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DE BEERS CONSOLIDATED MINES LIMITED, NAMAQUALAND MINES

Amended Environmental Management Programme for the Buffels Inland Right

Submitted to:
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REPORT

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. 12888-10331-8;

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 determined by 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 Buffels Inland Right

The Buffels Inland Right (BIR), one of the six active mining areas comprising Namaqualand Mines, is located approximately 40 km inland from the coast, to the west of the town of Kleinsee along the Buffels River. It covers an area of approximately 910 ha.

Mining licence 26/94 for the BIR encompasses all or portions of the farms:

- Langhoogte 184
- Nuttabooi 199
- Strydrivier 188
- Staanhoek 198

No ore is treated at the Langhoogte plant. Run of Mine (ROM) generated from the open pit in the BIR is treated at the Bulk Sample Plant in the Buffels Marine Right (BMR). A recovery plant located in the BMR is used for the final recovery of processed ore from all the Namaqualand Mines' areas.

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

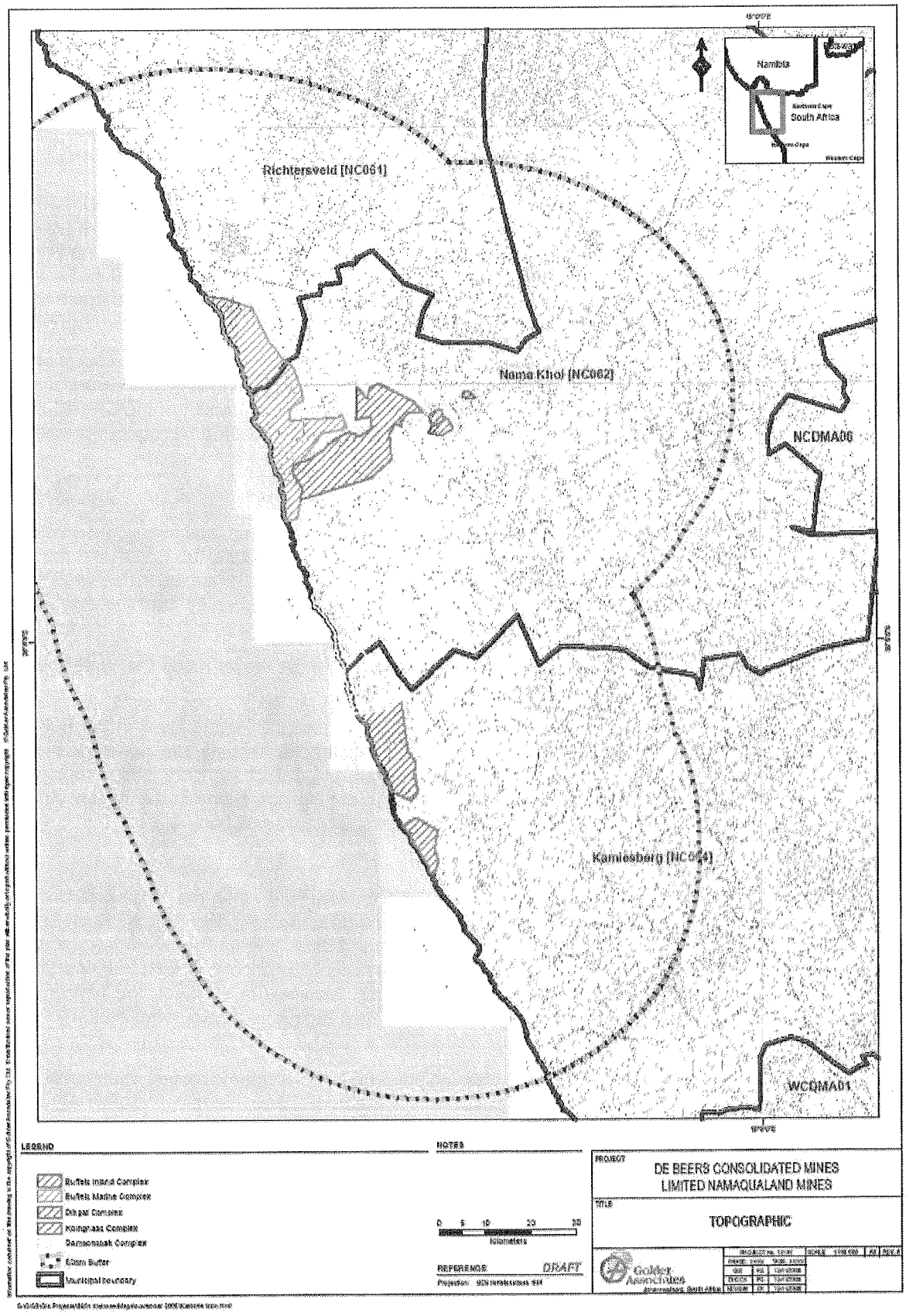

Figure 1: Geographic layout of the BIR within the Namaqualand Mines area

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 Mines 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 LM 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 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 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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1.0 INTRODUCTION

This amended EMP is based on the following documents:

- Environmental Management Programme for the Buffels Inland Right;
- 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 BIR 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.

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 BIR 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 BIR (ML 27/94) is located on all or portions of the farms listed below. These farming areas are owned by De Beers Consolidated Mines Limited - Namaqualand Mines. Portions of: Langhoogte 184 Nuttabooi 199 Stryd rivier 188 Staanhoek 198
SERVITUDES RELATED TO BUFFELS INLAND RIGHT (ML 27/94)	
Presence of servitudes on farms comprising the mining area as per the above list	The primary servitude is related to grazing and cultivation/servitude, as mentioned in Section 1.4.1. In addition, the Langhoogte and Nuttabooi mining areas are connected by a registered servitude haul road (S.R. No. E1316/88, S.G. No. 3905-88, 1/8/88, a servitude road area of 81.64 ha over the farm Wolfberg 187).

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 Buffel's Inland Right is operated from the town of Kleinsee situated 670 km north of Cape Town.

2.2.2 Location and neighbouring towns

The closest towns to the Buffel's Inland Right is Komaggas to the south of the mining area and Kleinsee to the West. Komaggas is linked to Kleinsee by approximately 40 km of privately-owned gravel road. The closest major centre is Springbok, some 105 km east of Kleinsee via a secondary gravel road. Port Nolloth lies 60 km to the north of Kleinsee and has the Northern Cape Provinces' only harbour facility. Other small towns in the vicinity include Koingnaas, Soebatsfontein and Hondeklip Bay.

2.2.3 Roads, railway lines and power lines

Access to the Buffels Inland 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 BIR; the closest of these being situated inland in the Port Nolloth area to the north (Figure 2. 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 BIR located in the quaternary catchment of the Buffels River (Figure 3). Just east of the BIR, the Buffels River converges with the Stryd River flowing from the north-east and the Komaggas River flowing in from the south-west into its final drainage line that flows in a westerly direction and forming an estuary as it opens into the sea.

