaining residue deposits and final voids as well as areas in a fragile state that are prone to wind erosion and related disturbances. Moreover, the remaining landscape, despite reclamation, would continue to display the scars of surface mining in the long term.

6.4.2 Positive effects

Mining has had indirect positive effects on the environment, which now represent development opportunities:

- **Undisturbed sections of mining area:** large areas, which have not been disturbed by mining, are in near pristine condition and have high conservation potential;
- **Some of the best farm land in Namaqualand:** progressive farming practice and low stocking rates on company owned farms has resulted in some of the best veld conditions in Namaqualand; and
- **Pristine stretches of coast:** while this is not relevant to the KNR, in the overall context of Namaqualand Mines, large coastal stretches where access and development has been controlled are among the most pristine stretches of the entire South African coastline. Significant progress was made towards the establishment of a National Park along some 55 kilometres of coast on mining properties.

7.0 ENVIRONMENTAL MANAGEMENT PROGRAMME

While it is anticipated that under current economic circumstances the life of mine is until around 2023, due to ongoing prospecting and anticipated sale and transfer of the mine within the next three years it is unclear what the operational life of the mine will be. In this respect the EMP has been divided as follows:

- Section 7.2: Construction phase – not applicable as the KNR is currently operational;
- Section 7.3: Operational phase – remaining operational life, which will describe the activities currently taking place in the mining areas; and
- Section 7.4: Decommissioning phase and closure, which will describe the activities in respect of the mines proposed closure in 2023.

7.1 Construction phase

Not applicable as the KNR is currently in the operational stage.

7.2 Operational phase

This section outlines the topics which are usually the result of activities, services and/or products associated with the operation of the KNR, and the objectives and mitigation measures required to manage and minimise the identified impacts (Table 14).

Table 14: Objectives and mitigation measures to manage and minimise impacts

Topic	Objective	Measure
Ongoing exploration	To limit the disturbance caused by exploration drilling and to reclaim exploration boreholes on an ongoing basis	■ Backfill the exploration boreholes to surface. In the case of large diameter auger holes, the soil will be returned as close as possible to the same sequence as it was removed during drilling; and ■ Limit areas disturbed by support equipment.
Reclamation of benches	To render benches safe and stable	■ Doze topsoil back away from the edge of the bench, for a horizontal distance of between one half to two thirds the height of the bench; ■ Doze the bench down to an angle of less than 20 degrees, pushing the material back into the open excavations; and ■ Bulldoze the stockpiled topsoil back across the area of the profiled/shaped bench. *NOTE: In the case of the ADT and excavator stripping method, benches are formed where the individual bench height is approximately 3 m.*
Soils	To remove and store useable soil for site reclamation.	■ Remove and stockpile the topsoil and associated vegetation; ■ Remove and dump the overburden separately from the topsoil; ■ Replace topsoil as soon as possible on profiled/shaped areas to prevent deterioration of the seed bank while protecting it with windbreaks where necessary if storing for prolonged periods; and ■ Limit stockpiling of topsoil to virgin cuts
Note: *Soil conditions play a critical role in the successful reclamation of mining areas. Due to the poor soil characteristics of the underlying overburden, topsoil is essential for the reclamation of mined areas. .*		
Exploration/prospecting	To limit surface disturbance and to re-instate pre-exploration land capability.	■ Vacate stock-camps of stock, where prospecting is being undertaken for the duration of work; ■ Reduce surface disturbance by limiting the number of new roads/tracks. Select routes that will not affect woody or protected species; ■ Refrain from the erection of permanent structures during prospecting ie, concrete slabs/buildings, etc. ■ Reclaim all disturbances to the pre-explored/prospecting status.

		Reclamation will only be carried out in areas where subsequent mining will not take place. The nature of this reclamation will vary as follows: ■ Clean up of the site generally, after which it will be left to recover naturally, ■ Rehabilitate the site intensively using methods such as backfilling trenches, and possibly even reseeding the area; ■ Rip or plough all compacted areas to ensure re-growth of vegetation; ■ Conduct checks prior to stripping, for any protected species. If any such plants are found, the necessary permission will be obtained for removal and replanting; ■ Encourage natural re-vegetation and to accelerate the plant succession process, sow seeds of endemic indigenous plants in the areas covered with topsoil; ■ Monitor the re-vegetation process and if necessary obtain plants (especially perennials) and plant on the area under reclamation; and ■ Remove invader species that have established themselves on the disturbed/reclaimed areas.
Mining	To re-instate the required land capability over mining related disturbed land to facilitate the implementation of the planned final land use.	■ Check for protected species and remove species such as tortoises off - site. This will be conducted prior to any surface disturbance; and ■ Institute the measures related to backfilling, profiling, top soiling and re-vegetation as amended by the initial reclamation and closure plan.
Drilling for blasting	To limit drilling related contamination that could compromise site reclamation and/or planned post closure land use.	■ Conduct shallow air-flush drilling or shallow auger drilling (average hole depth approximately 20 m) as required by the local diamond mineralisation. Under these circumstances no sumps for drilling fluids are required and hence the disposal of drilling fluids is not problematic; and ■ Collect all oil or similar products arising from the servicing of equipment and remove from the site for disposal as per operational procedure.
Land use	To conduct mining and associated reclamation in such a manner to facilitate the implementation of the planned land	■ Implement and maintain the measures stipulated in this table as required.

	use.	
Natural vegetation/plant life	To re-instate natural vegetation on profiled and top soiled disturbed areas to be self sustaining.	■ Prepare areas for vegetation after shaping and top soiling, including ripping of roads and other areas where soil compaction has occurred; ■ Erect nets at the required density/spacing and direction on the prepared areas to act as windbreaks and to trap any wind-blown seeds; ■ Establish vegetation as directed by the results/findings of the latest field trials; ■ Maintain nets and vegetation as guided by previous successful reclamation work; ■ Conduct monthly inspections during the first year. Record and report (including a photographic record) on progress; and ■ Monitor the site at a six-monthly frequency an after the first year and institute remedial action as required until considered suitably reclaimed.
Animal life	To encourage the return of animals to reclaimed sites/areas.	■ Observe the stipulated maximum speed limits for specific vehicles to limit possible injury to animals; ■ Create awareness for animal life and the measures to limit possible adverse effects on animals by including information on this in the Namaqualand Mines' environmental awareness training material; and ■ Present the material to mine personnel, contractors and others involved in mining. *NOTE: Experience has shown that animals move away when there is damage or loss of habitat as well as noise. Animals return gradually as those factors which had displaced them are removed and re-vegetation has occurred. Hence no active effort of relocation of animal life would be made.*
Water contamination	To limit possible surface water contamination within mining and surrounding areas under control of the mine.	**River crossings** ■ Try to avoid river crossing for access to mining areas as far as possible If not possible assess the possible effect on water quality and flow and minimise as far as possible ; and

		■ Register existing and planned river crossings. **Onsite sewage** ■ Provide portable chemical toilets on site to prevent water contamination due to uncontrolled sewage disposal practices. **Hydrocarbons** ■ Store all hydrocarbons in containers to prevent hydrocarbon contamination of local water; ■ Ensure responsible re-fuelling practices using quick couplers to prevent diesel spillage and placing drip trays under vehicles with oil/diesel leaks; ■ Ensure that spill-sorb or another approved absorbent product is available on site to treat spills in-situ. The drip trays will be standard Multiplus 'weaning trays' (1,2 x 0,6 x 0,20m) with a capacity of 140L ; ■ Report all incidents and review to ensure effective corrective and preventative action; ■ Report major incidents to the relevant authorities using the mine's Environmental Incidents reporting procedure. **Waste** ■ Comply with the latest version of the Minimum Requirements (DWA, 1998);. ■ Register all waste disposal facilities as per regulatory requirements; ■ Separate waste into hazardous and general waste as defined by the Minimum Requirements, Second Edition as follows: ■ Hazardous waste: "Hazardous Waste" is waste that has the potential, even in low concentrations, to have a significant adverse effect on public health and the environment because of its inherent toxicological, chemical and physical characteristics"; ■ General waste: refers to any waste that does fall within the definition of hazardous waste; ■ Dispose of domestic or general waste to a permitted waste site in

		Koingnaas; ■ Keep all hazardous waste (oil filters etc.) in 210 litre drums on a concrete slab with bund walls or on drip trays; ■ Inspect all containers for any leakage and secure to prevent accidental spillage; and ■ Remove all hazardous waste for safe off-site disposal by a suitable contractor at a quarterly frequency
Water balance	To maintain freshwater and seawater consumption within authorised limits.	Monitor seawater and fresh water consumption and keep within authorised limits. Inspect pipelines and containment facilities regularly for leakages and repair as required.
Storm water	No specific objective	Storm water is not of concern in the region.
Surface rehabilitation	Not applicable.	
Legitimate requirements of surface water users on the affected water course	Not applicable	No notable surface water that is beneficially used.
River diversions	Not applicable	
Optimising surface reclamation in order to minimise adverse groundwater impacts	To conduct selective pit backfilling in specific cases to limit the potential for groundwater quality deterioration.	■ Groundwater occurrence, the nature of mining and associated reclamation is such that in most cases on the mine site the potential for groundwater impacts are very limited, hence not requiring any specific action. However, in those cases where groundwater is encountered that could be beneficially used the following would apply: ▪ The execution of a dedicated groundwater investigation, including an associated hydro census; ▪ The implementation of the required mitigation measures as proposed by the groundwater investigation and as agreed with stakeholders, which could include selective open pit backfilling to limit the potential for groundwater quality deterioration; and ▪ Execution of the required monitoring to confirm the success of the implemented mitigation measures.
Meeting the requirements of legitimate groundwater users in the affected zone	No notable groundwater that is beneficially used.	See the above for those cases where groundwater that could be beneficially used is encountered

Air quality	To limit the dust mobilisation and wind erosion.	**Wind erosion** ■ Undertake surface stabilisation to control possible wind erosion until suitable vegetation cover is established; ■ Delay the re-introduction of stock to an area until acceptable re-vegetation has occurred; and ■ Conduct regular monitoring of these areas after reclamation, and maintain photographic and written records of the progress of re-vegetation. Conduct intervention/remedial action as necessary.
		Dust mobilisation ■ Observe the maximum speeds limits as stipulated for specific vehicles to minimize the potential for dust mobilisation; ■ Limit vehicle movement to defined haul and access roads; and ■ Water these roads as required to limit dust mobilization.
Noise	To limit excessive noise by mining related vehicles.	■ Conduct regular inspections of vehicles to ensure that noise levels generated by these vehicles are within acceptable limits; and ■ Observe the maximum speeds limits as stipulated for specific vehicles to limit excessive noise.
Sensitive landscapes	To protect sensitive landscapes, archaeological and heritage sites against mining related damage.	**Sensitive landscapes** ■ Protect sensitive landscapes by avoiding mining and/or associated activities within these areas or close by as far as possible; **Archaeological and heritage sites** ■ Avoid identified archaeological sites and shipwrecks; ■ Stop all activities if archaeological sites are found (that were not visible on the surface at the time of the initial survey) and report for further investigation; ■ Commission an archaeologist(s) to do further investigations and implement conservation measures arising from recommendations as required; ■ Obtain the necessary permits from SAHRA or the provincial heritage agency, depending on the type of permit required, to authorise the

		implementation of the required conservation measures.
Visual aspects	To ensure that the mine site after surface reclamation has an acceptable appearance that would not compromise the planned final land use.	Conduct surface reclamation and associated site tidying.
Regional socio-economic structures	To contribute to the local socio -economic situation as far as possible to support sustainable development.	■ The contribution by Namaqualand Mines to the local socio economic situation has already occurred is currently still occurring. However, as mining is scaled down in the near future, the mine is willing to participate and/or contribute to other initiatives that would reduce and /or off-set the possible adverse effects of reduced mining related contribution to the local socio-economic situation and maintain sustainable development as far as possible. Currently these initiatives include: ▪ the generation of renewable power through the establishment of a wind farm (Third Planet Enterprises and Namaqua District Municipality); ▪ the possible establishment of nuclear power stations on the farms Brazil and Schulpfontein, located between Kleinsee and Koingnaas; ▪ the creation of a wilderness area through the Namaqualand Wilderness Initiative (South African National Parks, Conservation International and De Beers); ▪ the general improvement of social and environmental situation through the Namaqualand Restoration Initiative (Conservation International) and the Arid Eden initiative (also Conservation International); and ▪ the investigation of the extension of marine aquaculture business through the establishment of oyster and abalone farming and fin-fishing within open pits on or close to the beach to be filled with sea water (De Beers).
Interested & Affected Parties	To ensure that the stakeholders are kept informed of the ongoing mining operations, reclamation, closure planning and other	Continue with the stakeholder consultation and deal with issues as identified under section 3.18 as well as arising from ongoing consultation.

	initiatives to support sustainable development.	
Submission of information	To ensure that the regulatory authorities obtain the required information as requested in permits, licences and directives.	■ The EO shall record whether each mitigation measure is being implemented successfully. If a measure is not implemented successfully, the EO shall record the corrective actions required as well as the measures taken to implement such corrective actions; and ■ Submit relevant information as requested by the DME, DWA and DEAT and or stipulated in permits, licences and directives.
Maintenance		
Reclaimed land	To conduct the required maintenance to ensure that the reclamation undertaken is successful and sustainable.	■ Provide ongoing maintenance to reclaimed land until such time as the natural conditions have been re-established; and ■ Establish maintenance intervals with the relevant sector specialists/managers.
Water pollution control structures		■ Ensure that water pollution control structures such as the bulk fuel storage banks have bund walls to contain spillages; ■ Ensure correct handling to minimise potential spillage; ■ Monitor tank volumes regularly to detect losses through leakage; and ■ Rectify if leakages detected.

7.3 Closure / Decommissioning phase

7.3.1 Guiding principles

The guiding principles and key considerations that have been adopted to guide mine closure are as follows:

- An outcome from which the mining proponent can "walk away," with limited residual care and maintenance requirements, must be sought. In this regard, proven sustainable passive measures must be favoured over measures that require ongoing maintenance and/or active care (treatment);
- The closure measures selected for implementation must be approved by the regulatory authorities before full-scale implementation. Hence, the need for an approved closure plan within which these measures are clearly documented;
- Cognisance must be taken of the success factors which allowed some of the "green areas" to be "signed-off" by the regulatory authorities. These factors must be incorporated in the trials as far as possible and be carried through to full scale implementation. This also applies to current knowledge and experience of Namaqualand Mine's staff as well as NRI that needs to be involved with the design and evaluation of the trials;
- Ecological sign-off of previously disturbed areas are done in collaboration with an external specialist West Coast ecologist;
- The trials must be tailored as that they inform the risk assessments (especially level 2) required by the latest MEM series guideline on mine closure;
- Rehabilitation and restoration trials are conducted as needed in new environments to ensure that the methodologies incorporated for final restoration of specific sites will ensure the sign-off of areas by regulatory bodies;
- Closure measures must be aligned to and/or compatible with operational measures and must allow for seamless transformation (as far as possible) from operations to the closure situation;
- The closure plan must be progressively developed and refined as information becomes available, resulting in an appropriate and up to date closure plan at the time of mine closure. This will include the gathering of information during the operational phase of mining to demonstrate the suitability of the closure measures selected for implementation;
- Reclamation of the mine site and associated disturbed areas must run concurrently with the mining operations, where feasible. On completion of mining within a specific area, and as soon as this area becomes available, reclamation in accordance with a site specific closure plan, aligned to he latest overall interim closure plan, must be instituted;
- The measures provided must be appropriate for a remote arid area;
- Consideration must be given to the possible transfer of portions of the mine site and/or surface infrastructure that could be beneficially reused after mining to third parties. These transfers should contribute to a sustainable socio-economic benefit to the region in which mining has taken place. These transfers could be done progressively as reclaimed areas become available and/or at closure;
- The closure measures stipulated in the closure plan must limit the potential adverse effects of the closed mine site on the receiving environment, and to ensure that the quality of life of the surrounding communities is not compromised after closure;

- It must be endeavoured to maximise the possible socio-economic benefit related to mine closure and that at least the final land use (after use) of the mine site is beneficial and sustainable in the long-term; and
- Stakeholders must be involved in a meaningful manner to inform closure planning by reflecting local requirements, priorities and preferences, preferably culminating in appropriate land use plans and tangible sustainable development initiatives/ventures.

7.4 Closure objectives

The overall goal for the closure of Namaqualand Mines is to create a mixture of land uses, mainly wilderness and small stock farming areas, interspersed with other land uses that evolve over time towards mine closure, supporting sustainable development as far as possible. The detailed performance objectives and associated measures following for these are described in Table 15

Table 15: Environmental Management Programme: Objectives and Measures

Topic	Objective	Measure
Upfront planning	To provide overall guidance and direction to closure planning and eventual site relinquishment.	
Closure plan, field trials and progressive closure.		■ Compile an initial reclamation and closure plan to identify the key aspects that need to be addressed for closure; ■ Conduct full scale field trials to inform reclamation targets and the required measures to achieve these targets related to the identified aspects; ■ Obtain further information from field trials, work sessions and other reclamation work to inform and finalise closure planning; and ■ Set the framework for progressive closure of reclaimed areas, both technically and regulatory, to facilitate site relinquishment and /or transfer to third parties as these areas become available after successful reclamation.
Physical stabilisation	To remove and/or stabilise surface infrastructure and mining residue and/or disturbances that remain on the site after closure to allow for the planned final land use.	
Surface infrastructure	To demolish buildings, plant and related surface infrastructure with no post-closure beneficial use to facilitate the implementation of the planned land use.	■ Demolish non-usable buildings, plant and related surface infrastructure and dispose of the demolition waste in accordance with disposal options. As a contingency measure, institute a process to investigate possible suitable sites for safe on-site disposal of demolition waste; ■ Clean machinery, equipment, and storage tanks and dispose as above; ■ Remove concrete structures, foundations and slabs to 1 m below final ground level; ■ Dismantle power transmission lines, pipelines, and remove from the site; ■ Decommission and remove buried support infrastructures (tanks, pipes, underground services etc.) in a safe, acceptable manner. Buried infrastructure remaining on site will be identified on site closure maps; ■ Fill decommissioned septic tanks with inert material and cover; ■ Decontaminate steel and scrap metal for salvage and recycling, if valuable; ■ Encapsulate or dispose off-site of hazardous material; ■ Conduct assessments of contaminated soils and amelioration and/or dispose; and

Topic	Objective	Measure
		■ Shape and re-vegetate the disturbed areas from which infrastructure have been removed.
Coarse residue deposit (CRD)	Not applicable for the KNR	N/A
Fine residue deposit (FRD)	Not applicable for KNR	N/A
Haul and access roads	To reclaim salt treated primary haul and access roads to the planned final land use for the mine site.	■ Deep rip the road surface and related areas; ■ Load and haul the ripped material for disposal in available mining voids. If possible, the material will be dozed into nearby voids; ■ Shape the cleared areas to emulate the natural surface topography as far as possible; ■ Shape cuttings and embankment suitably to ensure safety and decrease erosion potential; ■ Breach earth embankments associated with access roads and haul roads that could impede long term surface drainage and shape as above; ■ Ameliorate and vegetate disturbed areas. Ensuring that the surface soil is a suitable growth medium, and has a rough surface topography. This can be topsoil, topsoil mixed with subsoil, or where such soil is limited, patches of topsoil/subsoil and CRD. Growth medium should cover a minimum depth of approximately 150 to 300 mm depending on type; ■ Address possible wind effects on vegetation establishment as follows: ■ If the width of the disturbed area > 50 m, or exposed to wind erosion, erect wind netting as per specifications for the region; ■ If the width of the disturbed area < 50 m and adjacent to natural vegetation, natural dispersal and succession is sufficient for reclamation; and ■ If the width of the disturbed area > 50 m or not adjacent to natural vegetation, seeds, seedlings and transplants of indigenous species, and soil ameliorates are to be added in a manner that benefits from ecological dynamics. Specifications to be determined by soil type and habitat.
Secondary haul and access roads	To reclaim historically or sporadically salt treated secondary haul and access roads to the planned final land	■ Conduct salinity, compaction and related testing of the material from the road surface and related areas to determine the suitability of the material for re-vegetation;

Topic	Objective	Measure
	use of the mine site.	■ Based on the test results, determine whether the material: ▪ needs to be addressed similarly as the material from the primary haul and access roads ; and ▪ can be ameliorated in situ if the surface soil provides a suitable growth medium. Ensure that the surface soil is a suitable growth medium, and has a rough surface topography. A suitable growth medium need to have some biological activity, not have too high a clay content, and will have some primary nutrients (relative to agricultural soils, only very small amounts are necessary). This can be topsoil, topsoil mixed with subsoil, or where such soil is limited, patches of topsoil/subsoil and CRD. Growth medium should cover a minimum depth of approximately 150 to 300 mm depending on type; and ■ Ameliorate and vegetate disturbed areas: ▪ If the width of the disturbed area > 50 m, or exposed to wind erosion. erect wind netting as per specifications for the region; ▪ If the width of the disturbed area < 50 m and adjacent to natural vegetation, natural dispersal and succession is sufficient for restoration; and ▪ If the width of the disturbed area > 50 m or not adjacent to natural vegetation, seeds, seedlings and transplants of indigenous species, and soil ameliorates are to be added in a manner that benefits from ecological dynamics. Specifications to be determined by soil type and habitat.
Gravel roads and paths	To reclaim untreated (salt water) gravel roads and paths to the planned final land use for the mine site	■ Deep rip the road surface and related areas. If road surface does not consist of natural surface soils, apply a suitable growth medium as above; ■ If roads are not compacted and consist of natural surface soils, deep ripping is not necessary, only roughen the surface topography; ■ Ameliorate and vegetate the disturbed/ripped areas: ■ If the width of the disturbed area > 50 m, or exposed to wind erosion. erect wind netting as per specifications for the region; ■ If the width of the disturbed area < 50 m and adjacent to natural vegetation, natural dispersal and succession is sufficient for restoration; and ■ If the width of the disturbed area > 50 m or not adjacent to natural vegetation,

Topic	Objective	Measure
		seeds, seedlings and transplants of indigenous species, and soil ameliorates are to be added in a manner that benefits from ecological dynamics. Specifications to be determined by soil type and habitat.
Fugitive tracks	To reclaim fugitive tracks to the planned final land use for the mine site.	■ Erect barriers to prevent access by vehicles; and ■ Allow road to colonise naturally. If the width of the disturbed area < 50 m and adjacent to natural vegetation, natural dispersal and succession is sufficient for restoration.
Overburden and spoils	To render the overburden and spoils stable in the long-term and aligned to the planned final land use of the mine site.	■ Dose and/or load and haul spoils into available voids; ■ Profile the remaining spoils to suitable outer slopes and integrate the shaped outer slopes with the shaped upper surface; ■ Re-vegetate the shaped outer slopes and upper surface. Ensure that the surface soil is a suitable growth medium, and has a rough surface topography. This can be topsoil, topsoil mixed with subsoil, or where such soil is, limited patches of topsoil/subsoil and CRD. Growth medium should cover a minimum depth of approximately 150 to 300 mm depending on type; ■ Erect wind netting as per specifications for the region; and ■ Add seeds, seedlings and transplants of indigenous species and soil ameliorates in a manner that benefit from ecological dynamics. Specifications to be determined by soil type and habitat.
Vegetation	To ensure that the established vegetation on reclaimed areas becomes self-sustaining and is integrated into the overall vegetation community.	■ Maintain wind netting, i.e. repair or replace as necessary; ■ Conduct in-fill vegetation as required to ensure that predetermined basal cover and species mix are achieved; and ■ Hand-pull woody weeds/exotic/alien vegetation if present and dispose of this in a manner that would not result in secondary infestation.
Environmental quality	To ensure that local environmental quality is not adversely affected by possible physical and chemical effects arising from the mine site after closure.	
Dust	To limit the potential for dust generation on the reclaimed mine site that could cause nuisance and/or health effects.	■ Conduct surface reclamation as stipulated above; ■ Establish vegetation as stipulated above; and ■ Conduct monitoring and maintenance as stipulated.

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Topic	Objective	Measure
Surface erosion	To prevent surface erosion on disturbed/reclaimed areas to curb sediment wash-off and/or the creation of condition that could impede site re-vegetation.	■ Stabilise slopes by shaping and contouring emulating local stable land forms providing suitable conditions for sustaining vegetation; ■ Avoid the creation of conditions that could create gullies and/or rills on shaped slopes; ■ Provide diversion berms/trenches to direct excess/concentrated surface runoff from shaped slopes; and ■ Create suitable conditions (growth medium, vegetation mix, etc) for sustainable vegetation cover to contribute/assist with the prevention of surface erosion.
Surface water	To prevent the impairment of local surface water sources.	■ Re-instate local drainage lines as far as possible as part of site reclamation as stated in the initial reclamation and closure plan and/ or subsequent plans; and ■ Implement the stipulated measures in terms of prevention of erosion and sediment mobilization, assessment of salinisation as well as the re-vegetation of disturbed areas to protect local surface water sources.
Soil clean- up	To conduct soil clean-up/reclamation to ensure that the planned land use can be implemented.	■ Conduct site inspections at mine decommissioning to determine possible sources of soil contamination. Specific attention will be given to areas that have been exposed to possible soil contamination during the operational life of the tailings storage facility and surrounding areas; ■ Conduct soil tests to identify the possible nature of contamination, (i.e., organic or inorganic contamination); ■ If the contamination is primarily of an organic nature, the following will be done; ■ Collect composite soil samples within the identified contaminated area and analyze for total petroleum hydrocarbons (TPH). If the TPH concentrations are below 500 milligrams per kilogram, no decontamination is required. If the TPH concentrations are above 500 milligrams per kilogram, the contaminated soil will be removed if it is in manageable volumes. The collected soil will be deposited onto a dedicated on-site bioremediation facility. The reclamation of the soil will be successful if the TPH analyses of three composite samples indicate that the average TPH concentration is below 500 milligrams per kilogram; ■ In the cases of large volumes of organically contaminated soils a suitably qualified person will conduct an assessment and prepare appropriate reclamation strategy;

Topic	Objective	Measure
		■ In the cases where the TPH standard of 500 milligrams per kilogram is not applicable, other appropriate standards such as United States Environmental Protection Agency (US EPA) risk-based concentrations or action levels for industrial soil remedial goals for direct contact exposure pathways will be used; ■ If the contamination is primarily of an inorganic nature, the following will be done: ▪ Collect composite soil samples in the identified contaminated areas and analyze for total concentrations of the appropriate chemicals of concern (COC). The selection of COCs will be dictated by the historical activities that were conducted within or nearby the contaminated area(s); ▪ Due to the on-site use of sulphuric acid possible soil acidification also needs to be assessed; and ▪ Compare the results of the chemical analyses with the USEPA Preliminary Remediation Goals (PRGs) for industrial sites. If the values are not exceeded, no reclamation is required. If the values are exceeded, a suitably qualified specialist will assess the situation and devise an appropriate reclamation strategy for implementation including the recycling of these soils to recover any copper and/or cobalt metals
Health and safety	To limit the health and safety threats due to possible terrain hazards to humans and domestic animals utilising the reclaimed mine site after mine closure.	
Organic contaminated soils	To demonstrate upfront through soil testing that the remaining organic contaminated soils on site are acceptable	■ Identify areas that during the operation of the mine could have exposed to organic contamination. These could include: ▪ Transformer areas; ▪ Workshop areas; ▪ Conduct sampling at two horizons (0-150 mm and greater than 150 mm); ▪ Conduct shake-flask or other appropriate tests and analyse for Total Petroleum Hydrocarbons (TPH). In the cases where the TPH standard of 1 000 mg/kg is not applicable, other appropriate standards such as the Dutch Intervention Values for Soil Contaminants or US EPA Risk Based Concentrations or action levels for Industrial Soil Remedial Goals (PRGs) for Direct Contact Exposure Pathways or other procedures considered as best practice at the time of closure must be applied;

Topic	Objective	Measure
		▪ Interpret chemical analysis results and assess the potential for contamination; and ▪ If the TPH concentrations are below 1 000 mg/kg, no remediation is required. If the TPH concentrations are above 1 000 mg/kg, the contaminated soil will be removed if it is in manageable volumes. The collected soil will be taken to a bioremediation facility for reclamation. Reclamation will continue until the TPH analyses of three composite samples indicate that the average TPH concentration is below 1 000 mg/kg. *Note: If large volumes of organically contaminated soil and/or small areas with organic contamination other than normal petroleum products such as diesel, petrol (gasoline), and lubrication oil are found, the area will be assessed by a suitably qualified person and an appropriate remediation strategy devised.*
Chemical related contaminants	To ensure that no potential contaminants such as hydrocarbons, chemicals and associated waste remain on the site after closure.	■ Consume remaining chemicals, reagents and hydrocarbon products during mine decommissioning and/or return the remaining chemicals, reagents and hydrocarbon products to their respective suppliers; and ■ Ensure that no product of the above nature is disposed of on the mine site.
Slopes	To shape embankments and trenches to safe slopes as required.	■ Stabilisation of slopes resulting in rendering them safe.
Environmental quality	To ensure that the environmental quality as reflected above is achieved.	■ Environmental quality that should ensure that the local environment after closure will not be exposed to health and safety threats.
Land capability/land use	To ensure that the required land capability is achieved at mine closure to facilitate the implementation of the planned land use.	
Soil clean-up	To identify and assess potentially contaminated soils associated with the workshop and related areas to ensure that these areas are not potential sources of contamination to both local surface and groundwater, as well to ensure they may be re-instated as grazing areas	■ Delineate areas that could have been potentially contaminated by organic substances; ■ Select sampling points based on a predetermined geo-statistical grid over the delineated areas; ■ Conduct sampling at two horizons (0-150 mm and greater than 150 mm); ■ Conduct shake-flask or other appropriate tests and analyse for Total Petroleum Hydrocarbons (TPH). In the cases where the TPH standard of 1 000 mg/kg is not applicable, other appropriate standards such as the Dutch Intervention Values for

Topic	Objective	Measure
		Soil Contaminants or US EPA Risk Based Concentrations or action levels for Industrial Soil Remedial Goals (PRGs) for Direct Contact Exposure Pathways or other procedures considered as best practice at the time of closure must be applied; ■ Interpret chemical analysis results and assess the potential for contamination; and ■ If the TPH concentrations are below 1 000 mg/kg, no remediation is required. If the TPH concentrations are above 1 000 mg/kg, the contaminated soil will be removed if it is in manageable volumes. The collected soil will be taken to a bioremediation facility for reclamation. Reclamation will continue until the TPH analyses of three composite samples indicate that the average TPH concentration is below 1 000 mg/kg. *Note: If large volumes of organically contaminated soil and/or small areas with organic contamination other than normal petroleum products such as diesel, petrol (gasoline), and lubrication oil are found, the area will be assessed by a suitably qualified person and an appropriate remediation strategy devised.*
Stockpiled soils	To ameliorate disturbed stockpiled soils to alleviate shortcomings related to low fertility, low organic matter content and possible compaction.	■ Clean-up and trim areas from which surface infrastructure has been removed and/or those that were disturbed due to mining activities; ■ Ensuring that the soil is a suitable growth medium, and has a rough surface topography. This can be topsoil, topsoil mixed with subsoil, or where such soil is limited, patches of topsoil/subsoil; ■ Conduct relevant testing of the material from the stockpiles to determine the suitability of the material for re-vegetation; ■ Based on the test results, determine whether the material can be ameliorated in situ. A suitable growth medium will have some biological activity, not have too high a clay content, and will have some primary nutrients (relative to agricultural soils, only very small amounts are necessary); ■ Apply the stockpiled topsoil to the areas to a depth matching the original topsoil depth; and ■ Shape and level the top-soiled areas with a single pass of earth moving equipment, after surface infrastructure has been removed and the area cleaned-up, aligned with sustainable development initiatives.

Topic	Objective	Measure
Demolition of surface infrastructure	To demolish non-useable surface infrastructure and reclaim disturbed areas for re-use.	■ Clean-up areas from which buildings and surface infrastructure have been removed; ■ Identify and remove any hazardous material that accumulated on components of the buildings, machinery and equipment for safe off-site disposal; ■ Demolish remaining buildings and other infrastructure and dispose of the resultant demolition waste and any other inert non-hazardous materials that cannot be reused or recycled as stipulated in the initial reclamation and closure plan and/or subsequent plans; ■ Check the areas from which surface infrastructure has been removed for organic contamination and remediate; ■ Shape the areas from which buildings, plant and surface infrastructure have been removed to roughly emulate the natural surface topography, especially terrace and hard stand areas; ■ Ensure that the reclaimed sites are free draining and that, where possible, local drainage lines are re-instated; and ■ Prepare the shaped areas for re-vegetation and vegetate.
Transfer of surface infrastructure	To transfer mining-related surface infrastructure to third parties for beneficial use as part of progressive closure and/or at final closure.	■ Select suitable surface infrastructure for beneficial reuse, based on predetermined criteria below; ■ Develop the criteria for the selection of infrastructure for reuse, taking cognisance of the following: ▪ Possible heritage sites; ▪ Suite of final land uses as these are evolving; ▪ Mine areas suitable for the transfer to responsible/ suitable third parties; ▪ Suitable third parties for transfer; ▪ Long-term health and safety considerations; ▪ Ongoing regulatory requirements; ▪ Commercial value to Namaqualand Mines; ▪ Re-zoning requirements; and ▪ Develop a business case for each cluster of surface infrastructure identified

Topic	Objective	Measure
		for beneficial reuse for decision-making and if feasible implement.
Shallow bedrock areas	To reclaim shallow exposed bedrock areas to the planned final land use for the mine site.	■ Shape the perimeter of the shallow bedrock areas to a suitable gradient; ■ In-fill with available/suitable material "deep" cavities that could pose a safety risk; and ■ Create randomly spaced clusters of vegetation using a different suite of plants, adapted to rocky outcrops. The perimeter may need to be rehabilitated, as per the specifications.
Deep bedrock areas	To reclaim deep exposed bedrock areas to the planned final land use for the mine site.	■ In-fill the void areas with available material to emulate the surrounding surface topography as far as possible; and ■ Re-vegetate the in-filled areas. Ensure that the surface soil is a suitable growth medium, and has a rough surface topography. This can be topsoil, topsoil mixed with subsoil, or where such soil is, limited patches of topsoil/subsoil. Growth medium should cover a minimum depth of approximately 15 to 30 cm depending on type.
	To render shallow (less than 3 m high) benches safe and aligned to the planned final land use of the mine site.	■ Shape shallow high walls to a suitable gradient; and ■ Re-vegetate the shaped areas.
	To render high walls (exceeding 3 m in height) safe and aligned to the planned final land use of the mine site.	n/a to KNR
	■ To render the spoils stable in the long-term and aligned to the planned final land use of the mine site	■ Dose and/or load and haul spoils into available voids; ■ Profile the remaining spoils to suitable outer slopes and integrate the shaped outer slopes with the shaped upper surface; ■ Apply growth medium from stockpiled areas to a thickness of approximately 300 mm; and ■ Re-vegetate the shaped outer slopes and upper surface.
Aesthetic quality	■ To ensure that the reclaimed mine site will display, at a minimum, an acceptable aesthetic appearance that would not detract from the planned land use.	

Topic	Objective	Measure
Biodiversity		
Vegetation	To re-instate native species to create self-sustaining vegetation cover to stabilise disturbed/reclaimed areas against surface erosion and associated sediment mobilisation	***Disturbed areas < 50 m*** If the width of the disturbed area < 50 m and adjacent to natural vegetation, natural dispersal and succession is sufficient for restoration. ***Width of disturbed areas < 50 m but not adjacent to natural vegetation*** Seeds, seedlings and transplants of indigenous species, and soil ameliorates are to be added in a manner that benefits from ecological dynamics. Specifications to be determined by soil type and habitat. Indigenous shrubs include: ■ *Drosanternum hispidum;* ■ *Lycium tetlandrum;* ■ *Artiplex cinerea;* ■ *Artiplex lindleyi;* ■ *Psilocaulon spp; and* ■ *Mesembryanternu spp.*
Animal life	To facilitate the re-introduction of animal life to the reclaimed site area	■ To conduct surface reclamation and related work as required.
Progressive closure	■ To consider areas of the mine as these become available after reclamation for relinquishment and/or transfer to third parties and if feasible to implement.	
Delineation/ selection of area	To select suitable reclaimed areas for progressive closure	■ Confirm that the area under consideration is suitably reclaimed; ■ Confirm the planned land use and alignment with regional developmental initiatives; ■ Confirm aligned with sustainable development initiatives; ■ Compile business plan to confirm feasibility in transferred to third party, especially if to be used for commercial farming; and ■ Compile progressive closure plan, obtain approval and implement.
Stakeholder engagement	To establish and maintain a	■ Establish a stakeholder forum for Namaqualand Mines initially based on the key

Topic	Objective	Measure
	stakeholder forum to maintain communication between the mine and surrounding landowners as well as other key stakeholders on the mine's closure related initiatives.	stakeholders (communities and landowners) consulted with closure planning; ■ Maintain the forum as required to provide input to at least the following: ■ Land use planning; ■ Sustainable development; ■ Re-use of surface infrastructure; ■ Mine closure planning; ■ Leasing of property/land and the eventual purchase of mine property; ■ Property values; and ■ Augment the above stakeholder engagement with proactive contributions/interaction with the district municipality on IDP formulation and sustainable development planning.
Transfer of surface infrastructure and land.	To transfer surface infrastructure and/or land to contribute to the socio economic stability and sustainable development of the region.	■ Identify mine related surface infrastructure and or land becoming available as part of progressive closure that could be transferred to third parties; ■ Ensure that sale of land and/or the transfer of surface infrastructure is preferably to parties who are empowered towards efficient farming, chosen land use practices as well as capable to utilise and maintain transferred infrastructure; ■ In the event that the above could not be achieved, the fall back situation would be the following: ■ Disturbed areas would be reclaimed to grazing; and ■ Where possible, key biodiversity areas would be re-instated.
Land management	To ensure that land management is continued in a manner which is appropriate and takes into account principles of sustainable development.	■ Ensure that sale of land is only granted to parties who are empowered towards efficient farming and/or chosen land use practices; ■ Ensure integration with regional land use practices; ■ Reclamation is continued towards ecological integrity; and ■ Ensuring the area is safe for animals and humans.

7.4.1 Submission of information

The proponent's obligation in this regard, for the period after decommissioning activities have ceased, up to the time closure is approved, will be described within permits, licences and directives as relevant. The information must be submitted as stipulated or as requested by the relevant government authorities.

7.4.2 Maintenance

Where necessary, maintenance aspects are dealt with under each closure objective. Ongoing maintenance to achieve the desired final land use are covered in the closure plan.

7.5 Investigations, studies and trials

The further investigations/studies/trials listed in Table 16 have been identified to obtain additional information towards the finalisation and completion of the closure planning to ideally coincide with mine decommissioning.

Table 16: Identified investigations, studies and trial towards finalisation of closure planning at Namaqualand Mines

Topic	Study/investigation required
Stakeholder engagement and consultation	■ Based on the stakeholder and community engagement already undertaken at Namaqualand Mines (section 10), the scope of work is suggested to ensure this engagement process is ongoing, towards final site relinquishment
Surface infrastructure	■ Identify and quantify the nature and extent of asbestos in buildings that require demolition.
Site-wide assessment of growth medium	The availability of suitable growth medium is recognised as critical to the successful rehabilitation of Namaqualand Mines. In shallower mining areas where there has been mixing of the topsoil and overburden during the mining and profiling process, there is successful growth of vegetation during the reclamation process. In deeper mining areas further inland (particularly in the BMR) very saline sub-soils have been placed on the surface during mining. Large portions of these areas have been profiled and left for many years and no or very limited growth is evident. These saline sub-soils are also highly dispersive and heavy erosion is prevalent. Due to the necessity of effectively utilising all available growth medium, a study has been commissioned by the mine to identify all residue deposits, overburden and spoils stockpiles suitable for use as growth medium. However, as the results of this study were not available during compilation of this preliminary mine closure plan, Namaqualand Mines should ensure that the following components are included in the outputs: ■ Conduct waste characterisation of all residue- and waste-related stockpiles (dumps) to determine exact chemical composition; ■ Based on the above characterisation, quantify the amount of material available for use as/suitability for a growth medium. (A suitable growth medium will have some biological activity, not have too high a clay content, and will have some primary nutrients (relative to agricultural soils, only very small amounts are necessary); ■ Determine the distance from usable growth medium to areas where it is required; and ■ Develop a material movement plan/schedule indicating areas of high priority, such as those around the towns of Kleinsee and Koiingnaas, as well as areas identified along primary ecotourism/wilderness routes.
Furthering of business development opportunities	

A closure certificate can be issued by DMR once the objectives of the closure plan have been reached, and handover has successfully taken place.

7.6 Implementation of the EMP

7.6.1 Bio-physical measures

The current best indication of how closure planning and implementation of the bio-physical closure measures stipulated in this closure plan and subsequent plans will take place is outlined in Table 17

Table 17: Timeframe for the completion of bio-physical closure planning, implementation of related closure measures and site relinquishment

Mining phase	Closure-specific activity	Timeframe
Remaining operational period	■ Conduct and finalise the further investigations, studies and trails listed/stipulated in this preliminary mine closure plan.	■ Some work has already commenced and is ongoing. Further work still to be scoped and initiated.
	■ Continue with closure planning as per the AAplc toolbox	■ Already commenced and ongoing.
	■ Identify and allocate tasks for follow-up and implementation from the preliminary closure plan	■ Still to be undertaken by Namaqualand Mines.
	■ Develop cash flows and related financial information for funding the implementation of the stipulated closure measures taking account of at least the following:	■ Already commenced and ongoing
	■ The possible transfers and sell on/off of infrastructure and/or reclaimed mine areas.	
	■ Changes in land use in accordance with the closure land use plan.	
	■ Changes in status of buildings and infrastructure due to transfers to third parties and /or land use planning	
	■ Completion of progressive reclamation and follow-up care and maintenance	
	■ Ongoing surface- and groundwater- (as well as other related) monitoring to establish baseline conditions to benchmark the closure situation.	■ Already commenced and ongoing.
Decommissioning	■ Demolition/removal and/or transfer of surface infrastructure and general site reclamation.	■ 2020 - 2023 ■ To include care and maintenance of the reclaimed portions of the mine site, as well as the demonstration of the performance of the closure measures.
Care and maintenance	■ Maintaining closure measures and conducting required inspection and monitoring to demonstrate achievement (success) of closure measures.	
Closure	■ Application for closure certificate, initiate transfer of ongoing care and maintenance to third parties.	■ Approximately 3 - 5 years after care and maintenance.

Mining phase	Closure-specific activity	Timeframe
Site relinquishment	■ Receipt of closure certificate and hand-over to third parties for ongoing care and maintenance if required.	■ On receipt of a closure certificate.
Post-closure	■ Ongoing care and maintenance as per arrangement with third parties.	■ To continue until environmental and post-mining land-use objectives have been met, as per arrangement with third parties.

7.6.2 Social and economic measures

The current best indication of how closure planning and implementation of the social and economic closure measures stipulated in this closure plan and subsequent plans will take place is outlined in Table 18

Table 18: Timeframe for the completion of socio-economic closure planning, implementation of related closure measures and site relinquishment

Mining phase	Closure-specific activity	Timeframe
Remaining operational period	■ Conduct community engagement with relevant stakeholder and I&APs.	■ Already commenced and ongoing
	■ Identify possible post-closure business and livelihood opportunities and investigate the feasibility of implementation thereof.	■ Initial work has already commenced and is ongoing. Further work still to be scoped and initiated.
	■ Appoint an in-house closure champion to drive the updating of the preliminary mine closure plan as well as implementation of necessary investigations/project, as required.	■ Already commenced and ongoing.
	■ Undertake detailed land use planning and refine base case land use plan, as required.	■ Initial work has already commenced and is ongoing. Further work still to be scoped and initiated.
	■ Ensure legal contracts are in place for post-closure transfer of usable infrastructure to third parties.	■ Still to be undertaken by Namaqualand Mines.
Decommissioning	■ Undertake transfer of usable infrastructure to pre-determined third parties.	■ Still to be undertaken by Namaqualand Mines

7.7 Inspection, measurement and monitoring

The existing surface and groundwater monitoring systems will be adapted to serve for the decommissioning, closure and post-closure periods. Additional monitoring and measurement would also be devised. Table 19 provides the required frequency, parameters and objectives for the Namaqualand Mines' monitoring systems as well as the assessment methodologies to track/confirm the effectiveness of closure measures as well as providing possible abandonment criteria which could be applied at eventual mine closure. It should be noted that these criteria are indicative only and need to be updated and refined as closure planning progresses.

Table 19: Monitoring of effectiveness of closure measures towards site relinquishment

Monitoring objective	Frequency of monitoring	Parameters of monitoring	Method of assessment	Abandonment criteria
Soils				
■ To determine if remediation of previously contaminated areas was successful and land is suitable for envisaged land use.	Once off, at decommissioning.	Constituents of concern from future soils remediation work.	50 m grid soil sample of previously contaminated areas analysed for all constituents of concern as determined in the soil remediation work.	■ Soil analysis results comply with remediation targets at a 95 percentile level.
Air				
■ To ensure that the reclaimed mine site is not a source of dust.	Monthly, until abandonment criteria are attained.	Dust fallout.	Analyse and evaluate air quality data from the pre- and post closure air quality monitoring.	■ Air quality complies with objectives set at a 95 percentile level.
Land use				
■ To ensure that a sustainable final land use has been obtained for the entire mine site.	Once off, at decommissioning.	Compliance with afore-mentioned closure measures.	Assess activities completed, as well as legal and related documentation completed and signed-off.	■ Establishment of economically viable communities (Kleinsee and Koingnaas), interspersed by sustainable ecotourism opportunities,
General site status				
■ To ensure that the site is aesthetically neat and tidy; and ■ To ensure no health or safety risks exist on site.	Once off general visual site assessment, at decommissioning.	Compliance with afore-mentioned closure measures.	Visual assessment	■ Site is clean and neat and aesthetically acceptable; and ■ No health or safety risks remain on sites.

7.8 Environmental awareness plan

De Beers Consolidated Mines Limited is actively involved in environmental awareness training throughout its Namaqualand Mines, as is evident in the implementation of the following procedures:

- Environmental Monitoring and Measurement, De Beers' document NM-PR-17-SHHE (Appendix B); and
- Identification of Environmental Awareness and Competency Training, De Beers' document NM-PR-05-SHHE (Appendix C).

These documents are also implemented within the KNR.

7.9 Emergency procedures

Namaqualand Mines has emergency environmental and social response procedures in place for the entire mine site, as stipulated in the De Beer's policy for Emergency Preparedness and Response NM-PR-22-SHHE (Appendix D).

The same emergency response procedure is and will be applicable during the operation, decommissioning and closure of the KNR.

7.10 Proposed timetable, duration and sequence

It is currently foreseen that mine operations would continue to about 2023 and thereafter the following would apply however, due to ongoing prospecting and anticipated sale and transfer of the mine within the next two years the operational life of the mine will probably be extended albeit on a smaller scale..

- Cessation of mining;
- Decommissioning;
- Monitoring and maintenance;
- Closure;
- Site relinquishment; and
- Post relinquishment.

7.11 Financial provision

The Namaqualand Mines 2009 Closure Cost Model as provided by Golder and Associates was the first of its kind for a mine on the Namaqualand West Coast. This model was developed in line with the philosophies and standards of the time. There is currently no standard for this environment as it is significantly different from the majority of mining environments in South Africa. Several of the components incorporated in the 2009 Closure Cost Model were included based on solutions typical to inland mines. Some of these components were deemed impractical; however these cost values still remained within the model due to a lack of alternative solutions.

The 2009 Closure Cost Model has been adapted to accommodate rehabilitation methods and principles were further developed to suit the environmental conditions on the Namaqualand West Coast. Given data gathered and additional information acquired from sustainability investigations, it has become apparent that various components of the closure model can be adjusted, placing greater emphasis on a more realistic closure plan.

A mine closure cost estimate was undertaken as at September 2009 and revised during 2010. This included a comprehensive analysis of the site-specific closure costs requiring scheduled (planned) and unscheduled (unplanned) financial provision for the entire Namaqualand Mines (Golder, 2010), covering all the mining rights. The specific estimates are summarised in Table 20

Table 20: Estimated closure costs for KNR, as at December 2010

Unscheduled closure	Scheduled closure
R 73 648 888	R 10 384 752

For a detailed cost breakdown refer to Appendix F.

Namaqualand Mines raises provision for closure over the life-of-mine through the use of bank guaranteed cheques.

8.0 CONCLUSION

Namaqualand Mines has a long history of diamond mining which by the end of operations by 2023 will have disturbed large surface areas. The Koingnaas Right, combined with the other mining areas and associated secondary infrastructure would require reclamation. Due to the arid climate the land has low agricultural capability and due to factors such as remoteness, limited alternative land uses are currently apparent. Dependency on mining in the Namaqualand region is high.

Based on current ore reserves and production costs, the life of mine could extend beyond 2023. However, the ongoing operation is subject to change due to a variety of factors including:

- changes in the costs of production;
- changes in the diamond market; and
- possible discovery of new deposits.

The decommissioning of areas that are no longer being mined and infrastructure that is no longer in use will be addressed in the overall feasibility study.

The removal and site reclamation of processing plants, workshops and associated infrastructure will represent the main expenditure at mine closure. Some relief may be obtained through the introduction of light industry. It is hoped that the mining villages can be registered as public townships and are currently in the process of being proclaimed.

Decommissioning and closure will be undertaken in a phased approach which will include obtaining regulatory approval, taking cognisance of success factors and undertaking trials to obtain useful information. In this respect the closure measures will limit the potential adverse effects of the closed site on the receiving environment and ensure that the surrounding communities are not compromised after closure.

Based on this and owing to the nature of the material being mined and the surface infrastructure that has been established, the KNR can be successfully closed and the desired final land use achieved, provided that the closure measures as stipulated in this closure plan are implemented and maintained.

9.0 REFERENCES

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APPENDIX A

Golder Document Limitations

Golder Associates

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document5

APPENDIX B

De Beers Environmental Monitoring and Measurement

January 2011
Report No. 12888-10329-7

Golder Associates

MONITORING AND MEASUREMENT

(* denotes change from previous issue

1. OBJECTIVE

The objective of this procedure is to address SHE monitoring and measurement
(* as required by ISO 14001:2004 and OHSAS 18001:2007 and to ensure that:

- monitoring requirements are identified;
- monitoring of the key operations and activities is provided for;
- performance is tracked, specifically with regard to implementation of objectives and targets;
- monitoring equipment is calibrated and maintained;
- legal compliance is periodically evaluated; and
- (* reporting to the SABS, DEKRA and other agencies takes place as required.

2. SCOPE

This procedure applies to all employees responsible for the implementation of the Environmental Management System (EMS) and Occupational Health and Safety Management System (OH&SMS) at Namaqualand Mines (NM) and for monitoring and measurement in terms of legal requirements. This is not
(* restricted to the area covered by the scope of ISO 14001: 2004 and OHSAS 18001 certification.

3. LEGISLATION

- Environment Conservation Act no 73 of 1989, Section 20; Regulations GN GG 23053 of 01/02/2002, Section 8
- National Environmental Management Act no 107 of 1998, Section 24
- Minerals and Petroleum Resources Development Act no 28 of 2002, Regulations GG 26275 of 23/04/2004 Sections 50, 51,52,55,60 and 73
- National Heritage Resources Act no 25 of 1999, Sections 35, 36, 38
- National Water Act no 36 of 1998, Sections 19, 20, 26, 29; Regulations GN R2834 of 27/12/1985; Regulations GN 704 GG 20119 of 04/06/1999, Section 12
- Mine Health and Safety Act no. 29 of 1996

4. RESPONSIBILITY

(* The SHE Lead must establish and maintain procedures for, and records of, regular monitoring/measuring of the key characteristics of NM activities that can have a significant impact on the environment, safety or occupational health. The
(* SHE Lead must ensure that legal compliance is monitored and that a major legislative breach and/or pollution incident is reported.

Line management is responsible for implementing this procedure and for monitoring and reporting as required by permit and licences conditions as well as other applicable legislation.

Line management must ensure that the reporting frequency and requirements on permits is recorded to ensure that reports are submitted in time to the relevant government departments.

(* The Administrative Assistant is responsible for maintaining lists of permits and licences indicating reporting frequency and responsibility.

Line management with the assistance of the SHE Lead compile reports and
(* must inform the Administrative Assistant when reports are submitted.

5. REFERENCES

The following Namaqualand Mines policy manuals and procedures and other documents are also relevant:

(* NM-PM-01-SHHE	SHE Policy Manual
(* NM-PR-04-SHHE	SHE Legal, Other Requirements and Legal Appointments
NM-PR-15-SHHE	Accidents, dangerous occurrences and environmental incidents: Reporting and investigation
(* NM-PR-18-SHHE	SHE Management System Audit
NM-PR-21-SHHE	Environmental Performance Reporting
NM-PR-02-ADM	Records: Filing and Retention
ISO 14001 :2004	Element: 4.5.1 & 4.5.2
(* OHSAS 18001 :2007	Element: 4.5.1 & 4.5.2
SANS ISO 14004	EMS Interpretation document

(* Contracts between the SABS/DEKRA and NM

De Beers Group Reporting of Environmental Incidents Document

Template for Annual Environmental Reports for the De Beers Group

De Beers Group Environmental Dictionary

6. PROCEDURE

6.1 GENERAL

On receipt of a permit or license the employee responsible for implementing and reporting on the conditions must ensure that the original permit is forwarded to the Administrative Assistant and that the reporting frequency is recorded. The responsible employee must ensure that the Administrative Assistant is informed when a statutory report is submitted to a government department.

Note that monitoring is also required as per the Environmental Risk Report and the Closure Plan once an application for mine closure is submitted to the DME.

6.2 ENVIRONMENTAL MANAGEMENT PROGRAMME

In terms of the Minerals and Petroleum Resources Development Act 28 of 2002, Namaqualand Mines is required to conduct monitoring and performance assessments and to compile and submit a report to the DME as agreed in the EMP or by the Minister or every two years. Compliance to the approved Environmental Management Programme(s) and Addenda must be assessed. These self-assessments forms part of internal audits and currently an annual report is compiled and submitted to DME in January. The SHE Lead is responsible for this.

The above includes the monitoring of rehabilitation. Rehabilitation targets are set annually. Rehabilitation plans are available from Survey. Progress is measured by Survey and evaluated at EMSC Meetings. It is also tracked on Isometrix.

6.3 WATER MANAGEMENT

Water quantity and quality are monitored as required by permit conditions and reported quarterly to the Regional Director: Northern Cape, Department of Water Affairs and Forestry (DWAF). An independent laboratory monitors potable water, ground water and sewage effluent.

Water quality of the FRDs is monitored on a quarterly basis as required and described in the Code of Practice (COP) Fine residue.

The SHE Lead must ensure that the quarterly reports are submitted to DWAF.

The Engineers responsible for the sewage works at Kleinzee, Dreyerspan and Koingnaas must ensure that changes in personnel and other requirements in terms of Regulation 2834 are communicated annually to the Director General of DWAF.

See Appendix 1 for the Water Sampling Protocol.

6.4 AIR QUALITY

a) Fall out dust

If required monitoring is conducted in the town areas bi-monthly. This is usually required when mining operations occur close to the town's proximity. These samples will be collected at required locations. In addition total particulates at mining operations are measured on an ad hoc basis (when requested) by the Occupational Hygiene consultant. Reports are available at the Environmental Management Section.

b) Environmental perimeter nuisance noise

The Occupational Hygiene consultant monitors environmental perimeter nuisance noise on when mining occurs near town areas. The results are recorded and concerns elevated and the report are filed at the Environmental Management Section.

6.5 ELECTRICITY CONSUMPTION

Power consumption are monitored and measured by the Technical Support Department (Electrical Engineer).

6.6 WASTE MANAGEMENT

The monitoring of the 22 permitted waste sites on Namaqualand Mines is the responsibility of line management. The responsible Line Managers are responsible for submitting an annual report for each site as required by DWAF.

Waste water from the various oil separators are monitored at least annually to ensure that no substance that is likely to cause pollution enters the environment. The Environmental Management Section is responsible for ensuring that the inlet and outlet of the separators are monitored. The SHE Manager / Environmental Management Co-ordinator maintains the monitoring results.

6.7 OTHER MONITORING AND REPORTING AS REQUIRED BY PERMITS AND LEGISLATION

The SHE Lead or his/her delegate is responsible for monitoring and reporting on archaeological permits.

The Chief Safety Officer is responsible for monitoring and reporting on occupational hygiene matters. Aspects such as airborne pollutants and noise are monitored.

6.8 OTHER MONITORING AND REPORTING REQUIRED BY DE BEERS

Other environmental monitoring is conducted as requested by the De Beers Group and reported by the SHE Lead on EPRA. De Beers group determines the performance indicators. Environmental Sustainability performance is reported in the De Beers Annual Review. See Environmental Performance Review procedure NM-PR-21-SHHE and EPRA database.

6.9 MONITORING OF OBJECTIVES AND TARGETS

(* Conformance to NM environmental, safety and occupational health objectives and targets is tracked through progress reports as required. Effectiveness of actions is assessed during internal audits but the overall effectiveness of EMPs

(* are evaluated annually and reported at OH&SMS and EMS Steering Committee and OPCO Meetings.