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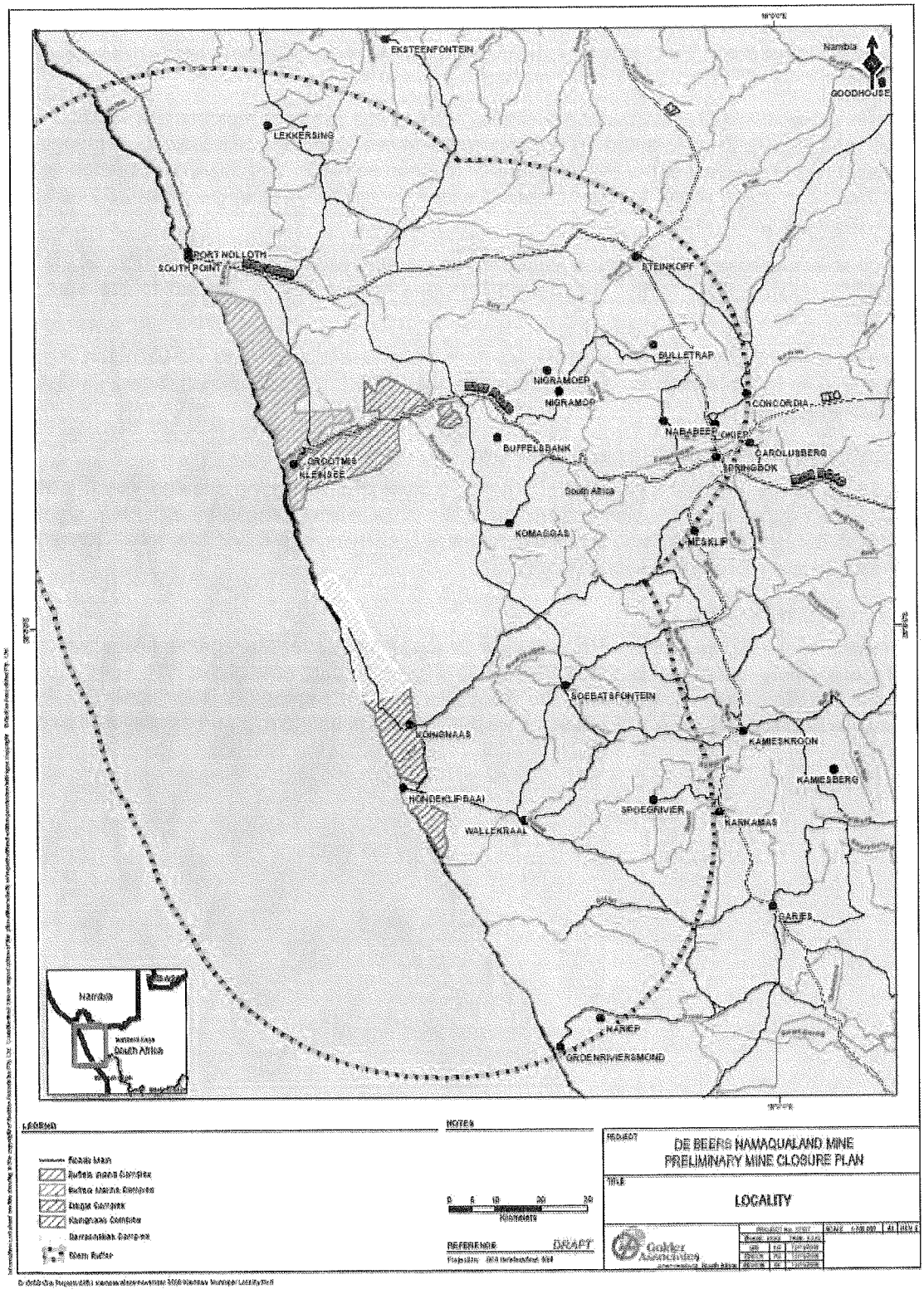

Figure 2: Location of Namaqualand Mines Rights

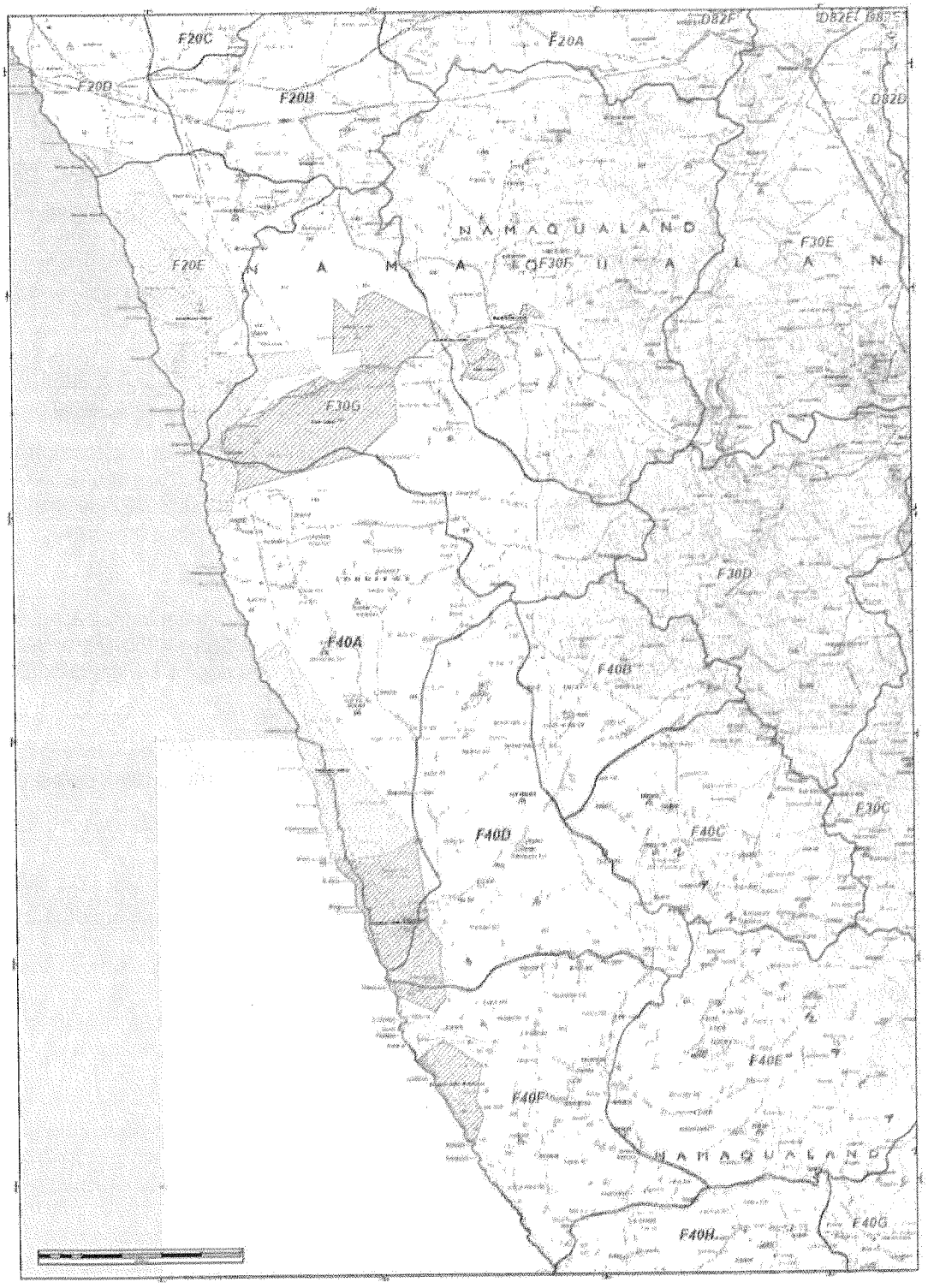

Figure 3: Catchments and associated rivers located within the BIR area

2.3 Local Setting

2.3.1 Mineral deposit

The BIR is associated with alluvial diamond deposits of fluvial 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.