6.10 MONITORING EQUIPMENT

Where monitoring equipment is required to measure key characteristics, this equipment is appropriately maintained and verified at regular intervals. Calibration is done to national or international standards and records of the calibration are maintained. Records should indicate the date of last calibration, company/person who carried out calibration, acceptance criteria and the effect on equipment suitability.

6.11 LEGAL COMPLIANCE MONITORING

(* Legal compliance to all identified environmental, safety and occupational health legislation was assessed during the initial review. Compliance will be self-assessed or by an independent legal specialist annually and when notification of changes to legislation is received.

Compliance is reported to the OH&SMS and EMS Steering Committee and OPCO Meetings. Compliance to permit/ license conditions is also reported annually to the De Beers Group (See EPRA). Records to demonstrate legal compliance are currently kept for an indefinite period. A major breach in legislation is reported in terms of NM-PR-15-SHHE.

7. RECORDS

Description	Responsible	Location	Retention	Status*
Objectives	Y1	Isometrix database	Current	A
Rehabilitation plans	U1	Survey	Current	A
Correspondence with Government Depts.	B2	Records	6 years	A
Permits and licences	B2	Records	Current	A
Potable water monitoring results	K1	Specific section	6 years	A
Water intake records	T1	Specific section	6 years	A
Quarterly water intake reports to DWAF	T1 / Y1	Specific section	6 years	A
Discharge monitoring results (seawater)	T1	Specific section	6 years	A
Sewage effluent monitoring results	K1	Mechanical services workshop	6 years	A
Quarterly wastewater reports to DWAF (sewage and sea)	Y1	SHE Department	6 years	A
Dust	Y1	Towns	6 years	A
Nuisance noise	Y1	Towns	6 years	A

Electricity Consumption	E1	All	6 years	A
Waste monitoring results	K1, M1	Specific section	2 years	A
Annual waste report to DTEC	Y1	Environmental Section	6 years	A
Monthly occupational hygiene report	Y1	Safety	LOM	A
Archaeological reports, Correspondence with SAHRA	Y1	Environmental Section	6 years	A
EMS and OH&SMS SC Minutes	Y1	Environmental Section	6 years	D
EPRA	Y1	Environmental Section	6 years	A
EMP performance assessment	Y1	Isometrix	Current	A
EMP performance report to DME	Y1	Environmental Section	6 years	A
Annual EMS / OH&SMS review	Y1	Isometrix	Current	A
Calibration records	All	Specific department and section	Current	D

* A = Archive; D= Destroy

8. AMENDMENT RECORD SHEET

Recorded below are all the amendments which have been made to this document and the date the amendment was effected.

Issue no	Page no	Section	Subject	Date
01	All	Complete	NM-PR-06-ENV replaces PR-18-60-05, issue 3	01/08/01
01	All	Complete	Total review to include reporting and related responsibilities as well as records. See SABS finding R 05. This document replaces NM-PR-06-ENV.	08/11/02
02	All	1, 3, 4, 5, 6.1, 6.2, 6.4, 7	Update legislation and references. General update to include designation changes, new SANS ISO 14001:2004 standard requirements and hydro-carbon monitoring (Finding DB04).	01/02/05
03	All	4, 5, 6.1, 6.3, 6.4, 6.5, 6.6	Update monitoring as currently on-mine. Include waster sampling protocol, dust, noise and electricity monitoring, change responsibilities	16/10/06
04	All	All	Review procedure	08/10/08
05	All	All	Include OHSAS 18001:2007 requirements	30/07/09

PA Sparks
OPERATIONS MANAGER
/mvw

NR Williams
SHE LEAD

Appendix 1

WATER SAMPLING PROTOCOL AT NAMAQUALAND MINES

Water Sampling Procedure for Oil/ Diesel Separators, groundwater and seepage from FRDs
Frequency: Annual
ISO Reference Procedure NM-PR-17-SHHE
Environmental Officer

Position No	Monitoring Positions	Responsible Person on Site
1	E44 wash bay	E44
2	K17 wash bay	K17
3	K46 wash bay	K46
4	K48 wash bay	K48
Other		
5	Swartlintjies seepage	K3
6	Jetsump KNC	K8
7	Mannels Vley	Y10 (see licence conditions)

Sampling Positions

Samples are generally taken from the separation chambers inlet and outlet of active separators i.e. the monitoring positions listed above. If there is no flow at the outlet or inlet, samples are taken from the last chamber of the separator.

Sampling Methodology

Samples are taken using a sampling tube at approximately 0,5m below liquid level (bll) from the small separators and at 1mbll from the large separators.

At present water from the sampling tube is transferred into the 1000ml glass bottles supplied by Al Abbott. The bottles are filled with liquid with a convex meniscus and capped without air bubbles. The samples are stored on ice packs and refrigerated overnight. AL Abbott collect samples a day after sampling is completed.

(*For sampling at the Swartlyntjies sampling are done at both the first and second trenches, as well as at prescribed boreholes up and down stream from the seepage plume. Samples are taken using a bucket connected to a rope, next to the pumps. Samples are then transferred to sampling bottles provided by AL Abbott.

Mannels Vley samples are taken by consultant from pre-determined sampling points.

Sampling Equipment

Gloves
1000ml Sampling tube
Soap
Distilled water
Sample bottles

Sampling Frequency

Samples are taken annually in November.

Laboratory

T.R. Davies
AL Abbott and Associates (PTY) LTD
No1 Vine Park
7925
Woodstock Cape Town
T: (021) 448 6340
alabbott@iafrica.com

Sampling Parameters

pH, Conductivity (mS/m), Sodium Adsorption Ration, Chemical Oxygen Demand, Oil and Grease, Sodium, Chloride, Total Suspended Solids.

Results

Al Abbott Laboratories report the results electronically and in hard copy.

Reporting

The results are reported at the management review session. Namaqualand Mines are seeking approval from DWAF to dispose of final effluent on haul roads in mining areas.

Actions

Separators producing water of poor quality are being scheduled for upgrading and sometimes replacement

(*Appendix 2

AIR QUALITY SAMPLING PROTOCOL AT NAMAQUALAND MINES

Air Quality Sampling for Fall-out Dust and PM10

Frequency: Monthly

ISO Reference Procedure: NM-PR-17-SHHE

Position No	Monitoring Positions
Kleinsee	
1	Driving School
2	West-End Hostels
3	B-Band Flats
4	Jnr School
Koingnaas	
5	Hostels
6	Mine Offices close To the Power Station

Sampling Positions

Samples are taken at the above mentioned sampling positions as predetermined by Dr. JDR Beukes. There are four monitoring sites in Kleinsee and two in Koingnaas.

Sampling Methodology

Samples are taken using the international *Standard Test Method for Collection and Measurement of Dust fall (Settle able Particulate matter) – ASTM International Designation: D 1739-98 (Re-approved 2004).* This method is prescribed by the Government of South Africa for personal dust monitoring. Measurements are usually taken for a period of 7 to 8 hours per measurement.

Samples are not taken during rain, because the sampling equipment is not waterproof.

Measurements for PM 10 are done according to SANS 69 following reference method EN 12341.

Sampling Equipment

Fall-out Dust:
270 mm diameter buckets
Fixed dust collecting stands
Distilled water
Bleach

PM10:
Dust Track electronic sampler
PM1o Sampling head

Sampling Frequency

Samples are taken at monthly intervals.

Laboratory

Johann DR Beukes
Health and Occupational Hygiene Laboratory

P.O. Box 51630
Wierda Park
0149

Tel: +2712 653 3850
Fax: +2712 653 0958
Cell: +2782 446 7532
e-mail: jdrb@telkom.net

Sampling Parameters

Fall-out dust and PM10

Results

JDR Beukes report results electronically every second month.

Reporting

These results are reported at the management review session.

Actions

Suspend mining activities if risk is high.

(*Appendix 3

Potable Water Sampling Protocol at Namaqualand Mines

Water sampling procedure for Drinking water (Potable water)
Frequency: Quarterly
ISO Reference Procedure NM-PR-17-SHHE

Position no	Monitoring Position	Responsible Person
1	Willem Cockrell	E17
2	Port Nolloth Road tap off	E17
3	Fellman Wells Pump Station	E17
4	Uitsight Single Hydrant	E17
5	Kleinzee Sewage plant	E17

Sampling Positions

Samples are taken from taps situated at the above mentioned sampling positions.

Sampling Methodology

Sample taps should be fully opened and allowed to run freely for about 30 seconds prior to sampling.

Two x 200 ml sample bottles should be filled completely and caps replaced immediately. Bottles should be rinsed three times with the running water to be sampled prior to filling.

For bacteriological analysis, aseptic procedures should be followed. This involves ensuring that neither the inner part of the screw top nor the neck of the bottle contacts anything but the water during sampling. No rinsing should take place. Cap to be removed immediately prior to filling and replaced as soon as the bottle is full. Sterile bottles must be used. One 200 ml bottle will suffice.

Samples are to be stored in a refrigerator at 4°C until collected by A.L. Abbott & Associates.

Ideally, taps should be flamed prior to sampling and free- and total- chlorine measured at the same time a sample is drawn.

Sampling Equipment

200ml Sample Bottles

Sampling Frequency
Samples are taken every three months.

Laboratory

T.R. Davies
AL Abbott and Associates (PTY) LTD
No 1 Vine Park
Vine Rd
Woodstock
Cape Town
7925
Tel: (021) 448 6340
alabbott@iafrica.com

Sampling Parameters

pH, Langelier Saturation Index (at 25 deg.C), Conductivity (mS/m) (at 25 deg.C), Turbidity (NTU), Colour (mg/l as Pt), Total Alkalinity (mg/l as $CaCO_3$), Total Hardness (mg/l as $CaCO_3$), Calcium (mg/l as $CaCO_3$), Magnesium (mg/l as $CaCO_3$), Chloride (mg/l as Cl), Fluoride (mg/l as F), Iron (µg/l as Fe), Manganese (µg/l as Mn), Aluminium (µg/l as Al), Calcium Carbonate Precipitation Potential, Free Chlorine (mg/l), Sodium (mg/l as Na), Potassium (mg/l as K), Zinc (mg/l as Zn), Nitrate Nitrogen (mg/l as N), Nitrite Nitrogen (mg/l as N), Nitrate & Nitrite Nitrogen (mg/l as N), Ammonia (mg/l as N), Sulphate (mg/l as SO4), Total Dissolved Solids, E.Coli (organisms per 100 ml), Coliforms (organisms per 100 ml) and Total Plate Count (organisms per ml).

Results

Al Abbott Laboratories report the results electronically and in hard copy.

Reporting

The results are reported at the management review session.

***) Appendix 4**

Summary of Monitoring at Namaqualand Mines

SUMMARY OF MONITORING ON NAMAQUALAND MINE								
Monitored Item	**Sampling Point**	**Type of Analysis**	**Frequency**	**Person/ Section Responsible for Sampling/Analysis & Interpretation**	**Standard to be Used to indicate limits**	**Record Location**	**Retention Period**	**Persons to whom Interpretation of Results Should be Sent**
Fine Residue Deposit (FRD)	AK3, Tweepad, Koingnaas, Michells Bay, Dikgat and Langhoogte	Water quality	Quarterly	Ore Processing	SANS	A7	Life of Mine + 10 years	SHE Department (DWEA)
Swartlintjies Seepage	Koingnaas FRD	Water quality	Quarterly	SHE Department Section - AL Abbott	SANS SABS	Y1	Life of Mine + 10 years	SHE Department (DWEA)
Separator water	E44 , K17 / K46 Wash bays	Hydrocarbons	Annually	SHE Department Section - AL Abbott	SANS / SABS	Y1	Life of Mine + 10 years	SHE Department (DWEA)
Jetsumps	Koingnaas	Hydrocarbons	Annually	SHE Department Section - AL Abbott	SANS / SABS	Y1	Life of Mine + 10 years	SHE Department (DWAF)

Monitored Item	Sampling Point	Type of Analysis	Frequency	Person/ Section Responsible for Sampling/Analysis & Interpretation	Standard to be Used to indicate limits	Record Location	Retention Period	Persons to whom Interpretation of Results Should be Sent
Dust Analysis - possible risk to human health	Traffic test area, West-end Washbay, Junior School, B-band flats, Koingnaas Town	Fall out dust	Bi-monthly as required	SHE Department - Johann Beukes	SANS 1929	Y1	Life of Mine + 10 years	SHE Department (DWEA / DMR)
Nuisance Noise in town close to mining	Kleinzee Town	Nuisance noise	Annually – as Required	SHE Department - Johann Beukes	SABS 0103 for Urban areas	Y1	Life of Mine + 10 years	SHE Department (DWEA / DMR)
Asbestos fibre risk assessment	All Namaqualand Mines	Asbestos fibre risk	Annually	SHE Department - Johann Beukes	Asbestos Regulation	Y1	Life of Mine + 10 years	SHE Department (DWEA / DMR)
Waste sites volumes	22 licensed - see file	Waste volumes	Annually	See responsibilities - NM-PR-10-SHHE	DWAF requirements	Y1	Life of Mine + 10 years	SHE Department (DWEA)
Energy Consumption	All Namaqualand Mines	Energy consumption	Annually	Technical Support - E11	ESKOM	E11	Life of Mine + 10 years	SHE Department (CHQ)
EPRA	All Namaqualand Mines	NM sustainability	Annually	SHE Department - Involve all Sections	DBCM Template	Y1	Life of Mine + 10 years	SHE Department (CHQ)
Performance Assessment	All Namaqualand Mines	Conformance to EMP	Annually	SHE Department - Involve all Sections	Audit EMP commitments	Y1	Life of Mine + 10 years	SHE Department (DMR)

APPENDIX C

De Beers Identification of Environmental Awareness and Competency Training

Golder Associates

DE BEERS
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Document no:	NM-PR-05-SHHE	Compiler/Reviewer:	EM Co-ordinator
Issue no:	04	Head of Department:	SHE Manager
Page:	1 of 4	Authorised by:	Operations Manager
Revision date:	8 October 2011	Issue date:	8 October 2008

IDENTIFICATION OF ENVIRONMENTAL AWARENESS AND COMPETENCY TRAINING

(* denotes change from previous issue

1. OBJECTIVE

The objective of this procedure is to ensure the environmental training needs as periodically identified, including general environmental awareness and job-specific environmental requirements of De Beers NM employees (including contractors) are met.

2. SCOPE

This procedure applies to all employees responsible for the implementation of the EMS at Namaqualand Mines.

3. RESPONSIBILITY

(* The **SHE Manager / Environmental Management Co-ordinator** is responsible for assessing environmentally specific training needs based on the information in the Isometrix database and requests from Line Management.

(* **Line Management** is responsible to forward all training needs identified to the SHE Manager / Environmental Management Co-ordinator.

Supervisors / Line Managers are responsible for providing on-the-job training.

Relevant employees implementing the environmental policy are responsible for participating in the processes set out in this procedure.

(* **Training and Development** is responsible to book attendees and dates on SAP.

4. LEGISLATION

- Occupational Health and Safety Act 85 of 1993 - GN Regulation 1179 of 25/08/1995; Section 3
- Skills Development Act 97 of 1998
- National Environmental Management Act 107 of 1998, Section 2
- Mineral and Petroleum Resources Development Act 28 of 2002, Section 39, 51

5. REFERENCES

The following Namaqualand Mines policy manuals and procedures and other documents are also relevant:

	NM-PM-01-SHHE ENV	Environment Policy Manual
(*	NM-PR-31-HR	Training and Development
	SANS ISO 14001:2004	Element: 4.4.2

6. PROCEDURE

6.1 TRAINING REQUIRED

All employees are to receive general environmental awareness training including:

- an understanding of the environmental policy,
- awareness that an EMS exists to manage aspects, and
- (* the importance of conformance with the policy and relevant procedures, as listed in the EMS Manual (NM-PM-01-SHHE ENV).

All new employees are to receive the above during Induction Training as well as on-the-job training where necessary.

All employees with activities that can have a significant impact on the environment shall:

- understand the environmental impacts of their activities and the consequences of departure from specified procedures,
- know how to respond to emergencies which can cause environmental damage,
- be able to recognise potential environmental impacts in their work area,
- understand the environmental benefits of improved performance, and
- be competent to undertake the procedures. In this case, based on activities and associated procedures, decide whether formal training, communication or re-orientation is required.

6.2 ASSESSMENT AND IDENTIFICATION OF TRAINING COURSES AND NEEDS

In the First Quarter of each year, and on an ad hoc basis, the Environmental Management Co-ordinator shall:

- conduct a review of training needs - based mainly on an assessment of the effectiveness of previous training, the results of audits, recommendations from non-conformances, needs identified by line management and availability of new courses - to enhance environmental understanding ensuring that:
  - the relevant persons have received or are to receive appropriate training as identified above, and
  - any employees that require re-training or refresher courses are identified.

- update the environmental training by :
  - identifying the target group to receive a particular type of training,
  - identifying the training courses for each target group,
  - detail the outputs from the course i.e. the form of understanding, skill or training capacity that will be gained from the course, and
  - detail the form of Evaluation that will take place to assess effectiveness of the course e.g. sample survey to assess the learning points in relation to the outputs of the course, examination etc.

- forward courses to Training Department to budget for the training.

(* On an ongoing basis, the SHE Manager / Environmental Management Co-ordinator is to:

- assess new courses that become available and assess the necessity for employees or contractors to attend these, and
- identify training needs based on non-conformances and audit results.

The person designated as responsible for each course is to ensure that all certificates and/or attendance records from the training courses are forwarded to the Snr HR Clerk – Training and Development for employee records.

Training Department will make course bookings on SAP, where necessary. Human Resources maintain employee training records for the length of service of each employee.

6.3 EFFECTIVENESS OF TRAINING

The effectiveness of training is determined by means of internal audit findings, incidents reported and legal compliance audit results as well as feedback received. Additional to this, some of the external environmental courses e.g. legal course presented by the North-West University/ South African Bureau of Standards provides for competency testing.

(*

7. RECORDS

Description	Responsible	Location	Retention	Status*
Attendance records	P29	SAP / Training department	LOM	A
Employee training records	P29	SAP	Current	A

* A = Archive; D= Destroy

8. AMENDMENT RECORD SHEET

Recorded below are all the amendments which have been made to this document and the date the amendment was effected.

Issue no	Page no	Section	Subject	Date
01	All	Complete	NM-PR-03-ENV replaces PR-18-60-03, issue 3	01/08/01
01	3	6.3	Add paragraph 6.3. See SABS audit Finding R03. This document replaces NM-PR-03-ENV.	07/11/02
02	All	All	Update legislation, references and the Procedure to include new SANS ISO 14001:2004 standard requirements and current practice.	07/11/05
03	1, 3 & 4	3, 6.2 & 7	Change responsibilities and recordkeeping	03/09/07
04	All	All	Reviewed, changes as per (*	08/10/08

PA Sparks
OPERATIONS MANAGER
/mvw

NR Williams
SHE MANAGER

APPENDIX D

Emergency Preparedness and Response

Golder Associates

DE BEERS
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Document no:	NM-PR-22-SHHE	Compiler/Reviewer:	SHE Lead
Issue no:	03	Head of Department:	SHE Lead
Page:	1 of 9	Authorised by:	Operations Manager
Revision date:	18 June 2012	Issue date:	18 June 2009

ENVIRONMENTAL EMERGENCY PREPAREDNESS AND RESPONSE

(* Denotes change from previous issue

1. OBJECTIVE

The purpose of this procedure is to document the process in the event of an occurrence of an environmental emergency in order to ensure timely response that plays an important role in mitigating the effects of such an emergency. This procedure will indicate the best practice in order to manage the negative environmental impacts resulting from identified environmental emergencies and the success of the recovery operation as well as the management of the negative aspects and impacts resulting from identified emergencies.

2. SCOPE

This procedure applies to all operations or activities/services performed by all employees and contractors at Namaqualand Mines.

3. DEFINITIONS, PRINCIPLES AND LEGISLATION

3.1 DEFINITIONS

The following definitions will assist in the interpretation of this procedure:

3.1.1 Environment
The surroundings in which the organisation operates, including air, water, land, natural resources, flora, fauna, humans and their interaction.

3.1.2 Environmental Impact
Any change to the environment, whether adverse or beneficial, wholly or partially resulting from the organisation's activities, products or services.

3.1.3 Pollution
Any change in the environment caused by:
a. Chemical substances
b. Radioactive substances
c. Noise, odours, heat, light or
d. Mechanical land disturbance

3.1.4 Emergency

a. Any unplanned or uncontrolled event that requires immediate action to prevent extensive environmental damage resulting from a major environmental incident.
b. Any significant wastage of resources or unplanned physical damage to the environment.

Note: Depending on the toxicity of the substance, any spill of one litre or more can be seen as an emergency.
As a general rule of thumb any oil, petrol or diesel spill onto soil larger than five litres is an emergency (as far as possible, all spills should be cleaned).

A major environmental incident is a reportable environmental incident associated with widespread long term irreversible negative ecological or social impact, with a high risk of legal liability.

Negative Impact:
An impact that may result in :

- Negative public's perception;
- Non-compliance with legislation;
- Complete disruption of a natural system;
- A high likelihood of prosecution;
- A high degree of irreversibility (5+ years);
- Complete disruption of our mining process; and
- Is reportable to a national authority in terms of national legislation

(* 3.2 LEGAL AND OTHER REQUIREMENTS

SANS ISO 14001: 2005 (4.4.7)
SANS ISO 14004: 2005 (4.4.7)
Hazardous Substances Act, 1973 (Act No. 15 of 1973)
National Water Act, 1998 (Act No. 36 of 1998), Section 20
National Environmental Management Act, 1998 (Act No 107 of 1998) Section 30
Environmental Conservation Act No. 73 of 1989
Minerals Act No. 50 of 1991
Mineral and Petroleum Resources Development Act No. 29 of 2002
Atmospheric Pollution Prevention Act No. 45 OF 1965
Other legislation and requirements as identified in NM-PR-04-SHHE

4. RESPONSIBILITY

It is the responsibility of :

4.1 The **Line Manager** to communicate and enforce this procedure.
(* 4.2 The **SHE Lead / Environmental Co-ordinator** to initiate environmental emergency response procedures for all identified environmental emergencies as identified in the aspect register.
4.3 **Line Management** is responsible to ensure that emergency drills are conducted, recorded and forwarded to the Environmental Management Section.
4.4 **All employees** are responsible to comply with all environmental emergency procedures.
4.5 The **Operations Manager** and his authorised designates, are responsible for ensuring that this procedure is adhered to.

5. REFERENCES

This procedure must be read in conjunction with the following:

NM – PR – 13 – SHHE	Fire Risk Management and Fire Fighting Facilities
NM – PR – 14 – SHHE	Fuel and Lubricant Pollution Prevention and Remediation Procedure
NM – PR – 15 – SHHE	Environmental Incidents: Reporting and Investigation
NM – PR – 04 – SHHE	Identification of and access to Environmental Legal and Other Requirements
MAN – DP – 01 – KNC	Emergency Procedure for Koingnaas Mining Complex
MIN-DP-01-BMC	Emergency Procedure for Buffels Marine Complex – Mining
MIN-DP-08-BMC	Preparedness for handling an emergency associated with Fine Residue Deposit facility failure - BMC
MET-DP-01-BMC	Preparedness for handling an emergency associated with Fine Residue Deposit facility failure - BMC
Other:	Code of Practice for Fines Residue Deposits - Intranet
	Code of Practice for Fall of Ground - Intranet
	Reporting of an Emergency – Intranet

6. PROCEDURE

6.1 REPORTING

6.1.1 Originator (The first person to witness an emergency incident e.g. fire)

a. Reports the matter immediately and verbally to his/her supervisor or the responsible person of the area or to the Security Control Room as soon as possible. (BMC – 3333 and KNC – 7399)

6.1.2 The security official should ensure that the relevant stakeholders are notified (see Reporting an Emergency on the intranet)

Note: *Once the emergency incident is reported to Security, the requirements as stated in the relevant procedure/plan must be carried out.*

6.1.3 Responsible Person (for relevant area)

a. Acts on the emergency incident report immediately and implements preventative and/or corrective measures.
b. Follows the steps in the prescribed incident reporting system to report the environmental incident.

Note: A serious event that could lead to danger to the public or the environment (e.g. **potential** death or a sustaining impact on the environment) must be externally reported to-

(i) the Department of Environmental Affairs;
(ii) the South African Police Service;
(iii) the relevant Municipality;
(iv) all persons whose health may be affected by the event and
(v) the Department of Water Affairs (in the event of water resource pollution only)

(*

The following information must be reported:

- Nature of the incident
- Substances and quantities involved and risks posed to public health, safety, property and environment
- Initial measures taken to minimise impacts
- Causes of the incident
- Avoidance measures

Note: The Operations Manager must approve all ***external*** communications.

6.1.3 SHE Lead/Environmental Co-ordinator/Alternate

a. Follows-up on environmental emergency incidents and reports it to the Namaqualand Mines Operations Committee **(OPCO)**.

b. Evaluates the success of the remedial action taken and reports this to OPCO.

6.2. EMERGENCY DRILLS

6.2.1 Emergency preparedness procedures, where practical must be practiced at least once per annum according to schedule. A schedule for these drills, in line with NM-PR-14-SHHE, must be compiled by the SHE Lead/Environmental Co-ordinator. The scheduling of all other emergency drills will be done by the Safety Section. The responsible person will keep records of such drills.

6.2.2 The emergency preparedness drills can either be in the form of a desktop study, or a physical exercise.

6.2.3 After each practice drill or actual emergency, the effectiveness of the procedure will be evaluated and revised where necessary.

6.2.4 A report of the emergency, the actions taken and the effectiveness thereof will be presented to management for the more serious emergencies, at the discretion of the SHE Lead/Environmental Co-ordinator.

6.2.5 The less serious emergencies will only be reported via the incident reporting system. The seriousness of an emergency will be decided on at the discretion of the environmental section and section heads.

6.3 POTENTIAL ENVIRONMENTAL EMERGENCY TABLE

The table includes all the potential environmental emergency situations for Namaqualand Mines that may lead to serious pollution or degradation of the environment, whether immediate or delayed.

Table 1: Environmental Emergency Incidents

DESCRIPTION	ASPECT	IMPACT	REFERENCE TO EMS	DRILL	RESP.
Fossil fuel:					
Old oil bulk tanks /containers /pipelines	Burst /Major leak	Soil and water pollution	NM-PR-14-SHHE MAN-DP-01-KNC MIN-DP-01-BMC MIN-DP-08-BMC	Annually	E21, E22, K17, K48
Bulk Diesel tanks and pipelines	Burst / pipe damage		MET-DP-01-BMC		S1, T1,S1, K1
Underground Petrol tanks	Rupturing of fuel tank				E21, E22, K17, K48
EMV Hydraulic hoses (200l)	Rupturing of hydraulic hoses and Burst /Major leak				E21, E22, K17, K48
Fuel tanker	Loading and off loading spills				S1, K1
Plant Thickeners	Cracking or rupturing of walls	Soil and water pollution	MET-DP-01-BMC	Annually	T1, K1
FRD	Wall failure	Soil and water pollution	COP.FRD	Annually	T1, K1
Flammable material	Uncontrollable fires	Air, soil and water pollution Damage to surrounding environment	NM-PR-13-SHHE MAN-DP-01-KNC MIN-DP-01-BMC MIN-DP-08-BMC MET-DP-01-BMC	Bi-annual	S1, K1
High tension Sub Station	Rupturing of walls and uncontrollable fires	Air, soil and water pollution. Possible damage to surrounding environment	NM-PR-13-SHHE MAN-DP-01-KNC MIN-DP-01-BMC MIN-DP-08-BMC MET-DP-01-BMC	Annually	E11
High rainfall/Floods	Access to mining areas	Wet roads and Buffels River flow		Annually, if possible	M1, K1, N1

7. TRAINING

Section Heads / line managers are responsible for training and testing of emergency procedures. The procedures must be tested, at least, once per annum. These emergency procedures must be reviewed and revised after the occurrence of an emergency incident.

8. RECORDS

Description	Responsible	Location	Retention	Status*
Incident reports	Y10	IsoMetrix	6 years	A
Drill reports (environment)	Y10	Files	6 years	A
Drill reports (safety)	Y1	Files	6 years	A

* A=Archive; D=delete

9. AMENDMENT RECORD SHEET

Recorded below are all the amendments which have been made to this document and the date the amendment was effected.