2.3.2 Mine product

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

2.3.3 Estimated reserves or extent of target area

At the current mining rate, it is estimated that reserves in Namaqualand Mines will last until 2023.

2.3.4 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.

2.3.5 Production rate

The total production rate of diamonds 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.

2.3.6 Planned mine life or prospecting duration

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.

2.3.7 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 BIR

The BIR stretches eastward inland along the Buffels River. Significant surface features used in the interpretation of local geology include:

- River channels, river beds and drainage basins;
- Rocky outcrops and bedrock exposures;
- Dunes; and
- Fossil deposits.

The largest of the diamond deposits along the Buffels River are found on the De Beers-owned properties Langhoogte and Nuttabooi. It is generally accepted that the deposits were formed by a previously meandering Buffels River that was also responsible for transporting diamonds to the coast. In these deposits the ore comprises remnants of fluvial gravels which are preserved as isolated patches in bedrock depressions and channels.

Diamonds occur on elevated fluvial terraces flanking the Buffels River. Two fluvial terraces occur namely the lower 'Meso' and the upper 'Proto' terrace. Only the proto terraces are currently economic. Ore consist of sub-rounded to rounded quartz gravel that can be up to 6m thick. Various suspended gravel layers may also occur. These are generally not economic to mine. The ore can be heavily cemented in places (silcrete & calcrete cement). The average ore thickness is generally 1.5m. The age for the fluvial deposits varies from <10 million years for the Meso deposits to between 15 million and 20 million years for the proto deposits. The origin of the diamonds is not clear but is thought to have been eroded by the palaeo-Buffels River from older meta-sediments on the escarpment and coastal plain. Grade generally varies from <5 carats per hundred tons (cpht) to 50 cpht with the average grade mined being approximately 10 cpht and stone size generally from 0.32 to 0.41 carats/stone. Overburden varies in thickness from <5m to 55m and consist of terrigenous sand, windblown sand, fluvial clay and fluvial sand. Laterite (dorbank) may occur close to or on surface.

3.1.3 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.

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, however the areas of the BIR situated further inland, are subject to more pronounced climatic extremes.

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.

Table 6 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.

Due to the proximity of the Buffels River, the BIR is more undulating than the other mining areas along the coast (Figure 4). A topographical assessment of the BIR has resulted in the delineation of the following units:

- Stabilised sandy areas: white and red sand plains are distinguished;
- Rocky hills and outcrops locally known as 'Klipkoppe'; and
- River valleys

Mining in the BIR has changed the topography. In addition to the construction of roads and buildings, the introduction of equipment and labour provides daily issues relating to the avoidance and cleaning up of waste materials, litter, etc. Inevitably these activities have resulted in unintentional changes to the topography. Figure 4 shows the typical landscape of the BIR as seen from the air.

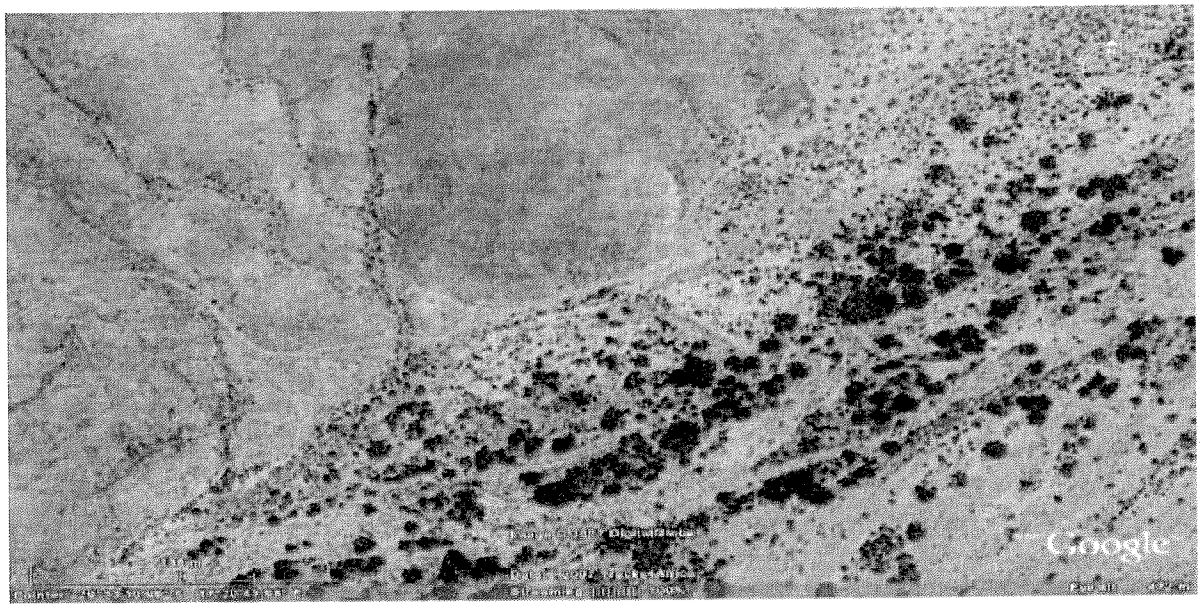

Figure 4: Undulating topography within the BIR

3.4 Soil

The soils of the BIR are characterised by reddish consolidated sands that are much older and less mobile than the soils found on the coastal plain. The reddish colour of the sand is a result of iron oxidation in the older sands.

The dominant soils in the BIR are the red-yellow a-pedal, freely drained soils with a red and yellow high base status, usually < 15% clay. There may, however, also be some red, high base status, 300 to > 300 mm deep. There are no dunes in this area

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 (not previously mined) 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

Stock farming is conducted on the BIR farms owned by De Beers Consolidated Mines Limited as part of an arrangement with local land owners who have grazing rights on the farms. Within the mine area, land owned by the mine but not used for mining operations is leased to farmers.

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 Buffels Inland 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 Buffels Inland 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 Buffels Inland Right include roads, water supply pipelines and power lines 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 and Figure 5

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; Kayaking;	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
		▪ 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;
			  ▪ Services;
			  ▪ Refuse areas;
				▪ 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
			▪ 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 ▪ Building footprint ▪ Sensitive biophysical features of significance,	▪ 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
			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.	
▪ ZONE 5: ▪ Settlements	▪ Existing towns with infrastructure in working	▪ Residential (employees of the various new sectors;	▪ Improve the sense of place: ▪ create and develop public open space (around existing public	▪ Koingnaas town service infrastructure may be a liability to Kamiesberg Municipality; ▪ It is possible that the Nama

Land use zone	Criteria	Land uses and activities	Development rules and guidelines	Risks associated with zone
	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.*	▪ 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	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 segregated parts of the town in order to integrate the two; and ▪ Introduce communal infrastructure to facilitate	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 the services that may need 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 infrastructure maintenance and repair costs); ▪ The simplest option is to privatise the town into a

Land use zone	Criteria	Land uses and activities	Development rules and guidelines	Risks associated with zone
			recycling of waste. Koingnaas Koingnaas remains in DBCM ownership, but DBCM is in negotiations with the Kamiesberg Municipality 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 Kamiesberg Municipality 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 town; ▪ In the meanwhile, as much activities and usage of the town must be promoted through eco- and golf	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
			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 ▪ Hospital (can be converted to frail care).	
▪ Zone 6: ▪ Farming/Agricul	▪ Areas that are not connected via land	▪ Agriculture (livestock)	▪ Transfer land where possible (when safe and rehabilitated) to suitable	▪ Overgrazing; ▪ Land degradation; and

Land use zone	Criteria	Land uses and activities	Development rules and guidelines	Risks associated with zone
tural Areas	ownership to mine Rights or DBCM owned land; and ▪ Areas that are already leased to adjacent farmers.		private persons; and ▪ Monitor and evaluate these farms that area leased to guard against the risk of overgrazing and subsequent land degradation.	▪ Illegal mining.

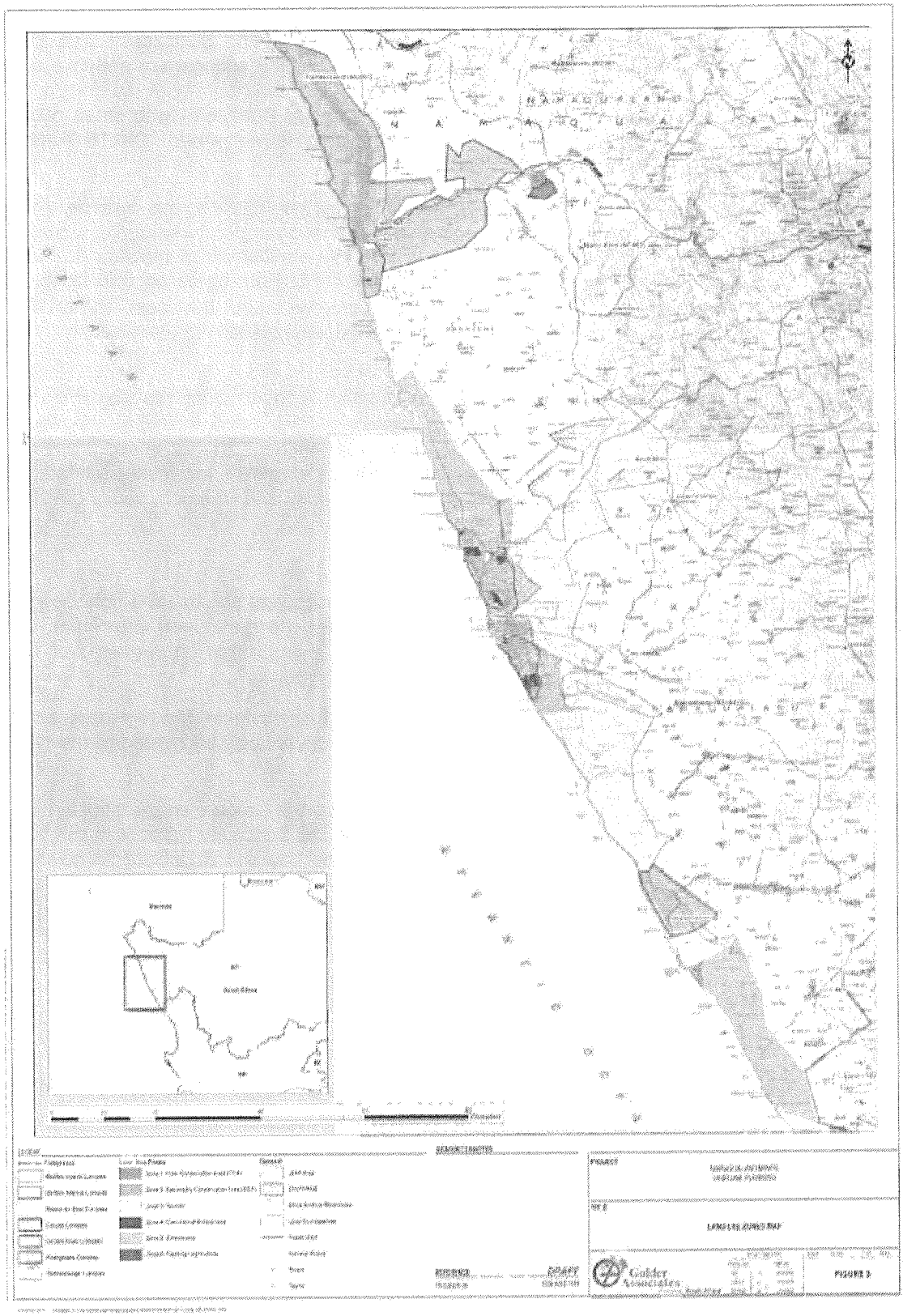

Figure 5:Land use zones proposed for the entire NM area

3.7 Natural Vegetation (plant life)

The Namaqualand Mines 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 BIR 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 BIR 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.

In addition, the Namaqualand coast is home to a diversity of invertebrate species, however the insect fauna of southern Africa and particularly the West Coast is poorly known.

3.8.2 Endangered or rare species

Several Red Data Species of various taxa are thought to occur in the area. These include:

- Mammals, for example Grant's golden mole (*Eremitalpa grantii*) and the African wild cat (*Felis silvestris lybica*);
- Avifauna like the Ludwig's bustard (*Neotis ludwigii*), Martial eagle (*Polemaetus bellicosus*) and Damara terns (*Sterna balaenarum*);
- Reptilians like the Namaqua Dwarf adder *(Bitis schneideri)* and
- Amphibians like the Desert Rain frog *(Breviceps macrops)*.

The insect fauna of southern Africa and particularly the West Coast is poorly known

3.9 Surface Water

The BIR is situated in the catchment area of the Buffels River; however there is little surface water. The Buffels River drains the western edge of the Bushmanland plateau, north of the Kamiesberg and the western slopes of the Namaqualand coastal escarpment, inland of Kleinsee. The main river and its tributaries only have surface flow after substantial rain has fallen. However, previous studies have indicated the possibility of subsurface flow.

3.9.1 Buffels River

The Buffels River is the largest system in the area, and drains the western edge of the Bushmanland plateau, north of the Kamiesberg and the western slopes of the Namaqualand coastal escarpment.

Surface water in the Buffels River estuary near Kleinsee is the result of the high water table caused by the presence of an aquifer in the lower reaches of this river.

The Buffels River system, including the main streams and tributaries, is ephemeral, meaning that surface flow only occurs after substantial rain has fallen. Subsurface flow is however likely. The mean annual run-off for the catchments is unknown.

A high water table and freshwater at the mouth of the river provides ideal habitat for many forms of West Coast fauna in an otherwise arid environment. As the estuaries are not generally open to the sea, they are not significant nursery areas for fish and other marine organisms.

3.9.2 Surface water quantity

No significant occurrence of surface water is found in the mining areas of the BIR. Small springs are recorded in the rocky outcrops of Goraap and Kourootje, approximately 25 km south-west of the BIR, but no perennial surface flows emanate from these. A series of pans are present, with extensive areas intruding in a north-south direction over Kannabieduin, Pienaars Bult and Honde Vlei. Pans are also to be found in the northern parts of Goraap. These pans may contain surface water during the winter months.

The balance of surface water is actually groundwater extracted from various operational boreholes and stored in farm dams and reservoirs.

3.9.3 Surface water quality

The lack of permanently flowing rivers within the study area implies that surface water is not generally available for use, and the quality thereof has not been tested.

3.9.4 Drainage density of areas to be disturbed

Not applicable.