Issue no	Page no	Section	Subject	Date
01	All	Complete	New Procedure	16/10/2006
02	All	Complete	As per (*	03/09/2007
03	2, 4 & 6	3.2, 4, 6.1 6.2	Included governmental reporting requirements as per legislation	18/06/2009

PA Sparks
OPERATIONS MANAGER
am/mvw

NR Williams
SHE LEAD

ENVIRONMENTAL EMERGENCY PREPAREDNESS DRILL CHECKLIST

NATURE OF EXERCISE: _____ DATE: _____

PROCEDURE(S) USED IN EMERGENCY DRILL: _____

ATTENDANCE REGISTER

NAME AND SURNAME	COMPANY NO	SIGNATURE

Scenario (Include points of consideration of the "Note" below):

_____

_____

_____

INSPECTION LIST

ASPECT OF COMPLIANCE	YES	NO	N/A	COMMENTS
Doors & Windows closed?				
First Aid Kit available?				
Attempt to extinguish fire?				
Fire extinguishers available?				
Alarm sound?				
Emergency Numbers phoned?				
Emergency numbers correct?				
All electrical appliances switched off?				
Proceeded to assembly point/Refuge bay?				
Waste procedure followed?				
Reaction time? (**comment on reaction time**)				Time:
Spill contained?				
Source mitigated/eliminated (e.g. valve closed?)				
Correct clean-up according to procedure?				
PPE Used?				

OBSERVATIONS AND RECOMMENDATIONS

_____

_____

Note:
- What was the perceived cause of the emergency?
- What equipment/process caused the emergency?

Corrective action	Isometrix incident no.	Resp.	Date

_____

SUPERVISOR/OFFICIAL/SENIOR PERSONNEL

FORWARD COPY TO SHE DEPARTMENT AFTER COMPLETION

APPENDIX E

Rehabilitation and Restoration Procedure

January 2011
Report No. 12888-10329-7

Golder Associates

DE BEERS
A DIAMOND IS FOREVER

Document no:	NM-PR-26-SHHE	Compiler/Reviewer:	Rehabilitation Officer
Issue no:	02	Head of Department:	Operations Manager
Page:	1 of 20	Authorised by:	Operations Manager
Revision date:	1 November 2013	Issue date:	1 November 2010

REHABILITATION AND RESTORATION PROCEDURE

1. OBJECTIVE

The objective of this procedure is to establish and maintain an effective process to reduce the NM financial liability through the sign off of assumptions and restored / rehabilitated areas.

2. SCOPE

This procedure applies to all employees and other persons at Namaqualand Mines (NM) involved in the rehabilitation, restoration and NM liability activities. The document also provides a framework for the sign off process by the Department of Mineral Resources.

3. LEGISLATION

- Constitution of The Republic of South Africa Act 108 of 1996; Section 24;
- Minerals and Petroleum Resources Development Act no 28 of 2002; and
- National Environmental Management Act No. 107 of 1998

4. DEFINITIONS

Reclamation:	The re-instatement of a disturbed area into a usable state (not necessarily its pre-mining state) as defined by broad land use and related performance objectives.
Remediation:	To assist in the reclamation process by enhancing the quality of an area through specific actions to improve especially bio-physical site conditions.
Rehabilitation:	The return of a disturbed area to its original state, or as close as possible to this state.
Scheduled closure:	Closure that happens at the planned date and/or time horizon.

Unscheduled Closure: Immediate closure of a site, representing decommissioning and reclamation of the site in present state.

Decommissioning: This relates to the situation after cessation of operations involving the deconstruction/removal and/or transfer of surface infrastructure and the initiation of general site reclamation.

Care & maintenance: This involves the maintaining and corrective action as required as well as conducting the required inspection and monitoring to demonstrate achievement of success of the implemented measures.

Closure: This involves the application for closure certificate and initiation of transfer of ongoing care and maintenance to third parties.

Site relinquishment: Receipt of closure certificate and handover to third parties for ongoing care and maintenance, if required.

Post-closure The period of ongoing care and maintenance, as per arrangement with third parties.

Preliminary and Generals (P&Gs) This is a key cost item which is directly related to whether third party contractors are employed for site reclamation. This cost item comprises both fixed and time-related charges. The former makes allowance for establishment (and de-establishment) of contractors on site, as well as covering their operational requirements for their offices (electricity/water/communications, latrines), etc. Time-related items make allowance for the running costs of the fixed charged items for the contract period.

Contingencies This is used for making reasonable allowance for possible oversights/omissions and possible work not foreseen at the time of compilation of the closure costs. Allowance of between 10 percent and 20 percent would usually be made based on the accuracy of the estimations. The South African Department of Minerals and Energy Guideline (January 2005) requires an allowance of 10 percent.

5. RESPONSIBILITY

5.1 The **Rehabilitation Manager** is responsible for administering this procedure.

5.2 The **Rehabilitation Officer** is responsible for contractors involved with restoration to ensure compliance to the procedure and addenda.

6. REFERENCES

The following Namaqualand Mines policy manuals and procedures and other documents are also relevant:

- NM-PM-01-SHHE ENV Environmental Policy Manual
- SANS ISO 14001:2004 Element: 4.5.1
- De Beers Group Environmental Dictionary (EPRA)

7. PROCEDURE

Rehabilitation of mine area at NM consists of three different aspects:
- Land forming, the earthmoving and shaping of a disturbed area
- Restoration, the ecological interventions for disturbed areas
- Sign off, the sign off and removal of an area from the mine's closure liability.

7.1 LANDFORMING

a) Predetermine the shape:
The Rehabilitation Manager and Officer determine the level of landforming and shape of a specific area.

b) Predetermine the earthmoving machine requirements:
The types of earthmoving machines that are used for this may vary from site to site, depending on factors such as the size of the area, the depth of the cut and or the type of area. The earthmoving requirements are determined by the Rehabilitation Manager.

c) Backfill mine dumps and cuts:
Overburden is backfilled into existing mine cuts and the resulting dumps profiled using the predetermined earthmoving equipment.

d) Profile dumps:
Backfilled overburden is profiled to the predetermined shape as was decided upon by the Rehabilitation Manager and the environmental officer.

e) Cover profiled area with topsoil or growth medium:
For optimal restoration results the profiled areas are covered with topsoil or suitable growth medium where available. The topsoil or growth medium is deposited at an approximate thickness of 30cm. Areas should only be covered with growth medium or topsoil if it can be netted and restored in the same restoration year.

7.2 RESTORATION

Restoration includes the ecological intervention to ensure that a disturbed area is recovered to a self-sustainable ecosystem.

The restoration is done in accordance with specifications set out by an independent ecologist. The following steps form part of the restoration process: netting, seed collecting and processing, restoration packs, transplants and broadcast seeding.

Strict methods have to be followed for each of the restoration activities (see attached addenda for methodology).

a) Netting:
Netting is erected on areas that have received topsoil or growth medium in order to stabilize the movement of the soil. The use of nets mimics the effect of larger plant in the natural ecosystems. The nets are set up in such a way that it is perpendicular to the dominant wind direction of the area in order to minimize wind erosion.

b) Seed collecting and processing:
Collecting and processing seeds are in accordance with the specifications as set out by the ecologist. This entails physically going out into the field and collecting seeds from naturally occurring plants. The seeds are dried and processed to get them out of their protective shields and enable germination. Further more the processed seeds are put into seed-packs to ensure a mixture of seeds from different species.

c) Restoration packs:
Restoration packs consist of planting cardboard boxes in the field and planting the processed seed-packs inside. The restoration packs are planted in patches of ten. These patches have two different seed-pack recipes planted together, five of each, to form the ten individual packs per patch. The boxes mimic the smaller to medium sized plants in the field, and provide protection against the wind for the seeds planted inside them. The specifications for the combination of seeds needed for restoration packs are determined by the ecologist depending on what species occur naturally in the area.

d) Transplants:
Transplants are plants that are removed from the field and planted in patches of ten between the restoration packs. These plants are removed from the natural veldt and/or from areas that are earmarked to be stripped for mining within the next year.

*) e) Broadcast Seeding:
Broadcast seeding is the physical sowing of seeds mixed with nutrients over large areas.

7.3 DEMOLITION AND REHABILITATION OF INFRASTRUCTURE

The demolition and rehabilitation of infrastructure, e.g. plants and workshops, will be handled within the mine closure plan. If infrastructure will be demolished,

the same steps of land forming and restoration will be followed after the demolition has occurred.

*) 7.4 SIGN OFF

The presentation of rehabilitated areas to the DMR for sign-off and removal from the Closure Liability Costing model occurs annually during the third quarter. During this process the DMR are invited to visit the mine to ensure that the areas that are presented for sign-off are of the accepted ecological standard.

Areas are presented in the form of a locality map that includes the name of the area as well as the costs associated with it. The map will have an attached signature page for the various levels of sign-off as required per area.

Maps as the above mentioned can be reproduced for the different stages in the rehabilitation and restoration process. It is possible to produce a map for an area that have been completed in terms of safety and stability as well as another map for the area relating to the ecological restoration of the area.

8. RECORDS

Description	Responsible	Location	Retention	Status*
Reports	Y6	SHE Department	LOM	A
CAD / Maps	G1 / M1	MRM Department	LOM	A

* A = Archive; D= Destroy

9. AMENDMENT RECORD SHEET

Recorded below are all the amendments which have been made to this document and the date the amendment was effected.

Issue no	Page no	Section	Subject	Date
01	All	Complete	New	09/07/2009
02		7.2 7.4 Annexures E & F	Broadcast Seeding Sign Off process	25/01/2011

WG MACDONALD
SITE MANAGER: NAMAQUALAND MINES

W Nel
REHABILITATION OFFICER

ANNEXURE A

RESTORATION NETTING METHODOLOGY

1. MATERIAL SPECIFICATIONS (NETS, DROPPERS, ANCHORS AND WIRE)

- Net height: 0.75m
- Net length: 225m
- Net material: 40% density, green shade, Eyelets top and bottom, pockets every 2.5m
- Droppers length: 1.2m
- Dropper diameter: 10 mm
- Dropper material: steel (reinforced steel or normal farm dropper)
- Anchor material: Steel
- Anchor length: 1.4m and 0.7m
- Anchor type (Post fence, Y or K type)
- Wire type for droppers: 1.6mm galvanised
- Wire type for anchors: 2.5mm galvanised

2. NET ERECTION

Intervals: 5-6m (a maximum of 6m intervals) in an east-west direction on all restoration areas (topsoil and overburden).

Direction: Running east-west direction (Perpendicular to predominant southerly wind)

Method:

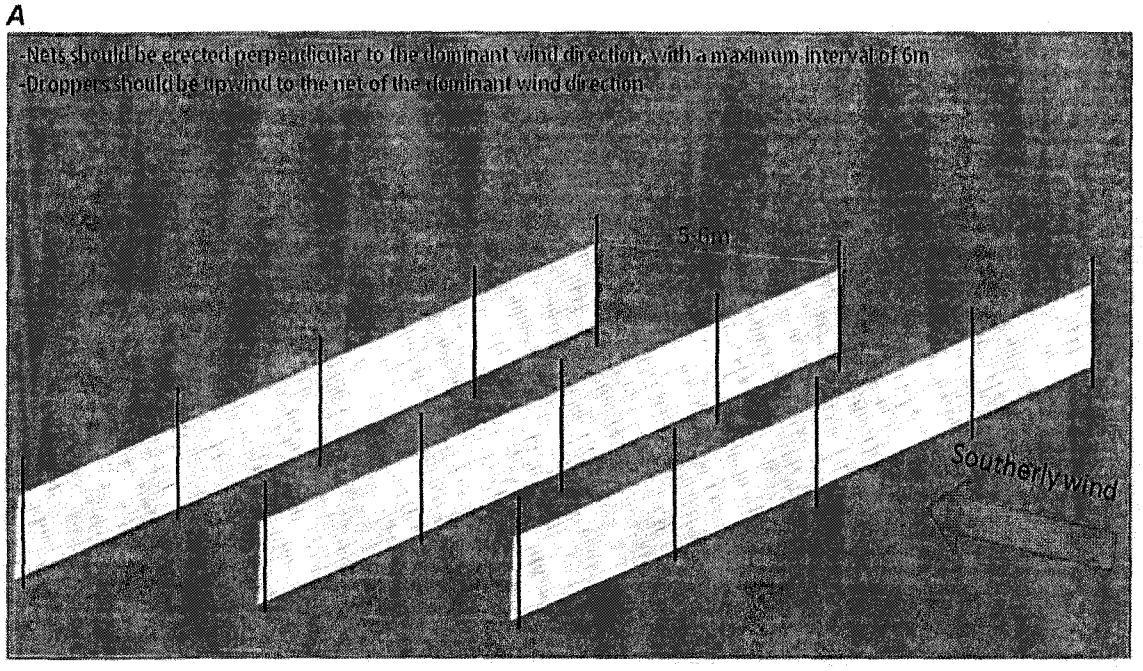
- Use anchor poles at each end of every net to anchor netting (y-poles, K- poles or old thicker droppers).
- Wrap net around the top of the 1.4m anchor pole 3 or 4 times to prevent tearing. Hit this anchor into ground in an upright position until net touches ground.
- In case of unstable conditions (very loose sand or shallow cover) insert a short 0.7m anchor at a 45° angle into the soil and use 2.5mm bind wire to tie to upright anchor.
- Insert droppers every 2.5m along the length of the net in the sleeves provided for this purpose.
- Pull netting tight and drive dropper into soil (Do not cut dropper off if not deep enough)
- Do not cut nets at the end of the line. Rather wrap the net at 90° to the start of the next line, and then use the rest of the roll for the next line (see figure 1).
- Ensure that the dropper sleeve is always facing south (i.e. the droppers are to the south of the net). Twist the net upside down at the end of the line where it is wrapped to the next line, thereby ensuring that the droppers are to the south of the net on the next line (see figure 1).
- Where the restoration site is wider than 225m in the east-west direction, gaps in the netting should be left for access roads every 225m (i.e. the length of one net). These access roads are to be used for setting out restoration packs, watering of restoration packs and maintenance of netting. There should be no access roads around the perimeter of the site, as this will prevent seeds from surrounding natural vegetation to be dispersed into the restoration site. Access roads (gaps in netting) should be a maximum of 5m wide, and should not run directly downslope, in order to avoid erosion. The road should not run directly north-south, in order to avoid the formation of a wind channel.

- Take netting about 3 to 5 meters into the undisturbed vegetated area. There should be no gap (or road) around the outer perimeter of the restoration areas, since this will limit the influx of seeds from the surrounding undisturbed areas.

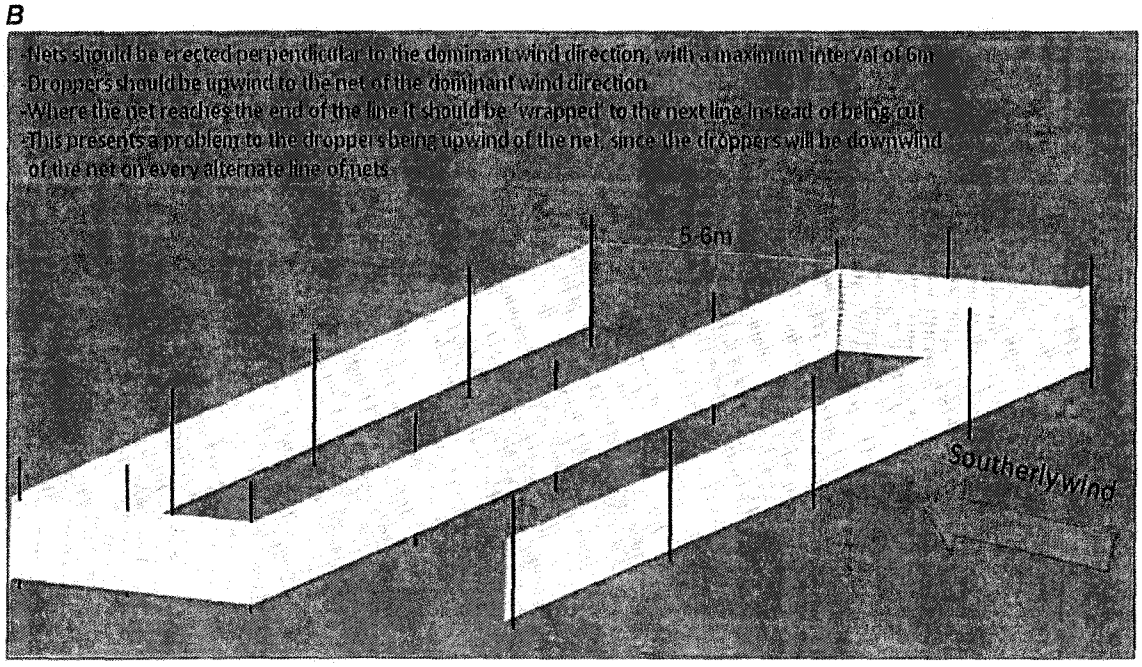
Figure 1

A) Nets should be place perpendicular to the predominant wind, and the droppers should face into the wind (to the south of the nets). ***B***) Nets should not be cut at the end of a line, but 'wrapped' to the next line, and ***C***) 'twisted' at the same time so that the droppers remain to the south of the net on the next line.

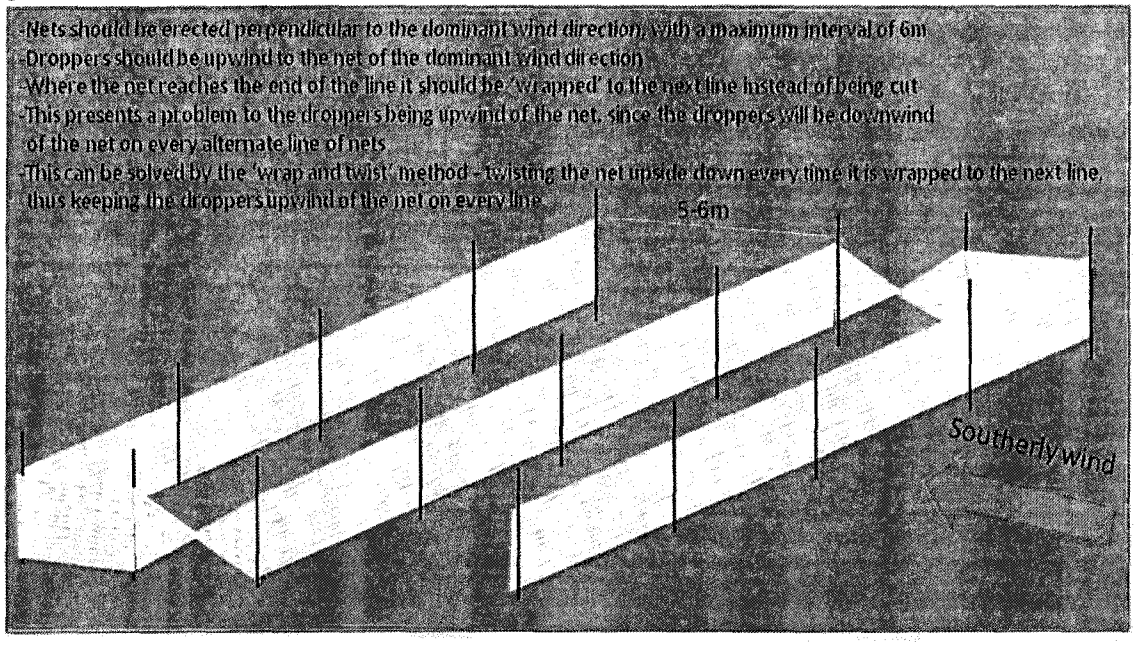
A



B



C



3. NET MAINTENANCE

Do maintenance checks on all nets at monthly intervals, and include the following:

- **Lift up netting** (& droppers) where soil has accumulated against the nets. Ensure the net and droppers are on top of the new soil level.
- The 'eyes' (holes) along the top edge of the nets are to be hooked around the droppers where the nets have stretched, in order to **make them tight**.
- Where nets have sagged down along the dropper, they need to be lifted up and tightened, as described above.
- Scoop away heavy sand built up with spades and level away from netting.
- Repair torn netting.

4. NET REMOVAL

Remove netting in areas where no longer needed as per request of the rehabilitation manager.

- Remove netting in such a way as not to damage it so it can be reused
- Reuse netting where possible
- Neatly stack material in grouped heaps for removal

ANNEXURE B:

SEED COLLECTION, STORAGE, CLEANING AND PREPARATION METHODS

1. PURPOSE OF SEEDS

The collection of seeds of perennial species is a necessary step towards the Restoration Pack (RP) intervention method, as described in the NRI Restoration Pack Methods document. Once seeds have been collected, they need to be stored appropriately in order to maintain their viability and value. Prior to using seeds in RP's, the seeds need to be extracted from the plant covering bodies that surround them (capsules, wings, fruit bodies etc), so that they will be able to germinate in the field.

This document will describe the generic methods of collecting, storing, cleaning and preparing all the possible species that are to be used in RP's, bearing in mind that the specifications for each restoration will be set by the NRI, and will therefore differ. The relevant sections of this document can be consulted based on the seed requirements provided in the specifications for each area.

2. SEED COLLECTION

2.1 Which species should be collected?

Only common perennial (long-lived) species of the following plant functional groups (as described in the NRI training manual / the NRI book) should be collected:
- Sprawling Mesembs (Mesembryanthemaceae)
- Upright Mesembs (Mesembryanthemaceae)
- Shrubs
- Large Shrubs

2.2 When can seeds be collected?

Seeds can be collected from about 2 weeks to 3 months after flowering – depending on the species. It should be noted when a population of a target species is flowering, so that collection can done there once the seeds are ready for collection.

Seeds should only be collected once they are ripe and fully formed. For Mesembs this means that the capsules have dried out and become hard and woody. For most other species it means that the fruit body or flower remnant must be fully dried out, and the seeds are hard and fully formed (often turning a darker colour when they are ready).

Seeds should be collected as soon after they have ripened as possible, since seeds are dispersed once they are ready (Mesembs release seeds every time it rains, wind-dispersed seeds are blown off the bushed with mild to strong winds), or lost by seed predation (beetles, insect larvae, birds, rodents).

2.3 How should seed be collected?

Seeds should be collected in hessian bags, paper bags or in cardboard boxes. As little plant material as possible should be collected with the seeds, since this will increase the moisture levels and the likelihood of mould or rotting occurring. They should never be collected in plastic bags, and should never be stored in a car or in the back of a bakkie with a canopy – since the heat can destroy the seeds very rapidly.

2.4 How much seed should be collected?

Enough seeds should be collected for the designated number of RP's in the target restoration area.

The necessary permits for seed collection should be obtained from the authorities. These deem that no more than 20% of the seeds of a population may be collected in the same year (by law).

3. SEED STORAGE

Seeds should always be dried prior to storage. Seeds and the associated plant material can be dried by placing them in open, shallow cardboard boxes or similar shallow containers. These boxes should be place indoors in a well ventilated place that is safe from rodents or other granivores. Seeds should also be fumigated as soon as possible after collection to eliminate any beetles or larvae that are already inside the seed storage bodies, as well as being treated with anti-mould treatments. This is best done during the drying time since seeds are spread in thin layers.

Once seeds and all the plant material that is amongst the seeds has been completely dried out, the seeds can be stored in bigger, closed cardboard boxes or similar containers that will allow them to 'breathe' (not plastic bags or containers). These boxes should be kept in a granivore-safe place that is cool, dry and preferably dark.

4. SEED CLEANING

Seeds should be removed from the coverings that surround them prior to being used in RP's.

The following methods are recommended by the NRI:

4.1 Cement Mixer

Seeds with hard capsules or coverings can be placed in a cement mixer together with 5 to 10 pieces of hard, heavy firewood (more, larger pieces for hard seed coverings; fewer, smaller pieces for soft seed coverings). The mixer bowl should not be filled more than half, otherwise it will not be efficient. Once the mixer is on, the pieces of wood will fall on the capsules or coverings and break them open, thus releasing the seeds.

The released seeds should be sieved out (see below) periodically to avoid them being damaged by the wood. For soft seed coverings this can be done every 20-30 minutes, and for hard seed coverings this can be done every 1 to 1.5 hours *e.g. Tetragonia, Zygophyllum, Lebekia, Tetragonia, Didelta, most of the Mesembryanthemaceae*

4.2 Sieves

Seeds that have been released by the cement mixer process can be separated from the remaining plant material by using an appropriate sieve mesh size or set of sieves with varying mesh sizes. This is useful to gain a more accurate estimate of the numbers of seeds, as well as reducing the volume for storage and packaging purposes.

Seeds with soft or leathery seed coverings, soft seeds or small seed coverings can often not be broken by the cement mixer, or may be damaged by the cement mixer. These seeds can be ground through an appropriately sized mesh sieve, so that the seeds fall through, but the

unbroken coverings do not. A wooden or rubber block can be used to grind the seed coverings through the sieve.
e.g. *Jordaaniella, Drosanthemum, Psilocaulon, Pharnaceum, Amphibolia*

4.3 Beating

Some early pioneer species are collected by removing part of the bush with the seeds on. These should be dried thoroughly, and once dry the seeds will be easily dislodged from the bush. This can be achieved by beating the bush with a stick, or hitting the bush against a sieve or flat surface. The seeds and leaves that come off can be sieved to remove any small branches or sticks that may have been removed during the process.
e.g. Atriplex

4.4 Other

Seeds of certain species do not need to be cleaned. These are seeds with thin or small seed coverings that do not inhibit germination, or do not result in seeds being clumped together once sown in a RP.
e.g. Manoclamys,

Seeds of certain species cannot be cleaned efficiently using any of the above methods, and should be left as is until they are sown into the RP's. These are mostly species of the Asteraceae that have seeds forming in 'cones' with plumes attached to the seeds. These should be broken up by hand during the process of sowing them into RP's. The seeds should be removed from the cones so that the seeds are spread out evenly over the area of the RP, and the plumes should be removed to prevent them from being blown around in the RP or being blown out of the RP.
e.g. Pteronia, Othonna, Arctotis

5. SEED PACK PREPARATION

Once seeds have been cleaned (and stored if necessary), they should be prepared for being used in RP's according to the specifications set out for the target restoration area by the NRI. Small seeds (all the Mesembryanthemaceae, and others with similar-sized seeds, like Pharnaceum and Galenia) are to be used in separate RP's to large seeds (all the remaining species), and should thus be put in different packets. Each packet (of small or large seeds) should contain the correct number of seeds of each species that is to be used in one RP. The number of seeds per pack can be determined on a weight basis, once the number of seeds per gram has been determined for each species.

ANNEXURE C:

RESTORATION PACK (RP) METHODOLOGY:

6. PURPOSE OF RESTORATION PACKS

Restoration packs are a cost-effective method to rehabilitate an area that maximizes the effectiveness of seeds, and facilitates the rehabilitation of a degraded area to:

- Introduce and establish natural and preferred species to an area in order to have better balanced species diversity in the area.
- Improve the ecological stability of the area, for instance stabilizing and preventing sand movement and the creation of sand plumes.
- Re-establish the ecological structure of an area, which will allow natural plant and animal establishment in the future
- Increase the natural and preferred species abundance, cover & biomass to a specific area

7. RESTORATION PACK TYPES

If small seeds are covered to deep they will not germinate. For this reason restoration packs are divided into two types: **large seed** and **small seed** restoration packs.