3.9.5 Surface water use

There is some surface water in the Buffels River estuary. This is the result of the high water table caused by the presence of an aquifer in the lower reaches of this river. The lack of any permanently flowing rivers within the study area implies that surface water is not generally available for use. Sub-surface water is extracted from a number of sources and made available for the inland mining operations and the associated towns in the area.

3.9.6 Water authority

The Namaqualand Regional Services Council and the Namakwa Water Board are the water authorities for the area. The control of river mouths and lower reaches of rivers where they flow through De Beers properties is exercised by the Company.

3.9.7 Wetlands

There are no pans or wetlands in the BIR. However, within the broader perspective of Namaqualand Mines, approximately 180 km of coastline are situated in access controlled mining areas and thus protected from unrestricted public access. Natural wetlands occurring in the region include salt pans that occasionally hold water, and estuaries.

3.10 Ground Water

3.10.1 Depth of water table

Assessment of boreholes on various farms in the area indicates that the regional flow is towards the coast but locally (inland) the flow is from the watersheds towards the Buffels River. Local movements towards the Kamma- and Swartlintjies River are not well defined due to the low concentration of data points in these areas.

3.10.2 Presence of aquifers

Groundwater investigations have shown the regional flow to be towards the coast. Locally the flow is from the watersheds towards the Buffels River.

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, construction of a groundwater barrier in the riverbed was completed which has resulted in a rise of the water level at the Fellman well and improving the recovery capacity.

3.10.3 Groundwater use

A study undertaken in the Mannels Vley area in March 2007 to assess the impact of dewatering in the area has indicated that groundwater is currently discharging into the Buffels River and providing water to downstream users. There are also upstream groundwater users at Dikgat and they are situated closest to the Mannels Vley mining area. The proposed mining area is in a bedrock depression off the main Buffels River channel and there is a single groundwater user upstream within the Mannels Vley depression.

The study has indicated that dewatering of the mining area may lead to reduced recharge of the Buffels River, which in turn could lead to a small reduction of yield at the Fehlman well that supplies part of the water to Kleinsee and possibly the other wells in the river. This effect is mitigated in that water pumped from the mining area will be discharged into the Buffels River bed in accordance to the dewatering license.

In Kleinsee fresh water is supplemented by groundwater pumped from the Fellman well (29°38.769'S, 17°05.818'E) in the Buffels River bed.

Abstraction also takes place from a borehole on the farm Nuttabooi where a permit was granted for a volume of 84 000m^3/a, however, is subject to a Water Court Order (No. 365) limiting the abstraction volume to 66 840m^3/a.

Farming operations in the region obtain groundwater from boreholes situated on various properties. Most farms in the region have at least one operational borehole.

3.10.4 Groundwater quality

In March 2007 a groundwater study undertaken in the Mannels Vley area indicated that the groundwater in the Mannels Vley area is high in sodium, chlorides, calcium and magnesium with a pH range between 4. 6 and 7.

3.10.4.1 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. The water abstracted from the well is pumped to the reservoirs and an electronic control system linked to floats in the reservoirs is used to control the pump operation at the well.

3.10.4.2 Somnaas–Noup aquifer

The Somnaas – Noup aquifer extends into the Samsonsbak Right and further north to the southern edge of the Farm Kannabieduin 324. Koingnaas's freshwater supply comes from a series of three boreholes tapping this aquifer approximately 12 km north of the township. The boreholes are situated in a sediment- filled palaeo-channel running north-south; the Sonnekwa palaeo-channel.

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 day or two and are responsible for some of the year's warmest and dustiest weather conditions, often carrying large volumes of dust out to sea.

3.11.2 Dust

In the BIR 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.

3.11.3 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 BIR, 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 Buffels Inland 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 (KhoiKhoin) 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 Buffelss 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 Buffels River estuary;
- 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 BIR mining area is partially visible from the road linking Springbok and Kleinsee, but not from any residential area.

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 km2) 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 km2, 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 km2. 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 km2, with the total population being approximately 44 740 in 2001, which has grown to approximately 48 430 in 2008 , with a population density of 3.2 persons per km2.

The Nama Khoi Municipality has its head office in Springbok, in the heart of Namaqualand. It covers an area of 13 970 km2 with a population density of three people per km2. The municipality includes the towns of Springbok, Fonteintjie, Kleinsee, Concordia, Bergsig, Matjieskloof, Okiep, Nababeep, Rooiwinkel, Balletrap, 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 NM employees and their families:

- 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.

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 .

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 starts up 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 %.

As part of the stream lining of Namaqualand Mines' mining activities, the full time work force will also be reduced. Within 2006, the work force declined from 1692 to 1353, as reflected in the latest Social and Labour Plan.

3.17.5 Economic activities

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

3.17.5.1 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.

3.17.5.2 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.

3.17.5.3 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.

3.17.5.4 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)

3.17.5.5 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.

3.17.6 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 %.

3.17.7 Housing

The private mining settlement of Kleinsee was developed to support the requirements of Namaqualand Mines and in particular the Buffels Marine Right and Buffels Inland 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 Kleinsee 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.

3.17.8 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.

3.17.8.1 Kleinsee

The social infrastructure of the town of Kleinsee is extremely well developed, including facilities normally provided in urban situations, such as housing, schools, a hospital, shops, sport and recreation and other

utilities (power, sewerage, roads, communication) (Figure 6). Post closure sustainability of these services is being investigated.

3.17.9 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.

3.17.10 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.

Figure 6: Layout of the town of Kleinsee

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 Council maintains theses roads (except for 20 km from Koingnaas to the intersection with the Hondeklip Bay - 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 BIR 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 Buffels Inland 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 BIR.

5.1.1.3 Power lines

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 line to Kleinsee and Tweepad.

From the Annex Kleinsee sub-station, electricity is distributed to the Dreyerspan, the Bulk Sample plant, Central Workshop and Recovery sub-stations, the Kleinsee township sub-station and the Annex Kleinsee power station (which is maintained as an alternative power supply and powered by diesel engines). These feeders supply the rest of the BIR.

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.

Three of these sites are situated within the BIR (Table 9).

Table 9: Waste sites located within the BIR

Location	Nature of waste *	No. Of sites
Langhoogte	Hard scrap	1
	Domestic waste	1
Nuttabooi	Soft scrap	1
Total waste sites:		3

**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 on the registered hazardous facility at Vissershok in Cape Town; and
- Process 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

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

No ore is treated at the Langhoogte plant and currently the CRD is not in use. However, CRD may in future be treated there.

Coarse residue arises from beneficiation of the ore originating from the BIR. The ROM is crushed to -12 mm or smaller and after various separation processes, including cycloning, the course discard produced is deposited onto a coarse residue deposit (CRD) located at Langhoogte (Table 10).

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

CRD	Height (m)	Rate of advance (m/month)	Materials deposited
Langhoogte	37.8	2.75	-12 mm +0.5 mm tailings

Fine residue produced from the BIR is disposed of in a dedicated fine residue deposit (FRD). The fines are deposited by open-end spigotting.

5.1.3 Water pollution management facilities

5.1.3.1 Sewage plant

The private mining settlement of Kleinsee has reticulated water borne sewage with an activated sludge treatment works that is registered as a Class D sewage works 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 Freshwater/potable water supply

Possible freshwater/potable water supply sources are either the Buffels- or Orange River, and on a smaller scale, from harvesting rainfall from roof runoff. In Kleinsee, the water from the Buffels- and Orange Rivers is collected in a reservoir outside of town and used as necessary.