Each **large seed restoration pack** should contain the following species and seed number:

Large seed restoration pack

Othonna cylindrica	4
Pteronia glabrata	250
Pteronia onobromoides	250
Tripteris oppositifolium	22
Didelta carnosa carnosa	20
Arctotis scullyi	14
Tetragonia fruticosa	70
Atriplex semibaccata	100
Manochlamys albicans	160
Zygophyllum morgsana	50
TOTAL	940

Each **small seed restoration pack** should contain the following species and seed numbers:

Small seed restoration pack

Amphibolia laevis	1000
Drosanthemum hispidum	500
Psilocaulon spp	500
Jordaaniela spongiosa	1000
Ruschia aggregata	2000
Stoeberia beetzii	150
TOTAL	6150

8. RESTORATION PACK MATERIALS SPECIFICATIONS (BOXES, SEEDS AND FERTILISER)

- **Boxes: corrugated cardboard box** (approximate dimensions of 400 x 500mm and 300mm deep)
- **"Veg" 6:3:4 Slow Release VITA Organic Fertilizer**, from Talborne Products.
- **"skommeltjies"** (plant material collected from under bushes)

9. RESTORATION PACK APPLICATION

Restoration packs are to be set out during the winter months from April to May as per the following Namaqualand Restoration Initiative's standards:

- Dig a hole slightly larger than the box and **insert corrugated cardboard box 10-15cm into the soil.** (To protect the growing seedlings)
- Replace the soil inside the box and follow these steps:
  - Add 35g of the 'Veg' 6:3:4 Slow Release VITA Organic Fertilizer to each restoration pack, and **mix into the top 5cm of the soil.**
  - Add approximately 3 large handfuls (roughly equivalent to 3 large coffee mugs) of 'skommeltjies' to each restoration pack, **and mixed into the top 5 cm of the soil** (this can be done at the same time as the nutrients).
  - Level and compact refilled mixture:
    - Compact softly on clay or overburden soils (push down with hand palms)
    - Compact well on sandy soils (step on it with one foot)
  - Lastly, add seeds:

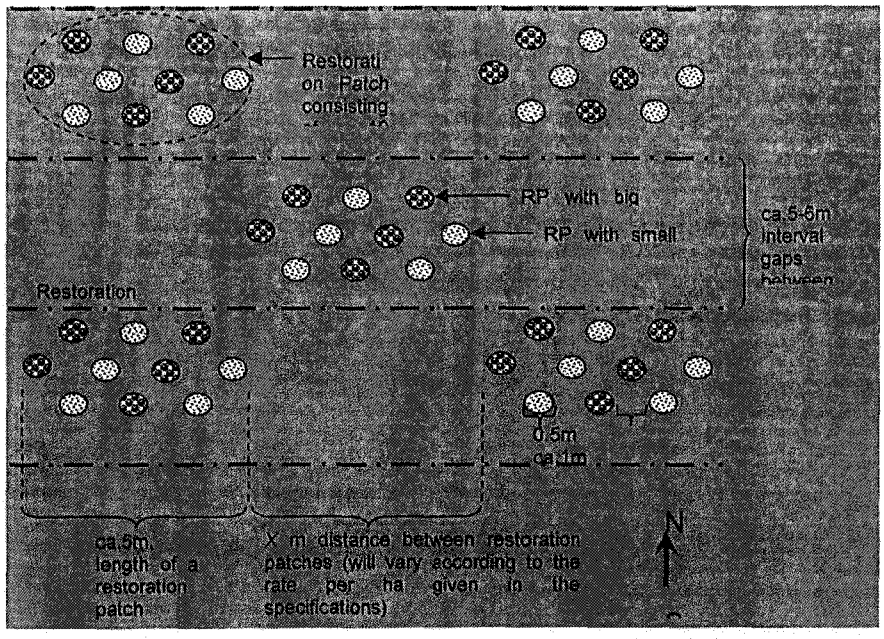
<u>Large seeds:</u>
- **Empty the seeds** from the envelope or bag **into one hand.**
- **Add a hand full of sand** to the seed in your hand palm.
- **Rub this mixture vigorously** between the palms, **while sowing** it **evenly** across the area of the restoration pack.
- Take care to **remove all seeds from** remaining **capsules** or seed coverings (e.g. *Pteronia*).
- Spread **3 or 4 handfuls of soil** over the seeds (cover seeds 1-2cm deep), and patted down with the palm of the hand.

<u>Small seeds</u>
- Sow evenly on the soil surface of the restoration pack.
- **Add a scoop of sand** to the seed in your hand palm
- Gently rub **this mixture** between your hand palms
- Lightly pat into the soil with the palm of the hand.
- **Do not place handfuls of soil on top of the small seeds** since these seeds will not be able to grow through even a shallow soil layer.
- (Note: the manual suggests using 1 handful of soil – we do not recommend this now as it has resulted in confusion when implemented in the field)

- <u>As a final step do the following</u>:
- **Soil inside the box must be 5cm higher than the soil outside the box** after everything has been added to the box
- **Soil within the box must be level** and not at an angle.
- **Soil outside the box must be sloped away** from the box. (The restoration pack must be in a slight depression, in order to increase the water input to the restoration packs)
- **Fill in any soil gaps ± 40 cm away from and around the outside of the box,** and stamp down this soil around the box.

- Any left over soil further than **± 40 cm** can be left in piles as uneven surfaces are good for restoration.

- Group restoration packs into patches of 10 and leave a slightly gap between each patch of 10 restoration packs.
- Ensure patches are spaced well across the area in order to cover the full extent of each ha (Do not cramp all RP's into one corner). Space the RP's evenly over the restoration site. The distance *X* between restoration pack patches will vary between restoration sites, and will be determined by density of RPs / ha. This will be set out in the specifications for each particular site.



10. RESTORATION PACK MAINTENANCE

In order to prevent seedlings from dying during a dry period the RP's need to be monitored and watered as explained:

- Monitor restoration packs on a two-weekly basis for the winter and spring season:
  - Monitored rainfall - if there has been no a rainfall event of greater than **4mm** in a 2 week period, the restoration packs should be watered. (1.5-2 litres of water per pack). This only applies until the end of October.
  - Where a box has collapsed entirely, cut the box off at the base and remove it from the site if it can not be lifted and kept opened.

ANNEXURE D:

TRANSPLANT (TP) METHODS:

1. PURPOSE OF TRANSPLANTS

Transplanting is the process of digging up established plants in undisturbed veld, usually from an area that is designated for mining, and transplanting these on restoration areas. The benefit of transplanting is that it is an easy and cheap way to establish a rapid vegetation cover on new restoration areas and also helps to improve topsoil retention. It is an especially useful technique to use for plant species that do not establish easily or cheaply from seed and in Namaqualand many plant species survive transplanting well because of the stored water in their leave and stems. In cases where transplants are removed from pristine (natural) sites, it is important that the right species and not too large a proportion of these species are removed so as not to disturb the ecological balance at the pristine site. Plants that do not have succulent leaves or stems do not survive transplanting, and should not be used. To ensure that transplant activity does not impact on indigenous, undisturbed areas, these protocols should be adhered to very strictly. Removing transplants poses is a danger of creating new degraded areas in pristine sites (studies are ongoing to make sure this doesn't happen), and the contractor or the mine could be liable for prosecution by the governing authorities if the correct protocols are not followed.

2. EQUIPMENT AND MATERIALS
   - Spades
   - Bags / crates / boxes (for carrying the transplants)
   - Bakkie (to transport the transplants)
   - Nutrients
   - Watering equipment

3. CHOOSING THE SITE WHERE TRANSPLANTS SHOULD BE TAKEN FROM
In choosing sites from where transplants can be collected, one needs to consider the future plan for the site.

3.1 Sites that are designated for mining in the near future
The most suitable sites to remove transplants from are areas that are designated to be mined in the near future. For such sites, the impact of removing transplants does not matter since the entire site is destroyed when the topsoil is removed.

3.2 Sites that are not destined to be mined in the near future
In some instances no sites that are destined to be mined in the near future will be available or more transplants than what these sites can provide are required. **Only** in such circumstances can transplants be taken from undisturbed / pristine sites. In such instances it is preferable to choose sites that are destined to be mined in the long term, or from pristine sites that fall within the mining area. **At no time should plants be taken from a previously disturbed / restored site,** no matter how well it has been restored.

4. HOW MANY TRANSPLANTS CAN BE REMOVED?

4.1 Sites that are destined for mining in the near future (less than 3 months)
Since the entire ecosystem will be completely transformed during the mining process, it is feasible to remove **all** individuals of suitable plant species before mining for use in transplanting. Suitable plants have one or more the following characteristics:
   - **Succulent leaves** (e.g. Mesembryanthemaceae, some Asteraceae, some Asphodelaceae, Crassulas)

- **Succulent stems** (e.g. Euphorbiaceae, some Asteraceae, few Mesembryanthemaceae)
- **Underground storage organs** (e.g. Amaryllidaceae, most Iridaceae, some Hyacinthaceae)

[Also refer to *Best practice guidelines for minimizing impacts on the flora of the southern Namib* by Antje Burke for further information on which plants are suitable for transplanting.]

Middle and late succession species should be used preferentially to early succession species. Unsuitable species should not be transplanted, since they will not survive transplanting, or benefit the restoration site. If these species are transplanted, they will not be paid for.

4.2 Pristine / undisturbed sites within the mining area:
Collect only 10% of the approved transplant species' individuals located in the demarcated area. This means that in a given population of the target species, a team should only collect 1 out of every 10 plants of that species. Transplants should be removed evenly throughout the site. One way to ensure systematic collection would be to line up transplant collectors standing a few meters apart on one side of the site. As each collector walks towards the opposite end of the site, they focus on collecting transplants only in the area ahead of them (on their 'line') (Figure 1). Once their bag / box is full of transplants, they should leave a marker (a spade or something else) where they have stopped, allowing them to return to and start from the same spot again after they have taken the full box / bag back to the bakkie.

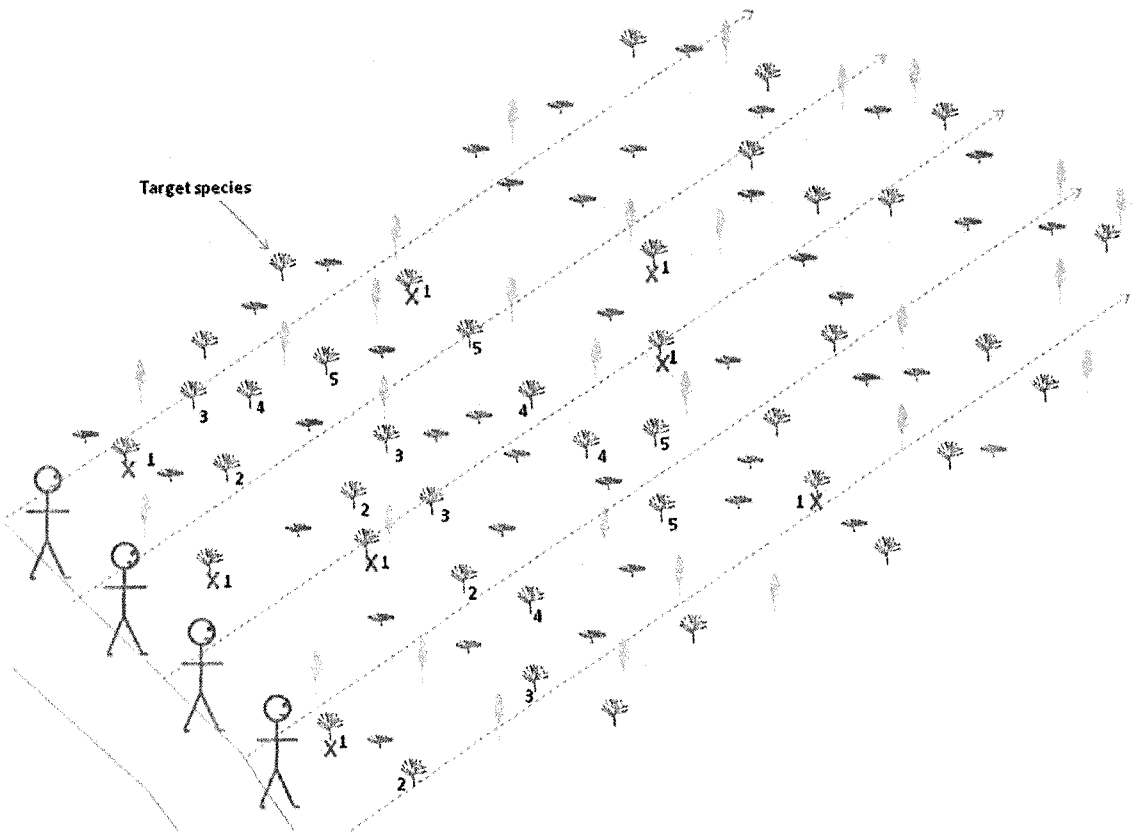


Figure 1. Transplant collectors should walk in straight lines in a collection area, and should be between 5 and 10m apart. Only every 10th plant of the target species should be taken out.

5. HOW OFTEN CAN TRANSPLANTS BE TAKEN FROM A SITE?

It is advisable that transplants are removed from a particular area of undisturbed or pristine veld only **every 5 years or longer**. Good record keeping of transplant collection should prevent more than one collection from the same site within 5 years.

Recording transplant collection activities should include the date (year and month) the transplant collection was made as well as the size and location of the collection area. The location of the collection site from which transplants are to be removed should be clearly defined e.g. between road 'a' and 'b', starting at 'place c', next to 'd', up to 'place e', approximately 'f'km^2. It would be most useful to get GPS co-ordinates for the perimeter of the area from which the collection was made.

6. WHICH PLANT SPECIES CAN BE COLLECTED FOR TRANSPLANTING?

Plant species collected for transplanting should be common generalist species (i.e. occur in a wide area, and in a variety of habitats), be abundant at both the site from which transplanting is done and in the type of soils into which they will be transplanted, survive transplanting well and have high recruitment rates. High recruitment rates would ensure that the population can readily recover once a collection has been completed.

The **only** species that are approved for transplanting from pristine areas are:
Ruschia rariflora
Amphibolia rupis-arcuatae
Aphiboilia laevis
Othonna cylindrica
Othonna sedifolia

7. WHAT SIZE SHOULD THE PLANTS BE THAT ARE USED FOR TRANSPLANTS?

Plant individuals that are too small or too big generally do not survive transplanting well. In general, plant individuals smaller than 10cm high and bigger than 30cm high (= height of the blade of a spade) survive transplanting less well. These heights are more applicable to *Othonna cylindrica*, since they grow much larger. Most adults of the other species fall within the 10 – 30cm size range.

8. WHEN SHOULD TRANSPLANTING BE DONE?

- Transplants should be done in winter (May to August), so that there is an increased likelihood of them still receiving follow-up rain, which allows the transplants to establish properly at the new site before the hot summer months.
- It is **very important** that transplants are **transplanted the same day** to reduce the amount of time the roots are exposed.
- Transplanting should never be done in the late winter (September) or in summer (Ocotber to April).

9. HOW SHOULD TRANSPLANTS BE TAKEN OUT OF THE NATURAL VELD?

- Care should be taken **not to damage the major roots** when transplants are pulled out. A spade is needed to remove the transplants. Insert the spade vertically (not at an angle) about 15 – 20cm from the base of the plant. Then lever the spade so that the

transplant is pushed up by the blade, without damaging the major root system and put the plant gently out of the soil holding on to the base of the plant's stem.

- Place the transplants in a box or hessian bag (streepsak). Transplants can be kept cool on hot days by wetting the bag, or by placing a wet bag on top of the transplants in a box.
- Where more than one species is removed, they should be kept in different boxes / bags. Never leave transplants inside a vehicle, or exposed to full sun as this will dry them out.

9. HOW SHOULD TRANSPLANTS BE PLANTED INTO A RESTORATION SITE?

- Transplants should **always** be planted into the restoration site **on the same day** as they were removed from the natural veld.
- Select an area which is already in a **natural depression or dip** (this collects water when it rains, giving the plant a greater chance of survival) (Figure 2).
- Dig a hole that is about twice the size of the roots of the transplant in the depression.
- Place one plant in the hole. While holding the plant up slightly, spread the roots out in the hole and fill the hole with soil in such a way that some soil is placed in between the roots and there are no air spaces left around the roots.
- Before the final soil is replaced in the hole, add the appropriate amount of nutrients evenly around the transplant (35g).
- Place the last bit of soil around the transplant, and press down firmly with the palm of your hand to compact the soil (overburden should not be overly compacted).
- Creating a slight depression around the transplant will aid catching additional water and nutrients (Figure 2).
- The transplant should then be **watered the same day as being planted** (1.5 liters of water per transplant) to ensure that the roots settle well and all the roots are in contact with the soil (there are no air spaces). This prevents the roots from drying out, allows the roots to take up water and nutrients from the soil immediately, and the plant to rapidly develop and replace the small roots damaged during transplanting (these responsible for nutrient and water uptake).
- Do not plant the transplants in rows or grids, but plant them in mixed species patches of 10 transplants per patch.

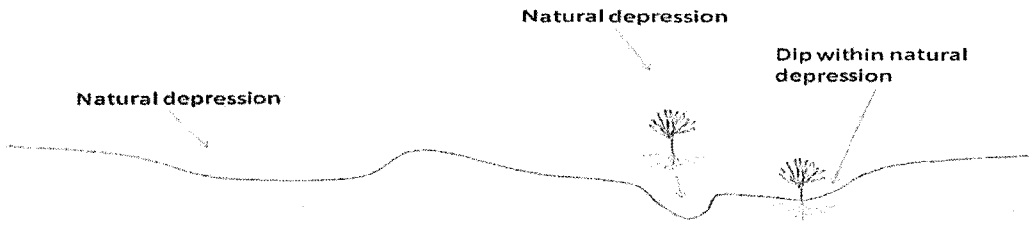


Figure 2. Transplants should be planted in natural depressions in the restoration site. A dip should be made within the natural depression to maximize the amount of water that the transplant gets when it rains.

ANNEXURE E:

BROADCAST-SEEDING METHOD:

Purpose of broadcast-seeding

- For the rapid stabilization of the soil on restoration sites (where high levels of soil loss are likely due to wind or water erosion)
- As an effective means of ameliorating soils across large areas; as a step in creating a soil a soil medium in which plants can establish and grow; a means to input and trap organic material and nutrients and create conditions suitable for perennial plant establishment (where soils need amelioration before mixed species perennial plants will establish).
- Broadcast seeding can be applied very rapidly to large areas.
- But very large quantities of seed are needed, and therefore only seeds that can be collected easily in large quantities should be used (annual and early-succession species).
- Broadcast seeding areas require netting to prevent soil and seed loss to wind erosion.

Requirements for broadcast-seeding

- Seeds should be broadcast into loose soil e.g. very soon after it has been profiled or ploughed by earth-moving machinery.
- Seeds need to broadcast (by hand or mechanically) at an even density (according to the specifications for the site) across the entire area.
- Broadcast seeding can take place before or after the erection of wind-nets, but if done before netting, nets must be erected immediately after seeding.
- Fertilizers (soil nutrients) frequently need to be applied across the entire site together with the broadcast seeding. This should take place at the same time.

Broadcast-seeding application

- Apply to loose (not compacted) soil; very soon after it has been profiled or ploughed by earth-moving machinery, or if necessary, by loosening the soil with rakes and hoes. Very small scale soil surface roughness is beneficial, e.g. small grooves in the soil created by rakes or branches.
- Spread seeds evenly across the entire area at the specified density (by hand or mechanically).
- If specified, spread all the specified soil nutrients (fertilizers) evenly across the entire site in the quantity specified (usually kg/ha).
- Lightly smooth over the seeded soil surface immediately after broadcast seeding by e.g. dragging leafy branches or lightly raking the soil after seeding. Soil smoothing must follow immediately after broadcast seeding, or at least take place on the same day.
- If wind-nets were not erected before broadcast seeding, they need to be erected the same day or the day following the application of broadcast seeds.

ANNEXURE F:

REHABILITATION AND RESTORATION SIGN OFF				
Area name:			**Date:**	
LEVEL	**LANDFORM**	**SAFE & STABLE**	**RESTORED**	**ECOLOGICAL STABLE**
ON MINE				
SENIOR REHABILITATION SUPERVISOR				
REHABILITATION OFFICER				
SITE MANAGER				
GROUP LEVEL				
LEAD: SHHE				
PRINCIPLE: ENVIRONMENT				
EXTERNAL				
SPECIALIST				
ECOLOGIST				
SLOPE ANGLE				
GOVERNMENT				
DMR – LOCAL				
DMR – NATIONAL				

APPENDIX F

Closure Liability Report

Golder Associates

DE BEERS
A DIAMOND IS FOREVER

Namaqualand Mines: Closure Cost Estimate 2010

NAMAQUALAND MINES

Executive Summary

The closure costs reflected in this report are for both scheduled and unscheduled situations. The closure costs are structured and presented in the format that is routinely used for the presentation of the closure costs for mining sites, reflecting the costs in terms of the following categories:

- Infrastructural areas;
- General surface reclamation;
- Water management;
- Post-closure aspects; and
- Additional allowances.

The cost estimate quantities were taken from available plans and maps as well as from previous closure cost estimates for the site. Unit rates were obtained from NM actual rehabilitation rates as well as from Golder & Associates' existing data base and/or in consultation with demolition practitioners.

The estimated scheduled and unscheduled closure costs for Namaqualand Mines as at October 2010 amounts to approximately R 179 million and R 24.5 million respectively, as summarised in the table below:

De Beers Namaqualand Mines- Scheduled and Unscheduled Closure costs - October 2010			
	Closure Components	Scheduled	Unscheduled
	INFRASTRUCTURE AND RELATED ASPECTS		
1	Infrastructural aspects	R 75,000.00	R 75,000.00
2	Mining aspects	R 0.00	R 0.00
3	General surface reclamation	R 14,785,418.78	R 147,456,152.00
4	Water management	R 0.00	R 0.00
	SUB-TOTAL 1 (Infrastructure and related aspects)	**R 14,860,418.78**	**R 147,531,152.00**
5	Post closure aspects	**R 7,969,577.71**	**R 7,969,577.71**
	SUB-TOTAL 2 (Post-closure aspects)	**R 7,969,577.71**	**R 7,969,577.71**
6	**ADDITIONAL ALLOWANCES**		
6.1	Preliminary and general (6 percent)	R 891,625.13	R 8,851,869.12
6.2	Contingencies (10 percent)	R 1,486,041.88	R 14,753,115.20
6.3	Engineering & project management (0 percent)	R 0.00	R 0.00
6.4	Management/staff cost	R 0.00	R 0.00
	SUB-TOTAL 3 (Additional allowances)	**R 2,377,667.00**	**R 23,604,984.32**
	GRAND TOTAL (Sub-total 1+2+3)	**R 25,207,663.49**	**R 179,105,714.03**

Table of Contents

List of terms used

Reclamation	The re-instatement of a disturbed area into a usable state (not necessarily its pre-mining state) as defined by broad land use and related performance objectives.
Remediation	To assist in the reclamation process by enhancing the quality of an area through specific actions to improve especially bio-physical site conditions.
Rehabilitation	The return of a disturbed area to its original state, or as close as possible to this state.
Scheduled closure	Closure that happens at the planned date and/or time horizon.
Unscheduled closure	Immediate closure of a site, representing decommissioning and reclamation of the site in its present state.
Decommissioning	This relates to the situation after cessation of operations involving the deconstruction/removal and/or transfer of surface infrastructure and the initiation of general site reclamation.
Care and maintenance	This involves the maintaining and corrective action as required as well as conducting the required inspection and monitoring to demonstrate achievement of success of the implemented measures.
Closure	This involves the application for closure certificate and initiation of transfer of ongoing care and maintenance to third parties.
Site relinquishment	Receipt of closure certificate and handover to third parties for ongoing care and maintenance, if required.
Post-closure	The period of ongoing care and maintenance, as per arrangement with third parties.
Preliminary and Generals (P&Gs)	This is a key cost item which is directly related to whether third party contractors are employed for site reclamation. This cost item comprises both fixed and time-related charges. The former makes allowance for establishment (and de-establishment) of contractors on site, as well as covering their operational requirements for their offices (electricity/water/communications, latrines), etc. Time-related items make allowance for the running costs of the fixed charged items for the contract period.
Contingencies	This is used for making reasonable allowance for possible oversights/omissions and possible work not foreseen at the time of compilation of the closure costs. Allowance of between 10 percent and 20 percent would usually be made based on the accuracy of the estimations. The South African Department of Minerals and Energy Guideline (January 2005) requires an allowance of 10 percent.

1.0 INTRODUCTION

De Beers' Namaqualand Mines (Namaqualand Mines), located within the Northern Cape Province of South Africa, is gradually reducing its operational activities by scaling down physical mining and/or selling-off of the mining areas to third parties. Final decommissioning and closure is planned for the end of life of mine, and it is currently estimated that the mining operations will operate profitably until 2024 (this assumes a 10 year life of mine and the resumption of production activities from 2014). The mine is currently undertaking the necessary studies/investigations to inform the development of a preliminary mine closure plan according to best practice and the Anglo American Mine Closure Toolbox (AAplc toolbox).

Golder Associates Africa (Pty) Ltd (Golder) was appointed to update the closure costs during 2004 specifically focusing on updating the physical closure component. The information gathered in 2004 was refined to greater detail during 2007, 2008 & 2009, where Golder assisted with the volumetric earthmoving quantum, required to estimate the rehabilitation cost

2.0 APPROACH TO COST DETERMINATION

The cost determination was completed in several phases, the basis of which was established during 2004 and refined during 2009.

The approach followed in 2004 can be summarized as follows:

- Execution of a week-long site visit by Golder to the mine, during which each of the mining areas were visually inspected and the information listed. No physical measurements and/or surveys of mining components/areas were conducted.
- Compilation and/or obtaining of quantities for closure cost estimates from mine survey data.
- Collation of the provided information into closure cost spreadsheets for each of the listed mining areas. The spreadsheet includes all the closure cost items as stipulated in the Department of Minerals and Energy closure cost guidelines.

The approach followed to determine the 2010 closure costs following on the 2004 estimate were as follows:

- Various site visits were conducted by Golder and during these visits the approach to surface reclamation was developed and refined;
- The original 2004 conceptual design for surface profiling was refined to provide clear materials movement boundaries, referred to as the *profiled model* completed for the 2010 closure costing;
- Visits to the Golder offices in Pretoria by Mr Johan van Zyl from the mine, to assist with further refinement of the respective areas to be included in the closure costing, and to integrate the refined profiling model with the survey categories provided by the mine. The data sets were interrogated utilizing a GIS package to deliver area and volume outputs according to which the costing was implemented;
- Buildings on each complex were surveyed and demolition and reclamation quantities determined during a site visit;
- Determination /verification of unit rates

Following on from the 2009 closure cost review carried out by Golder, further adjustments / exclusions were made by NM during the 2010 review (using the previous work completed by Golder as the base case).

3.0 AVAILABLE INFORMATION

The closure costs for the mine were mainly based on drawings, previous closure costs conducted by Golder in 2004 and 2009, reflecting both the scheduled and unscheduled closure situation.

The information listed in the table below was utilised for the costing as applicable.

Table 1: Information utilised for the closure costing of Namaqualand Mines

Drawing/report title	Drawing/report number	Date
Namaqualand Mines Closure Cost Estimates November 2004	6951-6567-1-E	November 2004
Environmental Management Programme for the various complexes of NM: ▪ Buffels Marine Complex; ▪ Buffels Inland Complex; ▪ Dikgat Complex; ▪ Brand-se-Baai Complex; ▪ Samson's Bak Complex; ▪ Koingnaas Complex; and ▪ Groenrivier Complex.	Various report numbers: ▪ 6951-9374-3-E; ▪ 6951-9376-4-E; ▪ 6951-9377-5-E; ▪ 6951-9378-6-E; ▪ 6951-9379-7-E; ▪ 6951-9380-8-E; ▪ 6951-10280-9-E.	September 2007
General arrangement drawings of the mine site from reclamation planning		
Rehabilitation designs of the mass earth works that were done based on the 2007 survey of the entire mine. The conceptual designs completed in 2007 were refined to detailed design level (in terms of volume movement only) to produce the profiling model. The volumes were re-calculated according to the new inclusion/ exclusion boundaries provided by the mine assessment.		
The aerial assessment based on the mines GIS information conducted by the mine and the integration thereof with the profiling model.		

4.0 BATTERY LIMITS

Closure costing for NM covered the specific mine related closure components listed below. In addition those associated areas possibly disturbed and/or contaminated by mining and ore processing were also considered in the closure costing.

The site comprises the following complexes:

- Buffels Marine Complex (BMC);
- Buffels Inland Complex (BIC);
- Dikgat Complex (DGC);
- Koingnaas Complex (KNC); and
- Samson's Bak Complex (SBC), this complex costing is included under KNC closure cost sheets.

The Brand-se-Baai Complex and Groenrivier Complex do not have items affecting the physical closure costing and therefore are not included in the costing sheets and this report.

As part of the reclamation planning, areas within the above complexes were identified as either included for closure or excluded for closure. Included areas will be profiled according to the mass earth works designs (profiling model) and have the remaining work defined by the survey categories. The excluded areas will be reclaimed according to the survey categories only and the volumes indicated by the rehabilitation designs for those areas will not be moved. The difference between the two approaches is reported in the excluded column, therefore the monetary values reflect the savings made due to having certain areas marked as excluded.

The following closure components have been removed from the costing:

- The towns and their related infrastructure (roads, powerlines, water infrastructure etc.) that are currently being proclaimed through a separate project.
- The main haul roads will not be decommissioned, at the request of the local authorities and will form part of a planned West Coast road.
- The associated borrow pits will also not be closed and will be used for future maintenance of the roads.
- The redundant processing plants and their related infrastructure that are in the process of being removed by a demolition contractor on a "cost neutral" basis.
- Coarse Tailings and Fine Tailings Mineral Resource Deposits
- Pre March 1980 areas not already rehabilitated
- Areas already restored, either naturally or as a result of NM's rehabilitation programme
- Areas identified as having an alternative land use requirement, these are:
  - The marine aqua-culture area
  - The Dreyerspan prison facility
  - BMC hazardous waste site
  - Wind farm development sites

Other initiatives for alternative land uses being considered include the Living Edge of Africa project. These projects could lead to further areas being excluded from the reclamation liability at a later stage.

4.1 Division of complexes

The mining complexes have been divided into included and excluded categories according to their reclamation requirements and their relation to the profiling model. These areas are particularly applicable to the mining aspects of each of the complexes mentioned above.

Similar to the 2008 closure cost estimates the entire NM area has been sub-divided into various categories based on the survey database for purposes of reclamation. These areas have assumptions which indicate the work required for each area.

4.1.1 Areas affected by profiling/reclamation modelling

These are areas that fit into the profiling model compiled by Golder. These are the areas that have been identified as areas to be included for closure.

The conceptual profiling model completed has been refined to remove all materials movement less that 0.1m in depth (inherent "noise" in the model). The removal of the "noise" in the profiling model defined clear materials movement clusters. The portions of the survey categories covered by the profiling model have been removed from that specific category and reported on as excluded. The clusters of profiling identified by the model then take priority as the reclamation activity to be completed. The remaining surface area covered by the category is then reported on as included (see 4.1.3). Small pockets of one or two points of profiling indicated by the model were not given the status of a cluster, the survey category according to which the area is classified as, and then received precedence above the profiling model.

4.1.2 Virgin areas affected by profiling/ reclamation modelling

There was no specific survey information for this category. It was indicated through combining the survey categories and the materials movement boundaries of the Golder profiling model. These are areas that were not disturbed by the mining operations but would be disturbed while profiling disturbed areas during reclamation operations. Given the slow growth rate and the natural revegetation of the majority of dumps, it has been decided to preserve the growth surrounding dumps by adjusting various profiles and limiting the amount of damage to surrounding areas. These adjustments have been made to the final model.

5.0 ASSUMPTIONS AND QUALIFICATIONS

5.1 General

- The closure cost estimate is aligned to the generic Guideline Document for the Evaluation of the Quantum of Closure Related Financial Provision Provided by a Mine, by the DME (January, 2005).

- In line with the MPRDA regulations for mine closure, the guideline is interpreted with emphasis being placed on cost efficiency and practicability. This has lead to the inclusion of site specific standards relating to rehabilitation methodology for Namaqualand mines
- In line with the point above, discussions were held with the DMR (DME at the time) in 2006, during which it was agreed that site conditions essentially dictate the rehabilitation requirements, e.g. the agreed upon slope angles were 18 degrees as it was deemed unnecessary and impractical to slope to a lesser angle.
- Allowance has also been made for third party contractors and consultants to conduct post-closure care and maintenance work as well as compliance monitoring.
- Fixed ratios for P&Gs and contingencies as generally accepted for this type of costing have been applied.

5.2 Site specific

- Namaqualand Mines are running down its operational activity and are concurrently busy with a dedicated effort to rehabilitate the disturbed areas of the mine towards eventual mine closure. This rehabilitation forms a substantial portion of the mine's current routine operational activity, with a notable portion of its resources and equipment devoted to this effort. Hence, for the purpose of this closure cost estimate, it has been assumed that a dedicated work force and equipment fleet which is adequately resourced, is currently actively involved with mine site rehabilitation;
- Normally the unit rates used with the determination of rehabilitation and closure costs are based on independent third party contractor rates, which are largely determined by market forces and related conditions, albeit normalisation/ moderation is required to take cycles in construction activity and/or site specific considerations into account. Owing to the fact that these rates are normally in the public domain they could also be independently verified. However, in the case of Namaqualand Mines, with a portion of the mines work force and construction fleet fully committed to mine site rehabilitation, dedicated costs for these activities could be obtained and documented.
- The major cost component of rehabilitation operations is the cost associated with earth moving activities. The earth moving cost contributes significantly to the overall calculation of rehabilitation liability associated with any mine and for the most part these costs are determined with reference to prevailing market related contractor rates. The NM mining operation is an earth moving intensive operation and as a result thereof, NM has its own fleet of earth moving machinery including a dragline.
- It is foreseen that the mine legacy rehabilitation which NM is currently conducting could take about a decade to complete and therefore a substantial portion of the rehabilitated areas would have been finally rehabilitated for a period up to at least a decade. Moreover, some of the areas could even have exceeded this period. Thus, with the unscheduled situation the allowance for care and maintenance of rehabilitated areas as well as the monitoring of these areas for only three years post closure has been costed.
- Owing to the sensitive nature of the local ecological system and especially the local vegetation, it has been assumed with this closure costing that only readily available growth medium would be utilised for rehabilitation. Virgin areas would not be disturbed for the purpose of obtaining growth medium. This "shortfall" in growth medium could result in bed rock areas as well as other swept areas not being covered by growth medium and vegetated.
- Concrete footings and bases would be demolished to 1 000 mm below the final surface topography.

Reclamation requirements for specific closure components are listed below:

Table 2: Survey categories for Namaqualand Mines

Category	Description
Roads ripped	Roads that have already been ripped. Allowance has been made for general shaping and levelling, salt/salinity remediation, monitoring and maintenance in these areas.
Roads	No reclamation conducted on these roads to date. Allowance has been made for ripping, general shaping and levelling, salt/salinity remediation, monitoring and maintenance in these areas.
Profiled	Areas already profiled in reclamation activities. Allowance has been made for, netting, seeding, monitoring and maintenance. **No allowance has currently been made for replacing growth medium.**
Borrow pits	This category of borrow pits exclude those next to the roads, which are assumed to be left to remain operational. These are borrow pits in the mining areas that require reclamation, therefore allowance has been made for minor shaping and levelling, netting, seeding, monitoring and maintenance.
Damaged areas	Areas around plant and mining activities which have been disturbed, but where topsoil was not removed but compacted. Allowance has been made for light agricultural ripping, monitoring and maintenance. Not requiring vegetation.
Dumps	These are small dumps that are assumed not to require profiling. Allowance has been made for netting, seeding, monitoring and maintenance. **Some of these dumps will be classified as topsoil storage facilities and utilized as growth medium according to the growth medium identification and quantification exercise to be done in the near future.**
Highwalls	These are assumed to be shallow high walls ranging from 1 to 3 m in height. Allowance has been made for topsoil removal, shaping, replacing of topsoil, netting, seeding and monitoring and maintenance.
Stripped Ore	It is assumed that all piles of stripped ore would be processed by closure. Allowance has been made for netting, seeding, monitoring and maintenance
Green areas	Areas that have been fully reclaimed and signed off as such by the mine. Allowance has been made for monitoring and maintenance.
Naturally reclaimed areas	Areas that have over time been reclaimed naturally. Allowance has been made for supplementing a portion of the area with vegetation packs, monitoring and maintenance.
Netted areas	Areas that have been netted.

Category	Description
	Allowance has been made for seeding, monitoring and maintenance.
Planted areas	Areas that have been planted already. Allowance has been made for monitoring and maintenance.
Seeded areas	Areas that have been seeded already. Allowance has been made for monitoring and maintenance.
Topsoiled areas	Areas where topsoil/growth medium has been replaced. Allowance has been made for netting, seeding, monitoring and maintenance.
Swept areas	Areas to be treated similar to bedrock, an average cover depth supplied by the mine survey department is used to calculate a volume to be covered. Allowance has been made for netting, seeding, monitoring and maintenance.

- The reclamation measures conceptualised and applied on the closure costing were as far as possible aligned to the latest Environmental Management Plans (EMPs) for the various mine complexes.
- A combination of final land uses was considered. These include extensive livestock farming, ecotourism and Mariculture.
- Profiling of opencast spoils to a minimum slope of 1:3.
- No water management structures have been devised and costed for erosion prevention since the areas where erosion protection could be required is mostly the saline spoil material within the deeper sections of the BMC. These saline soils cannot be used for the construction of the above water management structures since their integrity is questionable, being highly dispersive. In view of this, it has been assumed that if material has to be imported it would be more beneficial to import growth medium and establish vegetation to combat erosion.
- Mined out areas suitable for alternative land use with the aim of promoting sustainable development, will remain un-reclaimed and applied for this purpose.

6.0 UNIT RATES

With a portion of the mine's work force and construction fleet fully committed to mine site rehabilitation, dedicated costs for these activities have been established and documented. Since NM is already actively involved and committed to mine site rehabilitation, it has been assumed the above motivation for the site specific unit rates applies to both the scheduled and unscheduled situations.

Barring the earthmoving rates which NM has determined through years of rehabilitation experience in Namaqualand, all other unit rates were obtained from the Golder's database. Unit rates for determination of closure costs by Golder were obtained from the following sources:

- Consultation with the following reputable industry specialists:
- Reclamation specialists, with special reference to soil amelioration and re-vegetation;

- Civil engineers involved in shaping/profiling as well as stabilisation of areas disturbed by the removal of mining- and manufacturing-related facilities; and
- Demolition practitioners, focussing on the mechanical costs and associated professional fees required to dismantle and/or demolish steel, brick and concrete infrastructure.

Based on the above, Golder compiled a unit rate-specific database that is utilised for the overall determination of closure costs. This database and relevant unit rates are updated quarterly.

6.1 General surface shaping

It has been assumed that general surface shaping would be required over most of the areas where surface infrastructure had been removed, as well as fugitive disturbed areas, as part of the overall surface reclamation. For this purpose it has been assumed that shaping would involve the movement of material at about 500 to 700 mm average thickness.

6.2 Establishment of vegetation (see Appendix D for full restoration method)

6.2.1 Planting of restoration packs

No allowance has been made for growth medium amelioration prior to the establishment of vegetation. The cost of planting restoration packs, including labour, amounts to R 3 846/ha. This is assuming that the restoration packs are planted in block formations and every alternate block is planted, therefore in a 2 ha area, 1 ha is planted with restoration packs.

6.2.2 Netting

The latest cost of the nets is R 6/m, the netting is used three times, therefore the cost of netting is R 4 000/ha. The cost of droppers is R 8/each, which are also used three times therefore the cost of droppers is R 2667/ha. Further cost include anchors at R 520/ha, bind wire at R 60/ha and boxes at 1893/ha. The total cost for netting amounts to R 9 140/ha. This cost includes maintenance of the netting. Total costs for netting and seeding 1ha is R16,833.27

6.3 Surface water monitoring

It has been assumed that surface water quality monitoring at ten locations has to continue at a quarterly frequency for at least three years post-closure.

If it is assumed that three man-days would be required to conduct a monitoring event (including travelling), this would equate to R12,000. Allowance has also been made for chemical sample analysis at R1,500/sample. Hence, these costs amount to R 27,000 per sampling event which can be rounded to

R30,000 including travelling expenses. If sampling is to be conducted at a quarterly frequency, the annual costs amount to R120,000.00/year.

6.4 Reclamation monitoring

It has been assumed that five man-days would be required to conduct the reclamation monitoring. Assuming a consultant rate of R500/hr this would equate to R 20,000 per event. If it is assumed that this has to be conducted twice a year, the annual costs would amount to R 40,000 or roughly R400/ha if assumed about 100 ha would require monitoring. If an additional R50/ha is added for travelling and accommodation, the overall rate is about R450/ha/year. It has been assumed that reclamation monitoring will have to continue for about three years, which amounts to R 1,350.00/ha.

6.5 Care and maintenance of reclaimed areas

Based on the findings of the reclamation monitoring and/or other inspections, corrective action on the reclaimed areas could be required. If it is assumed that this would require six weeks per year of a team of 20 workers and two JCB's as supporting equipment, this equates to about R1600/ha, provided it is assumed that active care and maintenance also has to be conducted over roughly 100 ha. It has been assumed that the hourly rate of the workers is R15 and the equipment R3 000/d. If accommodation and travelling of R50/ha is also added, the overall rate is about R1650/ha/year. It has been assumed that the workers and equipment could be sourced locally.

7.0 APPLICATION OF MEASURES AND TOOLS

7.1 Profiling model

A dedicated reclamation model was set up and run to determine the mass volume of material that will have to be moved to achieve the specified maximum allowable slope. The model was applied to the full mine site during 2007 to reflect the required surface profile and associated material requirements to achieve this profile at a conceptual level. The particular profile is dependant on the site conditions, taking into consideration the soil stability vegetation, shape etc. Generally slopes will be profiled to a gradient of 1:3 and 1:5 where required.

The concept was taken to detailed design level for an area in the BMC referred to as the test area, covering 722 ha. The detailed design removed the "noise" in the model by eliminating all areas where shaping takes place at a depth shallower than 100 mm. The volume of material to be handled and moved was in this way reduced by approximately 20 percent across the test area.

The same exercise was completed for the full mine site, reducing the volumes of material requiring handling and movement as follows:

- By approximately 37 percent from 66,4 million m^3 to 42,1 million m^3 for included areas.

The mining areas were divided into various categories according to the survey database that enabled general reclamation requirements to be listed for each category

7.2 Exclusion of Pre 1980 areas

The regulations to the Mines and Works Act ("Mines and Works Regulations") were amended on 21 March 1980. The amended regulations required that a rehabilitation programme be submitted to the Inspector of Mines if requested by the Inspector of Mines and that rehabilitation of the surface at any open cast mine shall form an integral part of the mining operations. As from 21 March 1980 the Mines and Works Act enforced rehabilitation of the surface of land at mines. The Mines and Works Regulations imposed a positive obligation for the rehabilitation of the environment disturbed by mining operations and this obligation was carried through to the Minerals Act. Based on the promulgation of these regulations in March 1980, NM is therefore only obligated to rehabilitate environmental disturbances caused by mining operations as from 21 March 1980.

Having said this NM has already committed significant resources to the rehabilitation and making safe of these areas, the latter of which, will continue to ensure a safe area post closure.

7.3 Site clean-up

In all areas that were disturbed during operation, site clean-up would be necessary. In accordance with the EMP's, the following assumptions have been made regarding measures to be taken for site clean-up:

- Site inspections will be conducted to determine possible sources of soil contamination. Specific attention will be given to areas that have been exposed to possible soil contamination during the operational life of the tailings storage facility and surrounding areas.
- Soil tests to identify the possible nature of contamination will be conducted (i.e., organic or inorganic contamination).
- If the contamination is primarily of an organic nature, the following will be done:
- Conduct sampling at two horizons (0-150 mm and greater than 150 mm).
- Conduct shake-flask or other appropriate tests and analyse for Total Petroleum Hydrocarbons (TPH). In the cases where the TPH standard of 1 000 mg/kg is not applicable, other appropriate standards such as the Dutch Intervention Values for Soil Contaminants or US EPA Risk Based Concentrations or action levels for Industrial Soil Remedial Goals (PRGs) for Direct Contact Exposure Pathways or other procedures considered as best practice at the time of closure, must be applied.
- Interpret chemical analysis results and assess the potential for contamination.
- If the TPH concentrations are below 1 000 mg/kg, no remediation is required. If the TPH concentrations are above 1 000 mg/kg, the contaminated soil will be removed if it is in manageable volumes. The collected soil will be taken to a bioremediation facility for reclamation. Reclamation will continue until the TPH analyses of three composite samples indicate that the average TPH concentration is below 1 000 mg/kg.
- Note: If large volumes of organically contaminated soil and/or small areas with organic contamination other than normal petroleum products such as diesel, petrol (gasoline), and lubrication oil are found, the area will be assessed by a suitably qualified person and an appropriate remediation strategy devised.
- Collect composite soil samples within the identified contaminated area and analyze for total petroleum hydrocarbons (TPH). If the TPH concentrations are below 500 milligrams per kilogram, no decontamination is required. If the TPH concentrations are above 500 milligrams per kilogram, the

contaminated soil will be removed if it is in manageable volumes. The collected soil will be deposited onto a dedicated on-site bioremediation facility. The reclamation of the soil will be successful if the TPH analyses of three composite samples indicate that the average TPH concentration is below 500 milligrams per kilogram.

- In the cases of large volumes of organically contaminated soils, a suitably qualified person will conduct an assessment and prepare an appropriate reclamation strategy.
- In the cases where the TPH standard of 500 milligrams per kilogram is not applicable, other appropriate standards such as United States Environmental Protection Agency (US EPA) risk based concentrations or action levels for industrial soil remedial goals for direct contact exposure pathways will be used.
- If the contamination is primarily of an inorganic nature, the following will be done:
- Collect composite soil samples in the identified contaminated areas and analyze for total concentrations of the appropriate chemicals of concern (COC). The selection of COCs will be dictated by the historical activities that were conducted within or nearby the contaminated area(s).
- Compare the results of the chemical analyses with the USEPA Preliminary Remediation Goals (PRGs) for industrial sites. If the values are not exceeded, no reclamation is required. If the values are exceeded, a suitably qualified specialist will assess the situation and devise an appropriate reclamation strategy for implementation, including the recycling of these soils to recover any copper and/or cobalt metals.

7.4 Topsoil/growth medium

- Due to the arid West Coast climate in the Namaqualand region, topsoil is extremely scarce. The incorporation of environmental legislation post significant periods of mining meant that historically topsoil was not saved for rehabilitation purposes. Post the incorporation of the legislation, all topsoil which was made available as part of the pre-stripping process was used to rehabilitate areas mined within the same period. As a result there is no topsoil available to use as growth medium for the legacy areas. In areas where natural restoration is expected to take significantly longer, NM has made provision for induced restoration. This does however come at a significant cost and is therefore only applied where absolutely necessary.

7.5 Induced Vegetation

- Establishing vegetation on rehabilitated areas, characteristic of the surrounding environment, where it is anticipated that no growth will occur over an extended time period, the process includes netting, seeding and monitoring.
- Prepare the shaped areas for re-vegetation and vegetate.
- It is currently assumed that netting and seeding will only be done on half the area, effectively every alternate hectare, making provision for the natural spreading of the induced vegetation areas
- In-fill vegetation will be conducted as required to ensure that predetermined basal cover and species mix are achieved.
- It is assumed that if the width of the disturbed area is < 50 m and adjacent to natural vegetation, natural dispersal and succession is sufficient for restoration.

7.6 Demolition and removal of infrastructure

- All non-usable buildings will be demolished, including plant and related surface infrastructure. This will be completed by a contractor on a cost neutral basis
- General demolition waste will be safely disposed of by the responsible contractor in accordance with the required regulation.
- Asbestos waste will be safely removed in accordance with regulations and disposed off-site in an appropriate waste disposal facility.
- Resultant demolition waste and any other inert non-hazardous materials that cannot be reused or recycled as stipulated in the initial reclamation and closure plan and/or subsequent plans.
- Any hazardous material that accumulated on components of the buildings, machinery and equipment will be identified and removed for safe off-site disposal.
- Machinery, equipment, and storage tanks will be cleaned and disposed of as above.
- Concrete structures, foundations and slabs will be removed to 1 m below final ground level.
- Buried support infrastructures (tanks, pipes, underground services etc.) will be decommissioned and removed in a safe, acceptable manner. Buried infrastructure remaining on site will be identified on site closure maps.
- Decommissioned septic tanks will be filled with inert material and cover.
- Steel and scrap metal will be decontaminated for salvaging and recycling, if valuable.
- Hazardous material will be encapsulated or disposed of off-site.
- An assessment of contaminated soils will be conducted and will be ameliorated and/or disposed of accordingly.
- Areas from which buildings and surface infrastructure have been removed will be cleaned-up.
- Areas from which surface infrastructure has been removed will be checked for organic contamination and remediated.
- Areas from which buildings, plant and surface infrastructure have been removed will be shaped to roughly emulate the natural surface topography, especially terraces and hard stand areas.
- NM has outsourced the demolition of these infrastructural aspects as per the description above, and has proven it can be done cost neutrally. In essence the contractor will demolish free of charge and his profit will be derived from the sale of equipment and scrap steel.

7.7 Fugitive tracks

In accordance with the EMP's, the following assumptions have been made:

- Barriers that would prevent access by vehicles will be erected.
- The road will be allowed to colonise naturally. If the width of the disturbed area <50 m and adjacent to natural vegetation, natural dispersal and succession is sufficient for restoration.

7.8 Haul roads and access roads

The following assumptions have been made:

- The road surface and related areas would be deep ripped, unless ripping has already occurred.
- A general shaping and levelling cost has been allowed for, which should cover loading and hauling a portion of the ripped material for disposal in available mining voids. If possible, the material will be dozed into nearby voids (where it is covered by the profiling model), or cleared areas will be shaped to emulate the natural surface topography as far as possible.
- Cuttings and embankments will be suitably shaped to ensure safety and decrease erosion potential.
- Earth embankments associated with access roads and haul roads that could impede long term surface drainage will be breached and shape as above.
- Areas with high salt/salinity will be identified and receive amelioration, it is assumed that 10% of the indicated surface area of roads will receive treatment with gypsum.
- No growth medium replacement has been allowed for.
- It is assumed that if the width of the disturbed area is <50 m and/or adjacent to natural vegetation, natural dispersal and succession is sufficient for reclamation.

7.9 Coarse Tailings Mineral Resources (CTMR)

The following assumptions have been made.

- The CTMR's would remain in place post closure and are considered mineral resources. As such, they potentially play a crucial role in the establishment of small mining businesses post closure. The capping or profiling of these deposits will dilute the value, reducing the possibility of profitable treatment in the future.
- The CTMR's are stable and do not pose an environmental risk for the foreseeable future
- The CTMR's will be fenced off to "make safe" and restrict access.
- Following this methodology ensures the surrounding undisturbed areas are not destroyed by the profiling of the CRD's in order to obtain a required slope angle, which may not be required.

7.10 Fine Tailings Mineral Resources (FTMR)

The following assumptions have been made:

- The FTMR's would remain in place post closure and too are considered mineral resources. Current indications are that the FTMR's contain significant value in heavy minerals and any capping or profiling would, like the CTMR scenario, dilute the inherent value of the resource.

- The FTMR's are also considered assets to any future small mining operations, as the establishment and permitting of a new facility would come at significant cost. This would reduce the profitability of future mining operations, negatively impacting on sustainable development.
- The FTMR's are stable, but provision is made for the netting of areas which may be affected by dust plumes in extreme cases.
- FTMR's will be fenced off to "make safe" and to restrict access.

7.11 Overburden and spoil

In accordance with the EMP's, and the profiling model, the following assumptions have been made:

- Spoils will be dozed, loaded and hauled into the existing voids according to the profiling model to achieve a 1:3 or 1:5 slope. The volume to be moved is split into 75% dozing and 25% load and haul based on rehabilitation experience in the area.
- The mine has identified areas where the dragline could be effectively utilized to do reclamation according to the profiled model. The volume of material to be moved in the specified areas was split into 80% dragline work and 20% conventional dozing and load and haul methods costed in accordance with the weighted averages attached to the three scenarios. The following is noteworthy regarding the dragline use as specified:
- Of the total volume to be moved (about 42 million m^3 included areas), 28,5 million m^3 has to be moved in the BMC alone (67.5%). The volume assigned to the dragline for this exercise is 9,7 million m^3. If the current planning is implemented then the dragline will move 34.11% of the BMC total volume and 23.04% of the total NM volume.
- The total volume to be moved in the areas indicated for dragline utilization amounts to approximately 12 million m^3. The 80% dragline utilization and 20% load and haul split of this volume yields a 47.35%, 49.81% and 50.91% saving on the 90%-10%, 80%-20% and 75%-25% scenarios respectively (materials movement costs only).
- Seeds, seedlings and transplants of indigenous species will be added and the soil ameliorated in a manner that benefit from ecological dynamics. Specifications to be determined by soil type and habitat.

7.12 Virgin areas

In the virgin areas, which are adjacent to the areas being profiled, and would be disturbed during profiling, it is assumed that the growth medium would be dozed at a depth of 0.5 m and stockpiled. It is further assumed that the growth medium would be replaced at a depth of 0.3 m The shaping and levelling, netting, seeding, monitoring and maintenance of these areas is covered under the profiling model as the surface area falls within the materials movement boundaries.

7.13 Shallow and deep swept bedrock areas

In accordance with the EMP's, discussions with the mine and the profiling and GIS system analysis, the following assumptions have been made:

- The swept bedrock areas that are covered by the profiling model will be removed from the equation.
- It is assumed that half the surface area will be netted and seeded, as per the specifications discussed in the section on netting and seeding but only where the site conditions require it.

7.14 Transfer of infrastructure and land

In accordance with the EMP's, the following assumptions have been made:

- Suitable surface infrastructure and land for beneficial reuse will be selected, based on predetermined criteria below.
- The criteria for the selection of infrastructure for re-use will be developed, taking cognisance of the following:
- Possible heritage sites.
- Suites of final land uses, as these are evolving.
- Mine areas suitable for the transfer to responsible/ suitable third parties.
- Suitable third parties for transfer.
- Long-term health and safety considerations.
- Ongoing regulatory requirements.
- Commercial value to NM.
- Re-zoning requirements.
- A business case for each cluster of surface infrastructure identified for beneficial reuse will be developed for decision-making and if feasible, implemented.
- It will be ensured that the sale of land and/or the transfer of surface infrastructure will be preferably to parties who are empowered towards efficient farming, chosen land use practices as well as capable to utilise and maintain transferred infrastructure.
- In the event that the above can not be achieved the fall back position will be that the disturbed areas would be reclaimed for subsistence grazing and where possible key biodiversity areas would be re-instated.

7.15 Alternative Land Use

Although the general aim of the entire rehabilitation process if to return the land to its original state where practical and cost effective to do so, it must be said that there is a very strong drive toward creating a sustainable socio-economic environment post mining. It is for this reason that a number of development projects have been embarked upon with this exact intention. Various synergies have been identified which have led to the cost effective establishment of sustainable businesses. Some redundant mining infrastructure like sea water intakes, pumping stations and mined out pits, have provided the opportunity to explore marine aqua-culture activities in an area where it previously would probably have been too expensive.

Many other opportunities have arisen, creating win-win scenarios for the future communities and NM. These include the following projects, many of which have progressed to a significant level:

- Marine Aqua-culture – Oysters and Abalone
- Wind Energy
- Correctional Services Training and Rehabilitation facility
- Hazardous Waste Site

7.16 Other

In accordance with the EMP for the BMC, the following assumptions have been made:

- Regular monitoring and measurement relating to dust will be conducted after reclamation is complete.
- To prevent surface erosion, it is assumed the following will be done:
- Slopes will be stabilised by shaping and contouring, emulating local stable land forms providing suitable conditions for sustaining vegetation.
- Create suitable conditions (growth medium, vegetation mix, etc) for sustainable vegetation cover to contribute/assist with the prevention of surface erosion.
- Over and above the other measures that would protect the surface water bodies, local drainage lines will also be reinstated as far as possible as part of site reclamation as stated in the initial reclamation and closure plan and/ or subsequent plans.
- Remaining chemicals, reagents and hydrocarbon products will be consumed during mine decommissioning and/or returned to their respective suppliers.
- No product of the above nature would be disposed of on the mine site.
- Throughout the operational life certain areas would have been progressively reclaimed. In these areas the following actions will still take place:
- Confirm that the area under consideration is suitably reclaimed.
- Confirm the planned land use and alignment with regional developmental initiatives.
- Confirm alignment with sustainable development initiatives
- Compile business plan to confirm feasibility if transferred to third party, especially if to be used for commercial farming.
- Compile progressive closure plan, obtain approval and implement

8.0 REMEDIATION COST ASSESSMENT

The sub-sections following below give an overview of the specific actions considered and allowed for as part of the closure costing.

The closure cost estimate represents the scheduled and unscheduled costs utilizing the weighted average for moving material according to the profiled model assuming a 75:25 split between dozing as opposed to loading and hauling within a 1 km free haul distance. The summary of the costs for included areas is indicated below.

8.1 Infrastructural areas

Closure cost component	Remediation cost assessment	
	Unscheduled (Jan 2010)	Scheduled
Processing plants, steel structures, reinforced concrete structures, offices, workshops, residential buildings and related structures	▪ The demolition of plant infrastructure will be done as per current contract. The current contract allows for this to be completed at no cost to NM. All plant infrastructure will be removed in the same fashion	▪ The demolition of infrastructure will be conducted as for the unscheduled scenario. Most of the infrastructure will however have been removed by scheduled closure and the costs have been reduced accordingly.

8.2 Mining areas

Description of these components has been included under general surface reclamation given below.

8.3 General surface reclamation

Closure cost component	Remediation cost assessment	
	Unscheduled (Jan 2010)	Scheduled
Rehabilitation of Opencast areas (including final voids, ramps) overburden and spoils.	▪ Allowance was made for shaping of the outer slopes of the pits to 1:3 or 1:5 should site requirements dictate as well as the netting and seeding of the disturbed areas where soil conditions dictate.	▪ Allowances are the same as for the unscheduled scenario except that a significant number of opencast areas will have been rehabilitated by scheduled closure.
Rehabilitation of processing waste deposits and evaporation ponds	▪ No rehabilitation will take place as per 7.8 ▪ FRD's: No rehabilitation	▪ Same as for unscheduled scenario.