Potable water is supplied to the plant by tankers.

5.1.4.1 Orange River pipeline supply

Freshwater is abstracted from the Orange River at the Henkries weir, and delivered via pipeline (maintained by the Namakwa Water Board) to a reservoir in Nababeep, near Springbok. The Orange River pipeline which is approximately 88 km long and run by Namaqualand Mines draws water from the Nababeep Reservoir, and conveys the water in the pipeline along the length of the Buffels River to the mine's Main Resevoir located approximately 5 km from Kleinsee. There are a number of abstraction points from the main pipeline which supply farmers and other mines in the area. The pipeline discharges into a reservoir at Kleinsee. Water is supplied from the reservoir by pipeline to the recovery plant, workshops and the treatment plants.

The gross monthly water consumption from the Orange River, from 2006 to 2010 is illustrated in Figure 7.

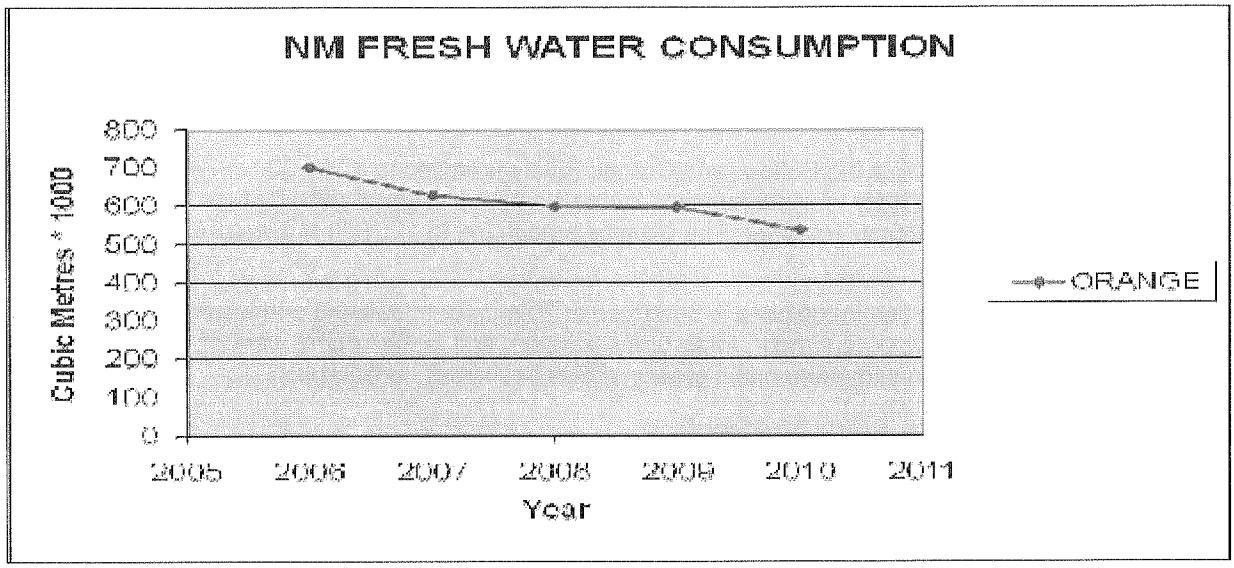

Figure 7: Gross monthly water usage from the Orange River (2006 – 2010)

5.1.4.2 Buffels' River groundwater abstraction supply

The Fellman well is situated in a natural sand reservoir near Dikgat (29°38.769'S, 17°05.818'E) and is used to supplement the Orange River pipeline demand. This groundwater abstraction serves as an important emergency supply in case the Orange River pipeline fails. In 1994, construction of a groundwater barrier in the riverbed, situated 800 m down river from the Fellman well, was completed. This formed an underground reservoir which has resulted in a rise of the water level at the Fellman well, improving the harnessing of this water.

The gross monthly water consumption from the Buffels River, from 2006 to 2010 is illustrated in Figure 8.

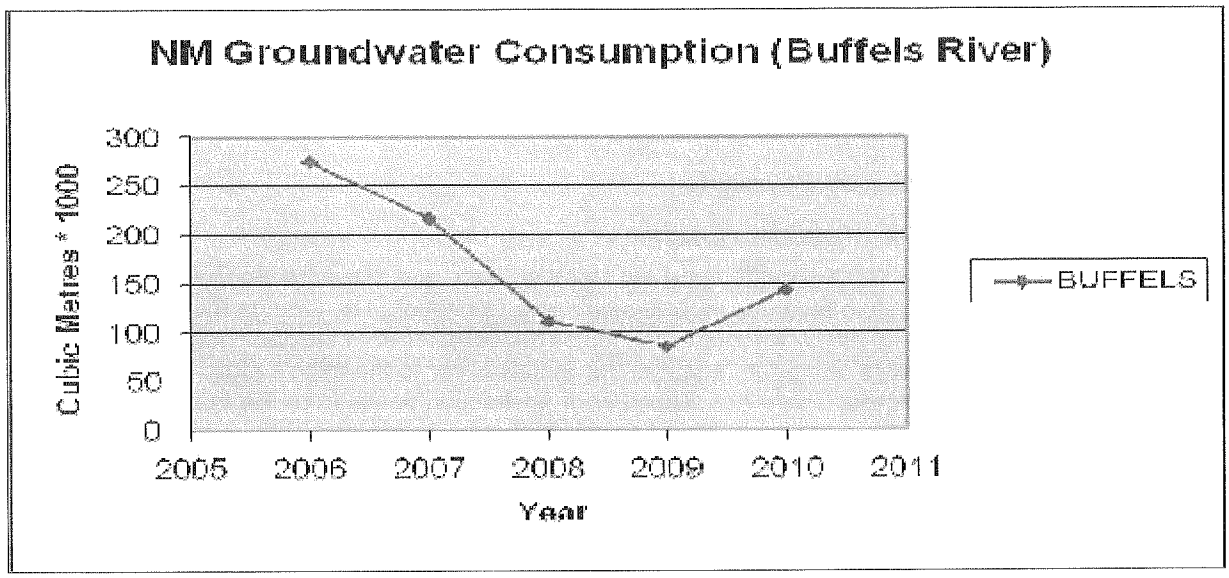

Figure 8: Gross monthly water usage from the Buffels River (2006-2010).

At present about one-third of Kleinsee's freshwater is obtained from sub-terranean flow in the Buffels River.

The combined use of water from the Buffels- and Orange Rivers is limited to 1 205 000 m^3/year as per permit No. 594N. The maximum quantity of water supplied by the Namaqua Water Board (Orange River pipeline) is limited to a maximum of 1 080 000 m^3/year. The balance amounting to 125 000 m^3/year must be abstracted from the Buffels River.

Water for domestic purpose use in Kleinsee is budgeted at 70 m^3/month/dwelling and watering of gardens is restricted to three hours a week (one hour, three times a week), and is the largest user of freshwater in the BMR. Watering of gardens in summer months greatly affects freshwater consumption.