	Remediation cost assessment	
	will take place as per 7.9 ▪ CRD's and FRD's will be fenced and netted where required to ensure they are safe and stable.	
Virgin areas affected by profiling	▪ Allowance is made for the stripping of 500 mm of soil from the area before the shaping and replacing 300 mm after shaping. Where possible virgin areas will not be destroyed to make way for profiling	▪ Allowances are the same as for the unscheduled scenario
Areas outside the profiling/reclamation model boundary	**Roads ripped**	
	Allowance has been made for the following: ▪ Shaping and levelling of disturbed areas; and ▪ Salt and salinity remediation with gypsum.	▪ Allowances are the same as for the unscheduled scenario except that a significant number of areas will have been rehabilitated by scheduled closure.
	Roads	
	Allowance have been made for the following: ▪ Ripping of compacted areas ▪ Shaping and levelling of disturbed areas; and ▪ Salt and salinity remediation with gypsum.	▪ Allowances are the same as for the unscheduled scenario except that a significant number of areas will have been rehabilitated by scheduled closure..
	Profiled areas	
	Allowance has been made for the following: ▪ Netting and seeding of profiled areas where required	▪ Allowances are the same as for the unscheduled scenario except that a significant number of areas will have been rehabilitated by scheduled closure.
	Borrow pits	
	Allowance has been made for the	▪ Allowances are the same as for the unscheduled

Remediation cost assessment	
following: ▪ Minor shaping and levelling of disturbed areas; and ▪ Netting and seeding of shaped and levelled areas.	scenario.
Damaged areas	
Allowances have been made for ripping of the area.	Allowances are the same as for the unscheduled scenario except that a significant number of areas will have been rehabilitated by scheduled closure.
Dumps	
Allowances have been made for the following: ▪ Netting and seeding of profiled areas where required	▪ Allowances are the same as for the unscheduled scenario except that a significant number of areas will have been rehabilitated by scheduled closure.
Highwalls	
Allowances have been made for the following: ▪ Removal of growth medium in undisturbed areas to a depth of 0.5 m; ▪ Shaping and levelling of highwalls; ▪ Dozing of growth medium back to a depth of 0.3 m; and ▪ Netting of highwalls.	▪ No allowances have been made as this will be completed by scheduled closure.
Stripped ore	
Allowances have been made for the following: ▪ Replace of growth medium in undisturbed areas to a depth of 0.3 m	▪ No allowances have been made as this will be completed by scheduled closure.

Remediation cost assessment	
Naturally reclaimed areas	
Allowances have been made for the following ▪ Supplementing areas assumed to establish vegetation naturally with vegetation pockets.	▪ No allowances have been made as this will be completed by scheduled closure.
Netted area	
Allowances have been made for the seeding of netted areas.	▪ Allowances are the same as for the unscheduled scenario except that a significant number of areas will have been rehabilitated by scheduled closure.
Swept areas	
Allowances have been made for the following ▪ Netting and seeding of swept areas where required	▪ Allowances are the same as for the unscheduled scenario except that a significant number of areas will have been rehabilitated by scheduled closure.

8.4 Water management

Closure cost component	Remediation cost assessment	
	Unscheduled (Jan 2010)	**Scheduled**
	▪ No provision was made as there is little or no ground water.	▪ No provision was made as there is little or no ground water.

8.5 Post-closure aspects

Closure cost component	Remediation cost assessment

Closure cost component	Remediation cost assessment	
	Unscheduled (Jan 2010)	**Scheduled**
Surface water quality monitoring	Allowance has been made for the monitoring of surface water for a three year period post closure.	▪ Allowances are the same as for the unscheduled scenario.
Groundwater quality monitoring	Allowance has been made for the monitoring of groundwater for a three year period post closure.	▪ Allowances are the same as for the unscheduled scenario.
Monitoring	Allowances have been made for monitoring for a three year period post closure in the following areas: ▪ Reclamation monitoring of reclaimed areas, these include pit areas, dumps, other areas ▪ Virgin areas affected by profiling; ▪ Areas outside the profiling/reclamation model boundary which include: roads ripped, roads, profiled areas, borrow pits, damaged areas, dumps, highwalls, stripped ore, green area, naturally reclaimed areas, netted areas, planted areas, seeded areas, topsoil areas, and swept areas.	▪ Allowances are the same as for the unscheduled scenario.
Care and Maintenance	▪ Allowance has been made for care and maintenance for a third of the area over a three year period.	▪ Allowances are the same as for the unscheduled scenario.
Management/staff costs	▪ Management costs have been included in the operational costing	▪ These costs are form part of the operational costs and are excluded here.
Specialist studies	▪ These have been excluded from the closure cost estimate.	▪ These have been excluded from the closure cost estimate.

8.6 Additional allowances

Closure cost component	Remediation cost assessment	
	Unscheduled (Jan 2010)	Scheduled
Contingencies	▪ An additional allowance of 10 percent has been made in the total infrastructure and related aspects to allow for contingencies.	▪ An additional allowance of 10 percent has been made in the total infrastructure and related aspects to allow for contingencies.
Preliminary and General (P&G's)	▪ An allowance of 6% has been made.	▪ An allowance of 6% has been made.

9.0 ASPECTS REQUIRING FURTHER ATTENTION

Since the closure planning and associated costing for Namaqualand Mines is well advanced, limited (if any), aspects are outstanding that could require intermediate attention to improve future closure costing. The roll-out and implementation of the conceptualised land use plan and the transfer of responsibilities within this plan to third parties is the main aspect that will influence the costing.

Another aspect is the rate and nature of surface rehabilitation currently being conducted and the process of obtaining sign-off / approval from the regulatory authorities for areas as these are rehabilitated. If acceptably rehabilitated and the associated vegetation is self-sustaining, the closure costs for these areas can be omitted from the closure costs. This process has been established in conjunction with a third party ecology consultant and the DMR and future closure cost updates will take any such sign-off / approval.

10.0 CONCLUSION

The closure costs as reflected in this report were based on the closure costing compiled by Golder and adjusted as per information gathered during the actual rehabilitation process over the past three years. These changes are confirmed by site specialists in a third party capacity. In those cases where the required information was not available, estimates were made based on experience. Unit rates for the costing were obtained from Golder's database and specific input from Namaqualand Mines to reflect site-specific conditions and associated rates.

Within the above context, the reflected remediation costs as at January 2010 provide a good basis for the provisions to be made in the De Beers Consolidated Mines Limited – Namaqualand Mines financial statements.

APPENDIX A

Summary of Scheduled and Unscheduled Closure Costs

Unscheduled closure

	INFRASTRUCTURE AND RELATED ASPECTS	BIR	BMR	DGR	KNR	SBR	BSBR	TOTAL
1	Infrastructural aspects	R 0.00	R 62,500.00	R 0.00	R 12,500.00	R 0.00	R 0.00	**R 75,000.00**
2	Mining aspects	R 0.00	R 0.00	R 0.00	R 0.00			**R 0.00**
3	General surface reclamation	R 6,777,035.00	R 75,249,124.00	R 1,904,793.00	R 60,652,819.38	R 2,872,380.62	R 0.00	**R 147,456,152.00**
4	Water management	R 0.00	R 0.00	R 0.00	R 0.00			**R 0.00**
	SUB-TOTAL 1 (Infrastructure and related aspects)	R 6,777,035.00	R 75,311,624.00	R 1,904,793.00	R 60,665,319.38	R 2,872,380.62	R 0.00	**R 147,531,152.00**
5	Post closure aspects	R 366,092.90	R 4,068,305.79	R 102,896.21	R 3,277,117.89	R 155,164.93	R 0.00	R 7,969,577.71
	SUB-TOTAL 2 (Post-closure aspects)	**R 366,092.90**	**R 4,068,305.79**	**R 102,896.21**	**R 3,277,117.89**	**R 155,164.93**	**R 0.00**	**R 7,969,577.71**
6	ADDITIONAL ALLOWANCES*							
6.1	Preliminary and general (6 percent)	R 406,622.10	R 4,518,697.44	R 114,287.58	R 3,639,919.16	R 172,342.84	R 0.00	R 8,851,869.12
6.2	Contingencies (10 percent)	R 677,703.50	R 7,531,162.40	R 190,479.30	R 6,066,531.94	R 287,238.06	R 0.00	R 14,753,115.20
6.3	Engineering & project management (0 percent)							R 0.00
6.4	Management/staff cost (0 percent)							R 0.00
	(Additional allowances)	**R 1,084,325.60**	**R 12,049,859.84**	**R 304,766.88**	**R 9,706,451.10**	**R 459,580.90**	**R 0.00**	**R 23,604,984.32**
	GRAND TOTAL (Sub-total 1+2+3)	R 8,227,453.50	R 91,429,789.63	R 2,312,456.09	R 73,648,888.36	R 3,487,126.45	R 0.00	R 179,105,714.03

Scheduled Summary Spreadsheet - December 2010

Scheduled closure

	INFRASTRUCTURE AND RELATED ASPECTS	BIR	BMR	DGR	KNR	SBR	BSBR	TOTAL
1	Infrastructural aspects	R 0.00	R 62,500.00	R 0.00	R 12,500.00	R 0.00	R 0.00	**R 75,000.00**
2	Mining aspects	R 0.00	R 0.00	R 0.00	R 0.00			**R 0.00**
3	General surface reclamation	R 1,382,694.39	R 6,756,046.80	R 537,159.58	R 6,109,518.01	R 0.00	R 0.00	**R 14,785,418.78**
4	Water management	R 0.00	R 0.00	R 0.00	R 0.00			**R 0.00**
	SUB-TOTAL 1 (Infrastructure and related aspects)	**R 1,382,694.39**	**R 6,818,546.80**	**R 537,159.58**	**R 6,122,018.01**	**R 0.00**	**R 0.00**	**R 14,860,418.78**
5	Post closure aspects	R 741,532.97	R 3,656,756.88	R 288,076.34	R 3,283,211.53	R 0.00	R 0.00	R 7,969,577.71
	SUB-TOTAL 2 (Post-closure aspects)	**R 741,532.97**	**R 3,656,756.88**	**R 288,076.34**	**R 3,283,211.53**	**R 0.00**	**R 0.00**	**R 7,969,577.71**
6	ADDITIONAL ALLOWANCES*							
6.1	Preliminary and general (6 percent)	R 82,961.66	R 409,112.81	R 32,229.57	R 367,321.08	R 0.00	R 0.00	R 891,625.13
6.2	Contingencies (10 percent)	R 138,269.44	R 681,854.68	R 53,715.96	R 612,201.80	R 0.00	R 0.00	R 1,486,041.88
6.3	Engineering & project management (0 percent)	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00
6.4	Management/staff cost (0 percent)	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00	R 0.00
	(Additional allowances)	**R 221,231.10**	**R 1,090,967.49**	**R 85,945.53**	**R 979,522.88**	**R 0.00**	**R 0.00**	**R 2,377,667.00**
	GRAND TOTAL (Sub-total 1+2+3)	R 2,345,458.46	R 11,566,271.16	R 911,181.45	R 10,384,752.42	R 0.00	R 0.00	R 25,207,663.49

APPENDIX B

Closure Costing Amendments

Amendment	BIC	BMC	DGC	KNC	Total	
Plants and Infrastructure	**R 1,973,927.00**	**R 48,505,698.00**		**R 12,433,147.00**	**R 62,912,772.00**	
Subtotal Infrastructural Aspects						R 62,912,772.00
CTMRs	**R 2,469,657.20**	**R 21,605,649.50**		**R 7,279,825.92**	**R 31,355,132.62**	
FTMRs		**R 34,183,399.13**		**R 15,420,340.03**	**R 49,603,739.16**	
Naturally Rehabilitated areas	**R 2,089,157.00**	**R 30,500,000.00**	**R 307,229.00**	**R 22,966,270.00**	**R 55,862,656.00**	
Altenative Land use	*R 0.00*	*R 44,273,825.17*	*R 0.00*	*R 632,282.22*	**R 44,906,107.39**	
Mariculture		R 627,126.90		R 632,282.22	R 1,259,409.12	
Dreyerspan Correctional Facility		R 93,426.58			R 93,426.58	
Windfarms		R 8,416,635.00			R 8,416,635.00	
Hazardous Waste Disposal Site		R 35,136,636.69			R 35,136,636.69	
Salt water remediation on Roads @ BIC	**R 14,000.00**				**R 14,000.00**	
Pre 1980 Footprint	**R 0.00**	**R 22,813,198.92**	**R 0.00**	**R 33,419,274.29**	**R 56,232,473.21**	
Slope Angle change to 1:3	**R 1,617,193.00**	**R 15,292,008.00**	**R 553,006.00**	**R 17,232,947.00**	**R 34,695,154.00**	
Subtotal General Surface Reclamation						R 272,669,262.38
Post Closure Aspects					**R 28,157,551.00**	
Subtotal Post Closure Aspects						R 28,157,551.00
Management Cost					**R 32,842,315.60**	
Subtotal Management Cost						R 32,842,315.60
Preliminary and General					**R 5,592,965.00**	
Contingencies					**R 33,388,833.00**	
Subtotal Finance Costs						R 38,981,798.00

APPENDIX C

Unit rates used for Demolition, Reclamation and Related Work

UNIT RATES FOR SCHEDULED DEMOLITION, RECLAMATION AND RELATED WORK - October 2010						
Ref No.	Cost Item		Currency	Unit Rate	Unit	Notes
1	**Concrete**					
1.1	Heavy concrete thickness greater than 750 mm	:	Rands	R 1,100.00	/m^3	
1.2	Medium concrete thickness between 750 and 250 mm	:	Rands	R 550.00	/m^3	
1.3	Light concrete thickness less than 250 mm	:	Rands	R 350.00	/m^3	
1.4	Strip footing	:	Rands	R 125.00	/m	
1.5	Column footing	:	Rands	R 850.00	no	
1.6	Bases and floors after removal of super structures	:	Rands	R 150.00	/m^2	
1.7	Heavy duty floors and bases after removal of super structure	:	Rands	R 550.00	/m^2	(500 mm thickness)
2	**Steel structures**					
2.1	Super structures, steel buildings and related infrastructure					
2.1.1	Cables/pipe racks	:	Rands	R 48.00	/m²	
2.1.2	Light plant buildings	:	Rands	R 96.00	/m²	
2.1.3	Medium plant buildings	:	Rands	R 180.00	/m²	Buildings with dynamic equipment
2.1.4	Medium/heavy plant buildings	:	Rands	R 1,200.00	/m²	
2.1.5	Heavy plant buildings	:	Rands	R 1,800.00	/m²	
2.2	Steelstructures (permanent shed type structures)					
2.2.1	0m – 5m high	:	Rands	R 50.00	/m²	
2.2.2	5m – 10m high	:	Rands	R 80.00	/m²	
2.2.3	10m – 15m high	:	Rands	R 100.00	/m²	
2.2.4	15m – 20m high	:	Rands	R 120.00	/m²	
2.4	Sorting and screening	:	Rands	R 2.50	%	
2.5	Disposal of demolition waste					
2.5.1	Disposal of demolition waste - benign, general waste	:	Rands	R 300.00	/m³	100 km away
2.5.2	Disposal of demolition waste - benign, general waste	:	Rands	R 88.00	/m³	10 km away
2.5.3	Disposal of demolition waste - hazardous waste	:	Rands	R 1,000.00	/m³	Such as tar
2.6	Cladding/sheeting (steel)	:	Rands	R 18.00	/m²	
2.7	Crane hire and use	:	Rands	R 22,000.00	/d	120 t crane
2.8	Steel tanks with rubber lining					
9.2	Excavation	:	Rands	R 1.26	/m^3	
9.3	Load and haul (0 - 1 km free haul)	:	Rands	R 6.89	/m^3	
9.4	Load and haul (1 - 2 km free haul)	:	Rands	R 6.89	/m^3	
9.5	Load and haul (2 - 3 km free haul)	:	Rands	R 6.89	/m^3	
9.6	Extra over rates for overhaul outside free haul distance	:	Rands	R 7.00	/m^3/km	
9.7	Weigted average 75% dozing 25% load & hauls	:	Rands	R 5.83	/m^3	
9.8	Dragline rehabilitation rate	:	Rands	R 3.02	/m^3	
9.9	Rip wrap of outer walls (AK3 FTMR)	:	Rands	R 65.00	/m^3	
9.10	Preparation of upper surface of FTMR's	:	Rands	R 4,500.00	/ha	To be confirmed
9.11	Light ripping	:	Rands	R 1,250.00	/ha	
9.12	Heavy ripping	:	Rands	R 7,000.00	/ha	
9.13	Shaping and leveling of cover	:	Rands	R 2.50	/m^3	
9.14	Removal and disposal of liner	:	Rands	R 5.00	/m^2	
9.15	Weigted: (20% (average 75% dozing 25% load & hauls) and 80% Dragline	:	Rands	R 3.58	/m^3	
10	**Fencing**					
10.1	Erection of security fencing	:	Rands	R 125.00	/m	
10.2	Erection of stock fencing	:	Rands	R 45.00	/m	
10.3	Dismantling of security fencing	:	Rands	R 20.00	/m	
10.4	Dismantling of stock fencing	:	Rands	R 7.50	/m	
10.5	Dismantling of concrete palisade	:	Rands	R 110.00	/m	
10.6	Erection of concrete palisade	:	Rands	R 110.00	/m	
11	**Post-closure aspects**					
11.1	Surface water	:	Rands	R 240,000.00	/yr	
11.2	Groundwater	:	Rands	R 26,666.67	/yr	
11.3	Reclamation monitoring	:	Rands	R 1,350.00	/ha	3 years
11.4	Care and maintenance	:	Rands	R 8,400.00	/ha	3 years
12	**Other**					
12.1	Not applicable	:	no.	0	no.	
12.2	Sum	:	sum	1	sum	

APPENDIX D

NM Rehabilitation and Restoration Procedure

DE BEERS
A DIAMOND IS FOREVER

Document no:	NM-PR-25-SHHE	Compiler/Reviewer:	Rehabilitation Officer
Issue no:	01	Head of Department:	SHE Lead
Page:	1 of 17	Authorised by:	Operations Manager
Revision date:	10 July 2012	Issue date:	10 July 2009

REHABILITATION AND RESTORATION

1. OBJECTIVE

The objective of this procedure is to establish and maintain an effective rehabilitation and restoration method.

2. SCOPE

This procedure applies to all employees and other persons at Namaqualand Mines (NM) involved in the rehabilitation and restoration activities.

3. LEGISLATION

- Constitution of The Republic of South Africa Act 108 of 1996; Section 24;
- Minerals and Petroleum Resources Development Act no 28 of 2002; and
- National Environmental Management Act No. 107 of 1998

4. DEFINITIONS

Disturbed area: An area that was previously mined and is stripped of natural vegetation. These areas include bedrock sites, mine dumps, exploration trenches and open pits.

5. RESPONSIBILITY

5.1 The **Rehabilitation Manager** is responsible for administering this procedure.

5.2 The **Rehabilitation Officer** is responsible for contractors involved with restoration to ensure compliance to the procedure and addenda.

6. REFERENCES

The following Namaqualand Mines policy manuals and procedures and other documents are also relevant:

- NM-PM-01-SHHE ENV Environmental Policy Manual
- SANS ISO 14001:2004 Element: 4.5.1
- De Beers Group Environmental Dictionary (EPRA)

7. PROCEDURE

Rehabilitation of mine area at NM consists of two different aspects:
- Landforming - the earthmoving and shaping of a disturbed area; and
- Restoration, the ecological interventions for disturbed areas.

7.1 LANDFORMING

a) Predetermine the shape:
The Rehabilitation Manager and Officer determine the level of landforming and shape of a specific area.

b) Predetermine the earthmoving machine requirements:
The types of earthmoving machines that are used for this may vary from site to site, depending on factors such as the size of the area, the depth of the cut and or the type of area. The earthmoving requirements are determined by the Rehabilitation Manager.

c) Backfill mine dumps and cuts:
Overburden is backfilled into existing mine cuts and the resulting dumps profiled using the predetermined earthmoving equipment.

d) Profile dumps:
Backfilled overburden is profiled to the predetermined shape as was decided upon by the Rehabilitation Manager and the environmental officer.

e) Cover profiled area with topsoil or growth medium:
For optimal restoration results the profiled areas are covered with topsoil or suitable growth medium where available. The topsoil or growth medium is deposited at an approximate thickness of 30cm. Areas should only be covered with growth medium or topsoil if it can be netted and restored in the same restoration year.

7.2 RESTORATION

Restoration includes the ecological intervention to ensure that a disturbed area is recovered to a self-sustainable ecosystem.

The restoration is done in accordance with specifications set out by an independent ecologist. The following steps form part of the restoration process: netting, seed collecting and processing, restoration packs and transplants.
Strict methods have to be followed for each of the restoration activities (see

attached addenda for methodology).

a) Netting:
Netting is erected on areas that have received topsoil or growth medium in order to stabilize the movement of the soil. The use of nets mimics the effect of larger plant in the natural ecosystems. The nets are set up in such a way that it is perpendicular to the dominant wind direction of the area in order to minimize wind erosion.

b) Seed collecting and processing:
Collecting and processing seeds are in accordance with the specifications as set out by the ecologist. This entails physically going out into the field and collecting seeds from naturally occurring plants. The seeds are dried and processed to get them out of their protective shields and enable germination. Further more the processed seeds are put into seed-packs to ensure a mixture of seeds from different species.

c) Restoration packs:
Restoration packs consist of planting cardboard boxes in the field and planting the processed seed-packs inside. The restoration packs are planted in patches of ten. These patches have two different seed-pack recipes planted together, five of each, to form the ten individual packs per patch. The boxes mimic the smaller to medium sized plants in the field, and provide protection against the wind for the seeds planted inside them. The specifications for the combination of seeds needed for restoration packs are determined by the ecologist depending on what species occur naturally in the area.

d) Transplants:
Transplants are plants that are removed from the field and planted in patches of ten between the restoration packs. These plants are removed from the natural veldt and/or from areas that are earmarked to be stripped for mining within the next year.

7.3 DEMOLITION AND REHABILITATION OF INFRASTRUCTURE

The demolition and rehabilitation of infrastructure, e.g. plants and workshops, will be handled within the mine closure plan. If infrastructure will be demolished, the same steps of landforming and restoration will be followed after the demolition has occurred.

8. RECORDS

Description	Responsible	Location	Retention	Status*
Reports	Y6	SHE Department	LOM	A
CAD / Maps	G1 / M1	MRM Department	LOM	A

* A = Archive; D= Destroy

9. AMENDMENT RECORD SHEET

Recorded below are all the amendments which have been made to this document and the date the amendment was effected.

Issue no	Page no	Section	Subject	Date
01	All	Complete	New	09/07/2009

PA Sparks
OPERATIONS MANAGER
/mvw

NR Williams
SHE LEAD

W Nel
REHABILITATION OFFICER

ANNEXURE A

RESTORATION NETTING METHODOLOGY

1. MATERIAL SPECIFICATIONS (NETS, DROPPERS, ANCHORS AND WIRE)

- Net height: 0.75m
- Net length: 225m
- Net material: 40% density, green shade, Eyelets top and bottom, pockets every 2.5m
- Droppers length: 1.2m
- Dropper diameter: 10 mm
- Dropper material: steel (reinforced steel or normal farm dropper)
- Anchor material: Steel
- Anchor length: 1.4m and 0.7m
- Anchor type (Post fence, Y or K type)
- Wire type for droppers: 1.6mm galvanised
- Wire type for anchors: 2.5mm galvanised

2. NET ERECTION

Intervals: 5-6m (a maximum of 6m intervals) in an east-west direction on all restoration areas (topsoil and overburden).

Direction: Running east-west direction (Perpendicular to predominant southerly wind)

Method:

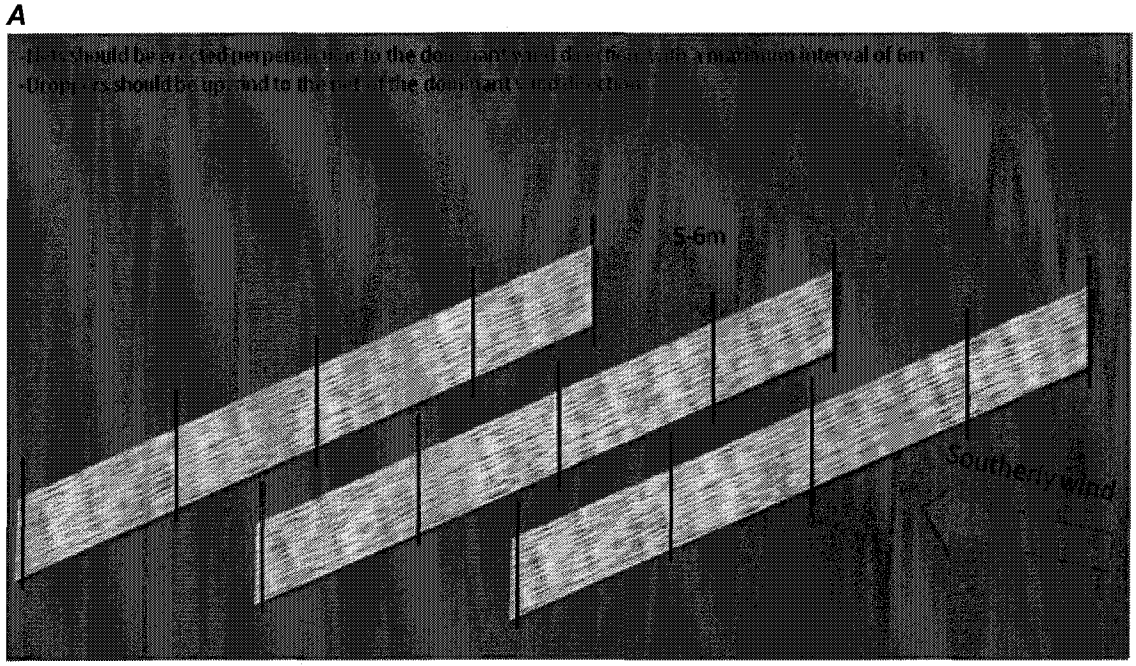
- Use anchor poles at each end of every net to anchor netting (y-poles, K- poles or old thicker droppers).
- Wrap net around the top of the 1.4m anchor pole 3 or 4 times to prevent tearing. Hit this anchor into ground in an upright position until net touches ground.
- In case of unstable conditions (very loose sand or shallow cover) insert a short 0.7m anchor at a 45° angle into the soil and use 2.5mm bind wire to tie to upright anchor.
- Insert droppers every 2.5m along the length of the net in the sleeves provided for this purpose.
- Pull netting tight and drive dropper into soil (Do not cut dropper off if not deep enough)
- Do not cut nets at the end of the line. Rather wrap the net at 90° to the start of the next line, and then use the rest of the roll for the next line (see figure 1).
- Ensure that the dropper sleeve is always facing south (i.e. the droppers are to the south of the net). Twist the net upside down at the end of the line where it is wrapped to the next line, thereby ensuring that the droppers are to the south of the net on the next line (see figure 1).
- Where the restoration site is wider than 225m in the east-west direction, gaps in the netting should be left for access roads every 225m (i.e. the length of one net). These access roads are to be used for setting out restoration packs, watering of restoration packs and maintenance of netting. There should be no access roads around the perimeter of the site, as this will prevent seeds from surrounding natural vegetation to be dispersed into the restoration site. Access roads (gaps in netting) should be a maximum of 5m wide, and should not run directly downslope, in order to avoid erosion. The road should not run directly north-south, in order to avoid the formation of a wind channel.

- Take netting about 3 to 5 meters into the undisturbed vegetated area. There should be no gap (or road) around the outer perimeter of the restoration areas, since this will limit the influx of seeds from the surrounding undisturbed areas.

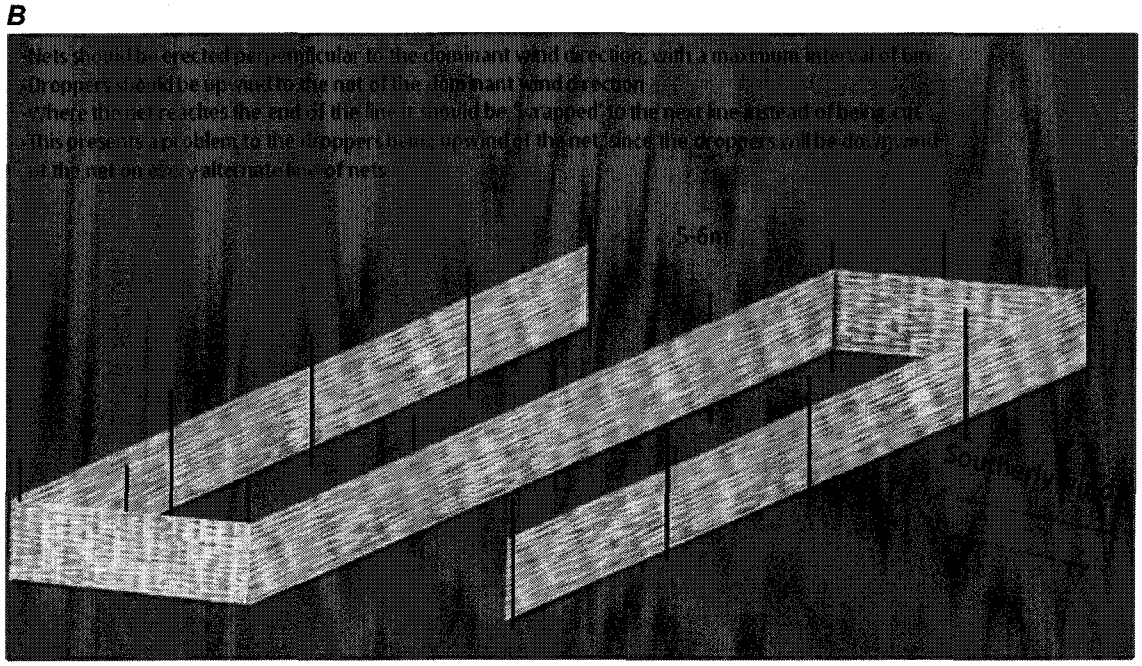
Figure 1

A) Nets should be place perpendicular to the predominant wind, and the droppers should face into the wind (to the south of the nets). ***B***) Nets should not be cut at the end of a line, but 'wrapped' to the next line, and ***C***) 'twisted' at the same time so that the droppers remain to the south of the net on the next line.

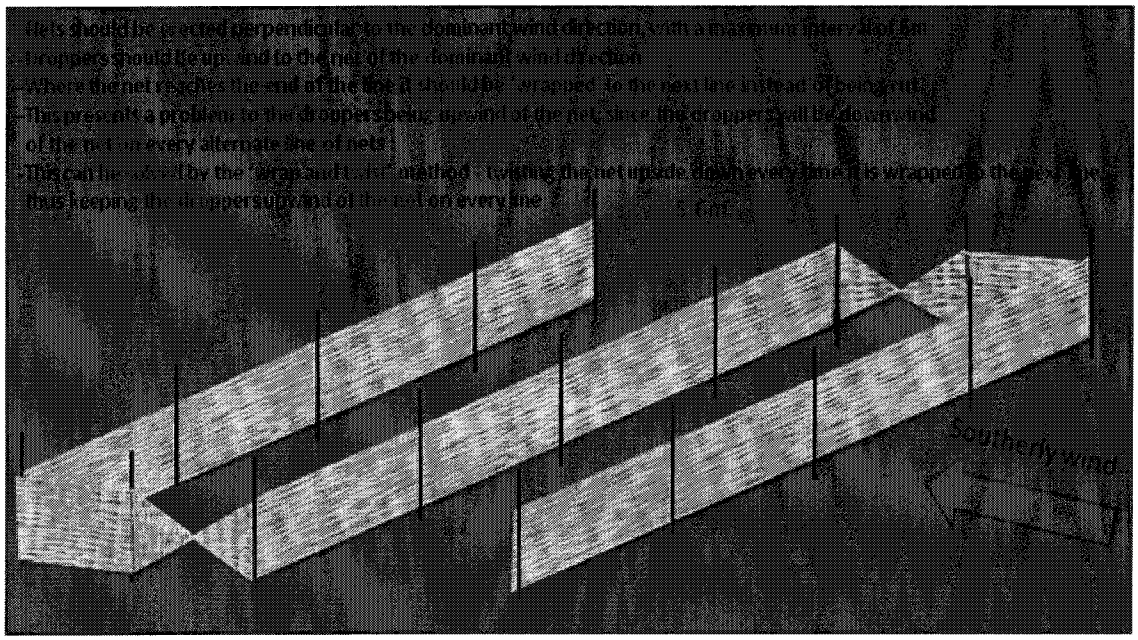
A



B



C



3. NET MAINTENANCE

Do maintenance checks on all nets at monthly intervals, and include the following:

- **Lift up netting** (& droppers) where soil has accumulated against the nets. Ensure the net and droppers are on top of the new soil level.
- The 'eyes' (holes) along the top edge of the nets are to be hooked around the droppers where the nets have stretched, in order to **make them tight**.
- Where nets have sagged down along the dropper, they need to be lifted up and tightened, as described above.
- Scoop away heavy sand built up with spades and level away from netting.
- Repair torn netting.

4. NET REMOVAL

Remove netting in areas where no longer needed as per request of the rehabilitation manager.

- Remove netting in such a way as not to damage it so it can be reused
- Reuse netting where possible
- Neatly stack material in grouped heaps for removal

ANNEXURE B:

SEED COLLECTION, STORAGE, CLEANING AND PREPARATION METHODS

1. PURPOSE OF SEEDS

The collection of seeds of perennial species is a necessary step towards the Restoration Pack (RP) intervention method, as described in the NRI Restoration Pack Methods document. Once seeds have been collected, they need to be stored appropriately in order to maintain their viability and value. Prior to using seeds in RP's, the seeds need to be extracted from the plant covering bodies that surround them (capsules, wings, fruit bodies etc), so that they will be able to germinate in the field.

This document will describe the generic methods of collecting, storing, cleaning and preparing all the possible species that are to be used in RP's, bearing in mind that the specifications for each restoration will be set by the NRI, and will therefore differ. The relevant sections of this document can be consulted based on the seed requirements provided in the specifications for each area.

2. SEED COLLECTION

2.1 Which species should be collected?

Only common perennial (long-lived) species of the following plant functional groups (as described in the NRI training manual / the NRI book) should be collected:
- Sprawling Mesembs (Mesembryanthemaceae)
- Upright Mesembs (Mesembryanthemaceae)
- Shrubs
- Large Shrubs

2.2 When can seeds be collected?

Seeds can be collected from about 2 weeks to 3 months after flowering – depending on the species. It should be noted when a population of a target species is flowering, so that collection can done there once the seeds are ready for collection.

Seeds should only be collected once they are ripe and fully formed. For Mesembs this means that the capsules have dried out and become hard and woody. For most other species it means that the fruit body or flower remnant must be fully dried out, and the seeds are hard and fully formed (often turning a darker colour when they are ready).

Seeds should be collected as soon after they have ripened as possible, since seeds are dispersed once they are ready (Mesembs release seeds every time it rains, wind-dispersed seeds are blown off the bushed with mild to strong winds), or lost by seed predation (beetles, insect larvae, birds, rodents).

2.3 How should seed be collected?

Seeds should be collected in hessian bags, paper bags or in cardboard boxes. As little plant material as possible should be collected with the seeds, since this will increase the moisture levels and the likelihood of mould or rotting occurring. They should never be collected in plastic bags, and should never be stored in a car or in the back of a bakkie with a canopy – since the heat can destroy the seeds very rapidly.

2.4 How much seed should be collected?

Enough seeds should be collected for the designated number of RP's in the target restoration area.

The necessary permits for seed collection should be obtained from the authorities. These deem that no more than 20% of the seeds of a population may be collected in the same year (by law).

3. SEED STORAGE

Seeds should always be dried prior to storage. Seeds and the associated plant material can be dried by placing them in open, shallow cardboard boxes or similar shallow containers. These boxes should be place indoors in a well ventilated place that is safe from rodents or other granivores. Seeds should also be fumigated as soon as possible after collection to eliminate any beetles or larvae that are already inside the seed storage bodies, as well as being treated with anti-mould treatments. This is best done during the drying time since seeds are spread in thin layers.

Once seeds and all the plant material that is amongst the seeds has been completely dried out, the seeds can be stored in bigger, closed cardboard boxes or similar containers that will allow them to 'breathe' (not plastic bags or containers). These boxes should be kept in a granivore-safe place that is cool, dry and preferably dark.

4. SEED CLEANING

Seeds should be removed from the coverings that surround them prior to being used in RP's.

The following methods are recommended by the NRI:

4.1 Cement Mixer

Seeds with hard capsules or coverings can be placed in a cement mixer together with 5 to 10 pieces of hard, heavy firewood (more, larger pieces for hard seed coverings; fewer, smaller pieces for soft seed coverings). The mixer bowl should not be filled more than half, otherwise it will not be efficient. Once the mixer is on, the pieces of wood will fall on the capsules or coverings and break them open, thus releasing the seeds.

The released seeds should be sieved out (see below) periodically to avoid them being damaged by the wood. For soft seed coverings this can be done every 20-30 minutes, and for hard seed coverings this can be done every 1 to 1.5 hours
e.g. Tetragonia, Zygophyllum, Lebekia, Tetragonia, Didelta, most of the Mesembryanthemaceae

4.2 Sieves

Seeds that have been released by the cement mixer process can be separated from the remaining plant material by using an appropriate sieve mesh size or set of sieves with varying mesh sizes. This is useful to gain a more accurate estimate of the numbers of seeds, as well as reducing the volume for storage and packaging purposes.

Seeds with soft or leathery seed coverings, soft seeds or small seed coverings can often not be broken by the cement mixer, or may be damaged by the cement mixer. These seeds can be ground through an appropriately sized mesh sieve, so that the seeds fall through, but the unbroken coverings do not. A wooden or rubber block can be used to grind the seed coverings through the sieve.

e.g. *Jordaaniella, Drosanthemum, Psilocaulon, Pharnaceum, Amphibolia*

4.3 Beating

Some early pioneer species are collected by removing part of the bush with the seeds on. These should be dried thoroughly, and once dry the seeds will be easily dislodged from the bush. This can be achieved by beating the bush with a stick, or hitting the bush against a sieve or flat surface. The seeds and leaves that come off can be sieved to remove any small branches or sticks that may have been removed during the process.
e.g. Atriplex

4.4 Other

Seeds of certain species do not need to be cleaned. These are seeds with thin or small seed coverings that do not inhibit germination, or do not result in seeds being clumped together once sown in a RP.
e.g. Manoclamys,

Seeds of certain species cannot be cleaned efficiently using any of the above methods, and should be left as is until they are sown into the RP's. These are mostly species of the Asteraceae that have seeds forming in 'cones' with plumes attached to the seeds. These should be broken up by hand during the process of sowing them into RP's. The seeds should be removed from the cones so that the seeds are spread out evenly over the area of the RP, and the plumes should be removed to prevent them from being blown around in the RP or being blown out of the RP.
e.g. Pteronia, Othonna, Arctotis

5. SEED PACK PREPARATION

Once seeds have been cleaned (and stored if necessary), they should be prepared for being used in RP's according to the specifications set out for the target restoration area by the NRI. Small seeds (all the Mesembryanthemaceae, and others with similar-sized seeds, like Pharnaceum and Galenia) are to be used in separate RP's to large seeds (all the remaining species), and should thus be put in different packets. Each packet (of small or large seeds) should contain the correct number of seeds of each species that is to be used in one RP. The number of seeds per pack can be determined on a weight basis, once the number of seeds per gram has been determined for each species.

ANNEXURE B:

RESTORATION PACK (RP) METHODOLOGY:

6. PURPOSE OF RESTORATION PACKS

Restoration packs are a cost-effective method to rehabilitate an area that maximizes the effectiveness of seeds, and facilitates the rehabilitation of a degraded area to:

- Introduce and establish natural and preferred species to an area in order to have better balanced species diversity in the area.
- Improve the ecological stability of the area, for instance stabilizing and preventing sand movement and the creation of sand plumes.
- Re-establish the ecological structure of an area, which will allow natural plant and animal establishment in the future
- Increase the natural and preferred species abundance, cover & biomass to a specific area

7. RESTORATION PACK TYPES

If small seeds are covered to deep they will not germinate. For this reason restoration packs are divided into two types: **large seed** and **small seed** restoration packs.

Each **large seed restoration pack** should contain the following species and seed number:

Large seed restoration pack

Othonna cylindrica	4
Pteronia glabrata	250
Pteronia onobromoides	250
Tripteris oppositifolium	22
Didelta carnosa carnosa	20
Arctotis scullyi	14
Tetragonia fruticosa	70
Atriplex semibaccata	100
Manochlamys albicans	160
Zygophyllum morgsana	50
TOTAL	940

Each **small seed restoration pack** should contain the following species and seed numbers:

Small seed restoration pack

Amphibolia laevis	1000
Drosanthemum hispidum	500
Psilocaulon spp	500
Jordaaniela spongiosa	1000
Ruschia aggregata	2000
Stoeberia beetzii	150
TOTAL	6150

8. RESTORATION PACK MATERIALS SPECIFICATIONS (BOXES, SEEDS AND FERTILISER)

- **Boxes: corrugated cardboard box** (approximate dimensions of 400 x 500mm and 300mm deep)
- **"Veg" 6:3:4 Slow Release VITA Organic Fertilizer**, from Talborne Products.
- **"skommeltjies"** (plant material collected from under bushes)

9. RESTORATION PACK APPLICATION

Restoration packs are to be set out during the winter months from April to May as per the following Namaqualand Restoration Initiative's standards:

- Dig a hole slightly larger than the box and **insert corrugated cardboard box 10-15cm into the soil.** (To protect the growing seedlings)
- Replace the soil inside the box and follow these steps:
  - Add 35g of the 'Veg' 6:3:4 Slow Release VITA Organic Fertilizer to each restoration pack, and **mix into the top 5cm of the soil.**
  - Add approximately 3 large handfuls (roughly equivalent to 3 large coffee mugs) of 'skommeltjies' to each restoration pack, **and mixed into the top 5 cm of the soil** (this can be done at the same time as the nutrients).
  - Level and compact refilled mixture:
    - Compact softly on clay or overburden soils (push down with hand palms)
    - Compact well on sandy soils (step on it with one foot)
  - Lastly, add seeds:

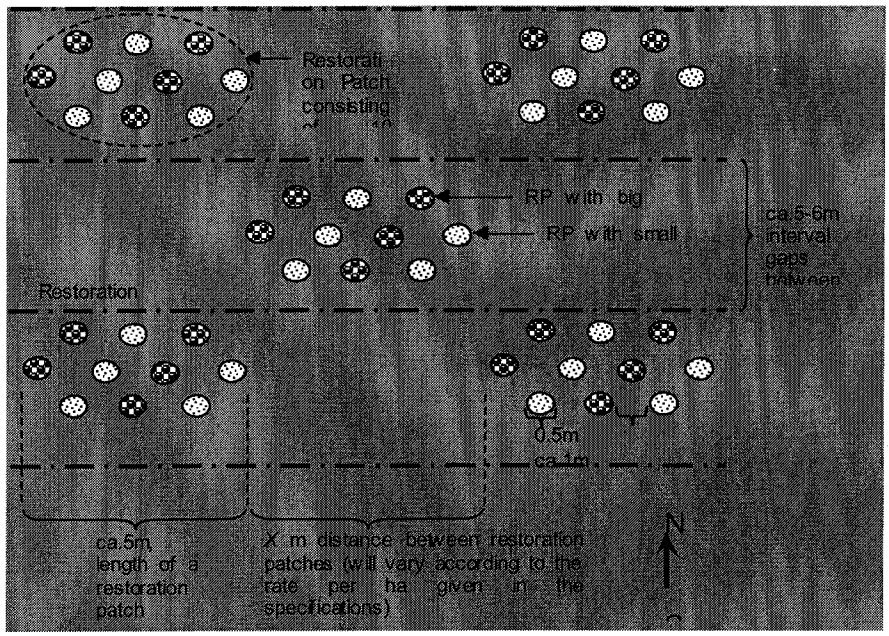
<u>Large seeds:</u>
- **Empty the seeds** from the envelope or bag **into one hand.**
- **Add a hand full of sand** to the seed in your hand palm.
- **Rub this mixture vigorously** between the palms, **while sowing** it **evenly** across the area of the restoration pack.
- Take care to **remove all seeds from** remaining **capsules** or seed coverings (e.g. *Pteronia*).
- Spread **3 or 4 handfuls of soil** over the seeds (cover seeds 1-2cm deep), and patted down with the palm of the hand.

<u>Small seeds</u>
- Sow evenly on the soil surface of the restoration pack.
- **Add a scoop of sand** to the seed in your hand palm
- Gently rub **this mixture** between your hand palms
- Lightly pat into the soil with the palm of the hand.
- **Do not place handfuls of soil on top of the small seeds** since these seeds will not be able to grow through even a shallow soil layer.
- (Note: the manual suggests using 1 handful of soil – we do not recommend this now as it has resulted in confusion when implemented in the field)

♦ <u>As a final step do the following:</u>
- **Soil inside the box must be 5cm higher than the soil outside the box** after everything has been added to the box
- **Soil within the box must be level** and not at an angle.
- **Soil outside the box must be sloped away** from the box. (The restoration pack must be in a slight depression, in order to increase the water input to the restoration packs)
- **Fill in any soil gaps ± 40 cm away from and around the outside of the box,** and stamp down this soil around the box.

- Any left over soil further than **± 40 cm** can be left in piles as uneven surfaces are good for restoration.

- Group restoration packs into patches of 10 and leave a slightly gap between each patch of 10 restoration packs.
- Ensure patches are spaced well across the area in order to cover the full extent of each ha (Do not cramp all RP's into one corner). Space the RP's evenly over the restoration site. The distance *X* between restoration pack patches will vary between restoration sites, and will be determined by density of RPs / ha. This will be set out in the specifications for each particular site.



10. RESTORATION PACK MAINTENANCE

In order to prevent seedlings from dying during a dry period the RP's need to be monitored and watered as explained:

- Monitor restoration packs on a two-weekly basis for the winter and spring season:
  - Monitored rainfall - if there has been no a rainfall event of greater than **4mm** in a 2 week period, the restoration packs should be watered. (1.5-2 litres of water per pack). This only applies until the end of October.
  - Where a box has collapsed entirely, cut the box off at the base and remove it from the site if it can not be lifted and kept opened.

ANNEXURE C:

TRANSPLANT (TP) METHODS:

1. PURPOSE OF TRANSPLANTS

Transplanting is the process of digging up established plants in undisturbed veld, usually from an area that is designated for mining, and transplanting these on restoration areas. The benefit of transplanting is that it is an easy and cheap way to establish a rapid vegetation cover on new restoration areas and also helps to improve topsoil retention. It is an especially useful technique to use for plant species that do not establish easily or cheaply from seed and in Namaqualand many plant species survive transplanting well because of the stored water in their leave and stems. In cases where transplants are removed from pristine (natural) sites, it is important that the right species and not too large a proportion of these species are removed so as not to disturb the ecological balance at the pristine site. Plants that do not have succulent leaves or stems do not survive transplanting, and should not be used. To ensure that transplant activity does not impact on indigenous, undisturbed areas, these protocols should be adhered to very strictly. Removing transplants poses is a danger of creating new degraded areas in pristine sites (studies are ongoing to make sure this doesn't happen), and the contractor or the mine could be liable for prosecution by the governing authorities if the correct protocols are not followed.

2. EQUIPMENT AND MATERIALS
   - Spades
   - Bags / crates / boxes (for carrying the transplants)
   - Bakkie (to transport the transplants)
   - Nutrients
   - Watering equipment

3. CHOOSING THE SITE WHERE TRANSPLANTS SHOULD BE TAKEN FROM
In choosing sites from where transplants can be collected, one needs to consider the future plan for the site.

3.1 Sites that are designated for mining in the near future
The most suitable sites to remove transplants from are areas that are designated to be mined in the near future. For such sites, the impact of removing transplants does not matter since the entire site is destroyed when the topsoil is removed.

3.2 Sites that are not destined to be mined in the near future
In some instances no sites that are destined to be mined in the near future will be available or more transplants than what these sites can provide are required. **Only** in such circumstances can transplants be taken from undisturbed / pristine sites. In such instances it is preferable to choose sites that are destined to be mined in the long term, or from pristine sites that fall within the mining area. **At no time should plants be taken from a previously disturbed / restored site,** no matter how well it has been restored.

4. HOW MANY TRANSPLANTS CAN BE REMOVED?

4.1 Sites that are destined for mining in the near future (less than 3 months)
Since the entire ecosystem will be completely transformed during the mining process, it is feasible to remove **all** individuals of suitable plant species before mining for use in transplanting. Suitable plants have one or more the following characteristics:
   - **Succulent leaves** (e.g. Mesembryanthemaceae, some Asteraceae, some Asphodelaceae, Crassulas)

- **Succulent stems** (e.g. Euphorbiaceae, some Asteraceae, few Mesembryanthemaceae)
- **Underground storage organs** (e.g. Amaryllidaceae, most Iridaceae, some Hyacinthaceae)

[Also refer to *Best practice guidelines for minimizing impacts on the flora of the southern Namib* by Antje Burke for further information on which plants are suitable for transplanting.]

Middle and late succession species should be used preferentially to early succession species. Unsuitable species should not be transplanted, since they will not survive transplanting, or benefit the restoration site. If these species are transplanted, they will not be paid for.

4.2 Pristine / undisturbed sites within the mining area:
Collect only 10% of the approved transplant species' individuals located in the demarcated area. This means that in a given population of the target species, a team should only collect 1 out of every 10 plants of that species. Transplants should be removed evenly throughout the site. One way to ensure systematic collection would be to line up transplant collectors standing a few meters apart on one side of the site. As each collector walks towards the opposite end of the site, they focus on collecting transplants only in the area ahead of them (on their 'line') (Figure 1). Once their bag / box is full of transplants, they should leave a marker (a spade or something else) where they have stopped, allowing them to return to and start from the same spot again after they have taken the full box / bag back to the bakkie.

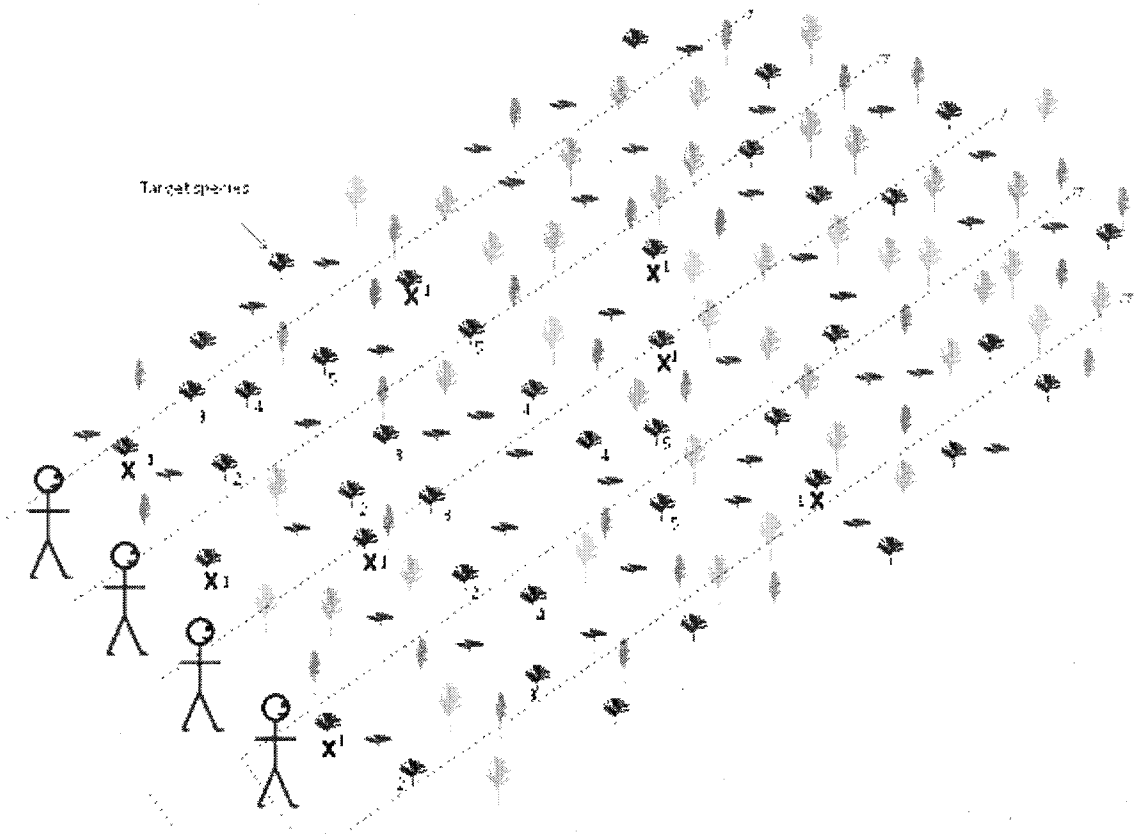


Figure 1. Transplant collectors should walk in straight lines in a collection area, and should be between 5 and 10m apart. Only every 10th plant of the target species should be taken out.

5. HOW OFTEN CAN TRANSPLANTS BE TAKEN FROM A SITE?

It is advisable that transplants are removed from a particular area of undisturbed or pristine veld only **every 5 years or longer**. Good record keeping of transplant collection should prevent more than one collection from the same site within 5 years.

Recording transplant collection activities should include the date (year and month) the transplant collection was made as well as the size and location of the collection area. The location of the collection site from which transplants are to be removed should be clearly defined e.g. between road 'a' and 'b', starting at 'place c', next to 'd', up to 'place e', approximately 'f' km^2. It would be most useful to get GPS co-ordinates for the perimeter of the area from which the collection was made.

6. WHICH PLANT SPECIES CAN BE COLLECTED FOR TRANSPLANTING?

Plant species collected for transplanting should be common generalist species (i.e. occur in a wide area, and in a variety of habitats), be abundant at both the site from which transplanting is done and in the type of soils into which they will be transplanted, survive transplanting well and have high recruitment rates. High recruitment rates would ensure that the population can readily recover once a collection has been completed.

The **only** species that are approved for transplanting from pristine areas are:
Ruschia rariflora
Amphibolia rupis-arcuatae
Aphiboilia laevis
Othonna cylindrica
Othonna sedifolia

7. WHAT SIZE SHOULD THE PLANTS BE THAT ARE USED FOR TRANSPLANTS?

Plant individuals that are too small or too big generally do not survive transplanting well. In general, plant individuals smaller than 10cm high and bigger than 30cm high (= height of the blade of a spade) survive transplanting less well. These heights are more applicable to *Othonna cylindrica*, since they grow much larger. Most adults of the other species fall within the 10 – 30cm size range.

8. WHEN SHOULD TRANSPLANTING BE DONE?

- Transplants should be done in winter (May to August), so that there is an increased likelihood of them still receiving follow-up rain, which allows the transplants to establish properly at the new site before the hot summer months.
- It is **very important** that transplants are **transplanted the same day** to reduce the amount of time the roots are exposed.
- Transplanting should never be done in the late winter (September) or in summer (Ocotber to April).

9. HOW SHOULD TRANSPLANTS BE TAKEN OUT OF THE NATURAL VELD?

- Care should be taken **not to damage the major roots** when transplants are pulled out. A spade is needed to remove the transplants. Insert the spade vertically (not at an angle) about 15 – 20cm from the base of the plant. Then lever the spade so that the transplant is pushed up by the blade, without damaging the major root system and put the plant gently out of the soil holding on to the base of the plant's stem.

- Place the transplants in a box or hessian bag (streepsak). Transplants can be kept cool on hot days by wetting the bag, or by placing a wet bag on top of the transplants in a box.
- Where more than one species is removed, they should be kept in different boxes / bags. Never leave transplants inside a vehicle, or exposed to full sun as this will dry them out.

9. HOW SHOULD TRANSPLANTS BE PLANTED INTO A RESTORATION SITE?

- Transplants should **always** be planted into the restoration site **on the same day** as they were removed from the natural veld.
- Select an area which is already in a **natural depression or dip** (this collects water when it rains, giving the plant a greater chance of survival) (Figure 2).
- Dig a hole that is about twice the size of the roots of the transplant in the depression.
- Place one plant in the hole. While holding the plant up slightly, spread the roots out in the hole and fill the hole with soil in such a way that some soil is placed in between the roots and there are no air spaces left around the roots.
- Before the final soil is replaced in the hole, add the appropriate amount of nutrients evenly around the transplant (35g).
- Place the last bit of soil around the transplant, and press down firmly with the palm of your hand to compact the soil (overburden should not be overly compacted).
- Creating a slight depression around the transplant will aid catching additional water and nutrients (Figure 2).
- The transplant should then be **watered the same day as being planted** (1.5 liters of water per transplant) to ensure that the roots settle well and all the roots are in contact with the soil (there are no air spaces). This prevents the roots from drying out, allows the roots to take up water and nutrients from the soil immediately, and the plant to rapidly develop and replace the small roots damaged during transplanting (these responsible for nutrient and water uptake).
- Do not plant the transplants in rows or grids, but plant them in mixed species patches of 10 transplants per patch.

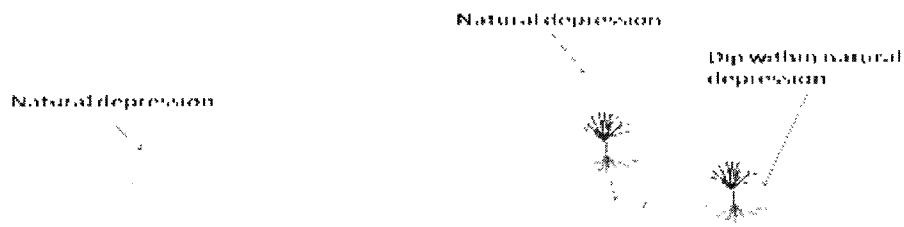


Figure 2. Transplants should be planted in natural depressions in the restoration site. A dip should be made within the natural depression to maximize the amount of water that the transplant gets when it rains.

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