5.1.5 Process-/sea water abstraction

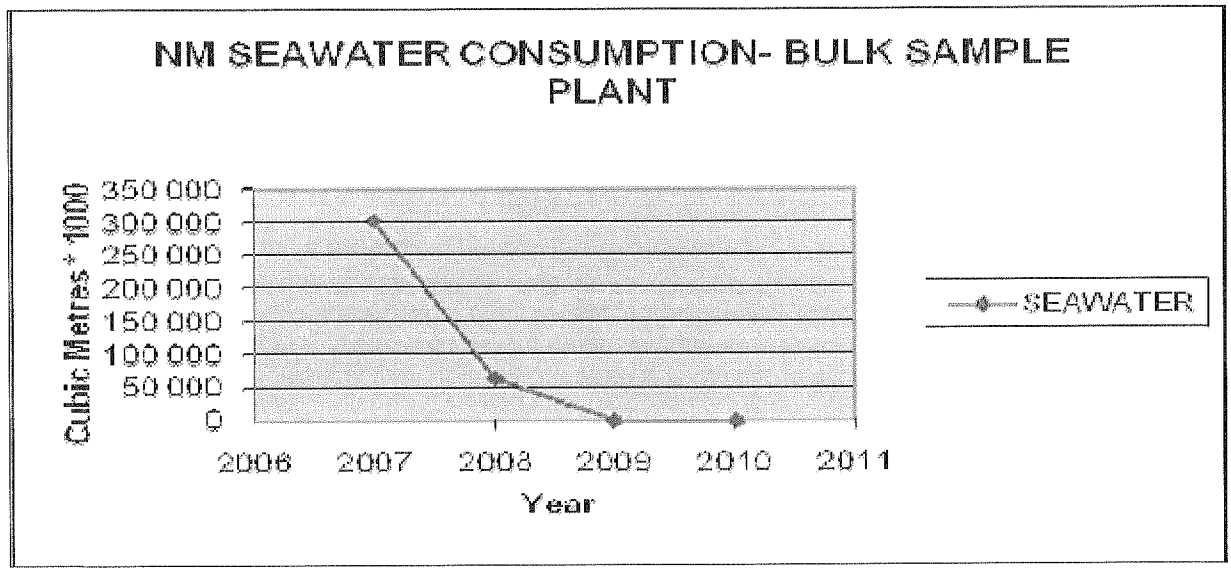

Figure 9: Process/Sea Water abstraction (2007 – 2010)

No sea water is used in the BIR, however all treatment of ore will be done at the Bulk Sample plant located in the BMR (Figure 9). Fresh water is used and is taken off the main Orange River supply line and is recycled in the process.

5.1.6 Mineral processing plants

The only processing facility in the BIR is the plant at Langhoogte. The Langhoogte plant will be demolished in 2011 and the Bulk Sample plant in the BMR will be used for treatment of ore when mining resumes.

5.1.7 Housing, recreation and other employee facilities

The closest housing and recreational facilities to the BIR is located in the private mining settlement of Kleinsee.

Recreational facilities in Kleinsee include a:

- golf course;
- rugby field;
- church;
- café;
- recreation club; and
- museum.

Table 11 provides a breakdown of the residential infrastructure of Kleinsee.

Table 11: Residential infrastructure of Kleinsee

Infrastructure	No. at Kleinsee
Occupancy rate	45%
No of houses	370
No of single quarters	86
No of hostel beds	488
No of telephone lines	2 PABX systems (radio/microwave) 60 external lines 2 000 internal lines 700 Post Office lines (private)
Schools	1 Nursery 1 Pre-primary 1 Junior primary 1 Senior primary
Recreational facilities	2 Recreational centres (community hall, restaurant, pub, canteen etc) 2 Sports fields 1 Indoor sports hall; 1 Golf course; 1 Bowling green; 1 Jukskei pit; 2 Swimming pools; 2 Squash courts; 8 Tennis courts; and 10 Club houses

Infrastructure	No. at Kleinsee
Sewage treatment works	1
Shopping centres; Banks; Post Office; Bottle store; Bakery; and Laundromat.	1 1 1 (Private) 1 1 (Private) 1 (Private)
Private garages	1
Medical facilities	1 Hospital / Clinic

5.1.8 Transport

Transport in the Buffels Inland Right is mainly by trucks or 4x4 vehicles.

5.1.9 Water balance diagram

A simplified water reticulation for Bulk Sample Plant is illustrated in Figure 10 .

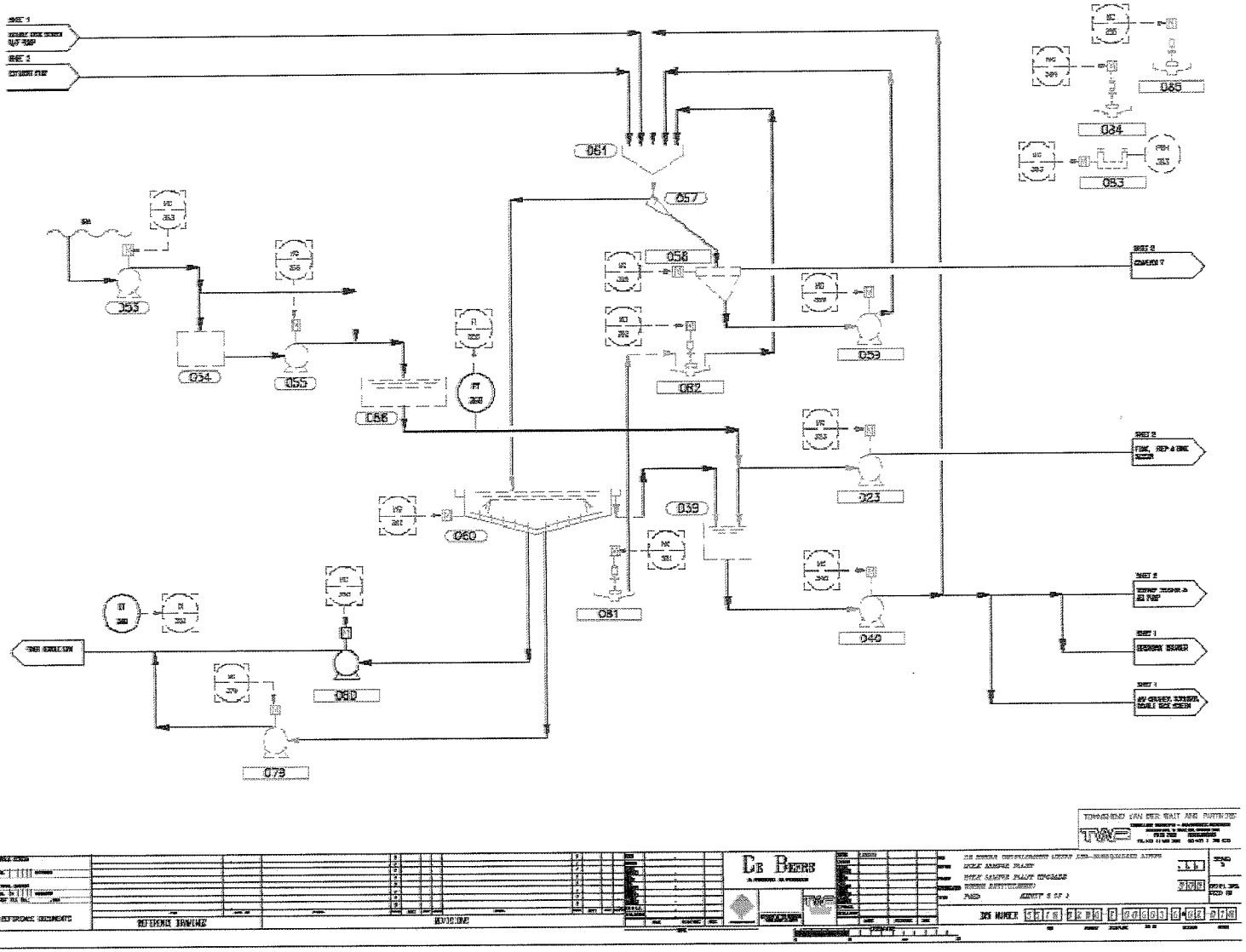

Figure 10: A simplified water reticulation for Bulk Sample Plant

5.1.10 Disturbance of watercourses

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

5.1.11 Storm water

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

5.2 Construction Phase

Not applicable as the Buffels Inland 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, is 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, followed by the 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 haul trucks to a centralized treatment plant situated in the BMR.

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

There are no coarse or fine reside disposal plants in the BIR. All processing activities associated with the BIR are situated in the BMR.

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. 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.

5.3.6 Proposed river diversions

There are no river diversions within the BIR.

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 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.

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 BIR 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 BIR 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 the BIR.

Table 12: Impact Assessment - Operational Phase

Area of impact	Environmental Significance (before mitigation)						Operational phase
	M	D	S	P	Tot	SP	
Geology	8	5	2	4	60	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.
Climate	-	-	-	-	-	N/A	There are no significant impacts on the climate, generated from the BIR.
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.
	8	5	2	5	75	M	The establishment and growth of FRDs and CRDs associated with the BIR will result in a moderate impact that will exist until reclamation of these dumps during decommissioning and closure.
Soils	10	4	2	5	80	H	Due to stripping, prospecting and mining result in the loss of topsoil from the areas.
	10	4	2	5	80	H	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	H	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.
Land capability and use	8	4	2	5	75	M	The BIR covers approximately 80 km2 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.
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.

Area of impact	Environmental Significance (before mitigation)						Operational phase
	M	D	S	P	Tot	SP	
	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 BIR.
	6	4	2	4	48	L	Areas disturbed during the operational phase of the BIR 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 BIR 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 BIR there is no surface water and 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 BIR.
Groundwater	8	5	1	5	70	M	The impact on groundwater is insignificant due to the arid environment and lack of free-standing water. As the exploration activities are confined to the company's mining areas there

Area of impact	Environmental Significance (before mitigation)						Operational phase
	M	D	S	P	Tot	SP	
							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 BIR is largely unknown and therefore may be seen as being moderate significant and will remain so until closure.
	4	2	1	4	28	L	Due to the arid environment and lack of groundwater in the BIR 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 BIR 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	4	2	4	48	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	4	2	3	3	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	H	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.

Area of impact	Environmental Significance (before mitigation)						Operational phase
	M	D	S	P	Tot	SP	
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 BIR.
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.						

Area of impact	Environmental Significance (before mitigation)						Operational phase
	M	D	S	P	Tot	SP	
	■ 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 BIR.
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	H	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 BIR.
	8	4	2	4	56	M	Areas disturbed during the operational phase of the BIR will be susceptible to the 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

Area of impact	Environmental Significance (before mitigation)						Decommissioning phase
	M	D	S	P	Tot.	SP	
							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 stormwater 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 BIR.
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 DGR 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 DGR 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 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.

Area of impact	Environmental Significance (before mitigation)						Decommissioning phase
	M	D	S	P	Tot.	SP	
	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	H	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 BIR.
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 BIR, 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 BIR 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 BIR 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 BIR, 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. ■ 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. ■ 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. ■ 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. ■ 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. ■ Institute the measures related to backfilling, profiling, top soiling and re-vegetation
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. ■ 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 use.	■ Implement and maintain the measures stipulated in this table as required.
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. ■ 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. ■ 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. ■ Register existing and planned river crossings. **On site 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 operating equipment on site. ■ 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 (DWAF, 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. ■ 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. ■ 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. ■ 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. ■ 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. 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 initiatives such as the Namaqualand Restoration Initiative 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 initiatives to support sustainable development.	▪ Continue with the stakeholder consultation and deal with issues as identified under section 35 as well as arising from ongoing consultation.
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. ▪ Submit relevant information as requested by the DME, DWAF and DEAT and or stipulated in permits, licences and directives.
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. ▪ 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. ▪ 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;

Topic	Objective	Measure
		■ Conduct assessments of contaminated soils and amelioration and/or dispose; and ■ Shape and re-vegetate the disturbed areas from which infrastructure have been removed.
Coarse residue deposit (CRD)	CRD included as part of the NM mineral resource and will be retreated.	■ Fence CRD zone of influence to prohibit access.
Fine residue deposit (FRD)	FRD is considered to be a potential source of alternative commodities (for example heavy metals)	■ Fence FRD zone of influence to prohibit access; and ■ Erect netting as required to eliminate possible dust plumes.
Haul and access roads	To reclaim 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

Topic	Objective	Measure
		▪ 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 secondary haul and access roads to the planned final land use of the mine site.	▪ 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; ▪ Based on the test results, determine whether the material: ▪ needs to be addressed similarly as the material from the primary haul and access roads ; ▪ 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 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

Topic	Objective	Measure
		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, 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 as per Section 6.3.4.1 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	■ Maintain wind netting, i.e. repair or replace as necessary; ■ Conduct in-fill vegetation as required to ensure that predetermined basal cover

Topic	Objective	Measure
	integrated into the overall vegetation community.	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.
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);

Topic	Objective	Measure

		▪ 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;
		▪ 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.	

Topic	Objective	Measure
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; ▪ 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.	▪ See section 45 on the stabilisation of slopes and hence rendering them safe.

Topic	Objective	Measure
Environmental quality	To ensure that the environmental quality as reflected above is achieved.	■ Ensure that the local environment after closure should 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 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	■ Clean-up and trim areas from which surface infrastructure has been removed

Topic	Objective	Measure
	to low fertility, low organic matter content and possible compaction.	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.
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

Topic	Objective	Measure
		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 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 discussed.
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

Topic	Objective	Measure
		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 BIR
	■ 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.	
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: ■ *Drosantemum hispidum;*

Topic	Objective	Measure
		■ *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 in section 12
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 stakeholder forum to maintain communication between the mine and surrounding landowners as well as other key stakeholders on the mine's closure related initiatives.	■ Establish a stakeholder forum for Namaqualand Mines initially based on the key 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

Topic	Objective	Measure
		▪ 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 Koingnaas, 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.	■ 2013 - 2018 ■ 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 5 - 10 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, as identified by LEAP and the land use planning.
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 BIR.

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 BIR.

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 BIR, as at December 2010

Unscheduled closure	Scheduled closure
R 8 227 453	R 2 345 458

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 BIR, 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 up 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 BIR 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

Department of Minerals and Energy, 1991, *Aide Mémoire for Environmental Management Programme Reports for Proposed Prospecting and Mining*

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Geo Pollution Technologies Report Numerical groundwater model for dewatering at Mannels Vley, March 2007

De Beers Consolidated Mines Limited Namaqualand Mines, 2006, *Social and Labour Plan*

Golder Report No 6951/6567/1/E, 2004, Namaqualand Mines Closure Cost Estimates

Golder Report No 12017-8395-1, 2010, Namaqualand Mines State of the Environment Report to Inform Closure Planning

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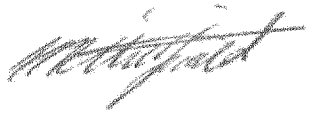

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APPENDIX A

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APPENDIX B

De Beers Environmental Monitoring and Measurement

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	